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MEMOIRS OF THE

Institute of
Scientific and
Industrial
Research



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Foreword

At the departure of the Network Joint Research Center and the new stage of the academia-industry relationship

Akihito Yamaguchi

Director, Institute of Scientific and Industrial Research

Japan's first nation-wide national university's collaboration network named "Network Joint Research Center for Materials and Devices" has been started on 1st April, 2010. In addition, SANKEN Incubation Building including Osaka University's first on-campus rental laboratories for private corporations (Company Research Park) as a novel open innovation core has been completed in April, 2010. On the basis of these two epoch-making achievements in addition to the reorganization of ISIR in last year toward the new stage of our multidisciplinary research, ISIR stands at the starting point for developing our new history.

ISIR was founded in 1939 with only 3 laboratories by the financial support from industries of KANSAI area to promote basic science for the development of industry. From then, ISIR has emphasized basic and applied researches to promote the multidisciplinary science for ultimate contribution to the industries in three main research areas, i.e., material science, information science and bio-science. In 2002, we founded the Japan's first university-attached Nanoscience & Nanotechnology Center. At present, we have 27 full-size laboratories divided into three divisions, i.e., Division of Information and Quantum Sciences, Division of Materials and Beam Sciences, and Division of Biological and Molecular Sciences, and Nanoscience & Nanotechnology Center. Now we aim to develop multidisciplinary sciences focusing Green Nanoscience and Bio-Nanoscience.

ISIR has also close contact with six graduate schools of Osaka University including Graduate Schools of Engineering, Science, Engineering Science, Pharmaceutical Science, Frontier Bioscience and Information Science and Technology. Started from 2010, we promote the Strategic Alliance Project for Creation of Nano-Materials, Nano-devices and Nano-systems with five university-attached institutes, i.e., RIES of Hokkaido Univ., IMRAM of Tohoku Univ., CRL of Tokyo Inst. Tec., ISIR of Osaka Univ. And IMCE of Kyushu Univ.

This publication "Memoirs of the Institute of Scientific and Industrial Research (ISIR)" is our annual publication summarizing the scientific activities of ISIR. We hope this annual publication will be useful and stimulating for all researchers and young scientists outside as well as inside our institute.

ISIR will continue to make contributions to the development of industry through basic science and technology and inspire the future.

Outline of ISIR

1. Research Activities

1) History and Organization

The Institute of Scientific and Industrial Research (ISIR) was founded in 1939 as a part of Osaka University, based on the strong desire of the business leaders of private enterprises in Osaka area. The purpose of the Institute is to study science necessary for industry and their applications. Since then, the institute had developed into one of the leading research organizations for science and engineering in Japan.

In 1939 ISIR had only 3 departments, however it had increased research areas and laboratories in the fields of electronic engineering, computer science, metallurgy and inorganic chemistry, organic chemistry, biochemistry, and beam science.

Modern industry in this country is, however, coming to a major turning point. There is a strong requirement to develop interdisciplinary sciences, or new fields which are away from conventional area in order to advance basic and applied sciences coping with social changes.

Since this Institute has researchers in a wide variety of fields and is suitable for making a new organization for interdisciplinary areas, it was restructured in 1995 to an Institute with 6 divisions with 24 departments for the purpose of promoting sciences on materials, information and biology. For solving problems related to energy, earth ecology, aging and advanced information technology, interdisciplinary and comprehensive studies have been conducted in the Institute. From 2002 through 2006, we have awarded as the best group in 21st Century COE program that is originally the top 20 group plan in Japan. This involves the positive exchange between different laboratories which yield results of the global level with respect to material, information and biotechnology.

In 2002, Nanoscience and Nanotechnology Center has started after restructuring Research Center for Intermaterials and Radiation Laboratory. The new Center focuses its research on nanomaterials and devices, beam science for nanotechnology and industrial nanotechnology. In 2003, the Center Building was constructed. In the new Center Building, there is a Nanotechnology Process Foundry for supporting the nationwide research in the nanotechnology field.

In 2006, Materials Science & Technology Research Center for Industrial Creation between ISIR and IMRAM (Tagenken) in Tohoku Univ. has started and then expanded to the Post-Silicon Materials and Devices Research Alliance including RIES

(Denshiken) in Hokkaido Univ. and CRL (Shigenken) in TIT next year. In 2006, Academia Industry Relation Office (AIR-Office) has been settled in order to strengthen cooperation between the institute and industries. In 2008, Division of special project has been founded for promotion of research by young faculties.

In 2009, we have made a great restructuring since 1995 in order to develop the novel interdisciplinary research fields and exercise leadership in nanotechnology research field into 3 great divisions (Division of Information and Quantum Sciences, Division of Material and Beam Sciences, and Division of Biological and Molecular Sciences) and expanded Nanoscience and Nanotechnology Center. We newly established the Center for Research Education and Training and the Center for International Collaboration. Former Materials Analysis Center was joined with Electron Microscope Laboratory and restricted into the Comprehensive Analysis Center. Research Laboratory for Quantum Beam Science was separated from Nanoscience and Nanotechnology Center for facilitating the collaboration in the beam science field.

In order to establish a core for academia-industry collaboration and open innovation, we constructed the SANKEN Incubation Building including Osaka University's first on-campus rental laboratories for private corporations (Company Research Park) in 2010. ISIR Manufacturing Factory has been moved into the building. In addition, Nanoscience Techno-Core, Company Research Park and Osaka University Renovation Center was settled in the building.

In 2010, the Network Joint Research Center for Materials and Devices including ISIR, IMRAM, RIES, CRL and IMCE (Sendoken) in Kyushu Univ. has been started. ISIR is a headquarter of this 5 institutes network.

Divisions

Departments

Division 1

Information & Quantum Sciences

Photonic and Electronic Materials
Semiconductor Electronics
Advanced Electronics
Intelligent Media
Reasoning for Intelligence
Knowledge Systems
Architecture for Intelligence
Quantum Information Photonics
(Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.)

Divison 2

Advanced Materials & Beam Science

Quantum Functional Materials
Semiconductor Materials and Processes
Metallic Materials Process
Advanced Interconnection Materials
Excited Solid-State Dynamics
Accelerator Science
Beam Materials Science

Division 3

Biological & Molecular Sciences

Molecular Excitation Chemistry
Synthetic Organic Chemistry
Regulatory Bioorganic Chemistry
Organic Fine Chemicals
Structural Molecular Biology
Cell Membrane Biology
Biomolecular Energetics

Next Industry Generation

New Industrial Projection
New Industry Generation System(s)
Intellectual Property Research

Special Projects

Laboratories of 1st Project

Laboratories of 2nd Project

Laboratories of 3rd Project

Laboratory of Microbiology and Infections Diseases
Laboratory of Atomic Scale Materials Processing
Beam Application Frontier Research Laboratory

Department of Disease Glycomics
(Seikagaku Corporation-Endowed Chair)

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Research Centers

Nanoscience and Nanotechnology Center

Functional Nanomaterials and Nanodevices
 Advanced Nanofabrication
 Nanocharacterization for Nanostructures and Functions
 Theoretical Nanotechnology
 Soft Nanomaterials
 Bio-Nanotechnology
 Nanotechnology Environmental and Energy Applications
 Nano-Intelligent Systems
 Nanodevices for Medical Applications
 Nanosystem Design
 Nanodevice Characterization
 Nanotechnology for Industrial Applications
 Simulation for Nanotechnology
 Nanoelectronics
 Nano-Function Characterization
 Nano-Medicine
 Nano-Biology
 Nano Information Technology

Open Laboratory

Nanofabrication Shop

Advance Nanotechnology Instrument Laboratory

Handai Multi-Functional Nanofoundry

Comprehensive Analysis Center

Research Laboratory for Quantum Beam Science

Center for Research Education and Training

International Collaboration Center

Materials Science & Technology Research Center for Industrial Creation

Materials Research Project

Hard Materials Research Group

Soft Materials Research Group

Human Interface Research for

Medical Sciences Research Group

Safety and Security Project

Human Interface Research Group

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Post –Silicon Materials and Devices Research Alliance

Molecular Nano-Electronics Research Group

New Functional Nano-Electronics Research Group

Molecular Nano-Mechanics & Bio-Mechanics Research Group

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Service Facilities

Workshop

Laboratory for Radio-Isotope Experiments

Electronic Processing Laboratory

Office of Information Network

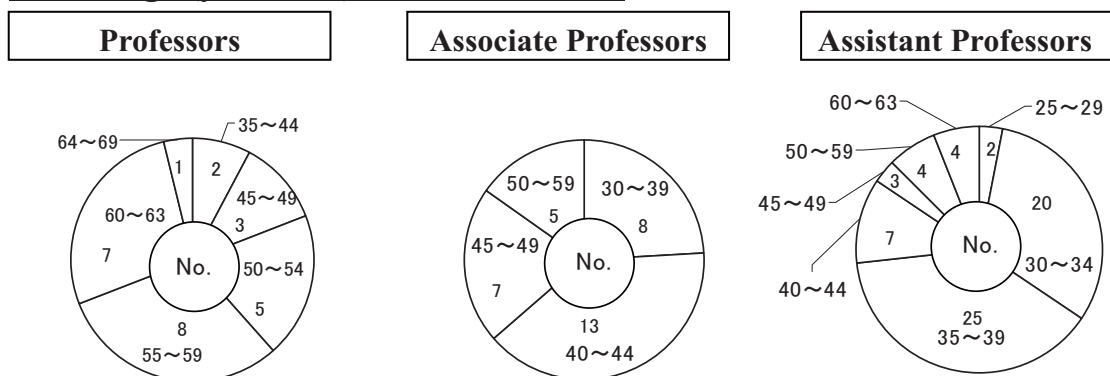
Academia Industry Relations Office

Technical

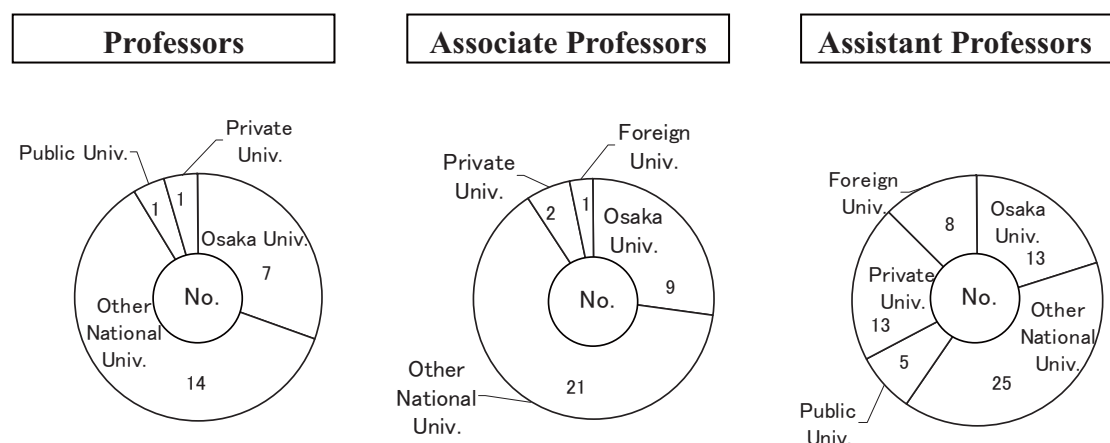
Administrative Office

Public Relations Office
Library
Machine Group
Measurement Group
Facilities Planning Office
General Affairs Division
Research Cooperation Division

Staffs' Age (years old) –As of 3.31.2010



Staffs' Alma Mater –As of 3.30.2010



2) Administration

Administration and management of ISIR are conducted by the Director elected from the full professors of ISIR. The term of the Director is two years. Reappointment is possible, but the Director can not be in the position for more than 4 years. Professor Akihito Yamaguchi has been a Director since April 1, 2008.

Important matters of ISIR are discussed and determined by the Faculty Council, which consists of the Director and all professors of ISIR. Various committees such as

International Exchange, Self-Review, Circumstances and so on are working for each purpose.

Administration of the Institute-associated Centers is conducted by Director of each Center and its Executive Committee.

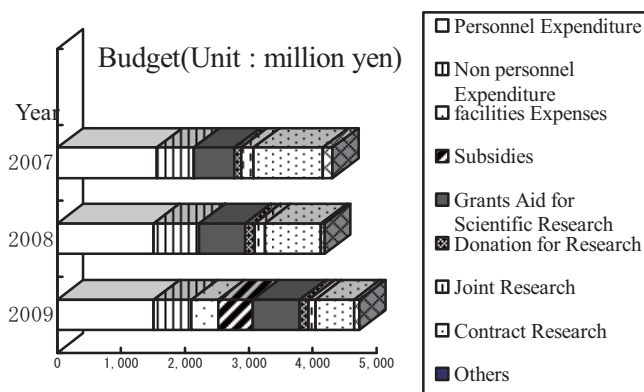
Evaluation Committee composed of outside experts in academic societies was established and the committee evaluated several items such as management, budget, facilities and research activities.

The new organization was highly evaluated, but with change of their structure to National University Agencies in April 2004, our management system needs reshaping. A Board of Directors under the Director has been formed, and Advisory Board has been set up to introduce opinions from outside into the Institute.

3) Research Budget

The budget of ISIR is mainly composed of Subsidy for operating expenses, Grants-in-Aid for Scientific Research of Ministry of Education, Sports, Culture, Science and Technology, Donations for Research, and Budget of Joint Research. The recent trend in the expenditure of ISIR is as follows.

Grants-in Aid for Scientific Research of Ministry of Education, Culture, Sports, Science and Technology are delivered to researchers and the total budget in 2009 is 742,334,000yen.



Donation for Research

Donation for Research is accepted after the Judgement of Committee and the amount are as follows.

(Unit : kilo yen , () Number)

Division \ Year	Information and Quantum Sciences	Advanced Materials and Beam Science	Biological and Molecular Sciences	Nanoscience and Nanotechnology Center
2009	13,758 (11)	11,900 (13)	33,187 (22)	7,450 (3)

Division Year	Special Projects	Others	Total
2009	20,800 (10)	55,200 (10)	142,295 (69)

4) Cooperative Research

Cooperative Researches and Contract Researches in the fiscal year 2008-2009 are as follows: Cooperative Researches are carried out with 57 organizations and the budget for the fiscal year 2008-2009 is 127,115,000 yen. The number of Contract Researches is 44 and the budget for the fiscal year 2008-2009 is 606,223,000 yen.

5) International Research

Department of Functional Nanomaterials and Nanodevices	Ewha Womans University	Korea	Fabrication of Nano-scale Oxide Heterostructures by Combination of Top-down and Bottom-up Nanotechnologies
Department of Functional Nanomaterials and Nanodevices	CNR-INFM	Italy	Microelectromechanical Devices Based on Vanadium Oxides
Regulatory Bioorganic Chemistry	Bern University	Switzerland	A Light-Driven, Supramolecular Optical Switch
Department of Intelligent Media	Peking University	China	Computer Vision
Statistical Science	University of Helsinki	Finland	Statistical learning of causal structures
Machine Learning	Washington University	United States of America	Combinatorial approach to machine learning
Department of Disease Glycomics	Scripps Research Institute	U.S.A.	Studies on Glycobiology especially Glycomics

Department of Disease Glycomics	University of Toronto	Canada	Studies on Glycobiology especially Glycomics
Department of Disease Glycomics	University of Giessen	Germany	Studies on Glycobiology especially Glycomics
Department of Disease Glycomics	German Cancer Institute, University of Heidelberg	Germany	Studies on Glycobiology especially Glycomics
Department of Theoretical Nanotechnology	Laboratory of Irradiated Solids	France	Research on superconductivity in semiconducting boron
Department of Intelligent Media	De La Salle University	Philippine	Empathic Computing: Ambient Intelligent Socio-Affective Adaptive Computing
Semiconductor devices	Slovak Academy of Science	Slovakia	Development of low temperature semiconductor processes and spectroscopic and electrical analyses
Semiconductor processes	Inner Mongolia Normal University	China	Development of nitric acid oxidation method
Metallic Materials Process	Inha University	Korea	Fabrication of light-weight and high-strength porous intermetallics
Metallic Materials Process	Fraunhofer Institute	Germany	Development of biocompatible porous magnesium alloys
Metallic Materials Process	Maribor University	Slovenia	Computer simulation of strength of lotus-type porous metals
Metallic Materials Process	Valladolid University	Spain	Severe plastic deformation of lotus-type porous metals
Organic Fine Chemicals	Institute of Microbiology, Academy of Sciences of the Czech Republic	the Czech Republic	Antioxidant and antiviral activities of silybin fatty acid conjugates
Molecular Excitation Chemistry	Oregon State University	United States of America	Development of Emission Materials Based on Electron-Donor Acceptor Type Molecules
Molecular Excitation Chemistry	Chosun University	Korea	Intermolecular Fast Charge Migration in Supramolecules

Molecular Excitation Chemistry	Jongbuk National University	Korea	Energy Transfer Using Two-collar Two-laser Irradiation
Molecular Excitation Chemistry	Konkuk University	Korea	OLED by π -conjugated polymer films
Molecular Excitation Chemistry	Korea University	Korea	Next Generation Solar Energy-responsible New Materials
Molecular Excitation Chemistry	POSTEC	Korea	Visible-light Responsible TiO ₂ Photocatalysts
Molecular Excitation Chemistry	National Taiwan University	Taiwan	Fast Excitation Energy Transfer in Supramolecules and Oligomers
Molecular Excitation Chemistry	Huazhong University of Science & Technology	China	Evaluation of the Photocatalytic Activity of Au/TiO ₂ Nanocomposite Particles
Molecular Excitation Chemistry	Tongji University	China	Formation and Photodissociation of Intramolecular Dimer Radical Ions

6) Symposia, Seminars, Workshops and Lectures

2009/5/26	Visual Interaction for Intelligent System
2009/6/26-27	Workshop of Molecular Nano-Mechanics & Bio-Mechanics Research Group, Post-Silicon Materials and Devices Research Alliance
2009/7/1	Current Challenges in Vision-Based Driver Assistance Systems / Skeletal curves in 3D images of human brain tissue
2009/8/3-6	The 2nd CMD Workshop Indonesia
2009/9/5-6	International symposium of Post-Silicon Materials and Devices Research Alliance Project
2009/9/8-10	International symposium "Innovative nanoscience of supramolecular motor proteins working in biomembranes"
2009/9/18-19	International Meeting on Interdisciplinary Chemistry 2009
2009/9/14-18	The 15th Computational Material Design Workshop
2009/9/22-9/23	The 2nd ASIAN CMD Workshop Philippines

2009/10/8	1 st Workshop of College of Science and Technology, Korea University and SANKEN, Osaka University
2009/10/9	Workshop of New Functional Nano-Electronics Research Group, Post-Silicon Materials and Devices Research Alliance
2009/10/21	Human Vision Property and Brain Function
2009/10/31-11/3	2009 Korean-Japan Bilateral Symposium on Frontier Photoscience
2009/11/17	Workshop between ISIR, Osaka University. and IIS, University of Tokyo
2009/11/19-21	Carbon nanotube nano-electronics
2009/11/26	Workshop of Molecular Nano-Electronics Research Group, Post-Silicon Materials and Devices Research Alliance
2009/11/30-12/1	Membrane-Drug Interaction Symposium
2009/12/3	SANKEN 70 th Anniversary symposium
2010/1/18-19	The 13th SANKEN International Symposium ,the 8th Nanotechnology Center Symposium , The 3rd SANKEN MSTeC Symposium ,The 2nd SANKEN Alliance Symposium
2010/1/21	Research meeting 2009 of Materials Science&Technology Research Center for Industrial Creation
2010/2/5-6	The 1st Symposium for Emergent chemistry of nano-scale molecular systems
2010/3/9-13	The 16th Computational Material Design Workshop
2010/3/10	Joint Symposium 2009 on Materials Science & Technology Research Center for Industrial Creation and Post-Silicon Materials and Devices Research Alliance
2010/3/15	PKU ECCS- OU ISIR ICT Collaborative Laboratory Seminar
2010/3/17	The 46th Japan Society of Applied Physics School: The Introduction to Computational Material Design
2010/3/24	Commemorative Symposium for the Establishment of Network Joint Research Center for Advanced Materials and Devices

Other Lectures and Seminars

2009/4/8	Advenit Makaya	National Institute of Advanced Industrial Science and Technology	Research Scientist	Fabrication of porous iron- and aluminum-alloys using solubility gap of gaseous atoms
2009/4/14~ 2009/4/15	Yumiko Takatsuka	University of California, Berkeley	Associate Specialist	Covalently linked trimer of the AcrB multidrug efflux pump provides support for

				the functional rotating mechanism
2009/4/15	Keiji Nagano	School of Dentistry, Aichi Gakuin University	Lecturer	Kinetic behavior of the major multidrug efflux pump AcrB of Escherichia coli
2009/4/22~ 2009/4/30	Allard Daniele	Dalhousie University	Assistant Professor	Cultural differences in language education
2009/6/5	Shigeki Imai	Systems Engineering Laboratories, Corporate Research and Development Group, Sharp Corporation	Director	Circuit technology for system display
2009/6/5-6/6	Michihiro Kasahara	Teikyo University	Visiting Professor	Research on substrate recognition mechanism of sugar transporter - focus on Vander Waals Forces
2009/6/5-6/6	Toshiko Kasahara	Teikyo University	Lecturer	Research on substrate recognition mechanism of sugar transporter - using comprehensive yeast proteome analysis
2009/6/6	Maged El-Kemary	Kafrelsheikh University	Professor	Fluorescence modulation and photodegradation characteristics of safranin O dye in the presence of ZnS nanoparticles
2009/6/17	Kenji Doya	Okinawa Institute of Science and technology	Department Head	The brain mechanism of reinforcement learning
2009/6/23	Shuji Hisaeda	Cambridge Soft	International Marketing, Manger	Chem Bio Office
2009/6/26	Shinichi Nakatsuji	University of Hyogo	Professor	Organic Functional Dye Materials
2009/6/26	Minoru Yamaji	Gumma University	Associate Professor	Photochemical formation of 4-tert-butyl-4'-methoxydibenzoylmethane via the Norrish Type II reaction

2009/7/3	Dae Won Cho	Korea University	Professor	Photochemistry of carboranes
2009/7/10	Masasuke Yoshida	Kyoto Sangyo University	Professor	How does chaperonin assist the folding of newly-synthesized proteins
2009/7/27	Michael BORSCH	Physikalisches Institut, Universitat Stuttgart	Research group Leader	Subunit movement in individual ATP synthases during ATP synthesis/hydrolysis revealed by single-molecule FRET
2009/7/31	Jungkweon Choi	KAIST	Professor	Photochemical detection of protein dynamics
2009/8/10	Shigeki Imai	Systems Engineering Laboratories, Corporate Research and Development Group, Sharp Corporation	Director	Fundamentals of TFT circuit
2009/8/24	Tomohide Takami	Department of Chemistry and Materials Science Program Washington State University	Specially Appointed Assoc. Prof	Exploring and manipulating single organic molecules
2009/8/27	Yutaka Matsuo	School of Science the University of Tokyo	Specially Appointed Prof.	Design and Synthesis of Fullerene Derivatives for Photocurrent Conversion Devices
2009/9/2~ 2009/9/4	Shigeki Imai	Systems Engineering Laboratories, Corporate Research and Development Group, Sharp Corporation	Director	Fundamentals of TFT process technology
2009/9/2~ 2009/9/4	Kenji Yoneda	Semiconductor Devices	Chief Engineer	Fundamentals of cleaning technology for fabrication of LSI

		Development Center, Semiconductor Company, Matsushita Electric Industrial Co., Ltd.		
2009/9/4	Sun, X. F.	University of Science and Technology of China	Professor	Thermal Conductivity in High-Tc Cuprate Superconductors
2009/9/9	Nathan Luedtke	Organic chemistry Institute University of Zurich	Associate Professor	Fluorescent probes for G-quadruplex DNA
2009/9/16	Masamichi Sakai	Saitama University	Associate Professor	Electrical Transport Mechanism and its Control at Metal-Hydrogen Coordinate Space
2009/9/28~9/30	Billy K.C. CHOW	The University of Hong Kong	professor	Growth hormone releasing hormone and its receptor
2009/10/2	Takayoshi Arai	Chiba University, Graduate school of Science	Associate Professor	Rapid Screening of Solid-phase Reactions Using Circular Dichroism: Search, Optimization, and Creation of Novel Asymmetric Catalysis
2009/10/2	Atsushi Nishida	Graduate School of Pharmaceutical Sciences, Chiba University	professor	Synthesis of Polycyclic Alkaloids
2009/10/14	Thomas Helmut Fauster	Universität Erlangen-Nürnberg	professor	Time-resolved two-photon photoemission spectroscopy for semiconductor surfaces
2009/10/16	Kenji Sugase	Suntry Institute for Bioorganic Research	Research group Leader	Conformational dynamics of intrinsically disordered protein using NMR relaxation dispersion method.
2009/10/16	Shigeki Imai	Systems Engineering Laboratories, Corporate Research	Director	Ultra-low power system display

		and Development Group, Sharp Corporation		
2009/10/21	Ajit P. Varki	Departments of Medicine and Cellular&Molecular Medicine, University of California at San Diego	Distinguished Professor	Sialobiology: A "Hot-Spot" in Human Evolution and Disease?
2009/10/22	Masahiro Kimura	Ryukoku University Department of Electronics and Informatics	professor	Social Network Analysis based on Information Diffusion Model
2009/11/11	Ryohei Fujimaki	Common Platform Software Research Laboratories NEC Corporation	Researcher	Linear Time Model Selection for Mixture of Heterogeneous Components
2009/11/19	Phil Baran	Scripps Research Institute	professor	Aiming for the Ideal Synthesis
2009/11/22	Takashi Yonetani	University of Pennsylvania	professor	Protein dynamics explain the allosteric behaviors of hemoglobin
2009/11/24	Duck-Kyun Choi	College of Engineering, Hanyang University	Professor	Current researches on the high quality TFTs and multi-bit NFGM
2009/11/27	Jungbea Kim	Korea University	professor	Nanobiocatalysis and its potential applications in biofuel cells
2009/12/3	Fumiyoshi Saito	Institute of Multidisciplinary Research for Advanced Materials, Tohoku University	Director	Great Expectation to the Net-work Type Collaboration research for Materials Creation from the Viewpoint of Nano-to Macro-Scale and New Process Development
2009/12/3	Hiroaki Misawa	Hokkaido University	Director	Advancement of Photoscience Based on Nanotechnology

2009/12/3	Takashi Tastumi	Tokyo Institute of Technology Chemical Resources Laboratory	professor	Synthesis of porous materials of new design and their applications
2009/12/3	Jun Takahara	Kyusyu University	professor	Precise Structure Control of Soft Interfaces and Their Surface Functional Properties
2009/12/14	Frederick G. West	Department of Chemistry University of Alberta	professor	Chemistry of Ammonium, Oxonium and Sulfonium Ylides, and Application to Natural Product Synthesis
2009/12/17	ABDEL-MOLA Mohaned Almokhtar	Assiut University	associate professor	Magnetic Semiconductor Quantum Well Structures and Magnetic Polaron
2010/1/8	Takashi Tomita	Research Center for Advanced Science and Technology	Visiting Professor	Fundamentals of silicon solar cells and TFT
2010/1/20	Andreas Marx	University of Konstanz	professor	DNA Polymerases: From Insights into Mechanisms to new Applications
2010/1/21	Micheal L. Turner	Organic Materials Innovation Center School of Chemistry, University of Manchester	professor	Soluble Phenylenevinylene Polymers by Ring Opening Metathesis Polymerisation
2010/1/25	Takashi Tomita	Research Center for Advanced Science and Technology	Visiting Professor	Fundamentals of solar cell processes and systems
2010/2/5~ 2010/2/6	Yoshio Okamoto	Nagoya University	honorary professor	evaluation
2010/2/5~ 2010/2/6	Teizo Kitagawa	Toyota Physical and Chemical Research Institute	Fellow	evaluation

2010/2/5~ 2010/2/6	Kazumi Matsushige	Organizations Related with Electricity and Electronics in Kyoto University	professor	evaluation
2010/2/5~ 2010/2/6	Koji Kaya	RIKEN Next-Generation Supercomputer R&D Center	Director	evaluation
2010/2/6	Masami Ogitani	Graduate School of Information Science and Technology The University of Tokyo	professor	Lecture
2010/2/5~ 2010/2/6	Kenichi Yoshikawa	Kyoto University	professor	Lecture
2010/3/17	Stephen Graham Davies	University of Oxford	professor	Total Asymmetric Synthesis of Amino Polyols
2009/8/6	Sung Sik Kim	Jeonbuk University	professor (Nanotech center)	Photochemical formation of metal nanoparticles
2009/9/2	Prashant V. Kamat	NotreDam University	professor	Carbon Nanostructures for Light Energy Conversion
2009/9/2	Wonyong Choi	POSTECH	professor	Solar Chemical Conversion through Photocatalysis
2009/9/7	David G. Whitten	University of New Mexico	professor (Nanotech center)	Conjugated Polyelectrolyte Materials
2009/10/7	David G. Whitten	University of New Mexico	professor (Nanotech center)	Biocidal Conjugated Polyelectrolytes
2009/11/15	Miguel A. Miranda	Universidad Politecnica de Valencia	professor	Photoinduced Electron-Transfer Cycloreversion

2009/12/24	Sung Sik Kim	Jeonbuk University	professor	Photo induced Electron-Transfer of Supramolecules
2010/1/20	Johan Hofkens	Katholieke Universiteit Leuven	professor	Polymers and single molecule fluorescence spectroscopy
2010/1/22	Kwang-Jin Hwang	Hongik University	professor	Fragmentation of Photosensitive Molecules on Solid Surface for Nanopatterned Alkyne Formation
2010/2/12	Sae Chae Jeoung	KRISS (Korea Research Institute of Standards and Science)	Senior researcher	Femtosecond laser ablation and its application to medical operation
2010/2/16	Jui-Hsiang Liu	National Cheng Kung University	professor	Biphotonic effect-induced phase transition in dye-doped cholesteric liquid crystals

7) Public Information Activity

Public information activity of ISIR in 2009 is as follows:

- Bulletin of ISIR 2009 (in both Japanese and English)
- Memoirs of the Institute of Scientific and Industrial Research, Osaka University Vol.66 2009 (in English)
- Annual Report of ISIR 2009 (in Japanese)
- SANKEN News Letters, 37-39(in Japanese)
- Report on SANKEN TECHNO SALON 2009 (in Japanese)
- WWW home-page (<http://www.sanken.osaka-u.ac.jp/>)
(English version is available.)

8) Research Reports

The number of scientific and technological papers published in 2009 is 426. The details are described in the part of activity of divisions and facilities.

9) Scientific Awards

H.Nakajima	Medal with Purple Ribbon	2009/4/29
H.Asahi	Osaka University Award for Outstanding Contributions to	2009/5/21

	General Education	
S.Suzuki	HIGH TEMPERATURE SOCIETY OF JAPAN "Best Reviewer Award"	2009/5/27
K.Nishino	Kao Foundation for Arts and Sciences Award	2009/6/1
K.Matsumoto	Catalysis Today Most Cited Author 2004-2008	2009/6/8
Y.Kou	JAMI Encouragement Award	2009/6/13
T.Washio	JSAI Contribution Award	2009/6/18
R.Mizoguchi	JSAI Contribution Award	2009/6/18
R.Mizoguchi	JSAI Fellow	2009/6/18
R.Mizoguchi Y.Hayashi	JSAI Incentive Award	2009/6/18
T.Ikeda	Japan Radioisotope Association Paper Award	2009/7/1
T.Kawai	Best Paper Award(ISSP 2009)	2009/7/10
T.Yanagida	Best Paper Award(ISSP 2009)	2009/7/10
Y.Yagi	Demo Session Award(Meeting on Image Recognition and Understanding 2009)	2009/7/22
R.Sagawa	Demo Session Award(Meeting on Image Recognition and Understanding 2009)	2009/7/22
A.Saeki	ICPAC Prizes 2008 for Young Chemists	2009/8/2
H.Sasai	Terahedron:Asymmetry Most Cited Paper 2006-2009 Award	2009/9/7
S.Takizawa	Terahedron:Asymmetry Most Cited Paper 2006-2009 Award	2009/9/7
S.Suzuki	The Japan Institute of Metals The Best Paper Award (Materia Japan)	2009/9/15
N.Taniguchi	HUPO Distinguished Service Award	2009/9/30
K.Nishino	Distinguished Investigator Award from the Astellas Foundation for Research on Metabolic Disorders	2009/10/17
T.Nakai	JB Paper Award	2009/10/21
H.Tanaka Cha Nam-Goo T.Kanki	Best Paper Award(2009 Fall Conference of Korea Physics Society)	2009/10/23
Y.Kitamura	Certificate of Merit for Frontier Achievement(The Japan Society of Mechanical Engineers (JSME), The Design and Systems Division)	2009/10/29
I.Mitsugami	SPC2009 Best Paper Award (International Conference on	2009/10/30

	Security Camera Network, Privacy Protection and Community Safety 2009)	
Y.Hayashi	Nominated for Best Technical Paper Design Award	2009/12/2
H.Sasai	Asian Core Program Lectureship Award	2009/12/2
H.Nakajima S.Suzuki K.Sugihara	The Japan Institute of Light Metals Kansai Branch/Best Poster Award	2010/1/6
S.Takeuchi	JSPS Prize	2010/2/12
S.Takizawa	Daiichi sankyo Awar in the Society of Synthetic Organic Chemistry,Japan	2010/2/19
K.Kaihatsu	Incentive Award(Biobusiness Competition Japan 2010)	2010/2/10
K.Takenaka	Meiji Seika Award in Synthetic Organic Chemistry, Japan(The Society of Synthetic Organic Chemistry, Japan)	2010/2/19
Y.Yagi	Fellow(IPSJ)	2010/3/9
H.Nakajima R.Nakamura	G-COE(ASFMD)/Best Poster Award	2010/3/13
H.Nakajima	JSME Kansai Branch Award	2010/3/16
T.Kozawa	Paper Award of Silicon Technology Division, The Japan Societyof Applied Physics	2010/3/18
S.Tagawa	Paper Award of Silicon Technology Division, The Japan Societyof Applied Physics	2010/3/18

2. Education

ISIR accepts graduate students (220) from the Graduate Schools of Science, Engineering, Engineering Science, Pharmaceutical Science, Information Science and Technology, and Frontier Biosciences, and also researchers for special training, including those from industry and from abroad.

Staff members also belong to various Faculties: Faculty of Science, Faculty of Engineering, Faculty of Engineering Science, Faculty of Pharmaceutical Science, Faculty of Information Science and Technology, and Faculty of Frontier Biosciences. Some members belong to two Faculties. They give lectures for graduate and undergraduate students in each Faculty.

Number of graduate students as of March 31, 2010 is as follows.

Field Course	Science	Engineering	Engineering Science	Pharmace- utical Science	Information Science and Technology	Frontier Biosciences	Total
Master Course	59	49	11	9	16	7	151
Doctor Course	21	31	6	2	5	4	63
Total	80	80	17	11	21	11	220

Number of students who had obtained Master's or Doctor's Degree in 2009 is as follows.

Field Degree	Science	Engineering	Engineering Science	Pharmace- utical Science	Information Science and Technology	Frontier Biosciences	Total
Master Degree	28	22	4	4	7	3	68
Doctor Degree	6	7	3	1	1	0	18
Total	34	29	7	5	8	3	86

3. International Exchange

1) Exchange Agreement

Academic Exchange Agreements are now concluded with the following 18 organizations.

- Faculty of Natural Science, Otto-von-Gueriche University Magdeburg (Germany)
- College of natural Science, Chungnam National University (Korea)
- Forschungszentrum Jülich GmbH (Germany)
- University College London (U.K.)
- College of Natural Sciences, Pusan National University (Korea)
- Research Institute of Industrial Science, Hanyang University (Korea)
- College of Science, National Taiwan University (Taiwan)
- Pacific Northwest National Laboratory (U.S.A.)
- Centre National de la Recherche scientifique : CNRS (France)
- Rwth Aachen University (Germany)
- College of Engineering, Gyeongsang National University (Korea)
- College of Natural Science, Chungnam National University (Korea)
- Institute of Remote Sensing and Geographical Information System, Peking University

(China)

- College of Science, National Taiwan Normal University (Taiwan)
- Faculty of Science, University of Geneva (Switzerland)
- Inner Mongolia Normal University (China)
- Korea University , College of Science and Technology (Korea)
- Indian Institute of technology Delhi, Department of Physics (India)

2) Foreign Researchers and Students

Number of foreign researchers and students staying in ISIR as of March 31, 2010 is 62 in total. Details are, Research Associates (9), Part-time Employee (16), Graduate Students (37:Doctor Course,20, Master Course,17). Their nationalities are: Korea(21), China(17), India(3), Viet Nam(8), Italia(1), U.S.A. (1), Russia(1), Brazil(1), Bangladesh(2), Thailand(1), Malaysia (1), Venezuela(1), U.K(1), Spain(1), Russia(1), U.S.A(1),Indonesia(1), Russia(1), Brazil(2), Bangladesh(3), Malaysia (1), Venezuela(1), Egypt(1),Iran(1),Turkey(1)

Foreign visitors in 2009 are as follows:

Korea (25), China(21) ,Taiwan(1) ,India (1) , Viet Nam(8) , Italia(1), U.S.A. (1), Russia (1), Brazil(1), Bangladesh(2), Thailand(5),Malaysia (1), Venezuela(1), Egypt(1), Iran(1) , Turkey(1),Canada(3),Mexico(2), Germany (3), Netherland(1), Switzerland(1)
Total 90.

3) International Conferences and Symposiums

Number of presentations (plenary, invited, oral and poster in various international conferences and symposia) by staff of ISIR is 497 in total.

Number of ISIR staffs who have been working as committee members of International Conferences or Editorial Board of international academic journals are 174 in total. For more details, see the part of activity of divisions and facilities.

4. Concluding Remarks

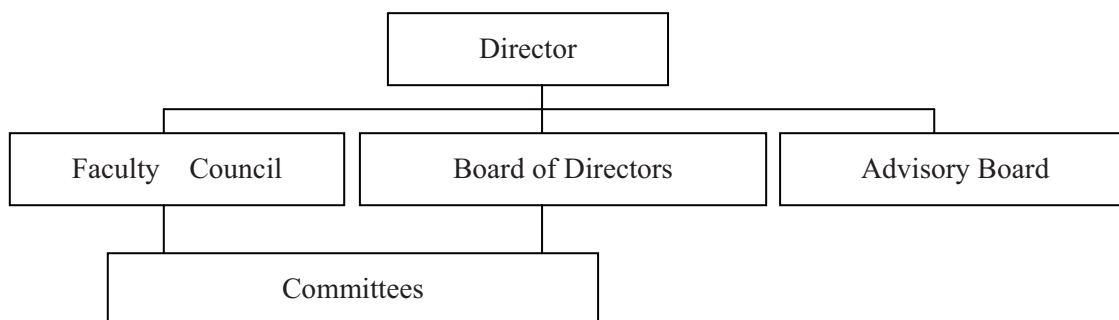
(1) Organization and Management System

After the reorganization in this spring (April 2009), ISIR has three major research divisions, Division of Information and Quantum Sciences, Division of Materials and Beam Sciences, and Division of Biological and Molecular Sciences, and one permanent research center “Nanoscience and Nanotechnology Research Center”. In addition, ISIR contains two divisions for special purposes named “Division of Next Industry Creation”

and “Division of Special Project Research”. The latter division contains independent laboratories supervised by associate professors with limited terms selected from young assistant professors of ISIR for promotion of young scientists. ISIR also has two research supporting centers, “Comprehensive Analysis Center” and “Research Laboratory for Quantum Beam Science”. Inter-institute project research, “Materials Science & Technology Research Center for Industrial Creation” and “Post-Silicon Materials and Devices Research Alliance” has been successfully finished in 2009 and the new inter-institute collaboration named “Strategic Alliance Project for Creation of Nano-Materials, Nano-Devices and Nano-Systems” on the basis of the Network Joint Research Center for Materials and Devices has been started in 2010. In the ISIR, the following facilities are also installed; Workshop, Office of Information Network, Laboratory of Radio-isotope Experiments, Library, Academia-Industry Relation Office, Public Relations Office and Technical Division.

Management of ISIR is performed by the Director and the Board of Directors supervised by the Faculty Council composed of all ISIR professors. Advisory Board has been set up to introduce opinions from outside into the Institute. Advisory Board has been set up to introduce opinions from outside into the Institute.

【Organization of ISIR】



(2) Research Activities

In 1997, Harmonized Materials Research Group was designated as one of the Centers of Excellence (COE) of Ministry of Education, indicating the high research activity of the Institute.

From 2002 through 2006, we have awarded as the best group in 21 Century COE program that is originally the top 20 group plan in Japan. This involves the positive exchange between different laboratories which yield results of the global level with respect to material, information and biotechnology.

In 2005, Materials Science & Technology Research Center for Industrial Creation

has launched as a joint Center between ISIR and Institute of Multidisciplinary Research for Advanced Materials, Tohoku University. It was expanded to Post-Silicon Materials and Devices Research Alliance for collaboration with four university institutes in 2006.

In 2010, nationwide Network Joint Research Center for Materials and Devices including five university institutes has been started. ISIR is a headquarter of the network.

ISIR's research environment as facilities and equipments has been becoming better. A new building was constructed in 2001 and 2003 to the increased number of scientists and the development of Nanotechnology, respectively and Nanoscience and Nanotechnology Center started in April 2002. In addition, the total repair of the old buildings into the earthquake-resistant structures has been completed in 2010. A new building named "SANKEN Incubation Building" has been completed in 2010 for open innovation by academia-industry collaboration.

(3) Education

Considering objective of ISIR, supporting the graduate and undergraduate education is one of the important missions.

ISIR has over 200 graduate students coming from 6 different graduate schools and faculties such as Science, Engineering, Engineering Science, Pharmaceutical Science, Frontier Biosciences and Information Science and Technology.

In 2009, we have set up the Centre for Research Education and Training in order to promote the ISIR original education on research. We already have ISIR original lecture "Nano Engineering" in Graduate School of Engineering. We aim to expand the ISIR original lectures authorized by various graduate schools in Osaka University as a sub-program.

The Sanken Techno-Salon is one of forums to exchange information between our staff member and the people from industries specializing in electronics, organic chemicals, semiconductors, drugs, etc. We have also seminars for providing seeds of new technologies to the industrial communities. The Institute aim to grow researchers and students with the best humanity, capable of innovation of their specific fields of research from basic point of view.

(4) Contribution to Societies

As the fast-paced advancement of science and technology and the rapid alteration of social and industrial structures, we must further recognize as the Institute open to society and industry. We consistently strive to deepen our cooperation with society

through positively opening of facilities, intellectual properties and achievements to meetings (ex. Sanken Techno Salon) and publications. Through them, we will be able to transfer our industrial seeds for new technology and exchange ideas for new materials. They have been highly evaluated that we have done joint researches with other university/industry.

In April 2005, AIR-office (Academia Industry Relations Office) has been settled in order to strengthen cooperation between the Institute and industries.

In 2008, Research Association of Industry and Science (RAIS), which is ISIR-supporting association having a history of 70 years, was reorganized, set up bureau office in ISIR and the bureau chief was adopted in order to promote and support the academia-industry cooperation.

In 2010, “Company Research Park” opens in the new SANKEN Incubation Building as Osaka University’s first rental laboratories for business enterprises.

(5) International Exchange

International Exchange is one of indispensable element for our Institute. We are trying to open the door widely to invite more researchers and students from other countries, and we have 3 kind of International exchange, Academic Exchange, Student Exchange and branches in France and USA. At present (March, 2008), 57 foreign researchers and students join in the Institute. International Conferences sponsored by our Institute have been held twice a year since 1998. It’s so important to release our results towards all over the world and have a chance to exchange opinions with foreign scientists.

In 2009, Center for International Collaboration was started for promoting the foreign exchange. Under the Center, three collaborative laboratories between foreign universities have been set up or in preparation as follows: ICT Collaborative Laboratory between the School of Electronics Engineering and Computer Science, Peking Univ. And ISIR, Collaborative Laboratory between College of Science and Technology, Korea Univ. And ISIR, and Collaborative Laboratory between Faculty of Mathematical and Physical Sciences, Univ. College of London and ISIR in Areas Relating to Excited Surface Science.

(6) Future Plan and Prospect

In 2010, nationwide “Network Joint Research Center for Materials and Devices” has been started. It is a greatest collaboration network between university institutes in Japan. ISIR plays a leading role in the network as the headquarters. At the same time,

our SANKEN Incubation Building will open for the core of academia-industry collaboration. So, we will advance to the next step of our ISIR in the next year.

In order to respond with flexibility to our quickly changing society, along with the rapid development of science and technology, we must understand our role of society and in order to stay effective and relevant Institute for industries, we must make independent researches and release widely our intellectual properties and achievement.

Keeping development of science and technology in Japan, we must cultivate researchers capable of producing academic and professional results that will benefit the people living on this planet. ISIR grow researchers and students who can active in the world.

You can see about ISIR on the following URL. (<http://www.sanken.osaka-u.ac.jp/>) The Institute of Scientific and Industrial Research keeps making efforts toward higher level contribution to science and industries, and keeps learning.

Activities of Divisions

Division of Information and Quantum Sciences

Outline

The advent of the digital society where tremendous amount of information is electronically accessible has brought the intelligent information processing technologies indispensable. This division consists of eight departments; Information Science Departments (Knowledge Systems, Intelligent Media, Architecture for Intelligence, Reasoning for Intelligence), Quantum Science Departments (Photonic and Electronic Materials, Semiconductor Electronics, Advanced Electron Devices, and Quantum Information Photonics [Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.]). The former four and the latter four departments aim to establish fundamental techniques to support the advanced digital society in terms of software and hardware technologies respectively. The departments on the former software technologies work on the task of computerizing the intelligent human information processing capability to help solving difficult engineering problems and assist intellectual activities. The departments on the latter hardware technologies pursue various approaches in the fields of electronic materials design and tailoring, surface physics, nanometer scale materials fabrication and characterization, semiconductor nanostructures for quantum devices, semiconductor-based new bio/chemical sensors, organic materials and biomolecules

We challenge to output world-widely significant achievements under our systematic cooperation, and further collaborate with researchers of domestic and overseas universities, research institutes and private companies. Moreover, we educate many graduate students belonging to Graduate School of Science (Department of Physics), Graduate School of Engineering (Department of Electrical, Electronic and Information Engineering, Department of Applied Physics), Graduate School of Engineering Science (Department of Materials Engineering Science), and Graduate School of Information Science and Technology (Department of Computer Science, Department of Information and Physical Sciences) under the aim to grow young researchers having both advanced knowledge and wide research scopes.

Achievements

- * Crystal growth, characterization and device application of new semiconductors
- * Quantum nanodevices and biosensor application using graphene and nanochube
- * Development of solution-crystalized organic transistors with the highest mobility
- * Commercial tool named OntoloGear for describing functional knowledge
- * Dense 3D Reconstruction Method Using a Single Pattern for Fast Moving Object
- * Introduction of sensors to Constructive Adaptive User Interfaces
- * Knowledge discovery from complex data, causal analysis and combinatorial discovery
- * The world largest-class photonic quantum circuit 'entanglement filter'

Department of Photonic and Electronic Materials

Professor: Hajime ASAHI
Associate Professor: Shigehiko HASEGAWA
Assistant Professor: Shuichi EMURA
Assistant Professor: Yi-Kai ZHOU
Post Doctoral Fellow: Daivasigamani KRISHNAMURTHY
Graduate Students: Jong-Uk SEO, Hiroyuki TAMBO, Siti Nooraya MOHD TAWIL
Kang-Min KIM, Takasi KUCHIYAMA, Kotaro HIGASHI
Rina KAKIMI, Masane KIN, Yuji SAKAI, Motoki SOTANI
Hiroatsu TANI, Seiichi HAYASHI, Akio YAMANO
Jin-Qiang LIU, Daijiro ABE, Shogo NONOGUCHI
Peng-Han FAN, Takaaki FURUYA, Fumio YUKAWA
Undergraduate Student: Hiroya ICHIHARA, NamSoo AHN
Research Student: Li ZHOU
Support Staff: Akiko WATANABE

Outline

The department of Photonic and Electronic Materials makes research on materials, mainly semiconductors and related materials, and processing on them. Four steps are required in materials research, that is, materials design, materials synthesis (crystal growth) and processing, materials characterization, and device application. In materials design, study on finding required characteristics by changing the combination and ratio of atoms is conducted. In materials synthesis, study on molecular-beam epitaxy growth is mainly carried out. In materials characterization, structure investigation by electron diffraction, X-ray diffraction, STM, EXAFS and Raman scattering, optical characterization by photoluminescence, optical absorption and so on, electrical characterization by Hall measurement, and magnetic characterization by SQUID are carried out. In device application, basic researches on photonic devices, electronic devices, and spintronic devices are conducted.

Current Research Projects

1. Crystal Growth and Properties of Diluted Magnetic Semiconductors

Diluted magnetic semiconductors are gathering great interest as a candidate for new functional materials. In 2001, we succeeded in the growth of GaCrN and observed the room temperature ferromagnetism as well as the PL emission. We also observed room temperature ferromagnetism and sharp PL emission for the GaGdN. Then, tunnel magnetoresistance effect was observed for the GaCrN/AlN/GaCrN tunnel diodes. Low temperature growth of high Gd concentration GaGdN with improved ferromagnetism was realized. Further increase of magnetization was obtained by Si co-doping. In 2009, successful growth of InGaGdN was achieved aiming at realization of long wavelength ferromagnetic semiconductors. In GaGdN/AlGaIn quantum well superlattices, giant red shift of PL peak was observed as well as enhancement of magnetization. Results for the existence of magnetic polaron were also observed.

2. Growth, Characterization and Device Application of Semiconductor-Semimetal Mixed Crystals; New Semiconductors Including TI

In 1995, we proposed new semiconductors TlInGaAs in which the bandgap energy is independent of temperature. In 2005, we obtained the small temperature variation of lasing peak wavelength as small as 0.06 nm/K for the TlInGaAs/TlInP/InP SCH LDs. We also proposed the TlInGaAsN/AlGaAs for both temperature-stable wavelength and threshold current LDs. In 2009, by optimizing the layer structures of

TlInGaAsN/TlGaAs/GaAs multi-quantum well (MQW) structures, relatively strong PL emission was obtained. We also obtained similar results for the TlInGaAsN/TlInP/InP MQW structures.

3. Growth of GaN Nanorods and Their Application to Field Emitter

III-V nitride semiconductors gather much interest from the viewpoint of application to light emitting devices as well as devices used in harsh environment. We grew GaN nanorods on Si substrates and obtained the very low threshold electric field of 1.1 V/ μm for FE. In 2009, feasibility of the selective area growth of GaN nanorods on Si was studied toward application of 2-dimensional field emitter arrays using GaN nanorods. It was found that by adjusting the growth temperature and the Ga supply, the selective area growth of GaN nanorods was achievable by using W as a mask.

4. Arranging and Localizing III-V Semiconductors on Si Substrates in a Nano-scale and Their Characterization

III-V semiconductors are attracting considerable attention as channel materials in the future advanced MISFETs with high performance (Beyond Si-CMOS), owing to their high electron mobility. We have demonstrated the selective area growth and arrangement of one separate InP single crystallite for each Si opening (800 nm or 400 nm square) formed on Si substrates masked with SiO₂ by using MBE. In 2009, it was found that when single crystallites coalesced into larger grains beyond Si openings, lattice strains were introduced in the grains because of the difference in thermal expansion coefficient between Si and InP. This clearly shows that the growth of one InP single crystallite for each Si opening is indispensable for growing stress- and defect-free InP regions on SiO₂ toward the application to next generation MOSFETs as the channel materials.

5. Spin Injection from Ferromagnets to Dilute Magnetic Semiconductors and Nanoscaled Characterization of Their Magnetic Properties

Spin injection from ferromagnets to dilute magnetic semiconductors (DMSs) is a very important subject to realize semiconductor spintronic devices as well as to investigate magnetic properties of DMSs using spin-polarized scanning tunneling microscopy (SP-STM). In 2009, we examined magnetic properties of ordered Fe nanodots on GaN coexisting with disordered ones under external magnetic field by using SP-STM. It was found that domains of ordered Fe nanodots were always observed lower in height than those of disordered ones by SP-STM. The difference in height between the ordered and disordered domains showed a hysteresis loop as a function of the external magnetic field. This indicates that boundaries between the ordered and disordered domains correspond to boundaries of magnetic domains.

6. XAFS Characterization of New Functional Materials

XAFS is a spectroscopy-based new characterization technique for analyzing atomic scale structures of materials and is only one technique directly analyzing the atomic arrangements/coordination for amorphous materials as well as very low density elements in materials. The atomic arrangements/coordination in the new functional materials, GaCrN and GaGdN, was characterized and it was showed that the Cr (Gd) atoms substitutionally occupy the group III sites. In 2009, GaGdN/AlGaIn multi-quantum well (MQW) structures and the MQW in rod form including Gd is vigorously examined on the coordination of Gd by the XAFS method. The Gd ions possibly locate at the interfaces because of the ultra- thin thickness of the well layer GaGdN. This may strongly affect to the ferromagnetism. Under the present growth conditions, we have no remarkable evidence for such situation.

Department of Semiconductor Electronics

Professor: Kazuhiko MATSUMOTO
Associate Professor: Koichi INOUE, Kenzo MAEHASHI
Assistant Professor: Yasuhide OHNO
Graduate Students: Yasuki YAMAMOTO, Tomoki TSUJI,
Takaomi KISHIMOTO, Takahiro OHORI,
Yasufumi HAKAMATA, Yusuke YAMASHIRO
Under Graduate Students: Satoshi OKUDA, Yasuyuki SOFUE
Supporting Staff: Misa KURIO

Outlines

Semiconductors quantum structures, where electrons and photons play remarkable roles owing to quantum effects, are expected to show superior properties. We study the basic problems in the fabrication and the characterization of such quantum structures in the atomic scale. The research activities include applications to new devices based on the quantum effects with the coherent ballistic transport of carriers and electron-photon interactions.

Carbon nanotubes (CNTs), especially single-walled carbon nanotubes (SWNTs), and single-layer graphene, are promising materials to realize quantum-effect devices because of their unique nano-structures. As a sensor of single charge or spin with the high sensitivity, the formation and characterization of field-effect transistors (FETs) and single electron devices using carbon nanotubes and graphene are studied using thermal chemical vapor deposition method, Raman scattering spectroscopy, scanning probe microscopy, and photoluminescence spectroscopy.

Current Research Project

Raman scattering study of SWNTs in the early growth stages of the laser-irradiated chemical vapor deposition

Under the intense laser irradiation onto substrate surfaces with Co catalyst at an atmosphere of ethanol vapor, the synthesis of SWNTs starts in a few seconds and continues during the irradiation. It is possible to stop the SWNT growth at any time by controlling the irradiation time. Thus we investigated the products in early growth stages of LICVD by Raman scattering spectroscopy and scanning electron microscopy. The results have revealed that SWNTs with small diameters are mainly grown in the early growth stages.

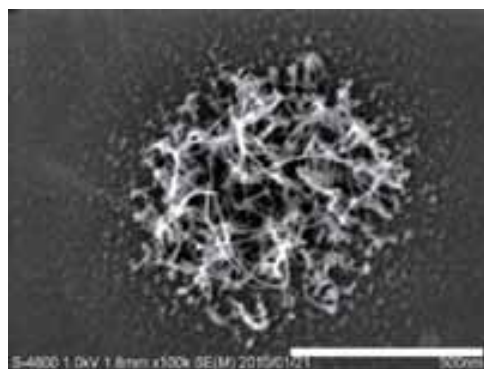


Fig.1 SEM image of SWNTs grown at a small spot in the early growth stage of LICVD.

With increasing the laser irradiation time, some SWNTs with larger diameters are contained in the growth products. This fact suggests that the diameters of catalyst nanoparticles become large due to the migration of catalyst during the LICVD processes.

Logic gates based on carbon nanotube field-effect transistors

We demonstrated logic gates based on complementary carbon nanotube field-effect transistors (CNT-FETs) with SiN_x passivation films deposited by catalytic chemical vapor deposition. The carrier type of CNT-FET was controlled by forming SiN_x passivation films. Electrical measurements revealed that the p-type characteristics of CNT-FETs were converted to n-type characteristics after the deposition of SiN_x passivation films. Then, the n-type CNT-FETs with SiN_x passivation films were reconverted to p-type CNT-FETs by annealing in N_2 atmosphere. As a consequence, high-performance complementary voltage inverters comprising p- and n-type CNT-FETs with SiN_x passivation films were demonstrated on the same SiO_2 substrate by conventional photolithography and lift-off techniques.

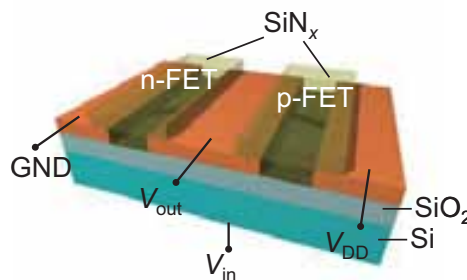


Fig. 2. Logic gate based on CNT-FETs.

Electrolyte-gated graphene field-effect transistors for detecting pH and protein adsorption

We investigated electrolyte-gated graphene field-effect transistors (GFETs) for electrical detecting pH and protein adsorption. Nonfunctionalized single-layer graphene was used as a channel. GFETs immersed in an electrolyte showed transconductances 30 times higher than those in a vacuum and their conductances exhibited a direct linear increase with electrolyte pH, indicating their potential for use in pH sensor applications. We also attempted to direct surface-protein adsorption and showed that the conductance of GFETs increased with exposure to a protein at several hundred picomolar. The GFETs thus acted as highly sensitive electrical sensors for detecting pH and biomolecule concentrations.

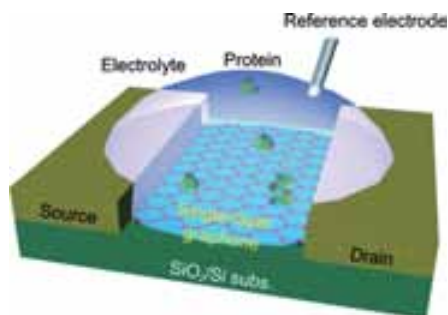


Fig. 3. Electrolyte-gated graphene field-effect transistor.

Department of Advanced Electron Devices

Associate Professor: Koichi SUDOH
Graduate Student: Masakazu OKANO
Under Graduate Student: Junya CHIBA
Supporting Staff: Kiyomi HIRASAWA

Outline

The Department of Quantum Molecular Devices is engaged in study of multi-scale surfaces/interfaces structures and nanoscale properties of materials for development of novel devices that integrate the quantum mechanical features of semiconductors and molecular functions of organic- and bio-molecules. In more concrete terms, we are studying dynamics of surface/interface structures under non-equilibrium conditions such as, relaxation, crystal growth, and interfacial reaction, using scanning probe microscopy.

Current Research Projects

Nonequilibrium Dynamics of Nanostructures on Semiconductor Surfaces

2D phase separation on $\text{SrTiO}_3(001)$ surfaces has been studied using scanning tunneling microscopy (STM). Utilizing the STM nanofabrication technique, homoepitaxial films with coverage of around 0.5 were formed on $\text{SrTiO}_3(001)$ surfaces, and the evolution of the film morphology showing spinodal-like patterns was observed in real time by STM. We have shown the novel relaxation mechanism for a 2D phase separation, which is composed of three different stages, based on the STM observations.



STM images (70 nm × 70 nm)

Fig. 1 2D phase separation on $\text{SrTiO}_3(001)$.

Void Structure Formation in Si by Spontaneous Shape Transformation

When high-aspect-ratio holes fabricated on $\text{Si}(001)$ surfaces are annealed at high temperatures, void structures are formed in the bulk Si. In order to achieve the precise control of the void formation, we have studied the mechanism of the void shape evolution during annealing. From the SEM observation of the void shape transformation, we have revealed that the dominant mechanism for the shape transformation is surface diffusion [Original paper 1]. We have also developed a numerical simulation method for the spontaneous shape transformation of high-aspect-ratio microstructures by surface diffusion, using the Cahn-Hilliard equation.

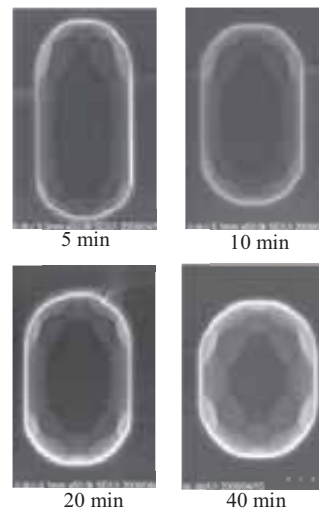


Fig.2 Void shape evolution in Si during high temperature annealing

Department of Intelligent Media

Professor: Yasushi YAGI
Associate Professor: Yasuhiro MUKAIGAWA
Assistant Professor: Ryusuke Sagawa, Yasushi MAKIHARA
Postdoctoral Researcher: Junqiu WANG, Chunsheng HUA, Hai VU, AI MANSUR,
Graduate Students: Ngo Thanh TRUNG, Takashi ANEZAKI, Haruyuki IWAMA,
Seiichi TAGAWA, Nguyen Da TAN, Yuya OHTA,
Yusuke NISHIDE, Atsushi MORI,
Mayu OKUMURA, Yoko BABA, Seiichiro KABASHIMA,
Akira SHIRAISHI, Kazuhiro SAKASHITA
Under Graduate Students: Naoki AKAE, Chika INOSHITA, Tomoya TAKEUCHI,
Shizuka FUJISAWA
Secretary: Masako KAMURA, Noriko YASUI, Makiko FUJIMOTO,
Technical Staff: Aya IYAMA(2009.9.16-), Yoko IRIE(2009.9.16-),
Yoshiko MATSUMOTO(2009.10.1-)

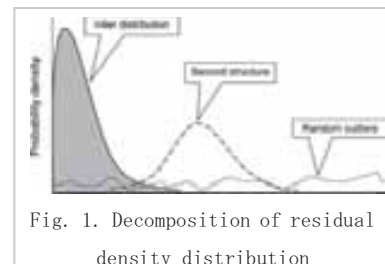
Outlines

The studies in this laboratory focus on computer vision and media processing including basic technologies such as sensor design and camera calibration, and applications such as an intelligent system with visual processing functions. Some of our major research projects are development of a novel vision sensor, including an omnidirectional mirror, calibration of an omnidirectional vision system, video analysis for endoscopic diagnosis assistance, measurement of detailed reflectance properties, gait identification, modeling of environments.

Current Research Project

Highly Robust Estimator Using a Case-dependent Residual Distribution Model

The latest robust estimators usually take advantage of density estimation, such as kernel density estimation, to improve the robustness of inlier detection. However, the challenging problem for these systems is choosing the suitable smoothing parameter, which can result in the population of inliers being over- or under-estimated, and this, in turn, reduces the robustness of the estimation. To solve this problem, we propose a robust estimator that estimates an accurate inlier scale. The proposed method first carries out an analysis to figure out the residual distribution model using the obvious case-dependent constraint, the residual function. Then the proposed inlier scale estimator performs a global search for the scale producing the residual distribution that best fits the residual distribution model. Knowledge about the residual distribution model provides a major advantage that allows us to estimate the inlier scale correctly, thereby improving the estimation robustness. Experiments with various simulations and real data are carried out to validate our algorithm, which shows certain benefits compared with several of the latest robust estimators.



Hemispherical Confocal Imaging using Turtleback Reflector

We propose a new imaging method called hemispherical confocal imaging to clearly visualize a particular depth in a 3-D scene. The key optical component is a turtleback reflector which is a specially designed polyhedral mirror circumscribed an ellipsoid. By combining the

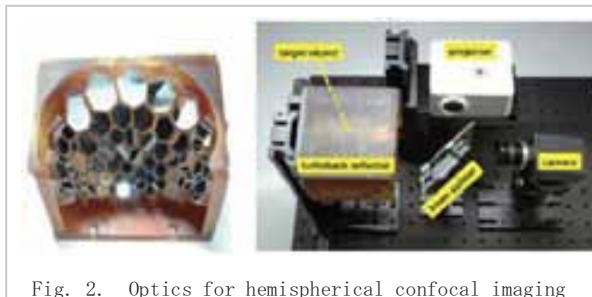


Fig. 2. Optics for hemispherical confocal imaging

turtleback reflector with a coaxial camera and a projector, many virtual cameras and projectors are produced on a hemisphere with uniform density to synthesize a hemispherical aperture. In such an optical device, high frequency illumination can be focused at a particular depth in the scene to visualize only the depth with descattering. Then, the observed views are factorized into masking, attenuation, and texture terms to enhance visualization when obstacles are present. Experiments using a prototype system show that only the particular depth is effectively illuminated and hazes by scattering and attenuation can be recovered even when significant obstacles exist.

3D reconstruction method with detection of dense pattern using the de Bruijn sequence and Belief-Propagation

Dense 3D reconstruction of extremely fast moving objects could contribute to various applications such as body structure analysis and accident avoidance and so on. In this paper, we propose such a technique based on a one-shot scanning method that reconstructs 3D shape from a single image. To realize dense 3D reconstruction from a single image, there are several issues to be solved; e.g. the reconstruct result is sparse because it cannot use a dense pattern. This paper describes the

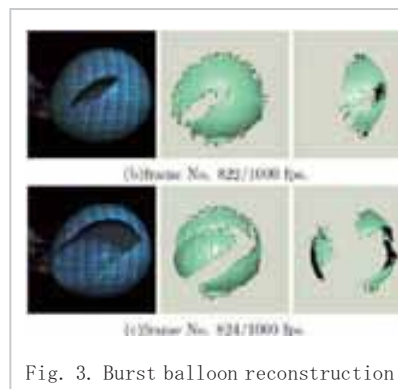


Fig. 3. Burst balloon reconstruction

solutions of the issues by combining two methods, that is (1) extension of shape from intersections of lines method, and (2) efficient line detection technique based on de Bruijn sequence and belief-propagation. In the experiments, the proposed method successfully captured the sequence of dense shapes at high frame rate.

Gait Recognition using Period-based Phase Synchronization for Low Frame-rate Videos

Gait analyses have recently gained attention as methods of identification for wide-area surveillance and criminal investigation. Surveillance videos are generally taken by low spatio-temporal resolution because of limitation on communication band width and storage device. Therefore it is difficult to apply existing gait identification methods to low spatio-temporal resolution videos. In this paper, we propose period-based gait trajectory matching in the eigen space using phase synchronization. A gait can be taken as a trajectory in the eigen space and phase synchronization is done by time stretching and time shifting. Statistical procedures on period-based matching results make robust matching for fluctuation among gait sequences. Experiments of performance evaluation on spatio-temporal resolution demonstrate the effectiveness of the proposed method.

Department of Reasoning for Intelligence

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Yoshinobu KAWAHARA (2009.10.01-)
Graduate Students: Viet Phuong NGUYEN, Vinh Duy NGUYEN
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Outlines

We, humans, extract variety of knowledge from given data by the full use of our reasoning. However, such reasoning ability of humans is so limited that most of the massive and complex data acquired through computer network are wasted without any humans' inspection. To provide efficient remedies to this difficulty, our department studies novel reasoning approaches to extract knowledge from the massive and complex data by using computers. These techniques are named data mining and knowledge discovery. We also study the application of these techniques to variety of fields such as science, information network, quality/risk management, medicine, security, marketing and finance. Recently, we obtained significant outcomes in the research topics of information estimation and knowledge discovery from extremely high dimensional data, knowledge discovery from graph sequence data, discovery of hidden causal structures in data and combinatorial approach to knowledge discovery from high-dimensional data.

Current Research Project

Information estimation and knowledge discovery from extremely high dimensional data

Data consisting of massive variables (extremely high dimensional data) representing numerous events and/or states became available by developments of computer network, ubiquitous sensing and scientific measurement technologies. Examples are sales data of a large scale shopping center under various conditions, global climate data consisting of various and massive meteorological measurements and the profile data of thousands of gene expressions in biological systems. We study novel techniques to estimate variable relations and dynamic mechanisms from such data acquired from large scale and complex structured systems. In this year, we developed filtering techniques to estimate state changes of a large scale objective system and dynamic mechanism governing the changes from a time series data consisting of several hundreds to several thousands measurement variables. These techniques enable to analyze mechanisms and to know the associated knowledge on the systems such as a large scale shopping mall and global earth climates.

Knowledge discovery from graph sequence data

A graph is a powerful data expression that can be used to represent arbitrary relations among entities. In addition, graph sequences can be used to model dynamic changes of objects for many real world applications. For example, a human network is represented by a graph where each human and each relationship of every human pair correspond to a vertex and an edge, respectively. If a person joins or leaves a community, the numbers of vertices and edges in the graph increase or decrease. Similarly, a gene network consisting of genes and their interactions produces a graph sequence in their evolutionary history. In this year, we developed methods for discovering characteristic and useful patterns from complex and massive graph sequence data. Discovered patterns enable us to understand the mechanisms governing the dynamics behind the graph sequences. The main results include algorithms called GTRACE and FRISSMiner to mine frequent patterns from graph sequences.

Discovering hidden causal structures in data

In this year, we develop advanced statistical methods for discovering useful causal structures in data. Such a causal structure is estimated in the form of a graph or a diagram that graphically represents causal relations in an objective system so that it is easily understandable by application experts. The key idea is to extract considerably more information from data than conventional approaches by utilizing non-Gaussianity of data. The idea of non-Gaussianity distinguishes our research from previous works on this line. A promising application is neuroimaging data analysis such as functional magnetic resonance imaging (fMRI) and magnetoencephalograph (MEG). Our method can be applied to brain connectivity analysis. One could model the connections as causal relations between active brain regions. Gene network estimation from microarray data in bioinformatics would be another promising application. Our framework also is a new useful alternative to financial data analysis in economics and traditional questionnaire data analysis in psychology and sociology.

Combinatorial approach to knowledge discovery from high-dimensional data

Against a backdrop of accelerating progress of data acquisition technologies, there are more scenes where we deal with high-dimensional data in a variety of engineering problems, such as bioinformatics, natural language processing and image data processing. Such data processing often requires combinatorial computation, where we select the subset of all dimensions that optimizes some criteria. One example is the problem where we seek to find a small number of genes most related to some disease or symptom in gene sequence data consisting of a huge number of genes. But this kind of computation often becomes intractable in practice because of combinatorial explosion caused by the high-dimensionality of data. In this year, we developed efficient algorithms applicable to such problems using discrete structure of data, especially submodularity (discrete convexity). And, we aimed at discovering important knowledge in a variety of applications by applying the developed algorithms to real-world data.

Department of Knowledge Systems

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Associate Professor:	Yoshinobu KITAMURA, Kouji KOZAKI
Assistant Professor:	Munehiko SASAJIMA
Specially Appointed	
Assistant Professors:	Yusuke HAYASHI, Hiroko KOU, Jun ZHOU(to Apr. 30)
Graduate Students:	Seiji ISOTANI(to Sep. 15), Mamoru OHTA, Kohei SUMITA, Sho SEGAWA, Takeru HIROTA, Jun NAKAYAMADA
Under Graduate Students:	Satoshi NISHIMURA, Keisuke HIHARA
Supporting Staff:	Naomi BANO

Outlines

Information science has developed into knowledge science which is expected to play critical roles in the advanced information processing in this new century. In their daily life, people enjoy higher performance computation and access to vast amount of information sources on WWW. In academic society, on the other hand, the research on artificial intelligence is changing from building stand-alone machines which try to solve problems by themselves to building intelligent partners which augment human capability of problem solving. This division has been run under the philosophy that it contributes not only to the promotion of knowledge science but also to prosperity of the real world by the feedback of the research results to it in the information era. The major topic here is to investigate Ontological Engineering to establish basic theories and technologies for the next-generation knowledge science. The current research projects include: methodology for ontology development and its support environment based on basic theories of ontological engineering, creative design work bench and advanced diagnostic systems based on knowledge systematization, knowledge sharing and reuse, intelligent educational/training systems, and ontology-aware authoring systems.

Current Research Project

1. Ontology: Theoretical Foundation of Knowledge Engineering

We theorized about the fundamental issues on ontology from both scientific and engineering viewpoints. One of the most remarkable achievements is the fact that a book on “Ontological Engineering” has been published from Ohm-sha Ltd. In January, 2005 which is the first book on the topic in Japan. HOZO, an environment for ontology building/utilization, has been augmented to make it a usable tool by revising its GUI and reimplementation of some functions. It has been extended to cope with distributed development of a large ontology and to improve the compliance with the WWW standards. We refined a mapping tool for enabling viewpoint-specific overview of ontologies and have evaluated it through the use by two domain experts of sustainability science and got a very positive result. We have finished building a comprehensive ontology of about 6000 diseases from 12 clinical divisions. We also developed an ontology for interoperability of phenotype descriptions of genomics in the collaboration with experts of RIKEN. Concerning theoretical issues, we have developed a theory and

method on on-demand *is-a* hierarchy organization and started research on an innovative theory of roles by employing the notion of meta-role and on a new theory of parts. In addition, we released an upper ontology named YAMATO, which we have been investigating for years, on the home page of HOZO.

2. Systematization of Functional Design Knowledge

The goal of this research is to promote sharing of knowledge about functionality of artifacts among engineers, which is important for sharing their design know-how and intentions behind design results. Aiming at reducing current difficulties in capturing function consistently, we have developed an ontology-based modeling framework, which provides rich concepts for describing consistent and reusable knowledge. The framework has been deployed successfully in some manufacturing companies. In 2009, aiming at clearer understanding of the notion of function, we investigated ontological distinctions of function and then developed a phase-oriented model of function along the product life-cycle and an evolutionary model along the evolutionary history of creatures. Furthermore, we developed a functional knowledge externalization and sharing tool named OntoloGear based on an advanced XML technology in the collaborative research with the Materials Science and Technology Research Center. In 2009, its usability and functionality have been matured and then its release as a product from a company was announced at a press conference.

3. Methodology for Building Learning Support Systems

The goal of research on intelligent educational systems is to implement the intellectual capability of human teachers on computer systems. Huge efforts have been devoted to the research for the last two decades. However, the research field has not been growing methodologically because of lack of theoretical foundation. In this research project, we have investigated the essential structure of a variety of educational tasks in detail and have proposed of Ontology-Awareness aiming at marriage of learning and educational theories and technology. The latest achievements include the following; 1) trials conducted to investigate the effectiveness of our authoring system in real lesson plan design by teachers, 2) integration of ontologies for individual and collaborative learning, 3) development of a multi-agent system that supports lesson plan design for ICT education and 4) a proposal of an improved framework of meta-cognition and analysis of representative models and learning support systems for meta-cognition.

4. Task Ontology-based Framework for Mobile Internet Services

We can get many kinds of mobile services via mobile handsets today. On the other hand, a large number of services cause difficulties in searching, finding and selecting suitable services for consumer's needs. Users have to learn the menu system to access the services; hierarchical structure of the menu, relation between name of the category and services in the category. To solve this problem this project aims at realization of task-oriented menu which is more efficient for retrieving information. In the task oriented menu, the users seek for services by the name of the directory which represents a task they are involved in rather than the name of category which might be unfamiliar to them. In this research project, we have been developing a task ontology-based modeling framework for mobile service navigation. We continued evaluation of the prototype software in the real field to find that our method works even with real scale.

Department of Architecture for Intelligence

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Under Graduate Students: Teppei KITAGAWA, Yujiro KONAKA, Takashi SHIRAI
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Chiharu WADA (2009.9.1 - 2010.3.31)

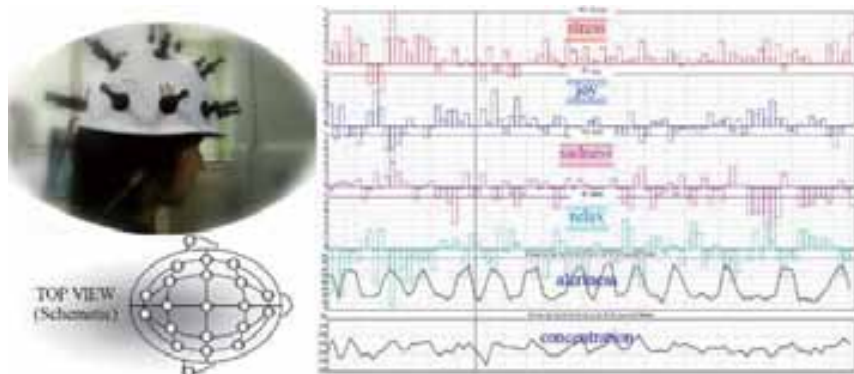
Outlines

The main research objective is to explore basic technology for computer systems, which support human learning and understanding, beyond conventional artificial intelligence. We particularly focus on the process of human-computer interaction to discover and create architecture of intelligence for such systems. We try to produce highly original research with findings from cognitive science, psychology, education, and computer science. Principal issues addressed are as follows: 1. Constructive Adaptive User Interfaces, 2. Intelligent Tutoring System, and 3. Intelligent Ubiquitous Sensor-Networks.

Current Research Project

Constructive Adaptive User Interfaces

This department is developing a computer with learning ability, for which it researches efficient learning algorithms, acquisition of background knowledge for learning, application to Intelligent Tutoring Systems. These are applied to adaptive user interfaces. The conventional adaptive user interfaces only select a good response out of some previously given ones. Although this helps to use interfaces, such as a navigation system, it is not sufficient to stimulate human intelligence or creativity. The department has developed a method to compose a new content adaptively. This technology enables automatic acquisition of human feelings, and automatic music



composition system adapted to personality and emotion of its user.

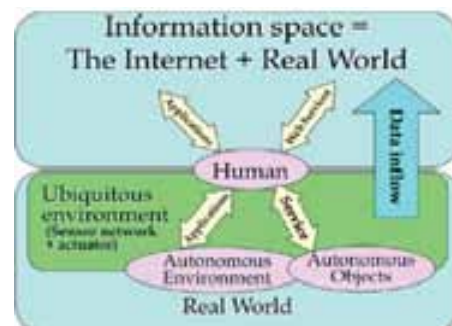
Intelligent Tutoring System

To have an instructional plan guide the learning process is significant to various teaching styles and an important task in an ITS. Though various approaches have been used to tackle this task, the compelling need is for an ITS to improve on its own the plans established in a dynamic way. We hypothesize that the use of knowledge derived from student categories can significantly support the improvement of plans on the part of the ITS. This means that category knowledge can become effectors of effective plans. We have conceived a Category-based Self-improving Planning Module (CSPM) for an ITS tutor agent that utilizes the knowledge learned from learner categories to support self-improvement. The learning framework of CSPM employs unsupervised machine learning and knowledge acquisition heuristics for learning from experience. We have experimented on the feasibility of CSPM using recorded teaching scenarios.

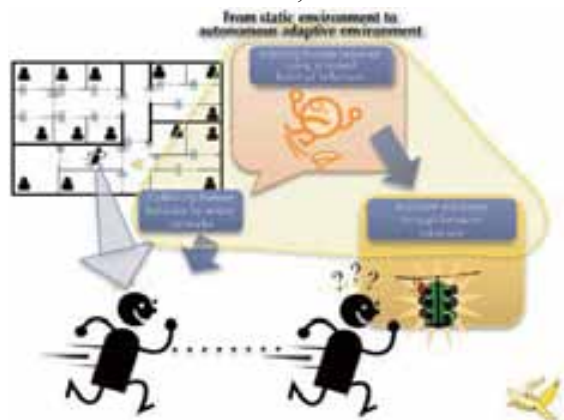
Intelligent Ubiquitous Sensor-Networks

In recent years, progress in computer technology, the appearance of IPv6, the development of various radio technology including IEEE802.11, and the practical use of radio-tags like RFID have greatly activated studies of ubiquitous computing like sensor-networks. But, the purpose of many proposed ubiquitous systems is to present information of the virtual-world like the Internet to humans living in the real-world by using physical properties like monitors and loudspeakers, etc. On the other hand, our purpose is to construct a framework to enable flexible and real-time interaction between humans and the real-world. Keyword is resonance. Each human has his own natural frequency, which is a metaphor for personality or daily habitual behaviors. In the proposed framework, each human behavior reacts with the environment and the environment performs sensor-data mining and extracts each human's natural frequency.

The real-world that we assume in this study is homes and offices, etc., where daily habitual behaviors of humans are easy to extract. So, we call the real-world “the environment.” The environment learns the daily habitual behaviors of each human, and performs the most suitable interaction to whoever should receive it. To embody this interaction framework, the environment must be an autonomous action entity, and it is



necessary to construct this entity as a massively multi-agent system to enable management and control of various broadly dispersed sensors and physical properties for interaction and to enable real-time interaction with humans. To begin with, we have set up several interaction devices between humans and the environment as well as various kinds of many sensors.



Department of Quantum Information Photonics

(Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.)

Professor:	Shigeki TAKEUCHI
Visiting Professor:	Jeremy O'BRIEN (- 2009.6.29)
Assistant Professor:	Ryo OKAMOTO
Assistant Professor:	Masazumi FUJIWARA
Post Doctoral Fellow:	Hideaki TAKASHIMA
Post Doctoral Fellow:	Hong-Quan ZHAO (2009.4.6-)
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Supporting Staff:	Izumi KASAGI

Outlines

By using quantum nature of light, it is predicted that we can drastically enhance the performance of information processing (Quantum Computer), secure communication (Quantum Cryptography) and even sensing (Quantum Metrology). We carry on experimental researches into the realization and the application of the novel states of light, by generating individual single photons and controlling the quantum correlation between these photons. Toward the perfect control of single photons, we investigate nano-scale photonic structures for optical quantum devices and single photon sources. Using those devices, we are constructing quantum optical systems and optical quantum circuits for quantum information processing, quantum metrology and quantum lithography. Our research topic also includes the generation and characterization of entangled photons, single molecular spectroscopy, and highly efficient single photon detectors.

Current Research Projects

- **Analysis of experimental error sources in a linear-optics quantum circuit**

We have investigated possible error sources in a linear-optics quantum gate, which is the basic technology of linear-optics quantum circuits. We took a simple controlled-NOT gate using partially polarizing beam splitters (PPBS) as a model of the quantum gate. We assumed, the deviation of the beam splitting ratios of the PPBS from the ideal values, the polarization dependent phase shift of transmitted (reflected) lights and the spatio-temporal mode mismatches are the possible sources of error in this quantum gate. Then we theoretically analyzed the contributions of these error sources by using process matrices (Fig. 1).

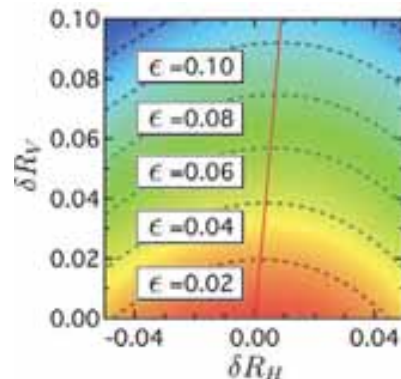


Fig.1: Error rate as a function of the deviations of the reflectance of vertical and horizontal polarizations

We found that the dependence of the error rate on each error source is different, especially for small errors. Moreover, the error rate is linearly dependent on the deviation of the reflectivity for horizontal polarization and the mode mismatch, while the dependence on the deviation of the reflectivity for vertical polarization and the phase shift is quadratic. Thus the reflectivity error for vertical polarization must be less than 0.1 % to realize a gate with an error of less than 0.1 %, whereas the reflectivity error for horizontal polarization can be up to 1 %. In addition, we found that the reduction of mode mismatch of the two photons for the two-photon interference is very important. It was also shown that the deviation from linear error model can exceed 10 % of the total error.

- **Realization of the heralding single-photon source with the world class visibility of the two-photon interference**

As we showed in the previous section, the reduction of the mode mismatch is very important to reduce errors in the linear-optics quantum circuits. We considered two types of mode mismatch. One is the spatial mode mismatch, resulting from the insufficient overlap of the two spatial modes at the beam splitter and the other is the temporal mode mismatch, resulting from the insufficient overlap of the two wave functions in time. Although the former one could be overcome by implementing optical quantum circuit using optical waveguide, the latter one remain as an important problem.

We theoretically analyzed the two-photon interference of photons generated by the parametric down conversion. We focused on the group velocity mismatch and the finite time width (approximately 100 fs) of the pump laser as sources of the temporal mode mismatch. We analyzed how these sources influence the two-photon interference and demonstrated effectiveness of our analysis by experiments. Based on this analysis we successfully realized a single-photon source with the world class visibility ($93 \% \pm 5 \%$) by optimizing the magnitude of the group velocity mismatch.

- **Phase shift spectrum and frequency-dependent quantum state tomography obtained from a microsphere resonator coupled with a tapered optical fiber.**

In the previous fiscal year, we demonstrated the measurement of phase shift spectrum of a fiber-microsphere system. We used the conventional laser light with several hundred micro Watt power, corresponding to the average photon number of 10^8 per pulse (10ns). However, the phase shift we aim to observe is due to the absorption saturation with single photon level, thus we have to develop a method to measure the phase shift with a very dim probe light.

In this fiscal year, we succeeded in the measurement of phase shift spectra and frequency-dependent quantum state tomography obtained in a microsphere resonator coupled with a tapered optical fiber (Fig. 2). The power required for the probe light has been reduced by 10 orders of magnitudes (and hence the photon number reduced from 10^8 to 10^{-2} per pulse).

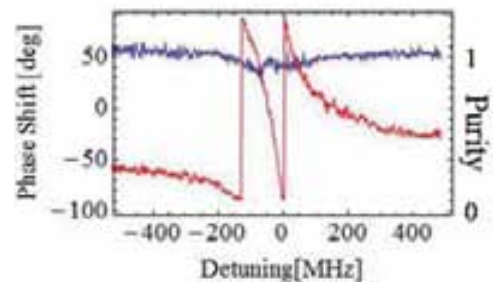


Fig.2: Phase shift (red) and purity (blue) spectrum of the microsphere resonator coupled with tapered optical fiber with smaller than 0.1 average photon number during 10ns

Division of Advanced Materials and Beam Science

Outline

This division is composed of seven departments with the following research fields: Quantum Functional Materials, Advanced Interconnection Materials, Semiconductor Materials and Processes, Metallic Materials Process, Excited Solid-State Dynamics, Beam Materials Science, and Accelerator Science. We aim to generate novel and new highly functional materials, which provide basis of rapid future developments in several important fields of information, energy, environmental and medical technologies. Emphasis is placed both on establishment of deep and full understanding of fundamental mechanisms of the functions and on evolutionary progress of material processing, including hybridizing different kinds of materials which are well designed and controlled with respect to their structures, dimensions, and physical and chemical properties. We also aim to develop new sources of quantum beams with high brightness and high quality, and use the quantum beams in a new field of beam-induced materials science.

Achievements

- Characterization of fundamental physical properties of novel ambipolar cuprates and transition-metal oxides.
- Developments of topological insulators and elucidation of their basic properties
- Development of chemical surface treatment of Si for reducing metallic contamination to 10-5 monolayer
- Creation of SiO₂/Si structure with ultra-high performance by gas-phase nitric-acid oxidation
- Development of continuous-casting technique for producing lotus-type porous metals by thermal decomposition of compound gasses
- Creation of lotus-type porous Al with high porosity
- Development of Ag-based inks and characterization of their basic properties
- Clarification of the Sn-whisker growth mechanism and developing high-temperature solders
- Finding of the third phase of carbons formed by photoinduced phase transition of graphite
- Development of femtosecond time-resolved transmission electron diffractometer
- Development of L-band RF photocathode
- Characterization of free-electron laser coherence

Department of Quantum Functional Materials

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Associate Professor: Kouji SEGAWA
Assistant Professor: Takafumi KUSUNOSE, Satoshi SASAKI
Post Doctoral Fellows: Alexey TASKIN, Zhi REN(2009.7.16-)
Graduate Students: Hideki HASHIMOTO, Kazuma ETOH, Takashi MISAO,
Daisuke HAMA, Tatsuya MINAMI
Under Graduate Students: Ryohei YOSHIDA, Shohei WADA
Supporting Staff: Atsuki KAGESHIMA

Outlines

The research of the Department of Quantum Functional Materials focuses on growths of high-quality single crystals and top-notch transport measurements of novel materials, such as topological insulators or unconventional superconductors. Our emphasis is on precise and systematic measurements of basic physical properties, which allows one to unveil the peculiar electronic states of novel materials. This is achieved by combining the expertise in solid-state physics and applied chemistry. Our goal is two-fold: Creating innovative materials for solving urgent issues of the human society, while exploring fundamental new physics in condensed matter.

Current Research Project

Basic Research of Topological Insulators

Topological insulator (TI) is an emerging class of materials that host a new quantum-mechanical state of matter where an insulating bulk state supports an intrinsically metallic surface state that is "topologically protected"; namely, the quantum-mechanical wavefunction of the bulk insulating state of a TI bears a " Z_2 topological invariant" distinct from that of the vacuum, which makes a smooth transition from a TI to the vacuum impossible without closing the energy gap along the way, making the surface of a TI to be intrinsically conducting. Intriguingly, the resulting metallic surface state is expected to be "helically spin-polarized" (i.e., right- and left-moving electrons carry up and down spins, respectively) and consist of "Dirac fermions" (i.e., the energy of quasiparticles is

linearly dependent on the momentum and hence they are "massless"). Those peculiar properties of the surface state open exciting new opportunities for novel spintronics devices with ultra-low energy consumptions. In 2008, angle-resolved photoemission spectroscopy (ARPES) studies on $\text{Bi}_{1-x}\text{Sb}_x$ have revealed that the energy dispersions of its surface states possess the distinctive character to qualify this material as a TI. So far,

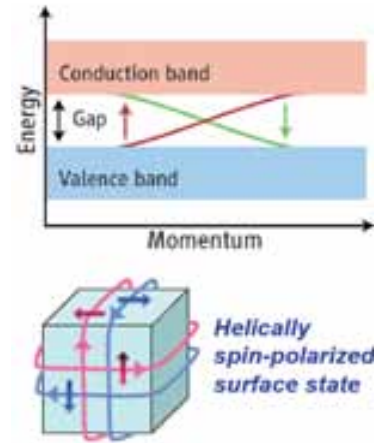


Fig.1 Peculiar surface state of a topological insulator

Bi_2Se_3 and Bi_2Te_3 have also been confirmed by ARPES to be TIs. However, to directly probe the unique properties of the surface states and to elucidate whether they could really be exploited on a macroscopic level for spintronics devices, transport and magnetic studies of high-quality single crystals are indispensable.

We have developed a technique to grow high-quality single crystals of $\text{Bi}_{1-x}\text{Sb}_x$ with a zone-melting method. Currently the $\text{Bi}_{1-x}\text{Sb}_x$ crystals grown in our lab are the world best in terms of the carrier mobility. Taking advantage of these crystals, we have succeeded in making the first observation of the surface state of $\text{Bi}_{1-x}\text{Sb}_x$ through quantum oscillations, giving confidence that the metallic surface state is indeed stable in ambient atmosphere and supports macroscopic currents.

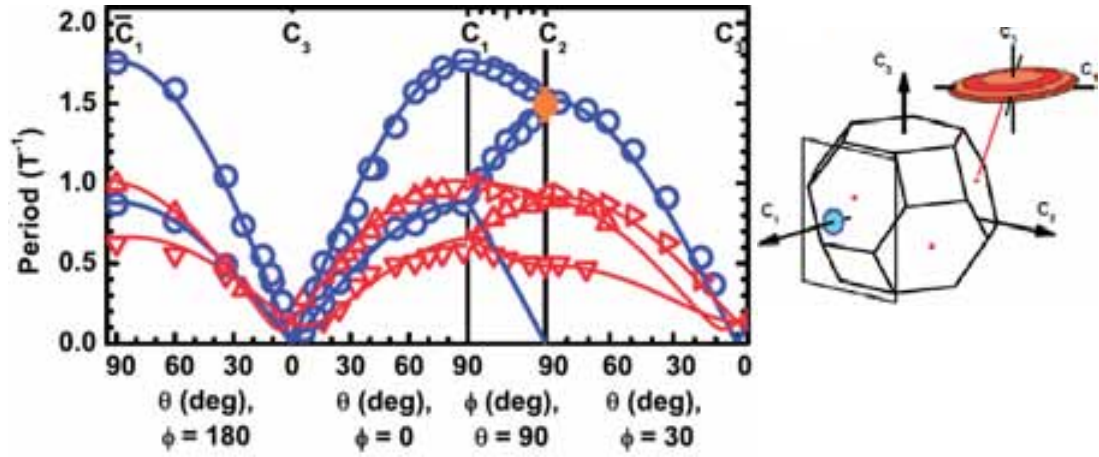


Fig. 2 Dependence of the observed de Haas-van Alphen oscillation period of $\text{Bi}_{1-x}\text{Sb}_x$ ($x = 0.09$) on the magnetic field direction, and the determined Fermi surfaces.

Basic Research of Intrinsic Spin-Hall Insulators

This project explores new avenues of the spintronics to utilize the intrinsic and dissipationless spin current that is expected to flow in spin Hall insulators. This is quite a different approach from the mainstream spintronics research to utilize magnetic materials or conventional semiconductors, where energy dissipation is inevitable. The idea of the spin Hall insulator was theoretically proposed in 2004 but is yet to be experimentally explored. One of the candidate materials of the intrinsic spin-Hall insulator is PbS. So far we have succeeded in growing high-quality PbS single crystals and tuning the carrier density for a wide range down to 10^{16} cm^{-3} , and we are currently making systematic magnetotransport measurements of those crystals.

Department of Semiconductor Materials and Processes

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Visiting Professors:	Hitoo IWASA, Sumio TERAOKAWA, Yoshihiro NAKATO
Research Technical Expert:	Masami SHOJI
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Outlines

The modern society is based on semiconductor technology. Our research is aiming to improve the characteristics of semiconductor devices and to develop semiconductor devices with new structures. For this purpose, we have developed new semiconductor chemical processes such as low temperature Si oxidation method by use of nitric acid and room temperature defect passivation method. Semiconductor devices studied in this department are: 1) Si solar cells, 2) Si or SiC-based metal-oxide-semiconductor (MOS) devices for LSI, 3) thin film transistors (TFT) for display devices.

Current Research Project

Development of Semiconductor Defect Passivation Etch-Less Cleaning Method by Use of a New Chemical Reaction

The local photovoltage of the pn-junction single-crystalline silicon solar cells observed by spot light scanning gradually decreases in the vicinity of edges. The energy conversion efficiency is increased by shadowing the edge regions where the local photovoltage is lower, showing that the defect density is high in the edge regions (Figure 1). From the analysis of the local photovoltage, the spacial distribution of defect states is obtained. The cyanide method, *i.e.*, immersion of solar cells in

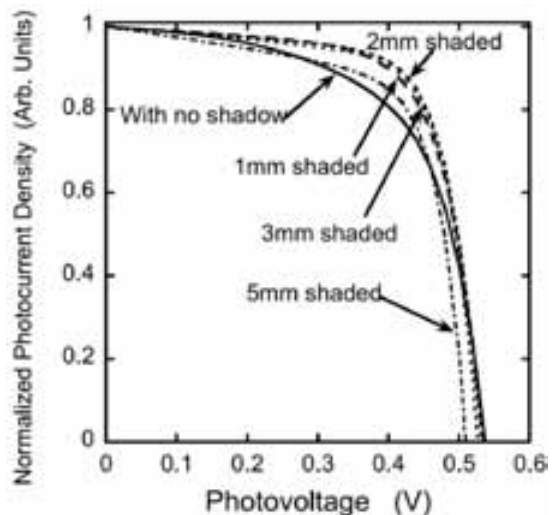


Figure 1 Photocurrent-photovoltage curves for the solar cells whose edge parts are shadowed.

HCN solutions at room temperature, increases the local photovoltage and increases the energy conversion efficiency. [Original paper 1]

Low Temperature Fabrication of Thick SiO₂/Si and SiO₂/SiC Structures by Use of Chemical Method and its Application to Thin Film Transistors (TFT)

An ultrathin silicon dioxide (SiO₂) layer with 0.65–1.5 nm thickness has been formed by ~100% nitric acid (HNO₃) vapor oxidation (Figure 2), and its electrical characteristics and physical properties are investigated. The oxidation kinetics follows a parabolic law except for the ultrathin (<0.8 nm) region, indicating that diffusion of oxidizing species (i.e. oxygen atoms generated by decomposition of ~100% HNO₃ vapor) through a growing SiO₂ layer is the rate-determining step. The diffusion activation energy for HNO₃ vapor oxidation is 0.14 eV, much lower than that of thermal oxidation of 1.24 eV. The leakage current density for the 0.65 nm SiO₂ layer formed by HNO₃ vapor oxidation is lower by approximately one order of magnitude than that for a thermal oxide layer with the same thickness. The low leakage current density is attributed to (i) the atomically flat SiO₂/Si interface and uniform thickness of the ultrathin SiO₂ layer, (ii) the low concentration of suboxide species and the low interface state density and (iii) the high atomic density of the SiO₂ layer, which leads to a high band discontinuity energy at the SiO₂/Si interface. The leakage current density is further decreased by PMA at 250 °C in 5 vol% H₂ atmosphere. [Original paper 8]

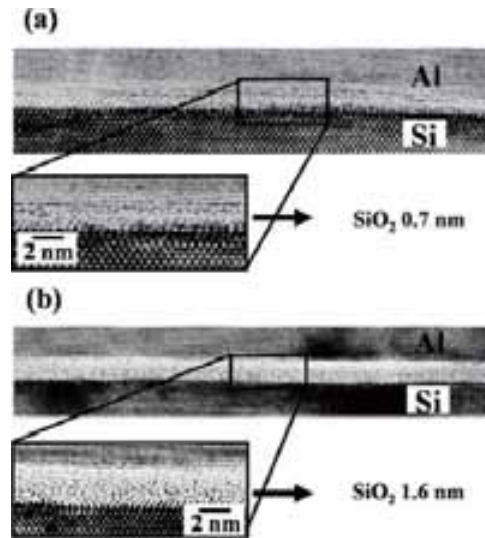


Figure 2 TEM micrographs of the <Al/SiO₂/Si(100)> MOS structure with the SiO₂ layer formed with ~100% HNO₃ vapor at 100 °C for 5 min (a) and at 200 °C for 1 h (b).

The leakage current density is further decreased by PMA at 250 °C in 5 vol% H₂ atmosphere. [Original paper 8]

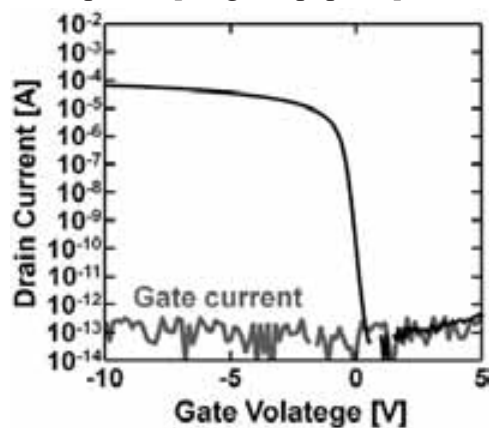


Figure 3 J_d - V_g and J_g - V_g characteristics for the TFT with the 1.8 nm NAOS SiO₂/40 nm CVD SiO₂ gate dielectric structure.

We have also fabricated TFT in which a gate oxide layer possesses stack structure with an ultrathin interfacial SiO₂ layer formed by the nitric acid oxidation of silicon (NAOS) method at room temperature and a 40 nm CVD SiO₂ layer. The drain current-voltage characteristics show that TFT with the NAOS interfacial layer can be operated at 3 V (conventional operation voltage: 12~15 V), indicating that a vast decrease in TFT power consumption is possible. The threshold voltage becomes less than 1 V, and the short-channel effect can be avoided. The gate leakage current density in the gate bias region between -10 and 5 V was in the 10⁻¹³ A order, which was below the noise level. [Electron Device Lett., in press.]

Department of Metallic Materials Process

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Outlines

Metals are fundamental materials indispensable to various structural and functional materials. The main purpose of this department is to investigate physics of metallic materials and develop novel processing of the metallic materials. The department has undertaken the following several topics of the metallic materials science and engineering. Lotus-type porous metals (lotus metals) developed by this department are unique materials which exhibit extraordinary superior mechanical strength. The materials have been fabricated by unidirectional solidification of the melts under pressurized gases. For practical use of lotus-type porous metal, fabrication of lotus metal with complex shape and lotus aluminum with high porosity were investigated in this year. Heat-transfer and solidification analysis near solid-liquid interface was carried out utilizing two-dimensional finite difference method. Lotus aluminum with high porosity can be fabricated through controlling solidification rate. In order to improve the mechanical strength of lotus metals, the effect of unidirectional pores on the mechanical properties was investigated on the basis of the micromechanical point of view. In particular, the correlation between the macroscopic deformation and crack formation around pores was investigated using acoustic emission method with can detect the crack formation during deformation. Furthermore, we are studying the formation mechanism on hollow nanoparticles and nanotubes to establish the principle for fabricating novel nanoporous materials. Our focus is on the use of generation and clustering of atomic vacancies, which are associated with diffusion phenomena, to introduce an interior nanopore into nanoparticles and nanowires. In this year, we showed that oxide nanotubes and porous nanowires were obtained via the oxidation of Cu, Fe and Ni nanowires.

Current Research Project

Control of pore growth directions of lotus-type porous metals and its numerical simulation

Lotus-type porous magnesium ingots were fabricated in pressurized hydrogen atmosphere through a mold casting technique. The mold consisted of two cooling blocks placed at the bottom and one lateral side. It was found that the pores started to grow upwards and horizontally and the both directional pores merged and then shifted

to the direction. Such anisotropic growth directions of pores were in good agreement with the directions of the temperature gradient predicted by two-dimensional finite differential analysis.

Fabrication of lotus-type porous aluminum

Lotus-type porous aluminum possessing directional pore aligned in one direction is expected for one of the most promising candidates for structural material with lightweight. However, it is hard to fabricate lotus

aluminum with high porosity owing to its low hydrogen solubility. We fabricated lotus aluminum under various solidification rate (Fig.

1) and we discussed pore formation of lotus aluminum. Lotus aluminum with high porosity can be fabricated at the slow solidification rate. It is thought that the hydrogen atoms in aluminum can migrate longer distance and more supersaturated hydrogen atoms can contribute to the pore growth.

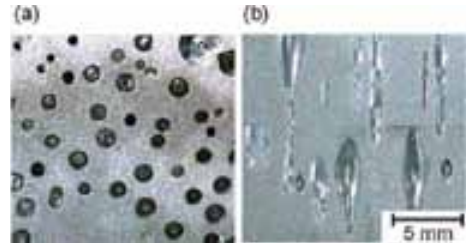


Fig. 1 Pore morphology perpendicular (a) and parallel (b) to the solidification direction of lotus-type porous aluminum.

Analysis of tensile deformation in lotus copper by acoustic emission method

The tensile deformation of lotus copper with cylindrical pores oriented in one direction was analyzed by acoustic emission (AE) method which can detect the crack formation during deformation. In the tensile deformation along the directions parallel and perpendicular to the longitudinal axis of pores (pore direction), it was found that many cracks are formed after yielding. The crack formation exhibits the anisotropy reflecting the anisotropic porous structure; the cracks are more easily formed in the tensile deformation perpendicular to the pore direction than in the tensile deformation parallel to the pore direction. The observation of deformed tensile specimens clarified that the formed cracks rapidly grow and connect with each other in the vicinity of peak stress (ultimate tensile strength). This indicates that the appearance of peak stress is caused by the growth and connection of formed cracks.

Formation of oxide nanotubes and porous nanowires through vacancy clustering

Changes in the morphology of Fe, Cu and Ni nanowires with a diameter of 55 nm during oxidation at 423–923 K were studied by transmission electron microscopy. Oxide nanotubes with a cylindrical interior pore of uniform diameter were formed after the oxidation of Fe and Cu nanowires in air at 573 and 423 K (Fig. 2(a)(b)), respectively,

while the Ni nanowires became bamboo-like nanowires of NiO with separate interior voids after oxidation at 673–773 K (Fig. 2(c)). The formation of interior nanovoids can be explained by the rapid outward diffusion of metal ions through oxide layers and the vacancy clustering.

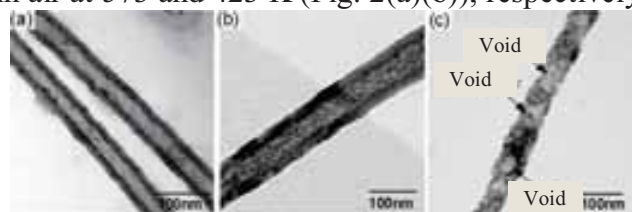


Fig. 2. Oxide nanotubes obtained via oxidation of (a)Cu nanowires at 423 K for 1 hr, (b) Fe nanowires at 573 K for 1hr and (c)Ni nanowires at 773 K for 1hr.

Department of Advanced Interconnection Materials

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Visiting Researcher: Xingfang Zhang(2009.12.7-2010.3.31)
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Takahiro KUWANA, Natsuki KOMODA, Nobuaki CHO
Support Staff: Mariko HATAMURA, Noriko KAGAMI, Miki KUBO
Kyoko HAMASAKI, Kozue IDE, Misa MATSUSHITA.

Outlines

Through nanotechnologies and knowledge for organic/inorganic materials, we are conducting the development of environmentally conscious fine technologies for electronics packaging area, i.e., lead-free soldering and conductive adhesives, and the composite materials based on metals and intermetallic compounds. We set our route towards contributions to our society in near future.

Current Research Project

Development of alternative technology for high-temperature soldering

The purpose of the project is to understand the current characteristics of conductive adhesives as the alternative to leaded solders, and, especially focusing on their characteristics of high temperature resistance and of low temperature manufacturing process, new conductive adhesives are targeted to be developed by the improvement of the current drawbacks.

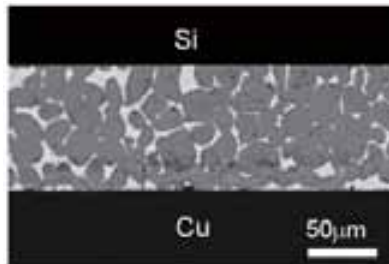


Fig. 1 Interface microstructure of Si die attach with TiN barrier coating on Si die and Cu with Zn-30Sn soldered joint after the 2000 cycles of thermal cycling test.

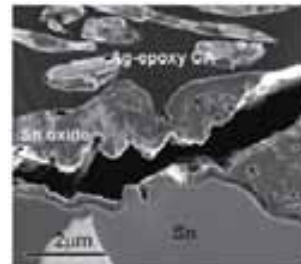


Fig. 2 Cross-sectional SIM images of the failed interface by external stress after the humid test for 1000 hours.

Development of new room temperature wiring method for Printed electronics

We have developed a new process, by which the paste of Ag nanoparticles protected with them can be successfully sintered at room temperature in air atmosphere. In addition, Ag organometallic compound inks were also developed for low temperature process below 150 °C.

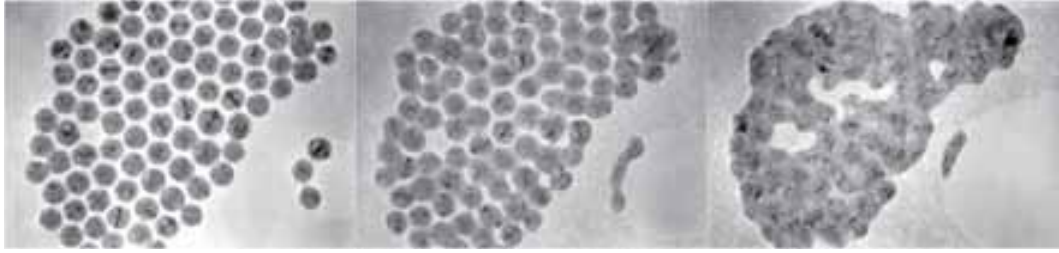


Fig. 3 Sintering process of Ag nanoparticles at room temperature.

Development of soft human/machine interfaces using super-flexible wiring technology

Recently, the super-flexible (bendy and stretchable) wiring technology using elastomer-based conductive adhesives was developed in our group. By using the super-flexible wiring, stretchable tactile sensor systems including piezoelectric sensor and novel electrostatic sensor systems for humanoid robots and related applications were successfully fabricated. In addition, these sensor systems were connected to a self-organized network of distributed processors in order to realize the fail-safe data processing system and shown to work successfully.



Fig. 4 A large-area tactile sensor system fabricated by integrating the stretchable sensor sheets and the self-organized network of distributed processors (256 channels).

Sn whisker growth in aerospace environment

The aerospace electronics have specific requirements as compared with consumer electronics. There have been the electronics failures of the satellites caused by Sn whiskers and Sn whisker failure is one of the most serious concerns for the space electronics. In this year, the influence of vacuum thermal cycling on the formation of tin whiskers was investigated. Vacuum whiskers are thinner than air whiskers. Sn whiskers grow thinner and longer in temperature cycling in high vacuum as compared with air while whisker density is not influenced by atmosphere.

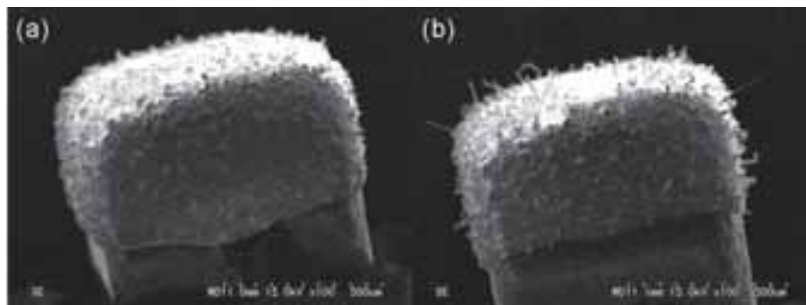


Fig. 5 Photographs of chip capacitor electrodes after 500 thermal cycles. (a) in air, (b) in high vacuum.

Department of Excited Solid-State Dynamics

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Assistant Professor:	Ei'ichi INAMI,
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Outlines

For fabricating highly functional nano-structured devices in future technology, it is essential to establish the ways to control structures and compositions of materials at the atomic level. In this department, we aim to establish the fundamentals for controlling the modes of atomic binding in solids via excitation-induced atomic reactions. For this purpose, we have carried out extensive experimental studies in the following three categories:

- 1) the primary processes of the photoinduced structural phase transitions,
- 2) ultrafast carrier dynamics on semiconductor surfaces,
- 3) excitation-induced structural changes of semiconductor surfaces,

In our studies, the main emphasis is placed on direct experimental determination of photoinduced changes of electronic and lattice systems at ultrafast temporal domains and at the atomic levels. As topics in the first category, we have studied the photoinduced phase transition in low dimensional crystals, like quasi one-dimensional organic solids and two-dimensional solids like graphite. As topics of the second categories, we have studied carrier dynamics on Si surfaces by means of femtosecond two-photon photoemission spectroscopy. And as the third topic, we have studied laser- or low-energy electron induced structural changes of clean surfaces of Si and InP by means of not only the direct imaging of the surface atomic structure and its changes by STM. Also, in order to reveal direct determination of crystalline structural changes in femtosecond temporal domains, we have successfully constructed a ultrafast high-energy electron diffractometer with 100-fs temporal resolution.

Current Research Project

1. Ultrafast surface carrier dynamics on semiconductor surfaces studied by femtosecond two-photon photoemission spectroscopy

The excitation induced structural instabilities are triggered by several modes of ultrafast relaxation of electronic excited states, like carriers, excitons, and electron-hole plasma. In order to elucidate the dynamics of photogenerated surface carriers, which play crucial roles in several photoinduced reactions in solids and on solid surfaces, it is essential to study the ultrafast carrier dynamics with resolving their evolutions in

momentum and energy spaces. Use of femtosecond laser for pump and probe pulses has a strong advantage for resolving the carrier dynamics directly. In particular, the new system based on a tunable OPA laser for pump pulses of 50-fs temporal width has opened a new breakthrough for studying the dynamics extensively.

By probing electrons populated near the conduction band minimum of Si directly, we have elucidated directly the ultrafast processes of intravalley relaxation and energy relaxation of hot electrons and L-to-X intervalley scattering of highly excited hot electrons. Furthermore, by using 6-eV probe photons, we can study the dynamics of photogenerated holes in surface occupied states and in bulk valence band, which can be probed as a small depression of occupied-state photoemission intensities. A typical result is shown in Fig.1, where the result of photo-induced hole dynamics on Si(111)-(7x7) are displayed. Holes generated in surface states S2 and S3 on Si(111)-(7x7) decays via two modes; one is the dynamical reaxation with 1 ps after excitation, and the other is the transfer-limited process of electron-hole recombination.

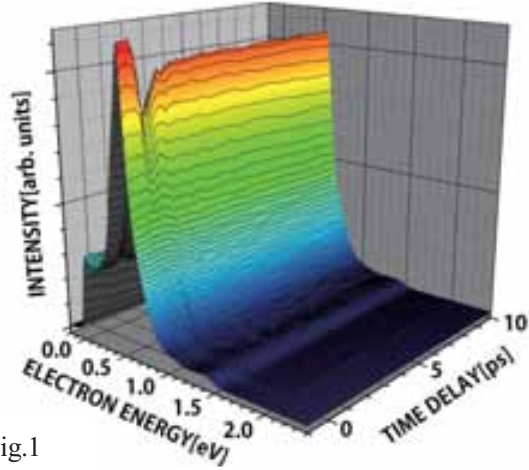


Fig.1

2. Development of ultrafast transmission electron diffractometer with 100-fs temporal resolution

In order to reveal ultrafast structural dynamics involved in photo-induced structural phase transformation, we constructed an electron diffractometer with transmission mode and with ultrafast temporal resolution less than 100 fs. In previously developed diffractometers in US and Europe are mostly operated with the reflection mode, which give rise to several drawbacks.

Our machine uses relativistic electron beams with energy of 2-3

MeV, generated by fs-laser induced RF photocathode, accelerated by RF in the cavity, and collimated beams are dispersed on the phosphor screen to display the diffraction patterns. In Fig.1, we show the picture of our diffractometer, together with the diffraction pattern measured for thin Al foil. Very clear rings corresponding to several plane distances have revealed the extremely good properties of probe electron beams. This machine has been used to study real-time observation of the ultrafast structural dynamics in photo-induced structural phase transitions in several solids.



Fig.2

Department of Accelerator Science

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Specially Appointed Assistant Professor: Shigemasa SUGA(2009.4.1-2009.9.30)
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Kenichiro FURUHASHI, Naoya SUGIMOTO
Research Student: Jen SHEN

Outlines

Particle accelerators are widely used from basic science to industrial applications. In this department, we conduct research on accelerators and quantum beams such as a free electron laser (FEL). Although accelerators are artificial things, fundamental aspects of physics such as non-linearity and the collective effect become apparent when extreme performance is pursued. Because new kinds of quantum beams extend the world we can see with, they are expected to be used in a large variety of fields extending from basic research to applications. To put it concretely, we conduct researches on production of a highly brilliant electron beam with a linear accelerator and related beam dynamics, development of an infrared FEL for user experiments and SASE (Self-Amplified Spontaneous Emission) in the infrared region.

Current Research Project

Development of Free Electron Laser

We are conducting research on development of the FEL in the infrared region using the L-band electron linac. The FEL is currently operated in the wavelength region from 25 to 150 μm at the saturation power level. We are conducting basic research on FEL physics to expand the wavelength region and to make its performance significantly higher. The temporal structure of the FEL is a series of a few tens ps light pulses (micropulse) at intervals of 9.2 ns continuing for 2~4 μs (macropulse), which is repeated in 10 Hz at maximum. The time resolution of our fast infrared detector is 10 ns, so that it is not possible to measure the time structure of the micropulse. In order to study details of FEL operation, we have introduced a Michelson interferometer and measured the temporal structure of FEL. Figure 1 shows measured interferograms for some cavity lengths. They change largely as the cavity length becomes shorter from the resonance condition $\delta L_c=0 \mu\text{m}$. The interference patterns not only expand with decreasing cavity length but also show intensity

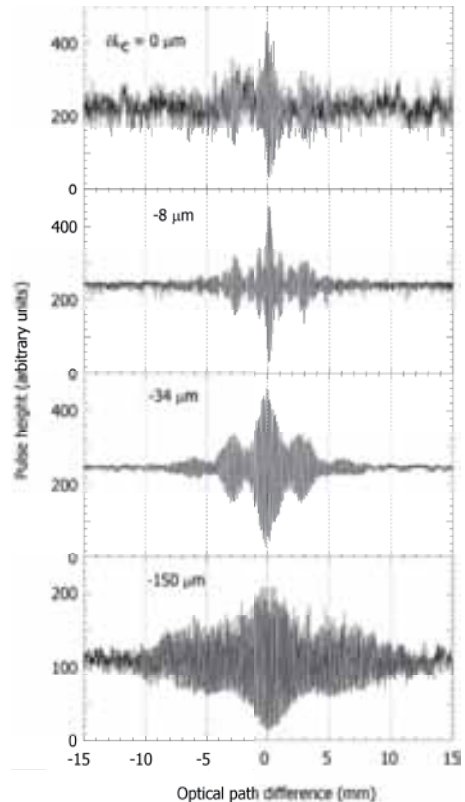


Fig. 1. Interferograms of FEL pulses. The panels show patterns for the optical cavity length decreasing from the resonant length $\delta L_c=0$ to $-150 \mu\text{m}$.

oscillations in short periods, which originates from the fine structure of the micropulse. The micropulse is 18.5 ps at $\delta L_c=0 \mu\text{m}$, and increases to 38.4 ps at $\delta L_c=-150 \mu\text{m}$.

Development of L-Band RF Electron Gun

The photo-cathode RF gun accelerates a short pulse electron beam in a high electric-field reaching some tens to 100 MV/m to the relativistic energy, some MeV, so that it can produce a highly-brilliant and short-pulse electron beam that cannot be possible with traditional methods. S-band RF guns operating at the 2.8 GHz frequency are widely used but only a few L-band RF guns have been developed at DESY. We are conducting research and development of the L-band RF electron gun for the L-band electron linac at ISIR, Osaka University in collaboration with the High Energy Accelerator Research Organization (KEK). Following the DESY design, our RF gun has the 1.5-cell RF cavity with a coaxial input coupler. A special specification for the RF gun is that it can endure the input RF power of up to 25 kW owing to the high-duty operation with the long pulse or the high repetition, because the RF gun will be also used for the superconducting linac at KEK. We have designed the cooling system to meet specifications that the temperature rise of the RF cavity is 5°C and that of the cooling water is $0.5\sim 1^\circ\text{C}$ for the stable operation of the RF gun at the maximum input power. Figure 2 shows results of the thermal analysis of the RF gun cavity with the numerical calculation, where the color temperature scale on the right is from 25 to 32°C , indicating that the design meets the specifications.

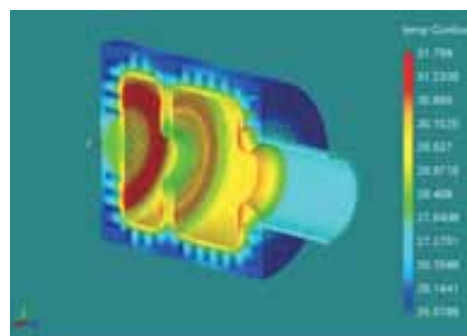
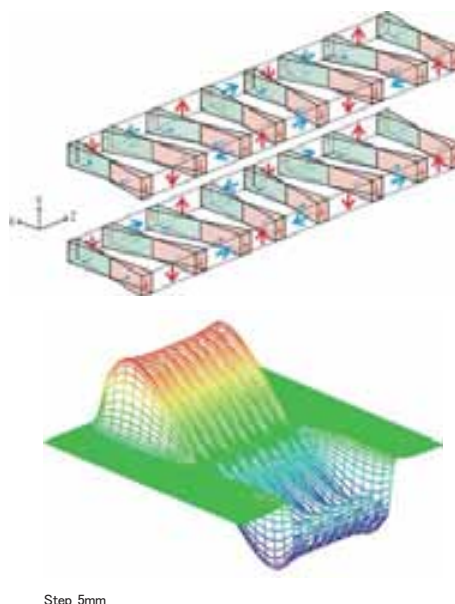


Fig. 2. Calculated temperature distribution of the L-band RF gun. The color temperature scale on the right is from 25 to 32°C .

Development of High Performance Wiggler

We are developing the edge-focusing (EF) wiggler for upgrading performance of the far-infrared FEL using the L-band linac at ISIR, Osaka University. The conventional wiggler generates the sinusoidally varying magnetic field along the beam axis using permanent magnet blocks, while the EF wiggler generates the transverse field gradient superimposed to the normal wiggler field using magnet blocks with the edge angle. The field gradient produces the transverse focusing force to the electro beam. The wiggler field decreases exponentially with increasing magnet gap and the slope can be scaled with the period length of the wiggler. The field gradient in the EF wiggler also decreases exponentially as the magnet gap increase, but the slope is different from that of the sinusoidal magnetic field. It is found that the variation of the field gradient with the magnet gap can be scaled by the magnet width of the EF wiggler and that the slope can be adjusted with the width.



Step_5mm
Fig.3. Model of the EF wiggler for the field gradient (upper) and the magnetic field distribution (lower).

Department of Beam Materials Science

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Supporting Staff: Kaoru KOJIMA

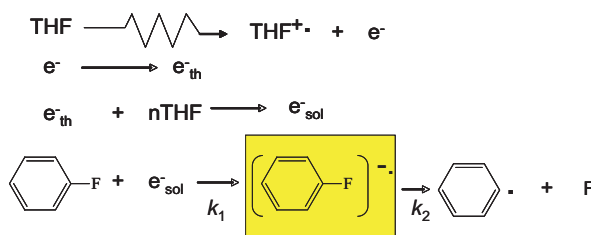
Outlines

The group of the Department of beam materials science conducts with the L-band electron linac and the ^{60}Co γ -ray irradiation facility. The aim of our research program is to fully characterize the process by which ionizing radiation alters the chemical structure of functional materials and biological molecules. One of the important missions is design and development of functional materials.

Current Research Project

Early Processes in Radiation Chemistry of Aryl Fluorides

Aryl fluoride has attracted much attention as a resist component of extreme ultraviolet (EUV) lithography, due to the high absorption cross-section of fluorine against EUV photon; however, less is known about the electron attachment to fluorobenzene (FBz). We performed pulse radiolysis of tetrahydrofuran (THF) solutions of FBz and examined the effects of isomeric structure and the number of fluorine atoms, as shown in Scheme 1. The scavenging of solvated electrons was found to correlate with electron affinity obtained by density functional theory in gas phase (k_1), while the decays of FBz radical anions were dominated by activation energy of fluorine anion dissociation. The lifetimes can provide information on molecular design of functional materials.

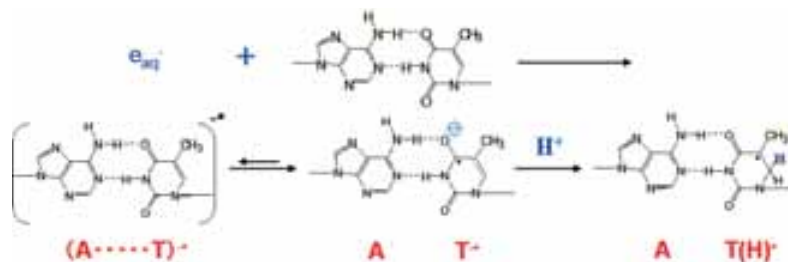


Scheme 1 Reaction of electron with FBz in THF solution

Dynamics of Hole and Electron in DNA

Identification of the DNA sites that trap holes and electrons is essential to understanding the progression of radiation-induced damage. We describe dynamics of cation and anion radicals of DNA by pulse radiolysis. We present spectral intermediates of a systematic series of electron adducts of oligonucleotides (ODNs) containing A·T base pairs. The transient spectra of excess electrons of the double-stranded ODNs shows that the transiently formed radical anion (A·T) is stabilized by hydrogen-bond base-pairing. Subsequently, the spectroscopic changes reflect progress from the

transient (A•T) radical anion to T radical anion, as shown in Scheme 2.



Scheme 2. Reaction scheme in electron adduct A-T base pairs

Long-range hole migration along the π stack of DNA currently receives much attention. It has been suggested that A plays a hole carrier in long A-T stretches. However, the mechanistic detail of A hopping remains unclear. Dynamics of A radical cation in both mononucleotide and ODN was measured by pulse radiolysis. The cation radical of A of deoxyadenosine (dA) rapidly deprotonated to form the neutral A radical. A similar process was observed on double-stranded ODNs. The transient spectrum of A radical anion in an ODN composed of alternating A•T pairs was essentially identical to that of free dA, and differed from the spectra of ODNs containing AA and AAA. These results suggest that the positive charge on A in ODNs is delocalized as the dimer stabilized by π -orbital stacking between adjacent As.

Catalysis and Oxygen Binding of a Heme-based Oxygen-sensor Enzyme, *Ec* DOS

A phosphodiesterase (PDE) (*Ec* DOS) is a novel heme-based oxygen sensor enzyme. Binding of O₂ to the heme iron in the sensor domain enhances PDE activity exerted by the catalytic domain. To establish the molecular mechanism underlying catalytic regulation, we analyzed binding of the O₂ ligand following reduction of heme

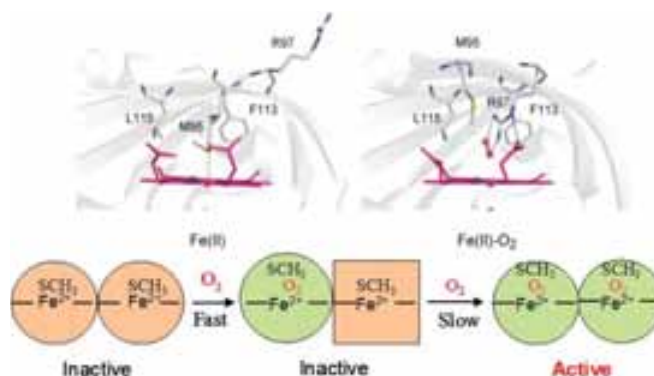


Fig. 1 Conformational change on oxygen binding to EcDOS

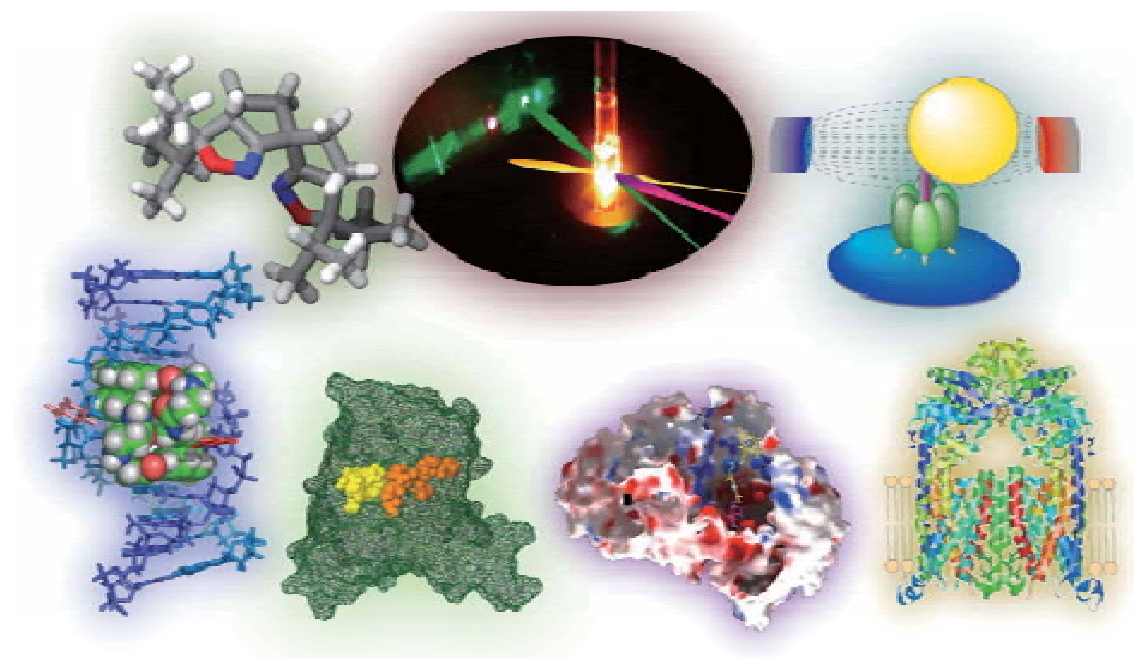
using pulse radiolysis. The O₂ binding processes were composed of two phases when high-dose electron beams were applied. In contrast, upon reduction of the dimer with a low-dose beam, the kinetics of O₂ ligation displayed single-phase behavior. Based on these results, we propose that the faster phase corresponds to binding of the first O₂ molecule to one subunit of the dimer, followed by binding of the second O₂ molecule to the other subunit, as shown in Fig. 1. Notably, O₂ binding displayed single-phase kinetics in the M95A and M95L mutant proteins. We suggest that global structural alterations around the axial ligand, M95, caused by the binding of external ligands within a single subunit of the dimer, transduce changes in heme iron characteristics to the second subunit.

Division of Biological and Molecular Sciences

Outline

The Molecular Science Group of this division is composed of four departments; Dept. of Molecular Excitation Chemistry, Dept. of Synthetic Organic Chemistry, Dept. of Regulatory Bioorganic Chemistry, and Dept. of Organic Fine Chemicals. The research field of the Molecular Science Group covers organic chemistry, physical chemistry, catalytic chemistry, surface chemistry, beam-induced chemistry, materials chemistry, bio-functional molecular chemistry, and chemical biology. The division also has a Biological Science Group, which is composed of three departments; Dept. of Structural Molecular Biology, Dept. of Cell Membrane Biology, and Dept. of Biomolecular Energetics. These departments are engaged in research in various fields of biological science including molecular enzymology, signal transduction, energy transformation, membrane transport, energy transport, and the mechanism of gene expression.

Within each department, own research topics are ongoing. Joint projects involving several departments are also underway.



Department of Molecular Excitation Chemistry

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Outlines

"Beam-induced molecular chemistry" based on photo- and radiation-induced chemistry of organic compounds has been investigated from both basic and beam-functional points of view. The research topics are underway with respect to developments of new beam-controlled chemistry, new synthetic chemistry, and new molecular devices and functional materials.

1. Formation and reactivities of reactive intermediates in photochemistry and radiation chemistry, and photochemistry of reactive intermediates
2. Multi-beam chemistry with irradiation by two-color laser-laser and electron pulse-laser flash
3. Multiple-photon chemistry of organic compounds using UV, visible, and infrared lasers
4. Beam-controlled chemistry of artificial biomolecules such as modified DNA and proteins

Current Research Project

Multi-beam Chemistry

Multi-beam chemistry has been studied using pulse radiolysis-laser flash photolysis combined method, two-color two-laser photolysis and three-color three-laser photolysis. Photochemistry of reaction intermediates and short-lived chemical species generated from the reaction induced by the first beam excitation of a starting molecule (two-step excitation method), and moreover, photochemistry of other chemical species generated from the reaction of the short-lived intermediate induced by the second beam excitation (three-step excitation method) can be studied. This year, we have investigated the intramolecular hole transfer via excited state of radical cation of oligothiophenes. Furthermore, we have investigated the electron transfer processes in the supramolecular donor-acceptor dyads of porphycene and hemiporphycene, structural isomers of porphyrin. We have also clarified by means of radiation chemical method that the stabilization energy of delocalized negative charge in the stacked benzothiadiazole, an

electron acceptor, depends largely on its direction.

Long-Range Charge Transfer through DNA by Replacing Adenine with Diaminopurine

DNA consists of two building blocks, adenine-thymine (A–T) and guanine-cytosine (G–C) base-pairs. By programming the sequences of these two building blocks, we can now construct various nanometer-sized two- and three-dimensional structures. The finding that a positive charge (a hole) generated in DNA migrates along DNA has made it an interesting molecule for the design of nano-electronic sensors and devices. It has been demonstrated that a charge migrates along DNA mainly via a series of short-range charge transfer (CT) processes between G–C base-pairs, with their relatively high HOMO-levels. As a consequence, the CT efficiency sharply decreases with the insertion of A–T base-pairs between the G–C base-pairs, hampering the construction of nano-electric sensors and devices in which the use of various sequence patterns is indispensable. We have previously reported that the CT efficiency can be drastically increased independent of the G–C content by replacing A–T with Z(deazaA)–T, which has higher HOMO-levels closer to those of G–C base-pairs than of A–T base-pairs. In the present study, we have expanded on this earlier work and clearly show that the substitution of A with diaminopurine (D), which can fully replace A during PCR, also dramatically increases the CT efficiency in DNA.

Single-Molecule, Single-Particle Spectroscopic Studies on the Mechanisms of Photocatalytic Reactions

Heterogeneous photocatalysts have both potential and demonstrated applications for use in the water-splitting reaction that produces hydrogen, the degradation of organic pollutants, the surface wettability conversion, etc. We have focused on the in-site observation of various reactive oxygen species (ROS), such as singlet oxygen and hydroxyl radical, generated by the photoexcitation of TiO₂ using single-molecule, single-particle fluorescence spectroscopy. The spatially-resolved fluorescence imaging techniques enable us to determine the location of the photocatalytically active sites that are related to the heterogeneously distributed defects on the surface and the importance of the transport behavior of reagents through the porous structures on the photocatalytic activity and the existence of the spatial heterogeneity of reactive sites in an isolated TiO₂ nanotube. We also investigated the nature of visible photoluminescence from individual TiO₂ nanowires using single-particle imaging techniques.

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Supporting Staff: Tomoko KISHI

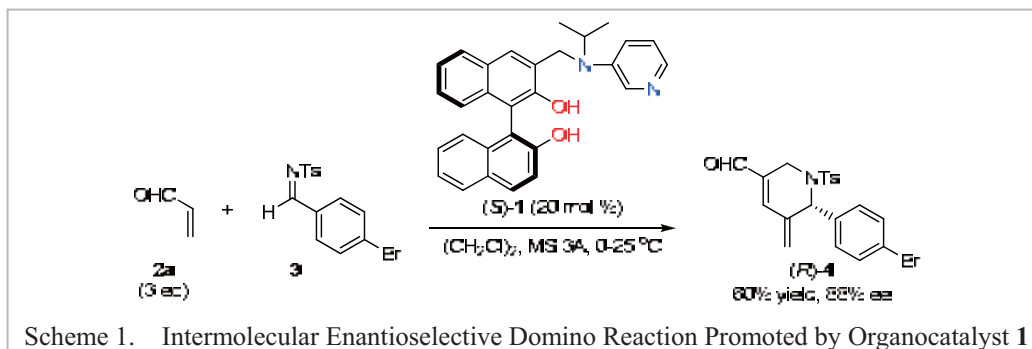
Outlines

Asymmetric synthesis, a phenomenon fine-tuned to perfection by nature, forms the central theme of our research efforts. We have been interested in the design and syntheses of a novel class of chiral ligands that are unique in promoting new asymmetric reactions. The mechanisms of these organic reactions are also studied by means of physical organic techniques. Novel chiral spiro ionic liquids and organocatalysts have been synthesized with a focus on developing environmentally benign asymmetric processes.

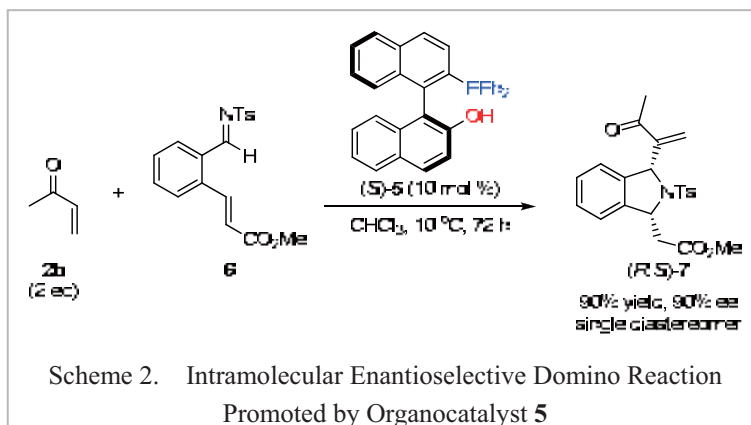
Current Research Project

Chiral Organocatalyzed Domino Cyclization Based on Aza-Morita-Baylis-Hillman Reaction: Application to Facile Synthesis of Tetrahydropyridines and Isoindolines

Acid-base organocatalyzed enantioselective domino reactions between enones and imines have been developed. (*S*)-3-*N*-isopropyl-*N*-3-pyridylaminomethyl-1,1'-binaphthyl-2,2'-diol (**1**) as an organocatalyst, promotes sequential aza-Morita-Baylis-Hillman (aza-MBH), aza-Michael, aldol, and dehydration reactions of acrolein (**2a**) with *N*-tosylimines **3** to afford tetrahydropyridine derivatives **4** with high enantioselectivity (Scheme 1).

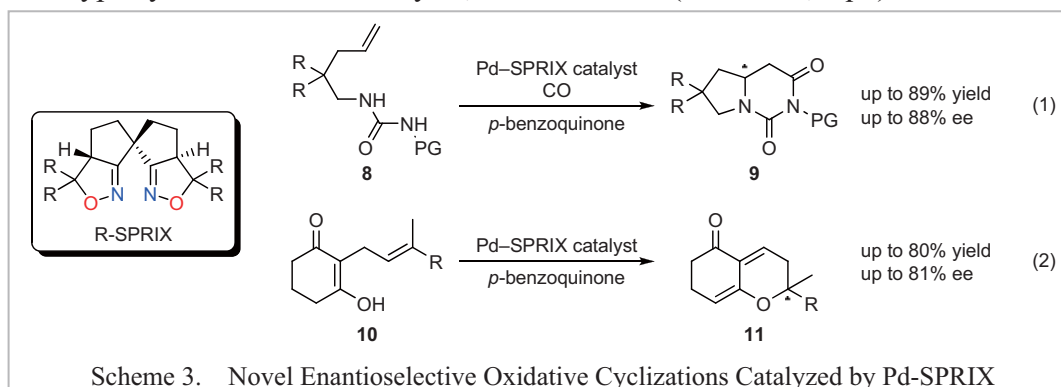


The enantioselective domino aza-MBH/intramolecular aza-Michael reaction of **2b** and **6** provides an efficient method to synthesize isoindoline derivative **7** (Scheme 2).



Enantioselective Oxidative Cyclization Catalyzed by Pd–SPRIX Complexes

Novel enantioselective Pd(0)/Pd(II) catalysis using SPRIX ligands has been developed. Oxidative aminocarbonylation of alkenyl ureas **8** proceeds enantioselectively to give cyclic β -amino acid derivatives **9** in high yields, which are valuable synthons for many biologically active substances (Scheme 3, eq 1) [Original Paper 3]. We have also succeeded in the synthesis of optically active chromenes **11** through an enantioselective Wacker-type cyclization of 2-alkenyl-1,3-diketones **10** (Scheme 3, eq 2).



Development of Novel Chiral Ligands Based on Spirobilactams

New chiral ligands, bithiolactams, dipyridines, and bis(aminophosphine) have been successfully prepared from spirobilactams which are readily available via an enantioselective Pd-catalyzed intramolecular *N*-arylation of malonamides.

Green Powder-Phase Oxidation Using Apatite Powder

We have developed a green powder-phase oxidation reaction for an organic compound, which has such advantages that the system does not require any organic solvent which may adversely affect the global environment, has a high product yield, and enables to reuse a catalyst and the like. The oxidation reaction is performed with the powder mixture comprising of a tungstate catalyst powder dispersed on apatite powder, and the added liquid reactants, an organic compound and aqueous hydrogen peroxide. By use of the powder epoxidation system with hydrogen peroxide, halogen-free high purity glycidyl ethers were prepared from the corresponding allyl ethers. The powder reaction system retarded hydrolyses of the epoxides, compared with hydrogen peroxide-liquid phase reaction.

Department of Regulatory Bioorganic Chemistry

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Assistant Professor: Masaki HAGIHARA, Chikara DOHNO, Fumie TAKEI
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Yoshimi OKA (~2009.11)
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Masami IMAMURA, Masatsugu OKAZAKI, Shun SAKAI,
Tomonori SHIBATA, Keisuke Yoneda, Seongwang Im,
Hiroki Nakagawa, Shizuka Matsunaga, Tomoyuki Mizunashi,
Xi CHEN
Under Graduate Students: Izumi KOHYAMA
Research Assistance: Risa YAMAUCHI (~2009.9), Mayo SENDA
Research Student: Lanxian CHEN
Supporting Staff: Yuriko YAGUCHI

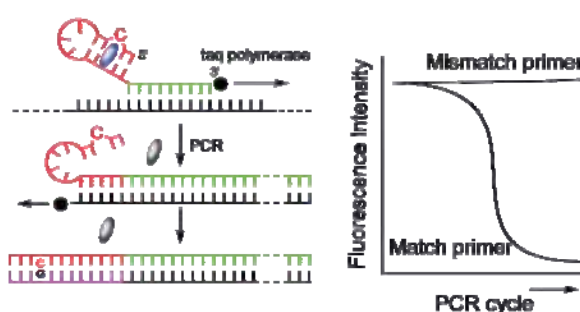
Outlines

We have studied on “Chemical Biology” and “Nano-Technology” based on synthetic organic chemistry. For chemical biology, we focused our attention on 1) molecular design of mismatch binding ligands, and 2) in vitro selection of RNA aptamer binding specific nucleic acid structure. Because DNA is not only a genetic materials but also an important organic materials consisting of C, H, O, N, and P atoms with ability of spontaneously forming a double helix. To use DNA as precision organic materials in nano-technology, we have studied on the chemical properties of DNA and on the synthesis of chemically modified DNA.

Current Research Project

Development of Technology for Single Nucleotide Polymorphisms (SNP)

The technique for promptly detecting the genetic mutation is expected as a basis technology that supports the personalized medicine. In this laboratory, we have proposed the technology for genetic mutation detection that uses a small molecule binding to the mismatch and the bulge structure in the duplex DNA. The

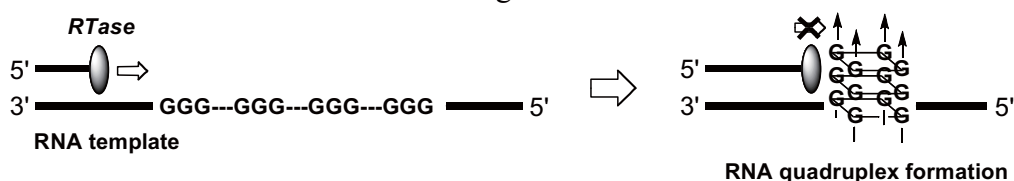


practical technology must be handy, accurate, and cheap in cost. To meet this demand, we did not study the chemical modification of DNA, but used the molecule selectively binding to the cytosine bulge. Upon binding to cytosine bulge, the fluorescence wavelength shifted the long wavelength by 30 nm. By using this characteristic fluorescence, we have succeeded to develop the method detecting single nucleotide polymorphisms. A primer having a cytosine bulge site in a hairpin structure and SNP

recognition site at the end of 3' was prepared for PCR. Using this primer and fluorescent molecules, allele specific PCR was monitored in order to do SNP typing.

Guanine quadruplex structures

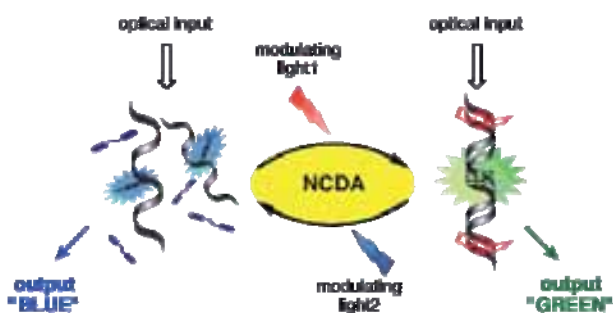
A wide variety of RNA plays an important role in the regulation of biological function within cells. The function of RNA largely depends on tertiary structures, in which RNA molecules use specific hydrogen bonds to form active structures. Among a variety of RNA ternary folded structures, quadruplexes are one of the unique structures, in which four guanine bases make Hoogsteen hydrogen bonds with each other in plane with incorporating metal ion, such as potassium and sodium, inside the tetrads. Recent reports have demonstrated that quadruplex structures in untranslated regions (UTRs) in mRNAs are involved in the translational regulation in vitro and vivo.



To gain insight into local quadruplex structures on an RNA template, we studied an RNA-dependent DNA polymerase stop assay, named a reverse transcriptase stop assay (*RTase* stop assay) [Original Paper 4]. By using the *RTase* stop assay, we revealed a plausible structural polymorphism in biologically important RNAs. The resolution of the *RTase* stop assay is high enough to address the structural diversity of quadruplexes, which would be feasible in many other guanine-rich regions in UTRs. In addition, we found that SNPs in the guanine-rich region affected the stability of quadruplex in UTRs in mRNA and successive protein synthesis.

Development of photoswitchable molecular glue for DNA.

The unique properties of DNA strongly imply its utilization for novel nano-scaled materials. Functional auxiliaries have been installed on DNA, and the function was turned on by hybridization. However, spontaneous double helix formation prevents the function from turning off under the isothermal conditions. Real



application of DNA in nano science needs the switch that turns the installed function on and off. The spontaneous and thermodynamically favorable double strand formation can be reversed by incorporating mismatched base pairs into the DNA sequence and a photoresponsive ligand selectively binding to the mismatched sites when it is activated by light irradiation. The combination of pyrene-based fluorescent base pair surrogates with distinct mismatches that are recognized by a photoresponsive ligand provides a light-driven, DNA-based switching device, that reversibly changes the fluorescence of a pyrene derivative from monomer (blue) to excimer (green) fluorescence or *vice versa* by forward and reverse DNA hybridization controlled by a light induced structural change of the photoswitchable, mismatch recognizing ligand NCDA [Original Paper 5]. The concept is applicable to control a broad range of function on DNA.

Department of Organic Fine Chemicals

Professor:	Nobuo KATO
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Graduate Students:	Takatsugu INOUE, Shinnosuke MACHIDA, Yu HARANOSONO, Yusuke HIGUCHI, Shinjiro SAWADA, Yuriko MARUYAMA, Akie KAWAMURA, Chihiro KONDO, Tomoya TAKAHASHI, Daisuke HAYASHI, Minoru YABU Takuya OHZAWA, Yoshinobu YAMAGUCHI, Tomohiro WATANABE
Under Graduate Student:	Chiaki OURA
Technical Assistants:	Hiroyo MATUMURA, Junko HIKITA (2009.11.2-2010.3.31) Azusa OHTA (2009.11.10-2010.3.31)
Supporting Staff:	Misuzu TANNO

Outlines

The major goal of this department is to identify promising lead compounds for drug discovery. Based on chemical proteomic approaches, our research interests focus on the rational design and synthesis of small organic compounds that potentially modulate/inhibit protein-protein interactions. These compounds are also utilized as a tool in our chemical genomic study to elucidate intracellular signaling pathways.

Current Research Project

Elucidation of the biosynthesis of diterpene glycosides? that can modulate 14-3-3 protein function

We have studied on the biosynthesis of fusicoccane type of diterpenoids? that can modulate 14-3-3 protein function. It has been confirmed that the enzymatic cyclization of geranylgeranyl diphosphate to fusicoccadiene involves transannular proton transfer processes, in which the proton generated from C-10 migrates to C-6 in the intermediary dolabellane framework by successive 1,4- and 1,5-proton transfers using C-2 as a springboard. We have also analyzed functions of related biosynthetic gene products and have clarified the functions of several P450 enzymes.

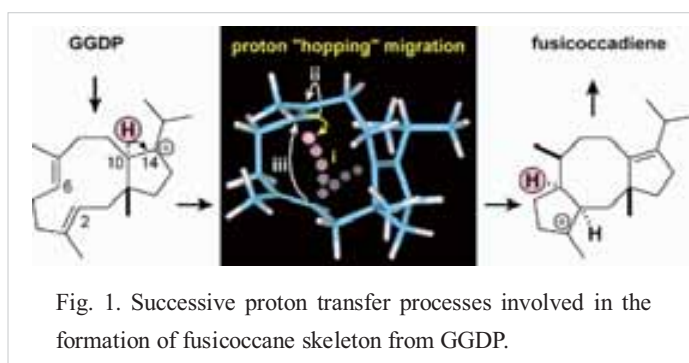


Fig. 1. Successive proton transfer processes involved in the formation of fusicoccane skeleton from GGDP.

Cell permeable dual prenyltransferase inhibitors that recognize identical surface structure

A series of hybrid compounds designed for simultaneous recognition of the active site

and the acidic surface, which is found in both farnesyltransferase (FTase) and type-I geranylgeranyltransferase (GGTase-I), were proven to be potent dual inhibitors for both enzymes *in vitro*. Confocal microscopic analysis by using BODIPY-labeled compounds confirmed that peptidomimetic modification of the anchoring module of the hybrid compounds improved their cell-permeability into A547 cells. The western blot analysis for HDJ-2 prenylation proved that the cell permeable compound inhibits FTase activity in micromolar concentration.

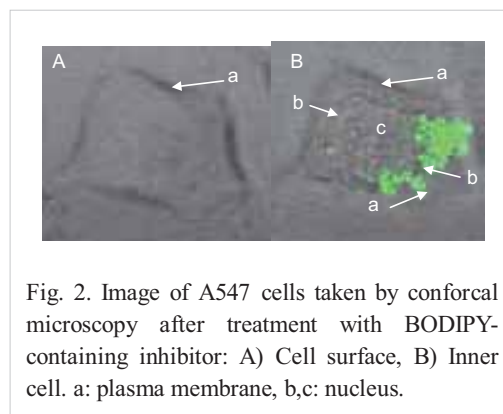


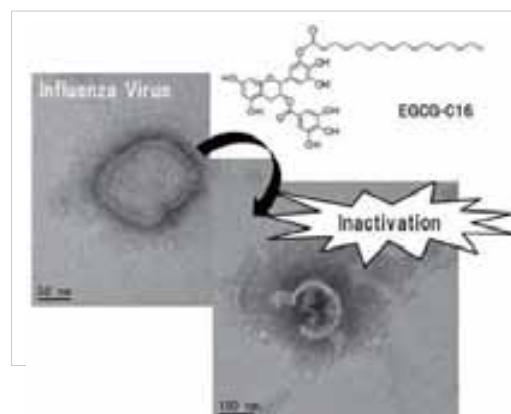
Fig. 2. Image of A547 cells taken by confocal microscopy after treatment with BODIPY-containing inhibitor: A) Cell surface, B) Inner cell. a: plasma membrane, b,c: nucleus.

Synthesis and functional evaluation of non-mevalonic pathway-directed inhibitors as antimicrobial agents

Low-molecular-weight compounds that inhibit non-mevalonic isoprenoid biosynthesis pathway can be potential candidates for selective and less toxic new antimicrobial agents. Based on the structure-activity-relationship study of ketoclofazone derivatives for growth inhibition activity against *H. influenzae*, we identified a series of hydroxamic acids as new antimicrobial agents, which were derived by the ring-opening reaction of isooxazolidione ring system of ketochlofazones. The growth inhibition activity for *H. influenzae* was cancelled in presence of deoxyxylulose, demonstrating that the compound inhibits deoxyxylulose phosphate synthase (dxs), which is responsible for the first step reaction of the biosynthesis pathway.

Inactivation of Pathogens with Polyphenol Fatty Acid Derivatives

A major green tea polyphenol component, epigallocatechin-3-*O*-gallate, was modified with fatty acid derivatives by lipase-catalyzed transesterification. Their derivatives effectively inhibited human and avian-pathogenic influenza viruses. In the collaboration work with Department of Cell Membrane Biology in ISIR, we confirmed that EGCG-fatty acid derivatives showed enhanced antibacterial activities against methicillin-resistant *staphylococcus aureus*.



We also synthesized fatty acid derivatives of silybin, a polyphenol component of milk thistle, and confirmed their enhanced anti-influenza virus activities.

Regulation of DNA Structures by Visible Light Sensitive Peptide Nucleic Acid

A visible light sensitive sulfur-substituted azobenzene (SAZO) was introduced into peptide nucleic acid (PNA). The PNA-SAZO conjugate was found to bind and displace the duplex DNA that involves complementary sequence under visible light irradiation.

Department of Structural Molecular Biology

Professor:	Katsuyuki TANIZAWA
Invited Professor:	Shun'ichi KURODA
Associate Professor:	Toshihide OKAJIMA
Assistant Professor:	Kenji TATEMATSU (2008.9.1-Long term study leave), Takashi MATSUZAKI, Tadashi NAKAI (2009.6.16-)
Part-time Researchers:	Nobuo YOSHIMOTO (-2009.6.30), Masumi IJIMA (-2009.6.30)
Graduate Students:	Mitsuo YAMADA, Yasuyuki TAKAISHI, Azusa TANIMURA, Akio HAMAGUCHI, Sayaka ISHII, Shigehiro MIZUNO, Shouta TSUCHIDA, Yuri KATO, Seigo KIKUKAWA
Supporting Staff:	Mayuko MURAI, Ai OKUBO (-2009.8.31)

Outlines

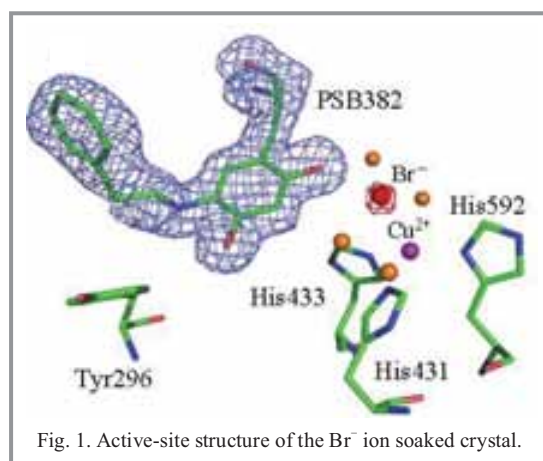
The research of this laboratory is focused on the biochemical and molecular biological studies on various enzymes. Their active-site structures and catalytic mechanisms are being investigated by site-directed mutagenesis, various spectroscopies, and X-ray crystallography. Previous conspicuous findings are the copper ion-dependent, post-translational modification mechanism for the biogenesis of the topa quinone cofactor in copper amine oxidase and the very unique structure of quinohemoprotein amine dehydrogenase (QHNDH) containing a novel built-in type quinone cofactor and internal thioether crosslink structures. Furthermore, we determine crystal structures of the protein domains involved in the bacterial two component signal transduction system (TCS) and elucidate the mechanisms of signal sensing and transcriptional regulation. Furthermore, we have developed hollow bio-nanoparticles displaying various bio-recognition molecules, which are expected to be an ideal vector for the tissue- and cell type-specific gene and drug delivery system.

Current Research Project

X-ray Crystallographic Evidence for Conformational Change of Topaquinone in the Reductive Half-reaction of Copper Amine Oxidase from *Arthrobacter globiformis*

The catalytic reaction of copper amine oxidase proceeds through a ping-pong bi-bi mechanism, comprising two half-reactions. In the former half-reaction, substrate amine reduces the Tyr-derived cofactor, topaquinone (TPQ), to an aminoresorcinol form (TPQ_{red}), which is in rapid equilibrium with the TPQ semiquinone radical (TPQ_{sq}) by intramolecular electron transfer to Cu(II). We have analyzed the reductive half-reaction in the crystals of the enzyme from *Arthrobacter globiformis* by single-crystal microspectrophotometry and x-ray crystallography. When the crystals were reduced anaerobically with a substrate (2-phenylethylamine), the equilibrium between TPQ_{red}·Cu(II) and TPQ_{sq}·Cu(I) shifted significantly toward the TPQ_{sq}·Cu(I) side with

the TPQ_{sq} lying in the ‘on-copper’ conformation, in which the C5-NH2 group of TPQ_{sq} was positioned opposite to the catalytic base (Asp298) and the C4-OH group ligated axially to Cu(I). In the presence of a halogen ion (Cl⁻ or Br⁻) that acts as an uncompetitive inhibitor in the steady-state reaction and shifts the equilibrium toward the TPQ_{red}·Cu(II) side in the reductive half-reaction, the TPQ_{red} in the ‘off-copper’ conformation back-reacted with the product (phenylacetaldehyde) remaining in the active site of the substrate-reduced crystals to form the product Schiff-base. The halogen ion was bound to the axial position of Cu(II) (Fig. 1). In the pre-steady-state analysis of the reductive half-reaction, the halogen ion affected only the rate constants associated with the TPQ_{red}·Cu(II)/TPQ_{sq}·Cu(I) equilibrium. These findings provide structural evidence for the conformational change of TPQ occurring in the reductive half-reaction and suggest that electron transfer from TPQ_{red} to Cu(II) occurs after the TPQ_{red} moving into the on-copper conformation.



Bio-nanocapsule-based enzyme–antibody conjugates for ELISA

Macromolecules that can assemble a large number of enzyme and antibody molecules have been used frequently for improvement of sensitivities in enzyme-linked immunosorbent assays (ELISAs). We generated bionanocapsules (BNCs) of approximately 30 nm displaying immunoglobulin G (IgG) Fc-binding ZZ domains derived from *Staphylococcus aureus* protein A (designated as ZZ-BNC) (Fig. 2). In the conventional ELISA using primary antibody and horseradish peroxidase-labeled secondary antibody for detecting antigen on the solid phase, ZZ-BNCs in the aqueous phase gave an approximately 10-fold higher signal. In Western blot analysis, the mixture of ZZ-BNCs with secondary antibody gave an approximately 50-fold higher signal than that without ZZ-BNCs. These results suggest that a large number of secondary antibody molecules are immobilized on the surface of ZZ-BNCs and attached to antigen, leading to the significant enhancement of sensitivity (Fig. 3). In combination with the avidin-biotin complex system, biotinylated ZZ-BNCs showed more significant signal enhancement in ELISA and Western blot analysis. Thus, ZZ-BNC is expected to increase the performance of various conventional immunoassays.

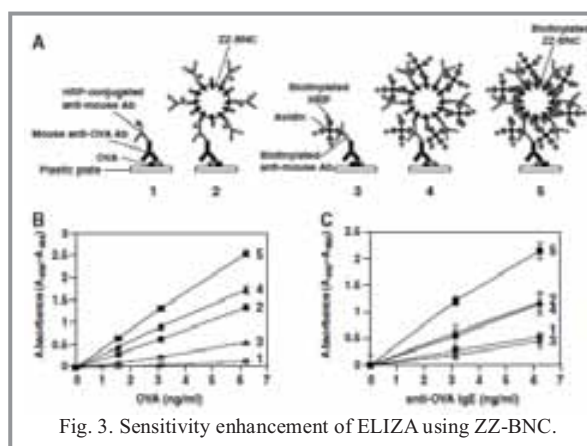
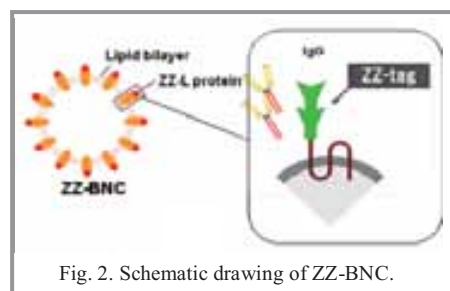


Fig. 3. Sensitivity enhancement of ELISA using ZZ-BNC.

Department of Cell Membrane Biology

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Visiting Professor:	Yoshimi MATSUMOTO
Associate Professor:	Tsuyoshi NISHI
Assistant Professor:	Ryosuke NAKASHIMA
Specially Appointed	
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Graduate Students:	Yu HISANO, Eiji NIKAIDO, Tamami UEDA, Ikue SHIROSAKA, Manami TANAKA, Maki MURATA, Eiji OGAWA, Manabu OJIMA, Shiro HAMANAKA, Tsukasa HORIYAMA, Yuko YOSHIMOTO
Under Graduate Students:	Jyunya OKUDE, Seiji YAMASAKI
Supporting Staffs:	Aiko FUKUSHIMA, Chiho MAEDA, Sumie MATSUOKA

Outlines

Xenobiotic extruding pumps have recently been known to be widely distributed in living organisms from mammalian to bacteria as a host-defense mechanism in cellular level. These pumps not only confer multidrug resistance of cancer cells and pathogenic bacteria but also cause hereditary diseases through the mutation. The purposes of our laboratory are to elucidate the molecular structures and the molecular mechanisms of these xenobiotic exporters and the roles of these exporters in cell functions.

We determined the crystal structure of bacterial major xenobiotic exporter AcrB and elucidated the molecular mechanism of xenobiotic export and the structural basis of multidrug recognition by determining the crystal structure of the drug-binding form of AcrB. In 2009, we continued to analyze crystal structures of the substrate-binding form of AcrB. In addition, studies on the exporters for lipophilic signal transducers in mammalian cells have also been advanced as described below.

Current Research Project

Crystallographic analysis of xenobiotic exporters.

We have succeeded to determine the first crystal structure of bacterial multidrug efflux transporter AcrB in 2002. This is the first crystal structure for transporter proteins. Then we solved the structure of AcrB in complex with its substrates, minocyclin and doxorubicin, in 2006. The AcrB-substrate complex consists of three protomers, each of

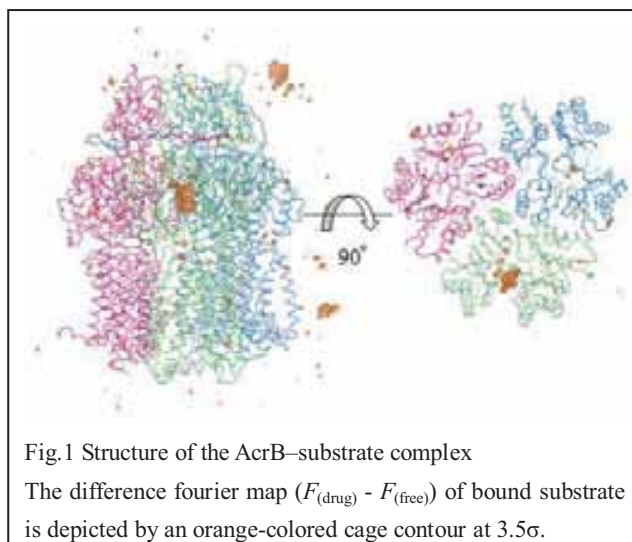


Fig.1 Structure of the AcrB-substrate complex

The difference fourier map ($F_{(\text{drug})} - F_{(\text{free})}$) of bound substrate is depicted by an orange-colored cage contour at 3.5σ .

which represents one functional state of transport cycle. Bound substrate was found in the periplasmic domain of one of the three protomers. The structure clearly revealed that drugs are exported by three-step functionally rotating ordered binding change mechanism. The multidrug recognition is revealed to be based on the multi-site binding of drugs. For further understanding of substrate recognition mechanism of AcrB, we solve crystal structure of AcrB in complex with substrate with high molecular weight (Fig.1). Unexpectedly, the bound substrate was found at upstream region from known "binding pocket" on the presumed substrate translocation pathway. This reveal that AcrB uses extremely wide area to recognize its substrates.

Identification of the sphingosine 1-phosphate transporter.

We have been studying to identify the physiologically functional sphingosine 1-phosphate transporter in mammals. We demonstrated that platelet and erythrocyte have similar ATP-dependent S1P export system. However, we could not identify the S1P transporter. To isolate the S1P transporter molecules, we performed the detail enzymatic characterization of the erythrocyte S1P transporter. This transporter is sensitive to the ABC-type transporter inhibitor, glyburide and Vacuolar-type proton ATPase inhibitor, bafilomycin A1 and is completely inhibited by global ATPase inhibitor, vanadate. Furthermore, in addition to ATP, non-hydrolysable ATP analogues AMP-PNP, ADP and dATP also support the S1P transport activity. These result suggested that erythrocyte S1P transporter is noble ATP-dependent glyburide, bafilomycin A1 and vanadate sensitive transporter (fig. 2).

We identified the spinster like protein 2 (spns2) was physiologically functional S1P transporter in zebrafish. In this year, we also identified that the spns2 orthologues in human and mouse genome (hspns2 and mspns2, respectively) and these orthologues have S1P transport activity as similar extent to zebrafish spns2. To characterize the physiological function of Spns2 in mouse, we established the S1P measurement system by the HPLC. Using this system, we could measure the S1P amount in mouse serum. It was reported that serum S1P plays an essential role for lymphocyte egress from the lymphoid organs. Thus, we would analyze the physiological function of spns2 as a S1P transporter in mouse; such as a maintaining of the blood serum S1P levels.

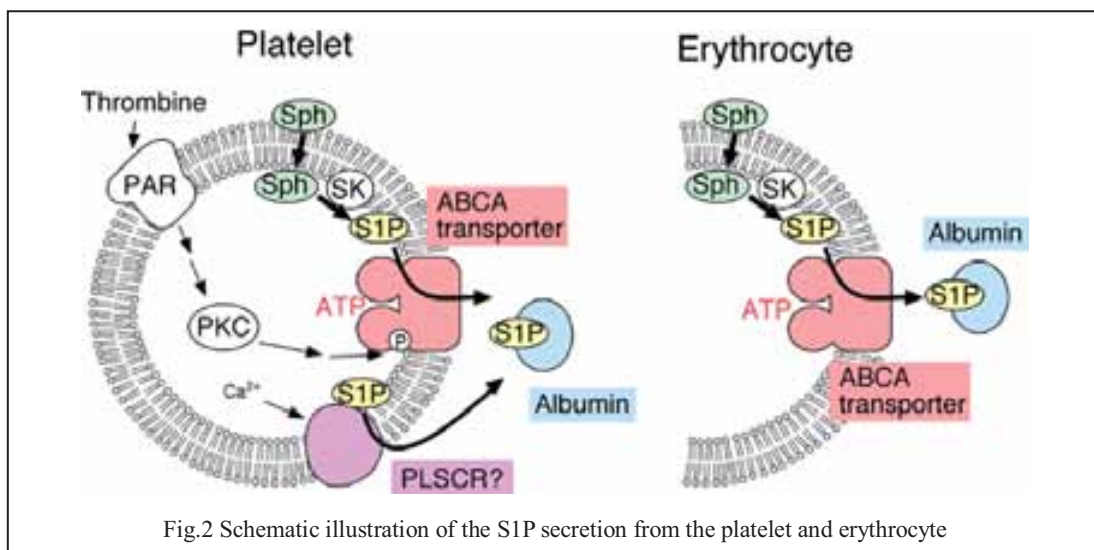


Fig.2 Schematic illustration of the S1P secretion from the platelet and erythrocyte

Department of Biomolecular Energetics

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Associate Professor: Yoh WADA
Assistant Professor: Kazuhito TABATA, Ryota IINO
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Kumiko HAYASHI, Masahiro NAKANO,
Rikiya WATANABE
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Hideyuki YAGINUMA, Uner Naciye ESMA,
Kumiko ARATA, Yuki MATSUKAGE,
Huynh Nhat Phuong KIM, Suguru ARAKI, Takuya OSAKA,
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Supporting Staff: Rie HASEGAWA, Kohei HAYAMA, Kazuyo SAKAI

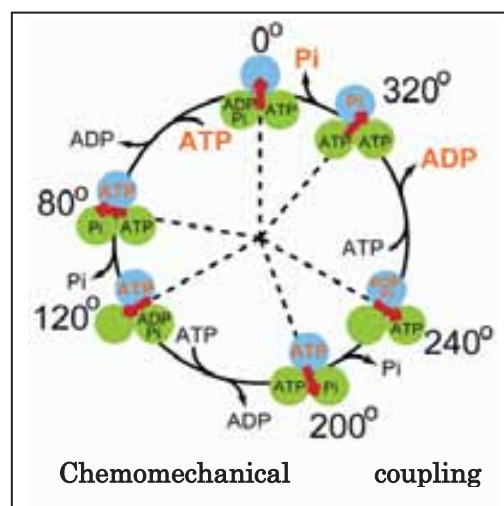
Outlines

Our main research objective is to reveal energy-conversion mechanism of biomolecular motors using single-molecule imaging and single-molecule manipulation techniques. We also conduct live-cell imaging to analyze intracellular level of ATP which is the major energy fuel not only for molecular motors but also for other biomolecules. The development of micron-sized devices for analysis of individual molecules or living cells, is also one of our current projects. Thus, we conduct interdisciplinary researches crossing biophysics, biochemistry, nanotechnology, and micro/nano fabrication.

Current Research Project

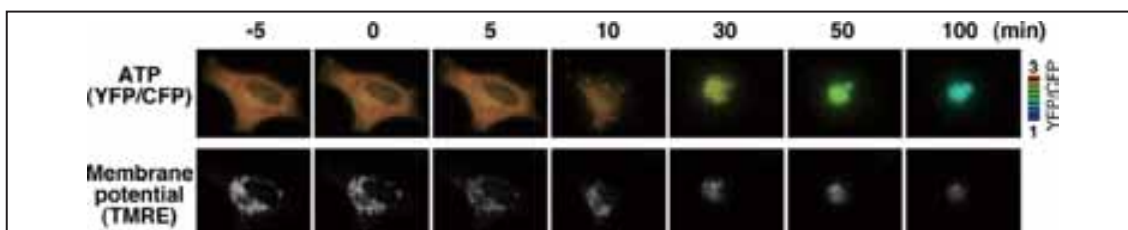
1. The establishment of reaction scheme of a rotary molecular motor, F_1 -ATPase

The establishment of reaction scheme is one of the most crucial steps for the understanding of how individual catalytic reaction steps of ATP hydrolysis are coupled with mechanical motion. While the reaction scheme of F_1 -ATPase has been almost revealed, the timing of release of inorganic phosphate (P_i) has not been identified although P_i -release is thought to be a main torque-generating step. Here, we revealed that F_1 releases P_i after 120-degree rotation from the angle of ATP hydrolysis. This finding is against the widely accepted model, but is consistent with the recently reported crystal structure. From the elaborated kinetic analysis, it was revealed that the affinity of F_1 to P_i exponentially decreases upon the rotation, implying that F_1 release a large amount of energy upon P_i -release via rotation.



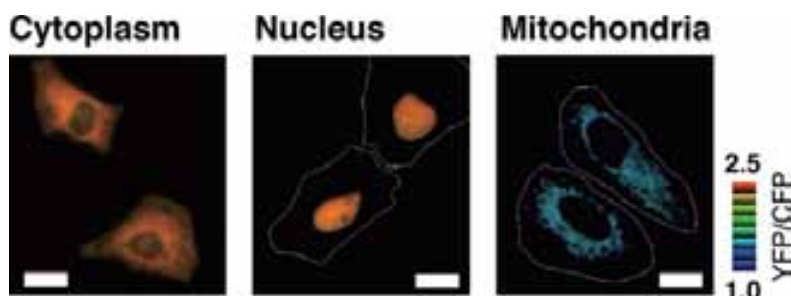
2. Apoptosis and intracellular ATP level.

Last year, we have developed FRET-based ATP sensor protein from the epsilon subunit of F_0F_1 -ATP synthase and fluorescent proteins (CFP and a variant of YFP), and visualized ATP level in cultured mammalian cells. Currently, we are studying about the correlation between apoptosis and ATP depletion in cells. It is thought that the ATP depletion causes inactivation of a lipid flippase and resultantly leads the exposure of phosphatidyl serine (PS) outside which is the chemical marker of the late stage of apoptosis. We simultaneously visualized intracellular ATP level and PS exposure, and found that PS exposure occurred several tens of minutes after the ATP depletion.



Monitoring of ATP level during apoptosis at single cell level.

Apoptosis was induced by 1 μ M actinomycin D to HeLa cells that expressed ATeam probe and was loaded with TMRE. Sequential images of YFP/CFP ratio (top, pseudo color) and TMRE fluorescence (bottom) of an apoptotic HeLa cell. Elapsed time (in minutes) after addition of ActD is shown to the top left of the cells. Images were obtained at 37 °C. Scale bar = 20 μ m



Comparison of ATP concentrations ([ATP]) between different cellular compartments.

Expression of ATeam in different cellular compartments. Ratiometric pseudocolor images of ATeam expressed in cytoplasm, nucleus, and mitochondria.

3. Microdroplet chamber array for single molecule study

We have developed array of micron-sized water droplets on glass coverslip covered with oil. We conduct, in microdroplets, single-molecule enzymatic assay of β -galactosidase and the rotation assay of F_1 -ATPase. These experiments verified the versatility of the developed microdroplets for single-molecule analysis.

Division of Next Industry Generation

Outline

Three new research departments have been established. The goal of each department is to provide advances in science and technology via close relationships with industry, which will lead to create a novel industry in the 21st century.

The departments are:

-Department of New Industrial Projection

Perform research on new projects that can lead to industrial-structure innovations in the next generation.

-Department of New Industry Generation System(s)

Investigate and develop novel business systems that enable transfer of academic research outcomes to a new industry effectively and promptly, and that intend to improve productivity through responding to social demands.

-Department of Intellectual Property Research

Perform the strategic world-leading study of intellectual property linked with potential needs of the society, where the academia is required to create intellectual properties efficiently from the wide-ranging knowledge accumulated from academic research of the new interdisciplinary fields of material, information, and biology.

Achievement

- Research on Analytical Method of Intellectual Properties Licensing of Universities
- Intellectual Property Seminar Series

Department of Intellectual Property Research

Specially Appointed Professor: Hirokazu SHIMIZU

Specially Appointed Researcher: Seiichiro TAMAI

Outline

The object of this department is to perform the strategic world-leading study of intellectual property linked with potential needs of the society, where the academia is required to create intellectual properties efficiently from the wide-ranging knowledge accumulated from academic researches of the new interdisciplinary fields of material, information, and biology.

Current Research Project

Research on Analytical Method of Intellectual Properties Licensing of Universities

We propose a new analytical method of intellectual properties licensing of Universities. Possible licensee of a patent may be picked out effectively by analyzing citation expressed in a proposed patent-paper linkage form. It is also pointed out that the value of the intellectual property may be enhanced by the accumulation of related research papers in explicit expression of patent-paper linkage.

Publications

Intellectual property valuation and licensing, S. Tamai, Intellectual Property Seminar, May 26, 2010

Technology transfer agreement and academia-industry cooperation, H. Shimizu, Intellectual Property Seminar, May 26, 2010

Division of Special Projects

Laboratory of Microbiology and Infectious Diseases

Associate Professor: Kunihiro NISHINO
Research Fellow: Naoki KOBAYASHI
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Manami TANAKA, Manabu OJIMA, Tsukasa HORIYAMA
Under Graduate Students: Seiji YAMASAKI
Supporting Staff: Aiko Fukushima

Outlines

Multidrug-resistant bacteria are now encountered frequently and the rates of multidrug resistance have increased considerably in recent years. Genome annotation produces a considerable number of drug efflux pumps in bacteria. We previously identified efflux pumps related with bacterial multidrug resistance and virulence. Our discoveries support the notion that drug efflux pumps have specific physiological substrates because these pumps have been shown to have roles in bacterial virulence. We are trying to identify natural substrates of drug efflux pumps in order to understand physiological functions of pumps. This knowledge should promote the development of novel inhibitors or strategies that could counteract the contribution of efflux pumps to drug resistance and virulence.

Current Research Project

Impact of the RNA chaperone Hfq on multidrug resistance in *Escherichia coli*

Hfq is a bacterial RNA chaperone involved in the post-transcriptional regulation of many stress-inducible genes via small noncoding RNAs. Although Hfq is related to important phenotypes including virulence in many bacterial pathogens, its role in drug resistance is unknown. The aim of this study was to investigate the role of Hfq in bacterial multidrug resistance. The *hfq* gene was inactivated in *Escherichia coli* by use of the pKO3, which is a gene replacement vector. The drug susceptibility and drug accumulation of the *hfq* mutant were determined. Production level of the AcrB multidrug efflux pump in this mutant was also measured. The *hfq* mutant was sensitive to acriflavine, benzalkonium, cefamandole, chloramphenicol, crystal violet, nalidixic acid, novobiocin, oxacillin, and rhodamine 6G. *E. coli* cells were strongly stained with rhodamine 6G compared to the wild type on deletion of *hfq*, indicating that Hfq affects the accumulation of drug in bacterial cells (Fig. 1). The

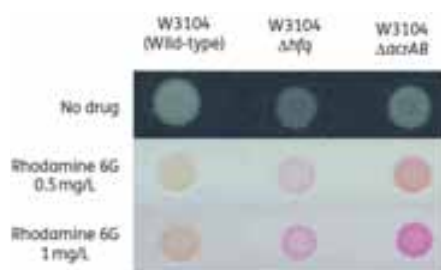


Fig. 1. Hfq affects drug accumulation in *E. coli*. Strains W3104 (wild-type), NKE461 (W3104 Δhfq) and NKE19 (W3104 $\Delta acrAB$) were spotted onto LB agar plates containing rhodamine 6G 0.5 or 1 mg/L. After incubation at 37°C for 20 h, *E. coli* colonies were observed under visible white light.

deletion of drug efflux gene, *acrB*, impairs the effect of *hfq* deletion on *E. coli* susceptibility. Furthermore, the level of AcrB protein production reduced in the *hfq* mutant, whereas *hfq* deletion did not affect the promoter activity of the *acrAB* operon. These results indicate that Hfq regulates the drug efflux system at the post-transcriptional level and reveals the previously uncharacterized role of Hfq in bacterial multidrug resistance.

Effect of NlpE overproduction on multidrug resistance in *Escherichia coli*

There are many putative and proven drug efflux pumps in *E. coli*, and we have previously identified 20 such functional drug efflux pumps. Because many such efflux pumps have overlapping substrate spectra, it is intriguing that bacteria, with their economically organized genomes, harbor such large sets of multidrug efflux genes. The key to understanding how bacteria utilize these multiple efflux pumps lies in the regulation of pump expression. In this study, we performed a genome-wide search for a regulator of multidrug resistance in *E. coli* by random shotgun cloning. We found NlpE, which increases resistance to oxacillin, cloxacillin, nafcillin, cefamandole, aztreonam, carbenicillin, sulbenicillin, carumonam, kanamycin, novobiocin, and deoxycholate by upregulating *acrD* and *mdtABC*. NlpE is anchored to the outer membrane through the lipid attached to its N-terminal cysteine and functions during envelope stress responses in Gram-negative bacteria. Because it was reported that NlpE is involved in copper tolerance, we tested effect of *nlpE*-overexpression on the susceptibility of *E. coli* to CuSO₄. NlpE slightly increased resistance to copper. NlpE-mediated copper resistance was due to increased expression of *acrD* and *mdtABC* via the Cpx pathway. In this study, it was also revealed that NlpE enhances multidrug resistance of *E. coli* in a dose-dependent manner. Structural study suggests that unfolded NlpE is plausibly related to activation of the Cpx pathway. Thus, it is possible that overproduction of NlpE may be resulted in increased amount of unfolded protein and then it stimulated multidrug resistance via the Cpx pathway. Previously, a relationship between NlpE and biofilm formation was also highlighted by a proteome analysis of *Acinetobacter baumannii*. We found the importance of NlpE as a drug resistance factor through the induction of the multidrug efflux genes in this study. Further investigation of the regulation of multidrug efflux systems in several natural environments such as those inside hosts is needed to elucidate the biological significance of their regulatory networks.

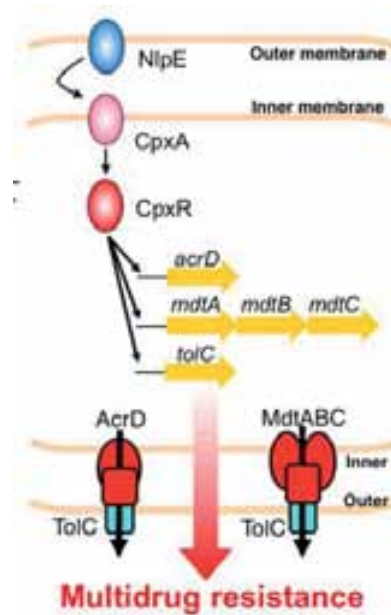


Fig. 2. The regulatory network of bacterial multidrug resistance modulated by NlpE

Laboratory of Atomic Scale Materials Processing

Associate Professor: Takeshi YANAGIDA (2010.1.16-)
Research Assistant: Noriko TAKAZAWA

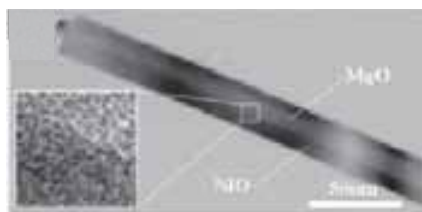
Outlines

This research group investigates the atomic scale materials processing by taking over the nature (biological systems), in which their 3D hierarchical structures are naturally formed by utilizing extremely small energy and reacting limited environments. We are trying to explore the construction of the atomic scale materials processing based on to the natural law, and to create the higher-order hierarchical nanostructures, the functional properties and unique novel devices. Main subjects are (1) Creation of one-dimensional functional oxide nanowires via identifying fundamental principles of the atomic scale materials processing, (2) Search for nanoscale physical properties in a single oxide nanowire, (3) Developments of green-electronics devices (nonvolatile memory and energy conversion, etc.) and biomolecular analysis devices.

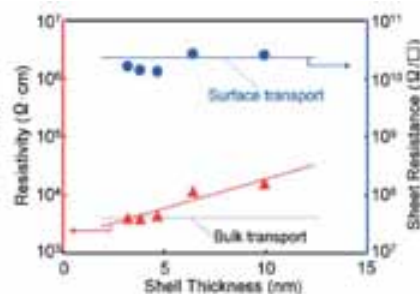
Current Research Project

Fabrication of Functional Oxide Nanowires

We have successfully fabricated the well-defined oxide nanowire heterostructures (MgO/NiO, MgO/Co₃O₄) via the in-situ nanowire template method. The non-contact transport measurements by utilizing a microwave conductivity method showed the inherent transport properties of single crystalline NiO/MgO heterostructured nanowires without the problems of contact resistance.



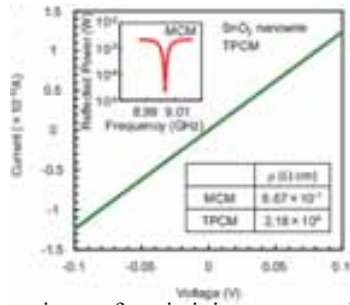
TEM image of the MgO/NiO nanowire.



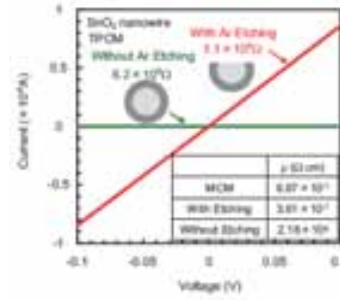
Shell thickness dependence on resistivity of MgO/NiO nanowires.

Development of Single Oxide Nanowire Conductivity Measurement System

We have succeeded in the development of single oxide nanowire conductivity measurement system by clarifying the interfacial effect on Pt metal/ SnO_{2-d} oxide nanowire junctions. We found the presence of insulating oxidized interfacial layer. Since most conductive oxides are typically n-type semiconductors via oxygen vacancies, above implications will be rather universal and crucial for reproducible emerging nanodevices using oxide nanowires.



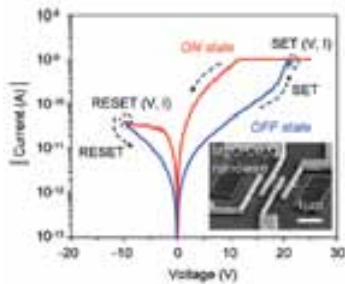
Comparison of resistivity measured by contact and non-contact method.



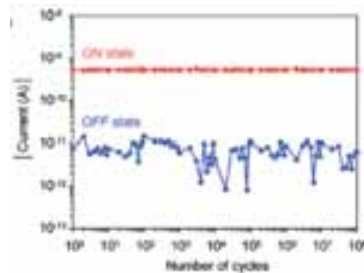
Effect of dry etching in conductivity of n-type nanowire.

Non-volatile Memory Switching in Single MgO/Co₃O₄ Heterostructured Nanowire

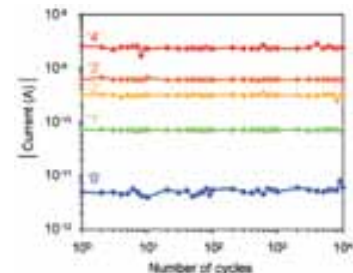
We successfully demonstrate the sublithographic scale (~ 10 nm) multistate non-volatile memory switching in MgO/Co₃O₄ core/shell nanowires. The switching endurance was confirmed at least 10^8 times, which exceeds the limitation of current flash memories. The memory switching could be operated for the power range ($\sim \mu$ W), which is much lower than typical operating power (~ 1 - 10 mW) for the thin film devices. These findings would open up opportunities to explore not only for the intrinsic nanoscale memory switching mechanisms with the ultimate size limit but also for next generation multistate 3D memory devices.



Non-volatile memory effect in single MgO/Co₃O₄ nanowire.



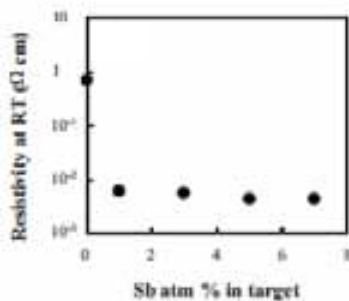
Switching endurance properties.



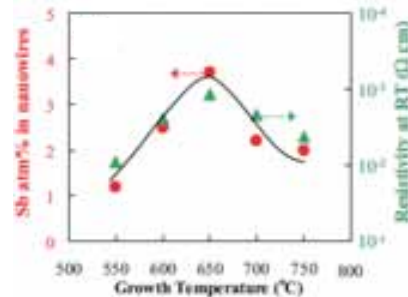
Multi-state memory effect.

Impurity Doping in Oxide Nanowires

We have succeeded in controlling the transport properties of SnO₂ nanowires by Sb doping. Sb doping decreased the resistivity of SnO₂ nanowires down to 10^{-3} ohm cm range. By understanding the Sb incorporation dynamics during the SnO₂ nanowire growth, we successfully improved the efficiency of Sb doping. Thus understanding the dopant incorporation dynamics is essential to control the transport properties of semiconducting oxide nanowires by impurity doping.



Variation of nanowire resistivity by impurity doping.



Improvement of doping efficiency by controlling the dopant incorporation dynamics.

Department of Beam Application Frontier

Specially Appointed Professor:	Seiichi TAGAWA
Specially Appointed Professor:	Masayuki ENDO
Specially Appointed Associate Professor:	Akinori SAEKI (JST PRESTO Researcher)
Specially Appointed Assistant Professor:	Kazuyuki ENOMOTO
Specially Appointed Assistant Professor:	Hiroki YAMAMOTO

Outlines

In department of Beam Application Frontier, we pursue the application of device systems which contribute to the forthcoming information society based on basic researches on materials and processes by applying beams to measurement and nanofabrication. The most important mission in our studies is the establishment of global science infrastructure. Therefore, we construct knowledge infrastructure and try to make new processes and high performance materials.

Current Research Project

1. Study on Radiation chemistry in organic compounds by means of pulse radiolysis

Physico-chemical reactions, which occur within nano- and pico- second region, are considered to dominate followed reactions and products in molecular materials. High-accuracy spectrum acquisition system was developed using CCD camera, highly-stable femtosecond white light continuum, and double pulse detection technique. Using this system, the direct observation of reactive intermediates is carried out to elucidate the mechanisms and to control the reaction. In particular, the dynamics of the radical cation of poly(styrene-ran-4-hydroxystyrene) was investigated. It was found that the hole transfer reaction in the matrix plays an important role in the sensitization of the resist. The hole transfer range is estimated to be ~ 2.5 units (~ 1.0 nm) [Original Paper 3]. Also, the radiation chemistry of fluoronaphthalene and fluorinated benzene derivatives was investigated in order to clarify the decomposition mechanisms and the reaction with acid generators using pulse radiolysis. It was clarified that the decomposition of radical anions and the electron transfer from radical anions depended on the molecular structure.

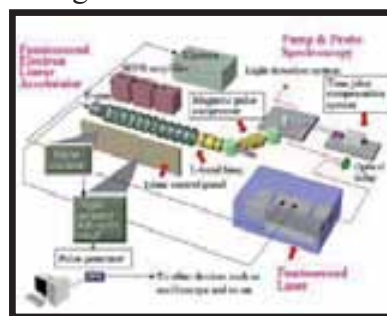


Fig.1 Pulse radiolysis

2. Development of materials and processes in EB/EUV chemically amplified resists

The effect of acid distribution on line edge roughness (LER) was theoretically investigated on the basis of the reaction mechanisms of chemically amplified EUV resists. The fluctuation of line edge originating from the initial acid distribution was compared with LER originating from the chemical gradient. It was found the microfluctuation in the initial acid distribution was sufficiently smoothed out through

catalytic chain reaction. This indicates that the smoothing effect of acid diffusion is essential to the ultrafine patterning with high sensitivity. Also, in a series of pattern formation processes, polymer structure effect on deprotection reaction was investigated in order to elucidate the phenomenon in acid catalytic reaction. The difference of activation energy caused by protecting groups and protecting ratio was observed. Furthermore, we investigated in detail the depth profile of acid generator concentration in PHS films by using X-ray Photoemission Spectroscopy (XPS) for wide concentration range. The samples were etched with electro-spray droplet impact (EDI). Using XPS with EDI, the depth profiles of acid generators in PHS films were clarified up to 100 wt% concentration.

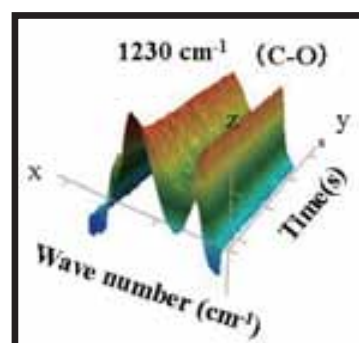


Fig.2 Deprotection Reaction Analysis

3. Simulations of chemical intermediates in chemically amplified resist regarding formation of line edge roughness

The trade-off relationships among sensitivity, resolution and LER (RLS) is the most serious problem. In order to overcome this problem, we successfully reproduced the trade-off RLS relationship depending on the line width of exposed area by Monte Carlo and dissolution simulations. It was demonstrated that LER follows the inverse of square root of exposure dose at moderate acid diffusion length. [Original Paper 4] Also, we examined the origin of frequency-dependent LER by this method. We found that the resist process parameters such as the exposure dose, the base quencher, and the development, cause low-frequency LER even in the absence of mesoscale resist roughness. [Original Paper 6]

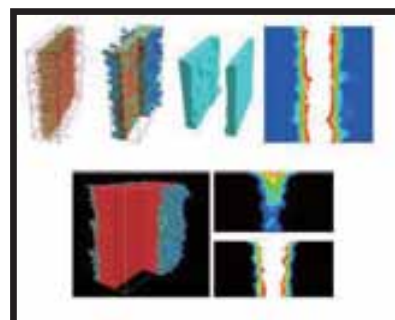


Fig.3 Resist Simulation

4. Optoelectronic properties of organic electronics by microwave conductivity

The dependence of alkyl chain length on transient microwave conductivity and photo-absorption kinetics was investigated for regioregular polythiophene films in the presence of PDI. The intensity of the TRMC signal at the peak and the decay speed decreased with the length of substituent alkyl chain, suggesting that charge carrier separation and decay are hindered by the barrier between polymer main chains. [Original Paper 13] Also, the single crystal of π -bowls sumanene was revealed to show the high electron mobility with large anisotropy by the TRMC method. [Original Paper 14]

5. Study on polymer functional material

Polymer electrolyte membranes (PEM) consisting of ion conducting alkylsulfonic acid and hydrophilic groups such as a hydroxyl group were synthesized by γ -rays-induced graft polymerization of vinyl acetate into a poly(ethylene-co-tetrafluoroethylene) film, followed by saponification and alkylsulfonation with 1,3-propanesultone to improve ion conductivity and mechanical properties under low relative humidity at higher temperatures for next generation fuel cells. The proton conductivity of PEMs was $3.8 \times 10^{-3} \text{ S cm}^{-1}$ (IEC = 1.86 mmol g⁻¹) at 80 °C under 30% relative humidity.

Department of Disease Glycomics (Seikagaku Corporation-Endowed Chair)

Professor: Naoyuki TANIGUCHI
 Associate Professor: Kazuaki OHTSUBO
 Assistant Professor: Congxiao GAO
 Specially Appointed Assistant Professor: Ayako MATSUMOTO
 Specially Appointed Assistant Professor: Kazuki NAKAJIMA

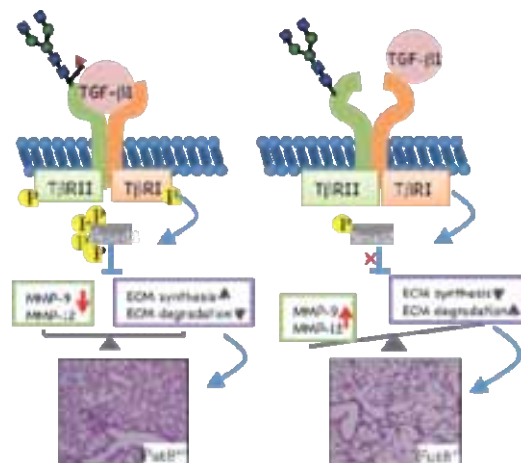
Outlines

Higher organisms use “carbohydrate” as the energy source, as well as the transmitter “Sugar Chain” encoding enormous bio-information by constructing particular glycan structures. The bio-information encoded in glycan structure has been gradually decoded along with the development of glycobiology, and it is well known that sugar chain is essential for maintaining biological functions. Indeed, glycosylation defect evokes various intractable diseases and life-style-related diseases. This laboratory is engaged in biochemical and molecular genetic approach to elucidate the disease process associated with dysglycosylation, to develop diagnostic marker of disease manifestation, and to develop novel strategies for therapy.

Current Research Project

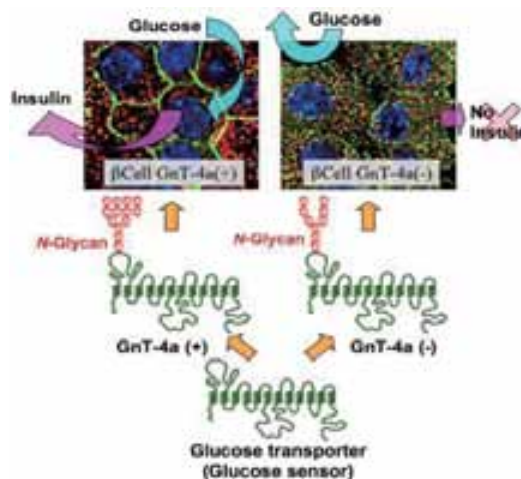
The role of glycosylation in pathology of pulmonary emphysema

In *Fut8* deficient mice, TGF- β receptor can not be fucosylated and diminishes the TGF- β signaling, that results in the MMP activation and lead to emphysematous changes.



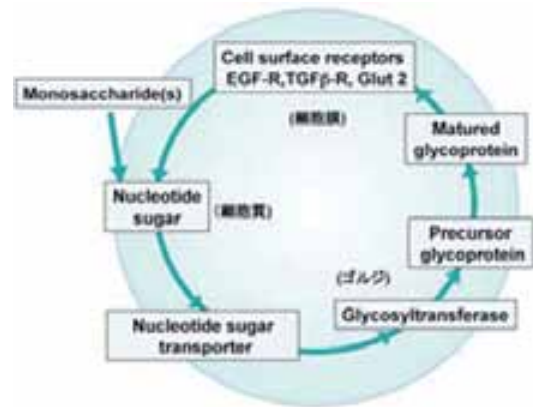
Functional analyses of protein glycosylation in pathogenesis of diabetes mellitus

The proper *N*-glycosylation of glucose sensor is required for the cell surface residency in pancreatic β cells that contributes to maintain insulin secretion. The failure of this mechanism evokes type 2 diabetes.



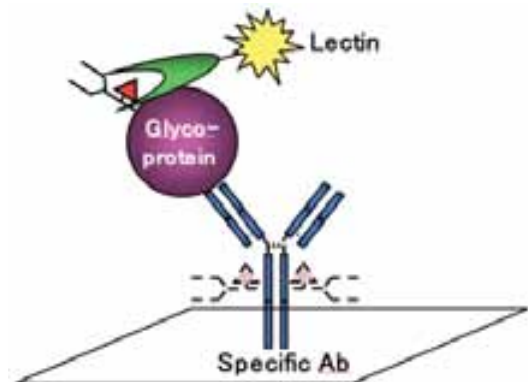
In situ tracing of the fate of carbohydrate

We develop a fundamental paradigm “Glycan Cycle” in which living cell regulates dynamic changes of glycans in response to cellular environments. We could grasp the dynamic cellular information by analyzing the glycan cycle.



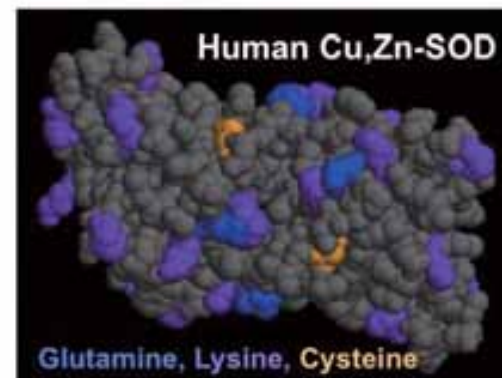
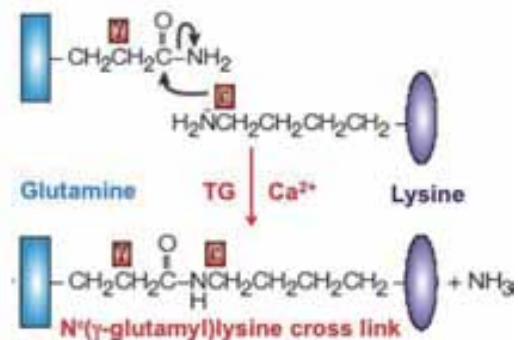
Development of the highly-sensitive and -specific tumor diagnostic marker

We are developing a novel diagnostic technology for cancer by detecting altered protein-glycosylations associated with tumor progression using lectin which preferentially binds to glycan.



Transglutaminase: A pharmacological target for preventing toxic protein aggregation in neurodegenerative diseases.

Transglutaminase (TG) catalyzes crosslinking of Aβ, tau, α-synuclein, and polyglutamylated proteins that causes progressive neuronal death in neurodegenerative disorders. We focused on TG2 as a pharmacological target for amyotrophic lateral sclerosis.



Activities of Centers

Nanoscience and Nanotechnology Center

Director, Professor: Yoshio ASO
Supporting Staff: Masayo HAYASHI

Outline

The Nanoscience and Nanotechnology Center was founded in ISIR in April 2002 as the first nanotechnology center in Japan for developing Bottom-up Nanotechnology, Top-down Nanotechnology, and their collaborated applications in industrial field. Following the reorganization in ISIR in 2009, the Center was strengthened to a new structure led by 6 full-time departments.

In the new Nanoscience and Nanotechnology Center, there are 18 research departments composed of 6 full-time departments, 3 departments on concurrently serving in ISIR, 6 departments on concurrently serving in Osaka Univ. 3 departments of domestic and foreign visiting professors. And the Advanced Nanotechnology Instrument Laboratory is newly opened in order to develop cutting edge researches on nanoscience and nanotechnology. The specified period of time set initially has been cancelled; now the Center focuses on nano-system creation in a wide variety of hard, soft, and bio-materials through the combination of top-down and bottom-up nanoprocess; and the new development generated by the interdisciplinary researches on theory and evaluation. Through these new innovations, nanotechnology research is expected to contribute to the interdisciplinary new science development. Furthermore, through constructing variety networks between Japan and oversea countries, the Center aims to become the hub in nanotechnology research.



Department of Functional Nanomaterials and Nanodevices

Professor: Hidekazu TANAKA
Assistant Professor: Teruo KANKI
Assistant Professor: Azusa HATTORI (2010.2.1-)
Specially Appointed Assistant Professor: Nam Goo CHA
Graduate Student: Hidefumi TAKAMI
Under Graduate Students: Atsushi ONO, Takuya SAKAMOTO
Supporting Staff: Megumi IKEDA

Outlines

This research group focuses on functional oxide materials showing huge response against external fields such as temperature, light, electric and magnetic fields, and establishes techniques for controlling dimensionality and position in nano-scale space concerning optimal oxide materials by fusing two processes of “Bottom-up nanotechnology”, which is a film fabrication technique using a pulsed laser deposition (PLD) method, and “Top-down nanotechnology” for nanoimprint (NIL) and /or atomic force microscopy lithography methods. Our fruition in the near future will lead creation of novel multi-function-harmonized nano-materials/devices with sensing, information processing and memories. The main subjects in this year are outlined below:

Current Research Projects

Nano-patterning of magnetic oxide nano-structures with large area by using nanoimprint lithography and evaluation of their physical properties

The advance of nano-patterning techniques for functional oxide materials is an important subject toward not only construction of nano-integrated devices but also interest in nano-physics for strongly correlated electrons.

Here we demonstrate an original oxide nano-patterning process and show spinel ferrite (Fe,Mn)₃O₄ (FMO) nano-dot structures obtained.

Figure 1 (a) shows a schematic representation of the process. First, a bilayer resist system was employed for the UV-NIL process. The patterned top resist had the same geometry as the quartz mold. The top resist patterns were transferred to the bottom resist following O₂ plasma and the side of bottom resists was more shaved. Mo was deposited on this patterned polymer substrates and the polymer resists were removed by acetone. Epitaxial FMO was grown on this Mo temperate by a PLD. Finally, the film was dipped in H₂O₂ (30%) to remove the Mo mask.

Figure 1 (b) shows SEM images of 60nm-scaled FMO dots.

Figure 1 (c) shows the magnetization hysteresis loop of the FMO nanostructures (red) compared

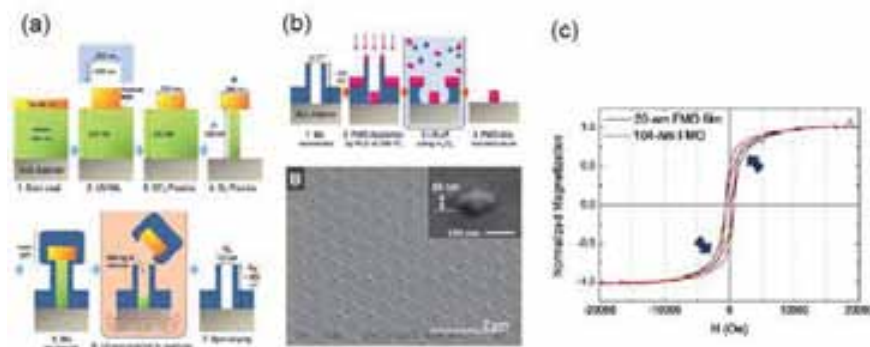


Figure 1 (a) Process of making oxide nanostructures, (b) Deposition of FMO by a PLD method and the SEM image of their obtained FMO nano-patterns. (c) Magnetization curves of FMO nano-dots and film

with that of epitaxial FMO film (black). Thus we successfully obtained FMO nano-dot array with a large area. The advantage of this new process is applicable to make 3D nano-structures.

Investigation of electronic states in W-doped VO₂ thin films

VO₂ with a strongly correlated electron system has an appropriate electronic property for heat sensing devices because of dramatic change of resistivity against small temperature changes originated from the metal-insulator transition. Nevertheless, it is not applicable at room temperature because of the transition temperature (TMI) at 340 K. It is necessary to control TMI down to room temperature. We controlled TMI by W-doping into VO₂ mother materials to obtain high TCR (Temperature Coefficient on Resistivity defined as $(1/\rho)(d\rho/dT)$), which is a performance index of heat sensors, at room temperature, and investigated the W-dopant effect. As a result, we achieved the TCR beyond 10 %/K in V_{0.99}W_{0.01}O₂ thin films as shown Fig.2(a). In order to understand detail mechanism of the high TCR at room temperature, we performed hard X-ray photoemission spectroscopy of the balance band states and the inner core states of V and W. It was found that the chemical state of doped W in VO₂ takes a 6+ valence state. This result shows that carrier density is controllable by filling-control of V⁴⁺ to V³⁺, making metallic states stable and enhancing TCR.

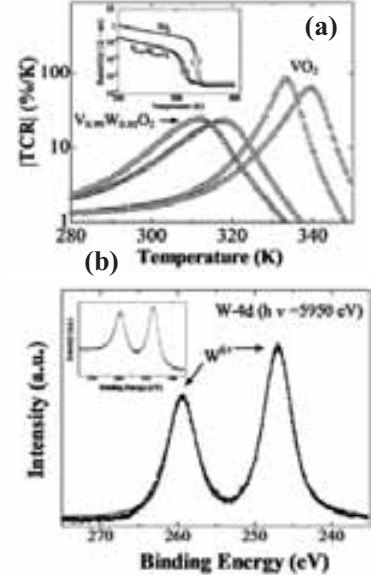


Figure 2 (a) Temperature dependence of TCR, (b) W 4d core level spectrum

Fabrication of stochastic resonance devices using huge non-linear response of VO₂ towards creation of novel information processors

VO₂ also shows huge nonlinear response by applying bias voltage. We propose and create a new concept device mimicking neurotransmission of bio-systems using the nonlinearity of VO₂. Biological systems detect weak signal in noisy environments and the detection ability sometimes enhances by the addition of noise, which is called stochastic resonance (SR). In this research, we succeeded in enhancement of the ability of signal transfer by the addition of noise in VO₂ thin films. Pulse signal was inputted into VO₂ films, which was lower level of amplitude (5.5V) than a threshold of metal-insulator transition (8.0V). Some output signals can be detected with increasing noise intensity. The signal-to-noise ratio between input and output signals enhanced under a particular noise level (Fig. 3), which is typical curve of SR. Thus we succeeded in obtaining SR property of VO₂ thin films. This achievement has fully potential to novel information processors using noise as bio-systems.

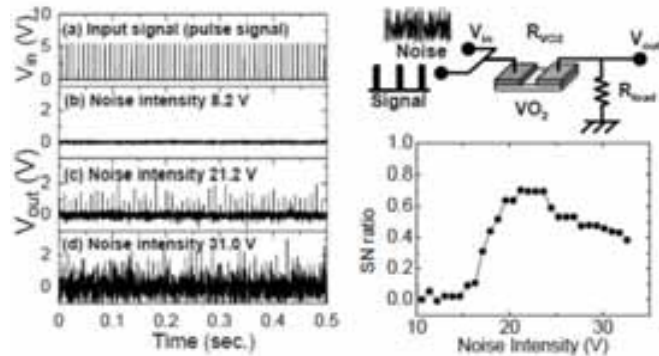


Figure 3 Input and output signals with time series and the stochastic resonance property

Department of Advanced Nanofabrication

Professor: Yoichi YOSHIDA
Associate Professor: Jinfeng YANG, Takahiro KOZAWA
Assistant Professor: Takafumi KONDOH
Specially Appointed Assistant Professor: Koichi KAN
Specially Appointed Professor: Atsushi OGATA
Under Graduate Students: Yohei UMEDA, Shiroaki MATSUKI
Supporting Staff: Mie KOBAYASHI

Outlines

The basic and primary processes in materials are studied for the development of advanced nanofabrication by using quantum beam by means of the time-space reaction analysis method. In order to realize the reaction mechanism in nanospace, a femtosecond/attosecond pulse radiolysis are being developed using an advanced photocathode electron linac. The new advanced nanofabrication process and the interaction of quantum beams with the nano structure are also studied.

Current Research Project

Femtosecond Pulse Radiolysis Study of Solvated Electron in Water

Radiation chemistry of water is very important on radiation therapy and cooling water of a nuclear power plant. It is well known that electrons produced by irradiation in water are stabilized by solvating with 6 H₂O molecules. The pre-solvated electrons are known as precursor of solvated electrons by the result of multiphoton excitation experiment with femtosecond laser. However, the formation process of solvated electron in water radiolysis is unclear because it is formed with the time constant of less than 1 ps. We developed successfully a femtosecond pulse radiolysis with a time resolution of 240 fs using a femtosecond photocathode electron linac and a femtosecond laser. The pulse radiolysis opened at the first time the study of radiation chemistry in the femtosecond time region. The formation and geminate recombination processes of solvated electron in water radiolysis were observed. The experimental data indicated that the hydrated electron is formed during water radiolysis with a time constant of 550 ± 50 fs. About 10% of the hydrated electrons undergo geminate recombination with H₃O⁺/OH radical pairs in the first ten picoseconds.

Femtosecond Pulse Radiolysis Study on Geminate Ion Recombination in Polyethylene Model Compound

The primary process of radiation chemistry was studied by the femtosecond pulse radiolysis of polyethylene model compound. The time-dependent behavior of geminate ion recombination in n-dodecane was investigated in neat n-dodecane and the solutions containing electron and cation scavengers. The excited radical cation was found from analyzing the geminate process by the theoretical simulation based on the diffusion theory. The life time of the excited radical cation was 7 ps in n-dodecane. The reaction rate constant of the excited radical cation with the triethylamine (TEA) was 3.3×10^{11}

$\text{dm}^3\text{mol}^{-1}\text{s}^{-1}$, which is one order higher than the normal diffusion rate constant. Although 74% of the excited radical cations are relaxed to the radical cation, the residual 26% are geminately recombined with electrons.

Development of femtosecond photocathode RF gun for attosecond electron bunch generation

In order to develop attosecond pulse radiolysis, a femtosecond electron source based on a photocathode RF gun and a femtosecond laser was investigated experimentally. Femtosecond ultraviolet (UV) light was injected into the photocathode RF gun with third-harmonic generation (THG) of the femtosecond laser. At a bunch charge of 8 pC, RF compression overwhelmed the longitudinal space-charge and electron bunch of 200 fs was generated successfully. Beam dynamics in the gun was studied and electron bunch with 1.2 mm-mrad emittance (high quality) was generated. Simulation study of bunch compression of the femtosecond electron bunch with higher-order compensation indicated realization of attosecond electron generation.

Study of EUV Lithography

Chemically amplified resist system is one of the most practical candidates in the future technology in semiconductor fabrication. Reaction mechanisms in the system were analyzed upon exposure to electron beams, X-rays, and laser beams to design a new lithography technique in the present program. The correlation between C37 parameter and acid generation efficiency was clarified. Electron beam lithography has the highest resolution among top-down writing systems. The ultimate spatial resolution is closely related to the reaction mechanism of resist materials. The relation between line edge roughness and reaction mechanisms was investigated by a subpicosecond pulse radiolysis. The feature sizes in micro-fabrication have shrunk with the progresses in lithography technology. The decrease in deviation of resist pattern has been also needed to molecular size. Thus, distribution of photo-acid generator (PAG) and orientation of polymer matrix have been important issues. X-ray reflectivity measurements were carried out to understand PAG distribution and polymer orientation from the resist film density map in-depth.

Department of Nanocharacterization for Nanostructures and Functions

OTAssociate Professor: Manabu ISHIMARU
Graduate Students: Fumihiko NAKAMURA, Yuusaku NISHIYAMA,
Takahiro HATTORI
Supporting Staff: Shigeko TOMII

Outlines

In controlling structures of new functional materials, introduction of new local structure analysis techniques to the materials becomes necessary. Using high-resolution electron microscopy, electron diffraction and electron energy-loss spectroscopy, we are mainly analysing local atomic structures and electronic states of functional alloy nano-particles, amorphous alloys, ion-irradiated ceramics and multi-layered materials. We are also developing new local structure analysis techniques using nano-sized electron probe, energy-filter and imaging-plate. Molecular dynamics and Monte-Carlo calculations and electronic band structure calculations of new materials are carried out for predicting their structures and physical properties.

Current Research Project

Structural characterization of low-dimensional nano-structured materials

The introduction of structurally and/or compositionally modulated structures into semiconductor materials is of technological importance for adding desirable functionalities to electronic and optoelectronic devices. Spontaneous formation of nanostructures during crystal growth, the so-called self-assembly or self-organization, is one of the useful ways to introduce the modulated structure to materials in atomic scale. Here we demonstrate that nanoscale phase separation perpendicular to the growth

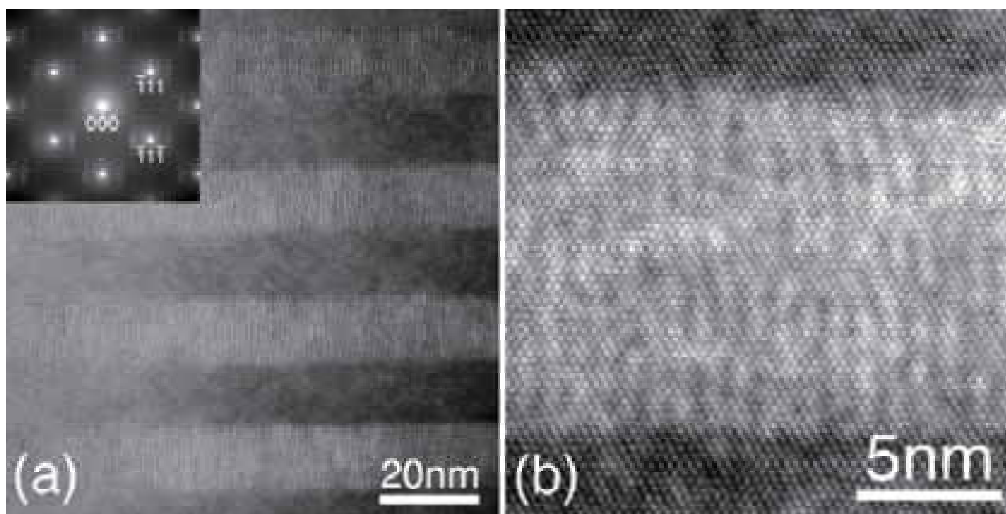


Fig. 1 (a) Bright-field image and electron diffraction pattern of TlGaInAsN/TlInP multiple quantum well structure. (b) HAADF-STEM image of TlGaInAsN layer.

direction can be realized in III-V semiconductor alloys. Figure 1(a) shows a cross-sectional bright-field TEM image of a TlGaInAsN/TlInP multiple quantum well structure, viewed along the [110] direction. The TlGaInAsN (bright contrast) and TlInP (dark contrast) layers are alternatively stacked. The TlInP layers reveal uniform diffraction contrast, whereas a modulated structure exists in the TlGaInAsN layers. In the electron diffraction pattern (inset), satellite reflections are apparent on both sides of the Bragg reflections, indicating that the modulated structure is highly arranged. The modulation period was estimated to be ~ 1 nm. On the other hand, no modulation was observed in the image and diffraction pattern viewed along the [1-10] direction. That is, vertical quantum wells are formed in the TlGaInAsN layers. The modulated structure is also confirmed by HAADF-STEM observations [Fig. 1(b)]. From the HAADF-STEM and EDX analyses, it was found that the modulated structure consists of Ga- and In-rich regions, indicating that nanoscale phase separation occurs along the lateral direction [Original paper 8].

Chemical disorder in ion irradiated GaN

Atomic structures of high-energy ion irradiated GaN have been examined using TEM. Figure 2 shows a cross-sectional TEM image of GaN irradiated at cryogenic temperature with 2 MeV Au^{2+} ions to a fluence of 7.35×10^{15} Au/cm^2 . It is apparent that an ion-beam-induced damaged region possesses a layered structure: A, C: amorphous/ nanocrystalline, B, D: defective crystalline GaN, and E: GaN substrate. The ion-beam-induced layer contains bubbles due to N_2 gas. The N_2 bubbles become large at the buried damaged layer and prominent phase segregation occurs accordingly. Figure 3 shows atomic pair-distribution functions of the surface and buried amorphous/nanocrystalline GaN. The atomistic structures of amorphous/nanocrystalline phases retain the GaN tetrahedral configuration as the primary structural unit of crystalline GaN, but some Ga-Ga bonds, which do not exist in the crystalline state, are observed within the first coordination shell [Original paper14]. The formation of the self-bonded Ga atoms is attributed to phase segregation during irradiation. It is found that the degree of chemical disorder becomes more pronounced at the buried damaged layer, as compared with the surface damaged layer. This is associated with prominent phase segregation due to the formation of large bubbles.

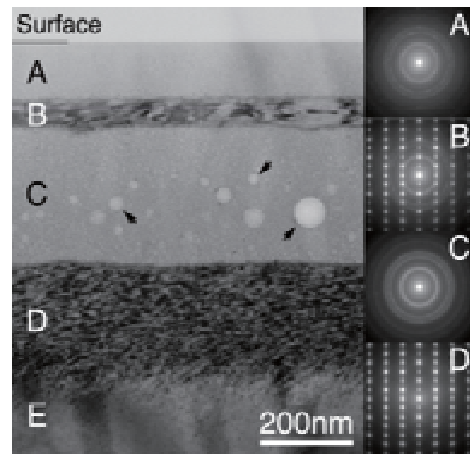


Fig. 2 Cross-sectional bright-field TEM image and electron diffraction patterns. The ion-beam-induced damage shows a layered structure.

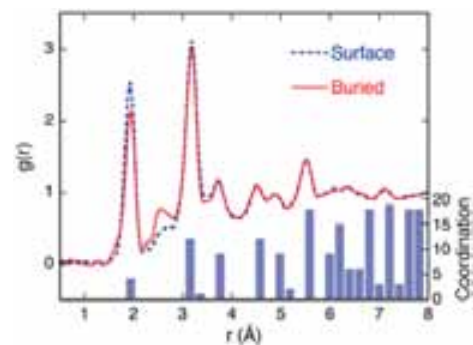


Fig. 3 Atomic pair-distribution functions, $g(r)$. For comparison, the interatomic distances and coordination numbers every 0.2 nm are indicated.

Department of Theoretical Nanotechnology

Associate Professor: Koun SHIRAI, Yoshitada MORIKAWA (-2009.9.30)
Professor: Yoshitada MORIKAWA (2009.10.1-2010.3.31)
Research Technical Expert: Akira YANASE
Guest Professor: Mitsuhiro MOTOKAWA
Post Doctoral Fellows: Susumu YANAGISAWA(-2009.9.30)
Graduate Students: Kenji TOYODA, Haruhiko DEKURA, Jun ISHISADA,
Nobuya NAKAE, Hideyuki MORIMURA, Shouhei
KOMORI, Takahiro SAIGO, Taiga YASUDA
Supporting Staff: Minako KAKIUCHI, Ryoko ITO(-2009.9.30)

Outlines

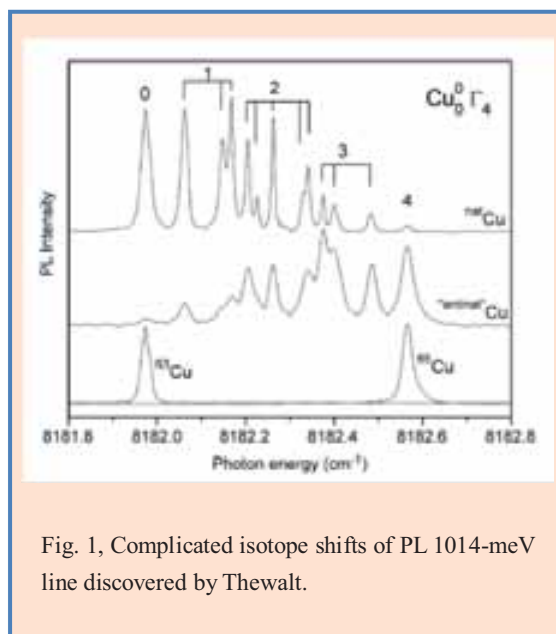
The primary activities of this department are theoretical study of electronic properties of nanomaterials, which are different from those of bulk crystals. The first-principles calculations based on the density-functional theory are used, in order to exclude any empirical parameters. More importantly, we wish to predict unknown features of new nanostructure and design novel nanomaterials. Leading of material researches from the theoretical viewpoint is one of our mission.

At the same time, efforts are continued to keep development in the methodologies in order to solve difficult problems encountered in this field, because nanoscience is different from study of bulk materials with many respects.

Current Research Project

Luminescence of Cu complex and design for light emission device

Control of defects is a major concern of semiconductor researches. In silicon, Cu impurity is usually regarded as a detrimental species. However, in some situation, Cu impurities form a complex and the complex becomes a very strong and sharp centre for photo emission, which is called PL 1014-meV line. A recent surprise of this subject is a discovery of special isotope shift of this emission by Thewalt's group. What their discovery indicate is that existing models of Cu pair, which have been accepted during two decades, are incorrect. Our study shows that the most probable form of the complex is a four-membered complex $\text{Cu}_{(s)}\text{Cu}_{(3i)}$ [Proc. 5]. This structural model is compatible with the new data. The most difficult problem then remained is how such a complicated



splitting occurs. There is no preceding theory. Our proposal for this problem is involvement of a non-totally symmetric mode in the zero-phonon transition.

Superconductivity materials research on boron-rich solids

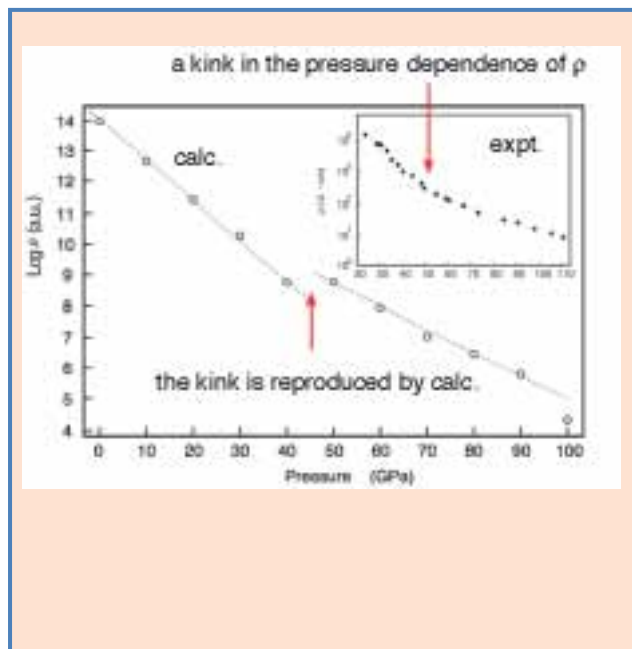
Boron solids are, similar to diamond, strong electron-phonon coupling systems and thereby have potentially high- T_c superconductivity [2]. Recently, it has been discovered that the semiconductor boron becomes metallic at high pressures and finally undergoes a superconducting transition at 160 GPa. Many things were unknown until recently; what is the structure at such high pressures? is there any phase transition? etc. We have established the phase diagram of boron, which were not available before our study.

Based on this phase diagram, study of superconductivity of α -boron at high pressures became to be most promising study, because of stability at high pressure and perfectness of crystal. Then, we got started collaboration work with experimentalists on this subject. The experimentalists discovered superconductivity in α -boron, and moreover the accurate structural study has been performed, which shows that there is no phase transition about α -boron. Therefore, it is clear that semiconducting α -boron becomes metal without changing the crystal structure. The intrigued mechanism of this change has been studied [1].

It is caused by a gradual change in the bonding character from semiconductor to metal. The increase in the metallic character is caused by the shortening of the three-center bond, which is a characteristic feature of icosahedron-based boron crystals. This shortening of the three-center bond enhances the bonding character of the conduction bottom band and finally closes the band gap.

However, even far before the gap closing, the shortening has important consequences for the crystal properties of α -boron: for the changes in the deformation of the lattice and in the librational phonon mode at approximately 50 GPa. This change in structure affects the change in band structure, which appears in a bowing of the energy gap. The kink in resistivity is a direct consequence of the change in this energy gap. This kink feature used to be thought to occur due to a phase transitions.

All these explanations provide a coherent understanding of the characteristic changes in resistivity, the deformation of the lattice, and the librational mode.



Department of Soft Nanomaterials

Professor: Yoshio ASO
Associate Professor: Yutaka IE
Assistant Professor: Makoto KARAKAWA
Graduate Students: Masaru ENDOU, Masashi NITANI, Tomoya HIROSE,
Takahiro NOZAWA, Yuuya HAMANO,
Takahiro SAKURAI, Kazufumi NISHIDA
Under Graduate Students: Masashi UETA
Supporting Staff: Misayo IMAI, Ming-chun HSIEH (2010.1-),
Etsuko TANI (2010.3-), Takeo MAKINO

Outlines

The main subject in the Department of Soft Nanomaterials is the development of novel molecular-based materials with promising electronic and photoelectric properties for organic electronics. The research is based on the design and synthesis of nano-scale p-conjugated molecular materials for organic electronics as well as molecular electronics and the elucidation of the relationship between molecular structures and physical properties to control and improve the functions. We have been focusing our research on the development and evaluation of (1) chemically modified pi-conjugated systems as organic semiconductors with high electron mobility, (2) photovoltaic materials based on pi-conjugated systems with increasing self-association tendency that forms carrier-transporting paths, and (3) functionalized molecular wires and metal-electrode-anchoring units applicable to molecular electronic devices.

Current Research Project

Organic Electronics Materials

We have developed organic materials for n-type field-effect transistors (FETs), p-type FETs, ambipolar FETs, and organic memories.

It has been known that the introduction of electron-withdrawing groups into pi-conjugated systems increases their n-type character. We have designed difluorodioxo-cyclopentene-annelated thiophene and carbonyl-bridged bithiazole monomer units and synthesized their based conjugated oligomers. Their electronic absorptions, X-ray analyses, and redox potentials indicated that ring fusion of aromatics not only keeps the planarity but also increases n-type character. [Original Papers 3, 8, and 10] (Fig. 1) On the basis of these findings, we have further modified the terminal groups of carbonyl-bridged bithiazole conjugated oligomers to highly electronegative structures and also introduced

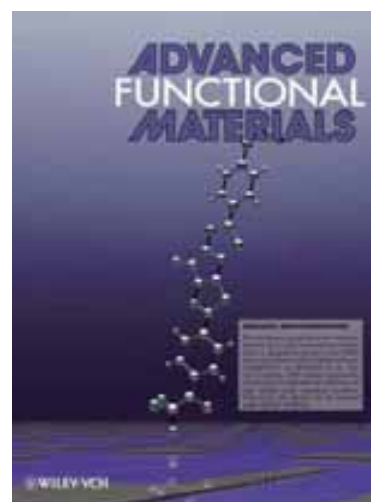


Fig. 1. Carbonyl-bridged bithiazole

solubilizing units to the oligomers for wet-process applications. Some of their wet-processed thin films revealed high field-effect electron mobility as well as air stability. Moreover, difluorodioxocyclopentene-annulated thiophene was converted to a dicyanomethylene-introduced thiophene derivative, and conjugated oligomers having its terminal unit have been developed. Their cyclic voltammetry indicate fairly low LUMO levels, and their FET devices showed high n-type FET performance and air-stable operation as our expectations. In addition, some these oligomers reveal a broad absorption band in a visible and longer wavelength region, and a preliminary photovoltaic-device application indicate that they can be new acceptor materials for organic solar cells.

In anticipation of self-association properties, we have synthesized the highly branched oligothiophenes with the juncture of 1,3,5-trisubstituted benzene for the development of high carrier-mobility materials in a film. [Original Paper 1] (Fig. 2)

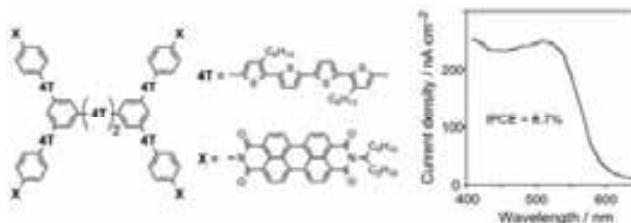


Fig. 2. Branched oligothiophenes and photovoltaic device.

We have synthesized new polymers having the branched structure and studied on the effects of branched structure to physical properties. Their FET devices showed a typical p-type characteristic, and the field-effect mobility increased with increasing the branch chains. Moreover, in order to develop new pi-conjugated compounds applicable to organic memory materials, we have studied the synthesis, optical and electrical properties, and device characteristics of the twisted polythiophenes. As we expected, the polythiophene with twisted structure showed interesting conductance switching property in a thin film device.

Molecular Electronics Materials

In the field of molecular electronics, it is highly important to connect securely each molecule to a metal electrode and to realize efficient carrier injection. In this context, we have developed tetraphenylmethane tripodal anchor units with variety functional groups [Original Paper 5] (Fig. 3) and phenylene-ethynylene molecular wires with anchoring units on the both terminal ends. We have newly synthesized tripodal compounds with pyridyl and amino groups. Their monolayers on a gold electrode revealed that the surface coverage of the pyridyl tripodal anchor is smaller in one order compared with tripodal thiol anchor, and that of the amino anchor is comparable to that of tripodal thiol anchor. These results indicate that functional groups having weak adsorption nature can be also connected to gold electrodes by integrating into the tripodal structure. Moreover, the phenylene-ethynylene compound with tripodal pyridyl anchors showed a good electrical conductivity on the STM break-junction measurement.

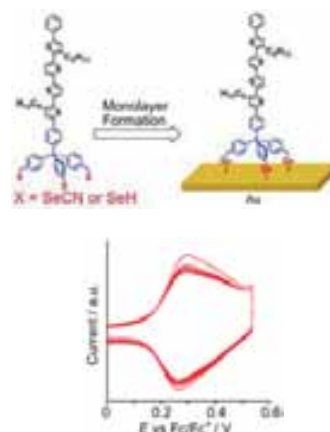


Fig. 3. Tripodal anchor unit.

Department of Bionanotechnology

Professor: Tomoji KAWAI
Associate Professor: Takuya MATSUMOTO, Masateru TANIGUCHI
Assistant Professor: Hiroyuki TANAKA,
Takeshi YANAGIDA(-2010.1.14)
Specially Appointed Professor: Hea-Yeon LEE
Specially Appointed Assistant Professor: Bong Kuk LEE
Post Doctoral Fellows: Masaki KANAI, Makusu TSUTSUI, Akihiko TAKAGI
Graduate Students: Koji SUZUKI,, Takumi KOBAYASHI, Kazumichi YOKOTA,
Kazuki NAGASHIMA, Hideyuki KAWAGUCHI, Keisuke
OKA, Yuji SEGAWA, Masahito KAWANO, Kosuke
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Under Graduate Students: Tetsuo NODA
Supporting Staff: Noriko FUJIBAYASHI, Yumiko NOGI

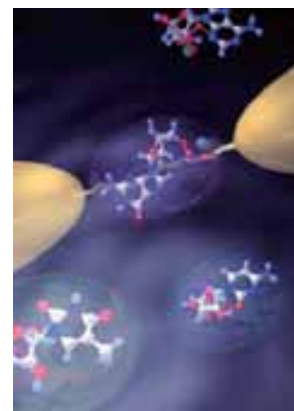
Outlines

This research group directs toward both nano-science and nanobio-technology in its activity. Main subjects are (1) Preparation of Function Harmonized Artificial Lattices, (2) Atomic Scale Surface Science, (3) Development of Bio-tip, and (4) Development of bio-molecular device constructed from DNA. By use of a laser molecular beam epitaxy technique under layer by layer growth conditions, we are challenging in development of highly sensitive IR –sensor by functional transition metal oxide nano-film. Observation and manipulation of a single atom or a molecule are undertaken on DNA molecules with Scanning Probe Microscopic (SPM) methods. And also we developed the ultrasensitive electrochemical gene sensing system by using nanowell array electrodes.

Current Research Project

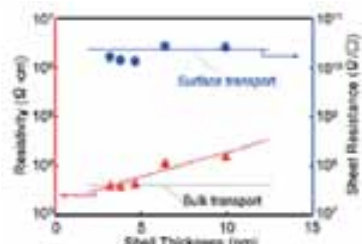
Identifying Single Nucleotides by Tunneling Current

Electrical detection of individual nucleotide molecule is accomplished by probing tunneling current across the nanogap electrodes whose gap size precisely controlled to the molecular length of nucleotides at a sub-picometer resolution. We also demonstrate clear statistical discrimination of single nucleotides via the HOMO-LUMO gap related tunneling currents, thereby providing essential scientific basis for the emerging DNA sequencing technology. [Original Paper 18]



Fabrication of Functional Oxide Nanowires

We have successfully fabricated the well-defined oxide nanowire heterostructures (MgO/NiO, MgO/Co₃O₄) via the in-situ nanowire template method. The non-contact transport measurements by utilizing a microwave conductivity method showed the inherent transport properties of single crystalline NiO/MgO heterostructured nanowires without the problems of contact resistance.



TEM image of the MgO/NiO nanowire. Shell thickness dependence on resistivity of MgO/NiO nanowires.

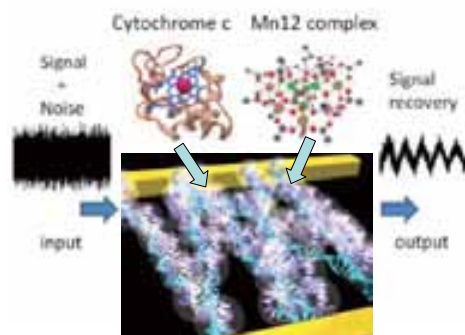
Single molecule Sequencing by Using of Scanning Tunneling Microscopes

We report single-molecule DNA sequencing with a STM by using an oblique pulse-injection method to deposit the molecules onto a copper surface. First, we show that guanine bases have a distinct electronic state that allows them to be distinguished from the other nucleic acid bases. Then, by comparing data on M13mp18, a single-stranded phage DNA, with a known base sequence, the 'electronic fingerprint' of guanine bases in the DNA molecule is identified. These results show that it is possible to sequence individual guanine bases in real long-chain DNA molecules with high-resolution STM imaging and spectroscopy. [Original Paper 29]



Stochastic Resonance Emerging on Self-assembled Molecular Network Devices

We have aimed the emergence of novel device that can induce SR, constructing the molecular network by coupling bio substances and organic molecules with the self-organization. We have used cytochrome *c* (cyt *c*) and Mn₁₂ complex including a redox center and DNA (Poly(dA)Poly(dT) DNA or λ-DNA) which can assist the fabrication of cyt *c* arrays which are charge transport route. Since the redox center in cyt *c* and Mn₁₂ is insulated, it is difficult to receive the influence of outside environment. Therefore, cyt *c* and Mn₁₂ arrays that the height of energy barriers is identical one after another are expected to be obtained. The I-V characteristics indicate that each cyt *c* and Mn₁₂ acts as Coulomb blockade element and the devices show the function of stochastic resonance.



Nanoarrays of Tethered Lipid Bilayer Rafts on Poly(vinyl alcohol) Hydrogels

We report a nano(submicro) array of tethered lipid bilayer raft membranes (tLBRMs) comprising a biosensing platform. Poly(vinyl alcohol) (PVA) hydrogel was directly patterned onto a solid substrate, using ultraviolet-nanoimprint lithography (UV-NIL), as an inert barrier to prevent biofouling. The deposition of tLBRM nano(submicro) arrays was accomplished by a mixed, self-assembled monolayer-assisted vesicle fusion method. These results suggest that the fabrication of inert nanostructures and the site-selective modification of solid surfaces to induce vesicle rupture may be essential in the construction of tLBRM nano(submicro) arrays using stepwise self-assembly.

Department of Nanotechnology for Environmental and Energy Applications

Professor: Yoichi ANDO

Outlines

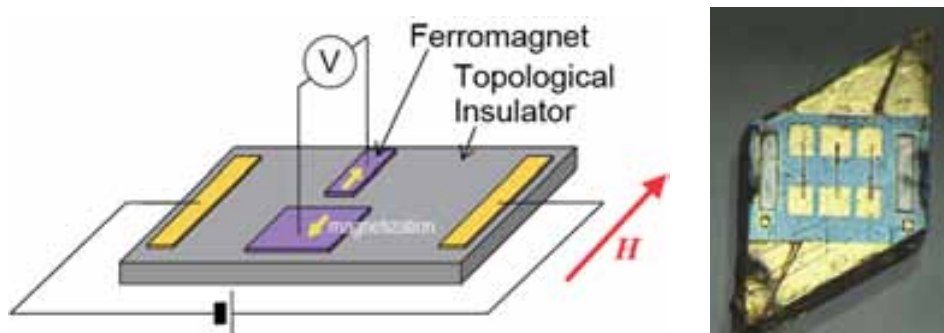
To address the urgent issues of environment and energy, we are studying basic properties of novel spintronics materials and unconventional superconductors by utilizing the facilities for micro/nano-fabrications available at the Nanoscience and Nanotechnology Center. This year, we mostly focused on topological insulators.

Current Research Project

Basic Research of Topological Insulators for Spintronics Applications

This project explores new avenues of the spintronics to utilize the “helically spin-polarized” metallic state that exists on the surface of a *topological insulator*, which is a new state of matter discovered in 2008. In the helically spin-polarized surface state, the current direction and the spin polarization is directly coupled; namely, right- and left-moving electrons carry up and down spins, respectively. This allows a completely new way to generate and control spins with minimal energy dissipation.

The helically spin-polarized surface states of topological insulators have been observed by photoemission experiments, but its implications on the spin transport properties have not been fully understood. In fact, it is not clear how one can extract spin currents from those peculiar surface states. It is therefore important to develop suitable device designs for electrically detecting the surface spin currents, based on the practical understanding of the topological insulator materials. We are pursuing an idea of detecting the surface spin currents in topological insulators by utilizing the “spin-valve effect” between a topological insulator and a ferromagnetic contact, which is based on the sensitivity of the electro-chemical potential on the relative directions of the surface spin polarization and the magnetization of the contacting ferromagnet.



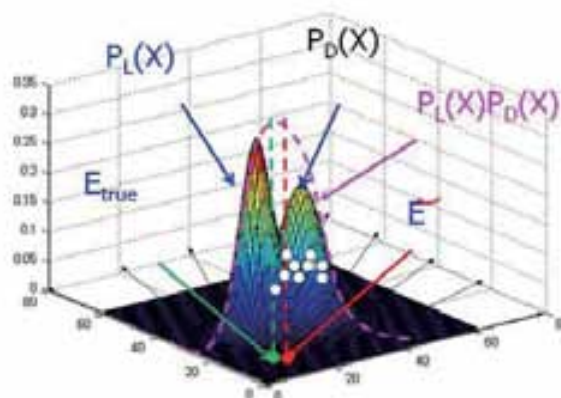
Schematic drawing of the spin-current-detection device and the photograph of a prototype.

Department of Nano-Intelligent Systems

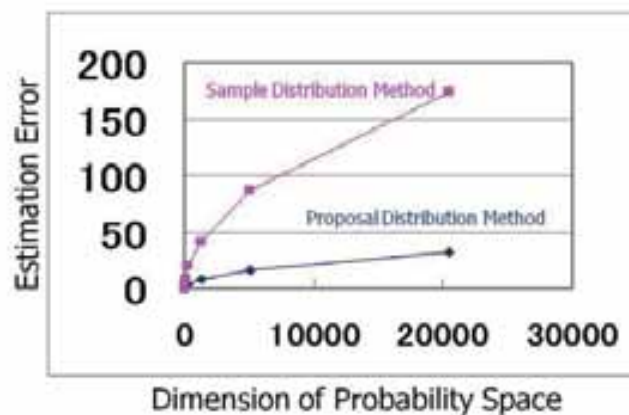
Professor: Takashi WASHIO

Outline

Massive data are being accumulated in nano-technology study along the development of experiment and measurement techniques. However, the fast extraction of meaningful knowledge from the massive data is difficult due to the limitation of human analyst's ability. To address this issue, we develop methods to efficiently extract or estimate meaningful knowledge from the massive data by applying various reasoning and searching mechanisms. Currently, we work on the development of an estimation method from data obtained in a large scale quantum experiments. Results of quantum experiments are known to satisfy a mathematical property named positive semi-definiteness due to their background physical nature. This study worked on the development of a method and its algorithm to derive the accurate estimation from a sample distribution and likelihood provided by the large scale experimental results and the positive semi-definiteness. As a consequence, our new approach named proposal distribution method achieved significant accuracy under high dimensional data space.



Sample distribution, likelihood and likelihood estimation in high dimensional space.



Accuracy of our proposal distribution method and the standard sample distribution method.

Department of Nanodevices for Medical Applications

Professor: Hiroyuki NOJI

Outlines

We are developing novel micro-nano devices for rapid and sensitive detection of multidrug resistant bacteria and persister bacteria down to single cell level. We are also developing micro-nano devices measuring multidrug efflux transporters down to single cell level.

Current Research Project

Rapid detection of multidrug-resistant *Pseudomonas aeruginosa*

Optimistic infection by multidrug bacteria is a serious problem in hospital. We developed a microchannel based device for the culture and detection of multidrug-resistant *Pseudomonas aeruginosa* (MDRP). Our device made it possible to detect MDRP in 3 hrs, much shorter than typical time (18 hrs) required for conventional agar plate method.

Rapid and sensitive assay of multidrug efflux transporters

Active efflux of drugs from cell is one of the causes of acquired resistance of the bacteria. We developed microchannel based device that can assess the activity of drug efflux transporters expressed in *Escherichia coli*. By our device the assay can be finished in 20 min.

Efficient detection of drug-tolerant persister bacteria

Very small population (<1%) of the bacteria often shows natural resistance (tolerance) against many drugs. These tolerant bacteria are called as persister. We developed microdevices for the efficient detection and continuous monitoring of the persister cells under optical microscope.

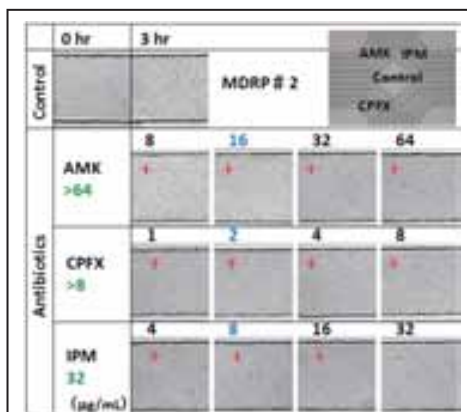


Fig. 1. Rapid detection of multidrug-resistant bacteria

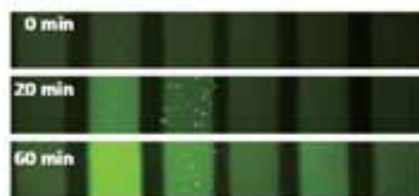


Fig. 2. Rapid and sensitive assay of multidrug efflux transporters.

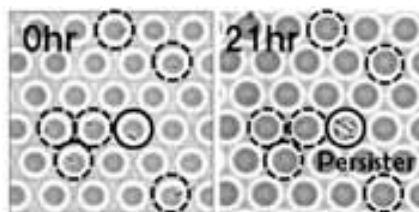


Fig. 3. Efficient detection of drug-tolerant persister bacteria

Department of Nanosystem Design

Guest Associate Professor: Masamichi SAKAI(2009.7.1-9.30)

Outlines

Our previous study on YH_2 showed that (i) the Hall coefficient (R_H) is extremely small owing to approximately identical characteristics between electrons and holes, and (ii) R_H has an approximately linear correlation with electrical resistivity (ρ) at room temperature. These features could enable us to make R_H small further by improvement of crystal quality of YH_2 , such that the zero-Hall conductivity characteristic could be used for spintronics application. In this study, we have fabricated YH_2 films under various conditions including electron beam (EB) evaporation and hydrogenation conditions, in order to investigate formation mechanism of Y_2O_3 , which has been known to decisively deteriorate film quality of YH_2 .

Current Research Project

Our findings are as follows: (i) the absence of crystalline Y_2O_3 was confirmed in as-deposited films of Y, whereas the presence of crystalline Y_2O_3 was detected in hydrogenated films, showing that formation of Y_2O_3 is significantly stimulated during hydrogenation process at temperatures above 400 °C; (ii) the transformation from hcp-Y to fcc- YH_2 phase can be achieved at a 270 °C hydrogenation process, which is the lowest process temperature among our experiences; (iii) XRD patterns of as-deposited Y film can be classified into two types, A and B, which respectively indicate relative strong and weak intensities in (102) and (103) diffraction peaks, and respectively show weak and strong intensities in Y_2O_3 -related peaks.

Department of Nanosystem Design

Guest Associate Professor: Yasushi KANAZAWA(2009.10.1-12. 31)

Outlines

The studies in this laboratory focus on computer vision and media processing. In particular, medical image processing including intestine image analysis with an endoscope camera is a central topic of this department.

Current Research Project

Endoscopic image matching for reconstructing 3-D structure of intestine

We present an image matching method between endoscopic images for reconstructing 3-D shape of an intestine. In this case, image matching is very difficult task because there are few explicit interest points in these images. In addition, by using usual interest point detector, many of the detected points are caused by lighting conditions and halations and those are not on the folds of the intestine. In this paper, we first propose a method for emphasizing

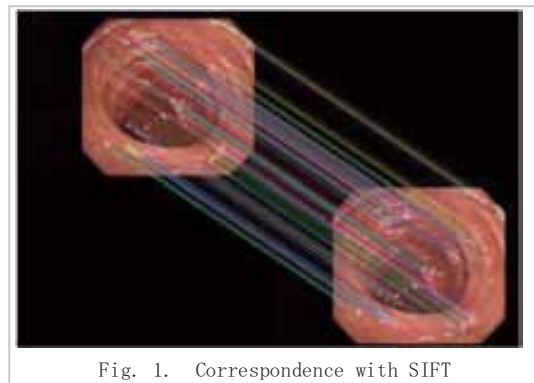


Fig. 1. Correspondence with SIFT

intestine folds which are suited for reconstructing the intestine structure. We also propose a feature descriptor for the detected points and a matching method between the descriptors. We show the effectiveness of our method using real image examples.

3-D Reconstruction of Intestine from Endoscopic Images

We present a 3-D shape reconstruction of an intestine from endoscopic images. Endoscopic images are one of the very difficult images for 3-D reconstruction. It is hard to find correspondences between such images and

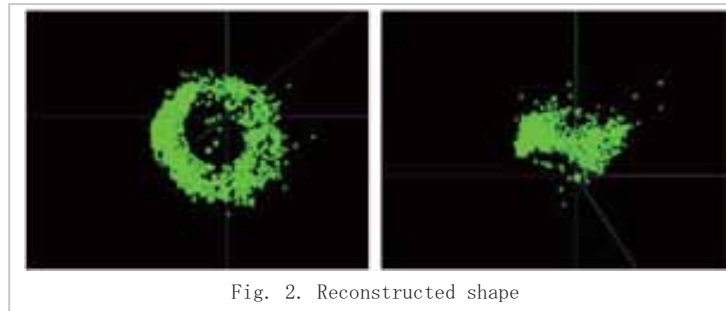


Fig. 2. Reconstructed shape

moreover to reconstruct the shape from the images because of poor texture in endoscopic images and the peculiar camera motions of the endoscopy. In this paper, we use the matching method using the folds of intestine and remove outliers using the knowledge of the peculiar motion. We also adopt an accurate method of 3-D reconstruction from two images without the camera motion. By using 3-D reconstructed shapes obtained from different frame pairs, we compose them into the large 3-D shape. We show the effectiveness of our method by real image examples.

Department of Nanosystem Design

Guest Associate Professor: Osamu Nakagawara (2010.1.1-2010.3.31)

Outlines

Study on the fabrication process and industrial applications of nano-structured oxide thin films.

Achievement

- (1) Discussions related to the combination of technologies on nano-box fabrication of oxide materials, layer-by-layer controllability of stacked structure by pulsed laser deposition technique and hetero structured nano-pillar fabrication provided the conclusion that these technologies and combination have great potentials as photovoltaic devices in the next generation having ultra high cell efficiency.
- (2) Presentation entitled “Epitaxial Aluminum Electrode on Piezoelectric Substrates for High Power Durable Surface Acoustic Wave Devices” was carried out at 1:30-3:00pm on Feb.23.

Department of Nanodevice Characterization

Visiting Research Scholar: Md.Altab HOSSAIN(2009.6.1-7.31)

Outlines

The studies in this laboratory focus on computer vision and media processing. In particular, person identification or verification with video-based gait analysis is a central topic of this department.

Current Research Project

Adaptive Acceptance Threshold Control using Matching Distances with Confidence Values for ROC Curve Optimization

In two-class classification problems such as one-to-one verification and object detection, the performance is usually evaluated by a so-called Receiver Operating Characteristics (ROC) curve expressing a tradeoff between False Rejection Rate (FRR) and False Acceptance Rate (FAR). On the other hand, it is also well known that the performance is significantly affected by the situation differences between enrollment and test phases. This paper describes a method to adaptively control an acceptance threshold with confidence values derived from situation differences so as to optimize the ROC curve. We show that the optimal evolution of the adaptive threshold in the domain of the distance and confidence value is equivalent to a constant evolution in the domain of the error gradient defined as a ratio of a total error rate to a total acceptance rate. An experiment with simulation and real data demonstrates the effectiveness of the proposed method, particularly under a lower FAR or FRR tolerance condition.

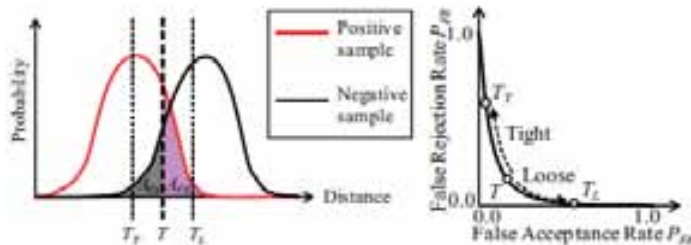


Fig. 1. PDF of feature distance and ROC curve

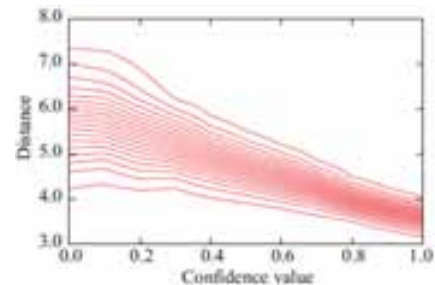


Fig. 2. Contour of error gradient

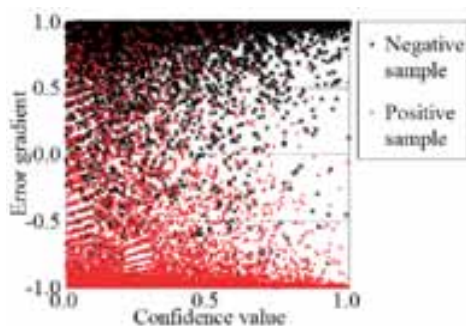


Fig. 3. Mapping to error gradient domain

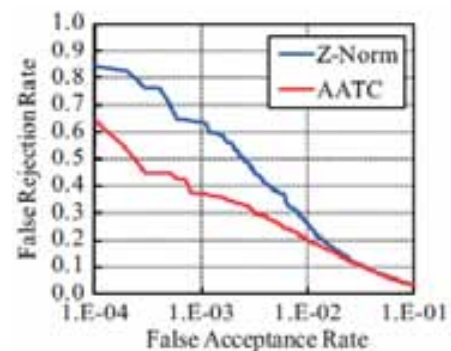


Fig. 4. Optimized ROC curve

Department of Nanodevice Characterization

Guest Associate Professor: Mohamed Almokhtar ABDEL-MOLA (2009.10.1-2010.1.5)

Outlines

Double-quantum-well (DQW) superlattice (SL) structure consisting of ferromagnetic and non-ferromagnetic layers is one of the most important structures for spintronics devices. GaGdN/AlGaN DQW-SL samples with room temperature ferromagnetic layer GaGdN and non-ferromagnetic barrier layer AlGdN were grown by molecular beam epitaxy (MBE) method. In this work, we study the structural, optical and magnetic properties of this DQW-SL structure. Especially, we focus on the interlayer exchange coupling between ferromagnetic layers of GaGdN in the GaGdN/AlGaN DQW-SLs.

Achievement

GaGdN/AlGaN DQW-SL structures were grown by radio-frequency plasma-assisted MBE on GaN templates. X-ray diffraction and atomic force microscopy measurements show that DQW-SL sample has smooth interfaces and good crystalline qualities. Room temperature ferromagnetism was confirmed for the GaGdN/AlGaN DQW-SL samples by alternating gradient magnetometer. Strong photoluminescence was observed from both GaGdN and GaN QWs at higher energy side of GaN excitonic peak. Magneto-photoluminescence spectra for GaGdN/AlGaN DQW-SL samples showed strong redshift of excitonic PL peak by applying a magnetic field up to 7 T. The observed strong redshift indicates an enhancement of Zeeman splitting of the free carriers energy levels in ferromagnetic GaGdN/AlGaN DQW-SLs. Results for the existence of magnetic polaron were also observed.

Department of Nanotechnology for Industrial Applications

Visiting Research Scholar: Lee Chil Woo (2009.5.7-5.31)

Outlines

The studies in this laboratory focus on computer vision and media processing. In particular, visual interaction for intelligent system is a central topic of this department.

Current Research Project

The Online Measurement of the Gait Feature \forall for an Audience-Participation Digital Entertainment

This paper presents a method to measure online the gait features from the gait silhouette images and reflect the gait features to CG characters for an audience-participation digital entertainment. First, we design the online measurement system composed of a walking path with chroma-key background and lights, so as that the gait silhouette images can be easily extracted from a captured image sequence. Second, the static feature like the height and the body size, and the dynamic feature like step and arm swing are measured from the silhouette images. Then, standard models of various types of gait features are constructed and stored, which are composed of a pair of parameters related to static body and motion for CG character obtained by a motion capture system and silhouette images synthesized from the parameters. Finally, in order to reflect the gait feature of an audience to a CG character by blending the standard models, weights (blend ratios) are estimated to minimize errors between a weighted linear sum of gait features extracted from the standard models and the online measured gait features. In an experiment, the large-scale gait database with 100 subjects are used for gait feature analysis and it is confirmed that the measured gait features are reflected to the CG character effectually.

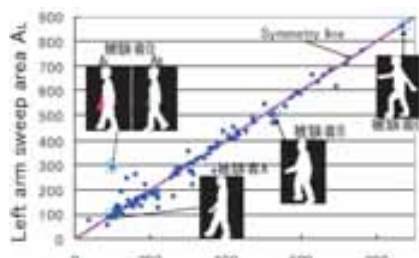


Fig. 1. Arm swing distribution

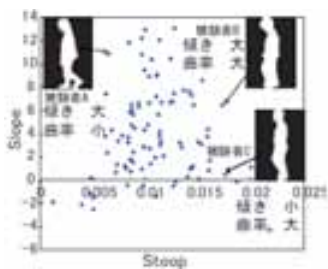


Fig. 2. Stoop distribution



Fig. 3. Gait personality casting

Department of Nanotechnology for Industrial Applications

Guest Professor: Sung Sik KIM (2009.7.1-2009.8.10)

Outlines

By excitation of a reaction intermediate, various new reactions become possible. In the present study, a novel dyad molecule, which is designed to realize an uphill electron transfer via the excited radical anion, has been synthesized.

Current Research Project

Synthesis of a novel dyad molecule for electron transfer via excited radical anion.

In order to realize electron transfer from the excited radical anion, we have designed a dyad molecule of naphthalendiimide (NDI) and pyromellitic imide (PI), which are well-known electron acceptors exhibiting a strong absorption band upon reduction. These properties facilitate the transient absorption study during the laser flash photolysis. The target molecule has been successfully synthesized by alkylation of naphthalene tetracarboxylic anhydride, coupling with diaminobenzene, and coupling with alkylated pyromellitic acid anhydride.

Department of Nanotechnology for Industrial Applications

Guest Professor: David G. WHITTEN (2009.7.1-2009.8.10)

Outlines

Single-molecule spectroscopy (SMS) has proven to be a unique tool for the investigation of conjugated polymers. It has allowed for the direct measurement of the inhomogeneous distributions of optical and structural properties of conjugated polymers. SMS has also been used to unravel complex photophysical and photochemical dynamics in conjugated polymers involving triplet states, photo-oxidation, and energy or electron transfer processes that would be extremely difficult to measure by ensemble methods.

Current Research Project

Single-Molecule Fluorescence Studies of Oligophenyleneethynyls (OPEs)

We planned SM studies of oligophenyleneethynyls (OPEs) molecules or aggregates using a fluorescence microscope system with high temporal and spatial resolution. In preliminary experiments, samples were prepared for total internal reflection microscopy (TIRFM) by drop casting onto a cover glass. Under 405 nm laser excitation, OPEs exhibited fluorescence intermittency, so-called “blinking”, with a stochastic switching on and off of the emission signal, and were found to irreversibly bleach in one step. Moreover, the samples using an aqueous solution of conjugated polyelectrolyte nanoparticles showed very different bleaching behaviors, i.e., the one-step (or multistep) and exponential decay behaviors (Figure 1). The observed blinking followed by one-step bleaching indicates the existence of some low-energy chromophores, which is likely to be resulted from chain-chain interaction in the aggregate.

In connection with studies related to the blinking or bleaching phenomenon, time-resolved experiments on single molecules or aggregates will be carried. With the help of advanced photon counting techniques, these samples can be investigated to obtain information about molecular diffusion, self-assembly, and energy migration. Applying a combination of fluorescence correlation spectroscopy (FCS) and antibunching measurements, we will describe the dynamics of self-assembly of OPEs on anionic scaffolds in solutions as well as the host-guest interactions and energy migration processes in the assembly.

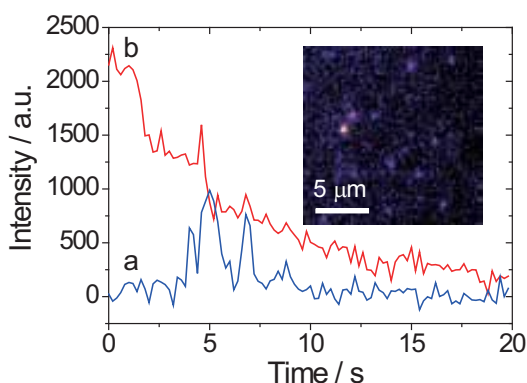


Figure 1. Typical SM fluorescence trajectories observed for poly(phenylene ethynylene)-type conjugated polyelectrolyte nanoparticles coated on a cover glass. Inset shows the SM fluorescence image.

Department of Nanotechnology for Industrial Applications

Guest Professor: Duck-Kyun Choi (2009.10.13-2010.1.13)

Outlines

Dry and wet manufacturing processes for semiconductor devices, invented by Professor Choi and Professor Kobayashi, respectively, were converged to achieve high quality and low cost at the same time. In this study, the nitric acid oxidation of Si (NAOS) method was applied to 4 bit non volatile memory to form a gate oxide with less leakage current, and the cyanide method was applied to amorphous InGaZnO thin films to passivate defects.

Current Research Project

4 bit nonvolatile memory with the gate oxide fabricated by the nitric acid oxidation method

An SiO₂ layer formed by the nitric acid oxidation of Si (NAOS) method was applied to a gate oxide for a 4 bit nonvolatile memory. The SiO₂ layer was fabricated by dipping in HNO₃ aqueous solutions at a low temperature of 120°C to use as a gate oxide of a 4 bit nonvolatile memory. The electrical characteristics will be studied for the nonvolatile memory.

Passivation of amorphous InGaZnO thin films in cyanide aqueous solution

The cyanide method was applied to defect passivation for semiconductor devices in order to improve electrical characteristics. A hole mobility was evaluated for an amorphous thin InGaZnO layer by the Hall effect measurements before and after dipping in the HCN aqueous solution. It was found that the cyanide treatment enhanced the Hall mobility from 2.84 cm²/Vs to 18.46 cm²/Vs.

Open Laboratory

Professor (concurrent, manager): Yoichi YOSHIDA
Professor (concurrent): Yoshio ASO
Professor (concurrent): Tomoji KAWAI
Professor (concurrent): Hidekazu TANAKA
Technical Staff: Kimihiro NORIZAWA
Supporting Staff: Kayoko OHASHI

Outlines

Open Laboratory supports the comprehensive research for creative and advanced academic research on materials and devices, which should become the foundation of scientific and technological development on nanotechnology.

Current Research Project

On 2009, the following 11 researchers used Open Laboratory.

Prof. Yasufumi FUJIWARA	Graduate School of Engineering
Prof. Kiichi FUKUI	Graduate School of Engineering
Prof. Kazuyoshi ITOH	Graduate School of Engineering
Prof. Yusuke MORI	Graduate School of Engineering
Prof. Takao YAMAMOTO	Graduate School of Engineering
Prof. Yoshimitsu YAMASAKI	Graduate School of Medicine
Prof. Hirotarō MORI	Research Center for Ultra-High Voltage Electron Microscopy
Prof. Tomoji KAWAI	Institute of Scientific and Industrial Research
Prof. Hika ru KOBAYASHI	Institute of Scientific and Industrial Research
Prof. Seiichi TAGAWA	Institute of Scientific and Industrial Research
Prof. Kazuhiko MATSUMOTO	Institute of Scientific and Industrial Research

Nanofabrication Shop

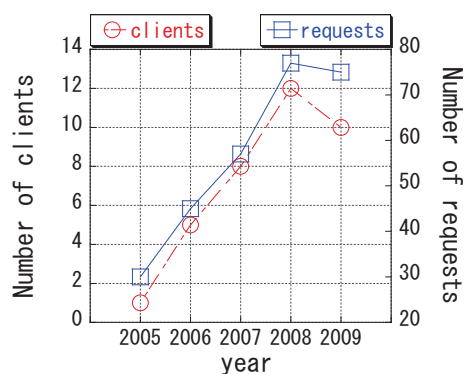
Professor, Director: Hiroyuki NOJI (concurrent)
Technical Staffs: Kimiaki TANIHATA, Shouichi SAKAKIHARA,

Outlines

Nanofabrication Shop (NS) was established in 2005 in order to promote nanotechnology-related research by supporting micro/nanofabrication of various materials such as silicon, metals, silicone sheet, and so on. In addition, NS supports training of micro/nanofabrication skills for the ISIR researchers.

Activities

In addition to conventional micro/nanofabrication, we carried out photolithography of curved surface and ultra thin silicon surface in 2009. These were challenging and new fabrication. Though the number of requests had increased since 2005, it seems to reach to saturation number. The figure shows the number of clients and request.



On demand fabrication requests

We have received requests from 10 laboratories in ISIR. Total number of their requests reached 70.

Participation in “nanotech 2010”

We demonstrated a offset printing chambers in the booth of Nanotechnology Center in the international nanotechnology exhibition and conference “nanotech 2010” which was held on 17th to 19th of February in 2010.

Advanced Nanotechnology Instrument Laboratory

Director, Professor: Hidekazu TANAKA (concurrent)
Technical staff: Michiko SAKUMA

Outlines

Advanced Nanotechnology Instrument Laboratory has founded in the new Nanoscience and Nanotechnology center since 2009 in order to develop cutting edge researches on the nanoscience and nanotechnology. The fine nano-fabrication system based on electron beam lithography is installed at present to construct fine nano-structures. Within this fiscal year, the nano-device fabrication system and nano-device characterization systems on structure and electrical properties of nano device will be installed, and enable us to study various nano-materials and nano-devices composed of inorganic/ soft organic /bio materials. This laboratory will continuously develop and work to promote advanced Nanotechnology.

Current Research Project

- The electron beam nano-lithography system has been used for fabrication of novel nano-patterning and nano-structure.
- Followings new nano-fabrication and nano analysis systems were installed and started for use.

Nanoparticle analysis device
Nanospace reaction analysis device
Thin-film nano structure analysis device
Nanoinprint microfabrication device
Infrared • Terahertz time resolution spectrum device
Nano organic film evaluation device
Nanodevice overly precision physical-properties evaluation device
Laser drawing device



Department of Handai Multi-Functional Nanofoundry

Professor:	Tomoji KAWAI
Specially appointed Professor:	Seiichi TAGAWA
Professor:	Hedekazu TANAKA
Professor:	Hirotarou MORI
Specially appointed researcher:	Akihiro OSHIMA Akira Kitajima Hideto OHNISHI (-2009.6.30)
Supporting staff	Masakazu MURASUGI Yasuo NAKAMURA (-2009.9.30) Naomi YANAMORI Miki KASHIWAKURA (2009.9.16-) Kouji HIGUCHI (2009.10.1-) Keiko EMMI

Outlines

Handai Multi-Functional Nanofoundry was founded in Mission of Nanotechnology Network Japan, supported by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. The purpose to start up the Nanofoundry is to establish a platform supporting Nanotechnology research and development, especially, for researchers outside of Osaka University. Nanofoundry started from April 2007, and our efforts resulted in supporting 93 research themes in 2009.

The Mission of Nanotechnology Network Japan was organized to respond to the requests that researchers belonging to public / private universities or companies hope to realize and to respond to researchers finding opportunity to use special facilities and equipments for their nanotechnology research and development program.

Institute of Science and Industrial Research (ISIR), Osaka University has played an important role in Nanotechnology fields by providing individual technologies and information. Our Nanofoundry supported lots of researchers inside / outside of Osaka University through “Nanofabrication”, “Molecular and thin film fabrication” and “Characterization & analysis”.

Focuses of Handai Multi-Functional Nanofoundry are shown below.

- (1) Innovation by integrated and speedy nanotechnology support consisting of “Fabrication (top-down and bottom-up)”, “Observation and Measurement”.
- (2) Creation of advanced interdisciplinary nanotechnology through integrated research and development of inorganic and organic materials, metals, semiconductor materials, and biomaterials.
- (3) Fostering of scientists in the field of advanced interdisciplinary nanotechnology.

Current Research Project

Bring-up Handai Multi-Functional Nanofoundry

The 93 research themes have been supported in this project in 2009. Considering they have been applied for by researchers in the universities, companies, and national institutes, we are able to see that Nanofoundry activates clearly nanotechnology field. Nanofoundry has been founded to support nanotechnology researchers through nanofabrication, molecular and thin film fabrication, characterization and analysis. These supports are divided into following four types. (a) Technical consulting, (b) Collaborative research, (c) equipment use, and (d) Technical substitution.

Break-through toward Multi-functional Nanotechnology R&D

Nanofoundry supports advanced nanotechnology research and development as well as fundamental study. The research on functional integration and system building based on nanomaterials is acceptable in the Nanofoundry.

Fusion between Top-down and Bottom-up Nanotechnologies

For top-down and bottom-up nanotechnologies, a lot of useful equipments such as FIB, EB drawing and PLD, and so on, are in operation. The fusion between top-down and bottom-up nanotechnologies will bring much important progress on nanotechnology in the near future.

Comprehensive Analysis Center

Professor Director:	Katsuaki SUGANUMA
Associate Professor:	Takeyuki SUZUKI
Assistant Professor:	Da-Yang ZHOU Kaori ASANO
Technical Staff:	Takeshi ISHIBASHI Takanori TANAKA Tsuyoshi MATSUZAKI
Support Staff:	Yoshio TAKAI Hitoshi HANEOKA Misayo IMAI

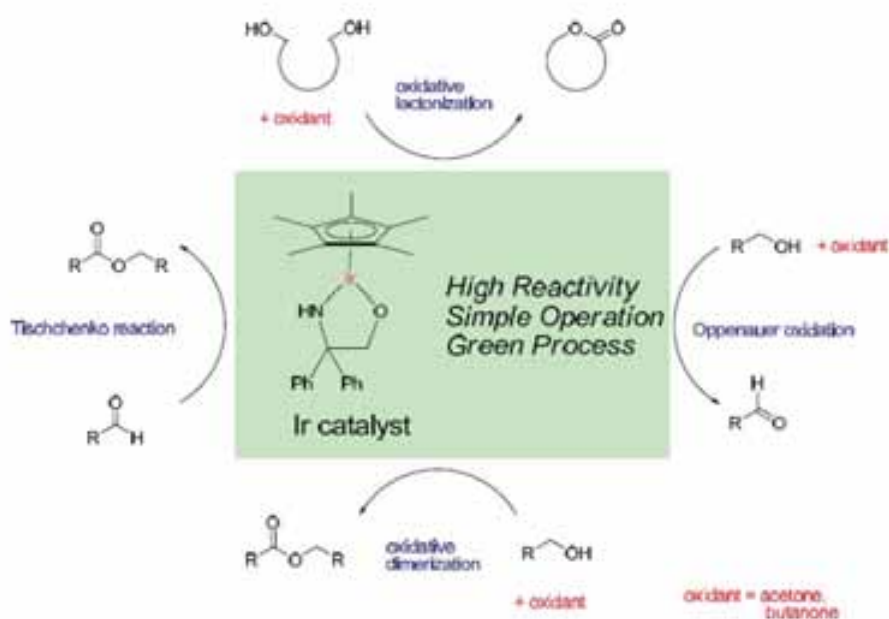
Outlines

The Comprehensive Analysis Center was founded in 2009, whose project includes (1) analysis of samples provided from other research sections in ISIR and (2) original research for developing novel synthetic methods using a molecular catalyst.

Current Research Programs

Iridium-catalyzed oxidation: development and applications

Development of catalytic reaction using clean oxidant is one of the most important themes in modern organic synthesis. In addition, desymmetrization of *meso* diols is the efficient methods for the synthesis of chiral building blocks. This time we have developed the catalytic asymmetric synthesis for the key intermediate of ottelione and scyphostatin by using desymmetrization of *meso* diols, which are a potent antitumor and a inhibitor of sphingomyelinase. The appropriate selections of cooxidant, base, and protecting group are important to obtain high yield and selectivity in this reaction.



Research Laboratory for Quantum Beam Science

Professor, Director: Yoichi YOSHIDA
Associate Professors: Yoshihide HONDA
Assistant Professors: Sachiko TOJO
Technical Staff: Tamotsu YAMAMOTO
Supporting Staff: Kumiko KUBO (2009.4.1-2010.3.31)
(Concurrent members)
Professors Goro ISOYAMA, Tetsuro MAJIMA
Specially Appointed Professor: Seiichi TAGAWA
Associate Professors: Ryuko KATO, Mamoru FUJITSUKA, Takahiro KOZAWA,
Kiyohiko KAWAI, Jinfeng YANG
Assistant Professors: Toshiji IKEDA, Kazuo KOBAYASHI, Shigeru KASHIWAGI,
Takashi TACHIKAWA, Takafumi KONDO
Specially Appointed Assistant Professors: Masanori SAKAMOTO, Koichi KAN,
Akinori SAEKI, Hiroki YAMAMOTO

Outline

The Research Laboratory for Quantum Beam Science (RLQBS) was newly established in 2009 as a successor of Radiation Laboratory. All the facilities such as L-band linac and ^{60}Co γ -ray irradiation facility were taken over. These are opened to users in Osaka University. Based on quantum beam science, frontier beam science relating to environmental material science, new energy sources and advanced medical technology as well as fundamental beam science are promoted with concurrent members. The management including operation, maintenance and the safety control of radiation related facilities are also conducted with the aid of concurrent members.

Current Research Projects

Facilities (L-band linac, S-band linac, RF-Gun S-band linac, ^{60}Co γ -ray sources)

L-band linac was operated for 193 days, about 2,600 hours, for the use of research subjects. (Fig.1) Through the year, several troubles taken place in the SHPB system, the modulator system, the klystron tank and the operation system were repaired. Concerning 150 MeV S-band electron linac, the setting of the modulator and replacement of the klystron tank were completed. The heater transformer of the klystron was replaced. The flow meters in the cooling system of S-band linac were replaced because of water leakage. RF-gun attached S-band linac was operated for 40 days, about 430 hours, for the use of research subjects and also operated for one month for developing new electron diffraction machine. Replacement of the pulser according to the

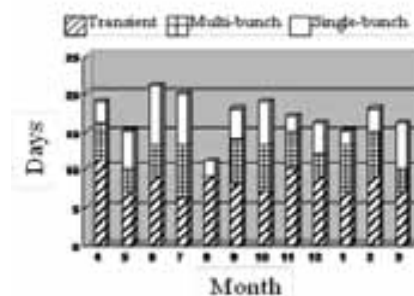


Fig.1 Progress of the operation days of L-band linac

change of thyatron was carried out and stable operation could be achieved. Cobalt-60 facility was used in 96 days, 1033 hours, for 20 subjects, which were proposed not only by ISIR staffs but also by the member of other faculties, as shown in Fig.2. On the occasion of the inspection of unregistered RI, unnecessary goods were discarded and the rooms were tidied up. The radiation monitoring system and the related registering system were remodeled. Annual check of the irradiation system was also carried out.

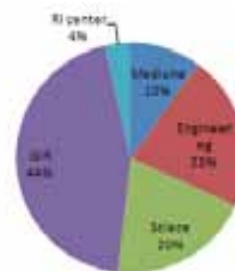


Fig.2 Share of the times in Co-60 facility

Management (Joint use & Radiation safety management)

Accepted subjects relating to the facilities were 42 in total. Specially programmed meetings were held three times and the annual briefing session was held in March. The joint meeting with Radiation Research Center in Osaka Prefectural University was held in February. More than 420 guests visited our laboratory. About radiation safety management, the number of users managing RI and/or radiation facilities in ISIR was 160. Educational and training courses were opened to the new users in May. Periodical check with respect to the facilities was performed and some defects were repaired. Application of approval concerning changes in use and storage of unsealed and sealed RI sources and installation of new 3 MeV electron accelerator were made.

Analysis of degradation process in polymer electrolyte membrane

Degradation process of Nafion[®]-117 has been studied. We planned to study the chemical reaction due to radicals in degradation process by producing radicals selectively. The radicals such as OH• and H• were selectively produced and Nafion was exposed to such radicals in solution separately. Proton conductivity was almost constant among the samples which experienced different number of specified radicals, whereas the great deal of scission of polymer chain was observed. This fact shows that proton conduction mechanism and scission of polymer chain are not directly correlated.

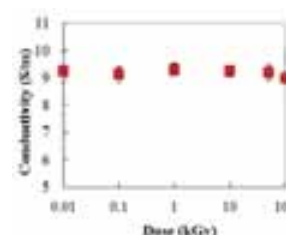


Fig.3 Correlation between conductivity and dose. H• radicals were produced in this case.

The formation and reactivity of short-lived reaction intermediates in quantum beam induced chemistry

Quantum beam induced chemistry of organic compounds based on radiation-induced chemistry has been studied using electron beam and γ -ray. This year, we have successfully generated the short-lived intermediate of an acyclic 1,4-distonic radical cation in solution. We also clarified the bimodal reactivities, absorptions and the emissions from the site-selective excitation of the radical and cation site of an acyclic 1,4-distonic radical cation. This is the first example of bimodal emissions of distonic radical cation. (Fig.4)

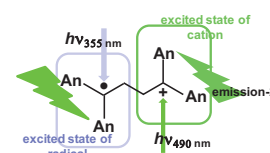


Fig.4 Bimodal emission of distonic radical cation.

Center for Research Education and Training

Director: Professor Nobuo KATO
Head of Educational Affairs Board: Professor Yoichi YOSHIDA
Head of International Affairs Board: Professor Riichiro MIZOGUCHI

Outline

One of the unique features of ISIR is that students from the six graduated schools in Osaka Univ. gathered together to carry out their research studies in the institute. To provide multidisciplinary education programs for them, the Center for Research Education and Training was founded in April 2009.

The Center will promote various kind of educational programs for the students, such as teaching interdisciplinary sciences by integrating our multidisciplinary research fields, giving internship opportunities with companies, exchanging students with foreign universities/research institutes and giving opportunities to acquire technical skills beyond their own research discipline.

International Collaboration Center

ISIR has promoted international collaboration with various universities and institutions all over the world based on the agreements on the academic exchange programs with the institutions and universities and by establishing the ISIR Branches in the foreign counties and so on. To further promote and to continuously support such international exchange and collaborations, International Collaboration Center was founded in April 2009. The center consists of several collaborative laboratories, which are established between ISIR and the universities / institutions in the foreign counties. Currently, three collaborative laboratories are working. Researchers and students who belong to the collaborative research projects stay at a collaborative laboratory on each side and perform the collaborative research.

ICT lab.

The School of Electronics Engineering and Computer Science, Peking University, and the Institute of Scientific and Industrial Research, Osaka University, have established a cooperative research laboratory on information and communication technology (ICT) between both institutions. The studies in ICT collaborative laboratory focus on computer vision and media processing including basic technologies and applications.

1. Range sensing and 3D reconstruction
2. Image segmentation and object detection
3. Human motion analysis and human recognition

AMR lab.

College of Science and Technology (CST), Korea University (KU), Korea, and the Institute of Scientific and Industrial Research (ISIR), Osaka University, Japan, based on the agreement on academic exchange between CST and ISIR, established a collaborative laboratory on each side on advance materials research between both institutions.

1. Fast energy and electron transfer of photoresponsible materials
2. Redox reactions of substituted carboranes
3. Solar light conversion materials

ESS lab.

In order to stimulate collaboration on the photo-induced structural changes of solid surfaces from both theoretical and experimental approaches, SANKEN has had one post-doctoral researcher, who stayed at UCL to perform theoretical investigation on the following topics:

1. Photoinduced structural phase transition of Graphite
2. The first principle calculation of electronic structures of Si surfaces
3. Theoretical methodology of the first-principle excited-state molecular dynamics

Materials Science & Technology Research Center for Industrial Creation (MSTeC)

Outline

Materials Science & Technology Research Center for Industrial Creation (MSTeC) was founded in April 2005 for contributing to the creation of new industry through the complementary cooperation with Institute of Multidisciplinary Research for Advanced Materials, Tohoku University. This center consists of two projects: P1 Materials Research Project and P2 Human Interface Research for Safety and Security Project which are divided to four groups: G1 Hard Materials Research Group, G2 Soft Materials Research Group, G3 Medical Sciences Research Group, and G4 Human Interface Research Group.

Director: Prof. T. Majima

P1 Materials Research Project

G1 Hard Materials Research Group: Group leader: Prof. H. Nakajima

G2 Soft Materials Research Group: Group leader: Prof. T. Majima

P2 Human Interface Research for Safety and Security Project

G3 Medical Sciences Research Group: Group leader: Prof. Y. Yoshida

G4 Human Interface Research Group: Group leader: Prof. M. Numao

Achievements

- Development of controlling the pore morphology in lotus-type porous metals
- Development of a new lotus-type porous materials and their application
- Development of on-demand printing circuit technology with nanopaste
- Development of lead-free electronic packaging technology
- Basic Research of High-Tc Superconductors
- Crystal growths and characterizations of useful quantum functional materials
- Laser-induced functionalized chemistry and its application
- Functional nano-scale wires using biomolecular building blocks
- Development of multifunctional asymmetric catalysts and multifunctional asymmetric organocatalysts
- Excited radicals for the preparation of nanomaterials
- Development of spiro chiral ligands for novel Pd catalyzed enantioselective reactions
- Identification of the enzymatic properties of the erythrocyte S1P transporter.
- Identification of the S1P transporter that regulates the migration of cardiac precursors.
- Elucidation of intracellular membrane dynamics as well as interaction between host cells and bacteria by using electron tomography.
- The Research of new possibility of the radiation therapy
- Dynamic optical modulation of electron beam using the Digital micro mirror device for high-performance intensity modulated radiation therapy
- Sophistication and application of knowledge sharing software called OntoGear for secure, safe, and creative manufacturing support.
- The adaptive interface by the sensor network and machine learning.
- Research on bio-applications of novel nano structures and on integrated operation of the interfaces.

Materials Research Project

Outlines

The Materials Research Project is composed of two groups with research fields: Hard Materials (such as metals, semiconductors and ceramics) and Soft Materials (such as organic molecules, polymers, and biomolecules). We actively make joint researches with Institute of Multidisciplinary Research for Advanced Materials in Tohoku University and private enterprises. The development of high-degree materials can be obtained by highly advanced processes with new functional materials and their characterization.

In Hard Materials Group, the purpose is to develop novel processing of porous materials which controlled by nanostructure, microstructure and shape design. In addition, this group focuses on the identification of interconnection process, and on the development of new materials for environmental electronics packaging, as well as on basic research of useful quantum functional materials such as topological insulators.

In Soft Materials Group, the achievement of design, synthesis, assembly, and construction of functional organic molecules, polymers, and biomolecules is conducted for development of new functional molecules and materials based on elucidation of photoelectronic function, molecular recognition, catalytic reaction, high-ordered structure, and combination of multi-functions.

Current Research Project

1. Development of a new heat sink with lotus-type porous copper
2. Development of a new lotus-type porous materials and their application
3. Suppression of metal whisker formation on lead-free finishes
4. Development of high-temperature lead-free joining material for power electronics packaging
5. Basic Research of Topological Insulators
6. Growth process and photochemical reactivity of Au clusters using the single molecule fluorescence spectroscopy
7. Conformational dynamics of Zn-CytC investigated by the single molecule spectroscopy
8. Development of Novel Chiral Ligands Based on Spirobilactams
9. Enantioselective Oxidative Cyclization Catalyzed by Pd-SPRIX Complexes

Hard Materials Research Group

Professor: Hideo NAKAJIMA, Katsuaki SUGANUMA and Yoichi ANDO

Designated Associate Professor: Shunkichi UENO

Designated Assistant Professor: Seongjun KIM

Outlines

The main purpose of this department is to investigate physics of materials and develop novel processing of the materials. The department has undertaken the following several topics of the metallic materials science and engineering.

Lotus-type porous materials developed by this department are unique materials which exhibit extraordinary superior mechanical strength. The materials are fabricated by unidirectional solidification using gas solubility gap at their melting point. Main issues are to develop a new simple and safety fabrication process for lotus-type porous materials and to fabricate new lotus-type porous materials. In this year, we have established a simple fabrication method for controlling the pores morphology by addition of oxide powders during the solidification.

We focus on the identification of interconnection process, and on the development of new materials for environmental electronics packaging. We are conducting the development of on-demand printing circuit technology with nanopaste, and of lead-free interconnection technology.

In addition, we conduct basic research of novel “quantum functional” materials, by focusing on growths of high-quality single crystals and top-notch transport measurements. This year, we focused on clarifying the electronic properties of topological insulators.

Current Research Project

1. Development of a new heat sink with lotus-type porous copper

We developed a new measuring technique for thermal properties of porous metals and the thermal conductivity of lotus-type porous copper was obtained. And we applied the data for setting up a new type heat sink with lotus-type porous copper.

2. Development of a new lotus-type porous materials and their application

In the formation mechanism of lotus-type porous materials during the unidirectional solidification, the convection in the liquid phase is an important factor for formation of pores at solid-liquid interface. The convection in the liquid phase can be controlled by high static magnetic field. The effect of high magnetic on the formation of pores is examined. Furthermore, a coating method for SiC layer on lotus-type porous copper is developed using Ultrasonic-based Coating Method. These research and development are conducted as collaborative research with Institute of Multidisciplinary Research for Advanced Materials, Tohoku University.

3. Suppression of metal whisker formation on lead-free finishes

As a result of the global transition to lead-free electronics, the majorities of the electronic component manufacturers are now using pure Sn or Sn-rich lead-free alloys for terminal and lead finishes. Not only because of lead-free, metal whiskers has been one of the serious failure causes for electronics and aerospace equipments. The author's research group has proposed a new approach to prevent metal whisker by surface treatment on lead-free plating. In this year, Tin whisker formation and growth behavior of pure Sn plating and metal layer/Sn plating samples during 55°C/85% and 85°C/85% relative humidity (RH) exposure and thermal cycling tests were investigated. Ni, Au and Pd layers on the Sn plating significantly suppressed the whisker formation under the severe thermal and humid conditions.

4. Development of high-temperature lead-free joining material for power electronics packaging

With advances in the power semiconductor devices, there are increasing demands for reliable packaging technology that can support them. Because of the exposure to severe thermal environment, the development of joining materials for die-attach become one of the key issues. Our research group has proposed Zn-xSn (x=20, 30, and 40 wt.%) solder as one of the best candidates. In this year, thermal fatigue reliability of Si die attached joint during thermal cycling from -40 to 125 °C has been investigated. As a result, the Zn-Sn solder represents a more reliable high-temperature lead-free solder than the currently used Au-20Sn and Pb-5Sn solders, from the viewpoints of interfacial microstructure and joining strength.

5. Basic Research of Topological Insulators

Topological insulator (TI) is an emerging class of materials that host a new quantum-mechanical state of matter where an insulating bulk state supports an intrinsically metallic surface state that is “helically spin-polarized”, that is, right- and left-moving electrons carry up and down spins, respectively. This peculiar property of the surface state opens exciting new opportunities for novel spintronics devices. Recently, photoemission experiments on $\text{Bi}_{1-x}\text{Sb}_x$ have revealed that its surface states possess the distinctive character to qualify this material as a TI. However, to directly probe the unique properties of the surface states and to elucidate whether they could really be exploited on a macroscopic level for spintronics devices, transport and magnetic studies of high-quality single crystals are indispensable. We have developed a technique to grow high-quality single crystals of $\text{Bi}_{1-x}\text{Sb}_x$ with a zone-melting method, and currently the $\text{Bi}_{1-x}\text{Sb}_x$ crystals grown in the our lab are the world best in terms of the carrier mobility. Taking advantage of these crystals, we have succeeded in making the first observation of the surface state of $\text{Bi}_{1-x}\text{Sb}_x$ through quantum oscillations, giving confidence that the metallic surface state is indeed stable in ambient atmosphere and supports macroscopic currents.

Soft Materials Research Group

Professor:

Tetsuro MAJIMA, Hiroaki SASAI

Specially Appointed Assistant Professor:

Masanori SAKAMOTO (~2009.10.31),

Jungkweon CHOI (2009.11.1~)

Ramalingan CHENNAN

Outlines

Achievement of design, synthesis, assembly, and construction of functional organic molecules, polymers, and biomolecules is conducted for development of new functional molecules and materials based on elucidation of photoelectronic function, molecular recognition, catalytic reaction, high-ordered structure, and combination of multi-functions.

Current Research Project

Growth process and photochemical reactivity of Au clusters using the single molecule fluorescence spectroscopy

Noble-metal clusters, composed of several tens of atoms, have attracted considerable attention for a variety of reasons, ranging from a fundamental scientific interest in nanoscopic materials to technological applications.

Here, we have successfully fabricated Au clusters through the in situ photochemical reduction of Au ion in a polymer film (Fig. 1. a and b). The investigation using the single molecule fluorescence spectroscopy gave us important insight about the nucleation and growth process of clusters (Fig. 1. c). It was discovered that the excited Au cluster shows the reactivity toward the O₂, depending on the number of Au atom.

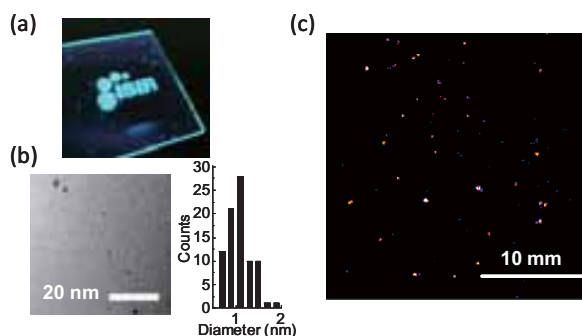


Fig. 1 (a) The emission of Au clusters fabricated in the polymer film. (b) TEM image and size distribution of Au clusters. (c) Single molecule fluorescence microscopy image of Au cluster.

Conformational dynamics of Zn-Cytc investigated by the single molecule spectroscopy

The structural reorganization and photophysical properties of the folded/unfolded Zn-Cytc have been investigated by the single molecule spectroscopy and the ensemble-averaged

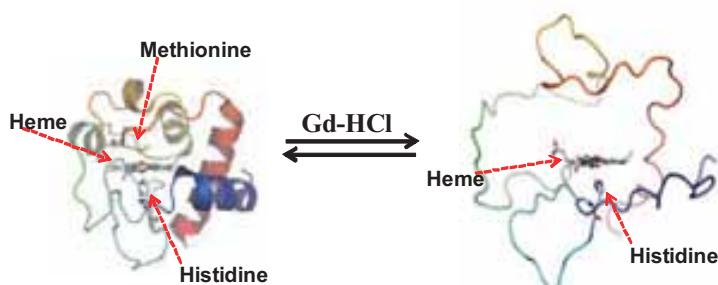
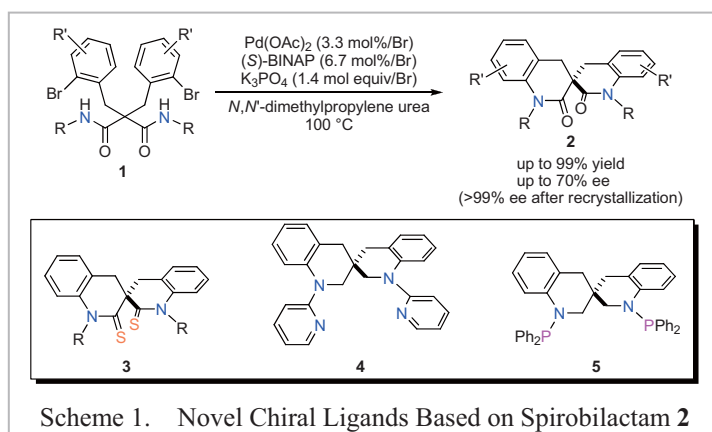


Figure 1. Transition between folded and unfolded Zn-Cytc induced by a denaturant such as the guanidine hydrochloride (GdHCl).

spectroscopy. In the ensemble-averaged experiments, Zn-Cytc exhibited the similar dynamical features with a fast decay followed by a slow decay regardless of the conformational change of a protein induced by a denaturant (GdHCl). These results were interpreted in terms of the vibration relaxation of the hot S_1 Zn-porphyrin and the lifetime of the singlet state of Zn-porphyrin rather than the structural reorganization and ligand dissociation. On the other hand, the single-molecule photophysics of Zn-Cytc such as blinking were elucidated. By recording fluorescence intensity trajectories of the folded and unfolded single-protein, we found that the photobleaching behaviors of Zn-porphyrin in Zn-Cytc significantly depend on the structure of a protein, while the fluorescence dynamics of Zn-Cytc in the bulk phase is not associated with conformational change of a protein. These results indicate that the fluorescence dynamics of Zn-Cytc investigated in the single molecule level can provide an important clue for the conformational changes of Zn-Cytc.

Development of Novel Chiral Ligands Based on Spirobilactams

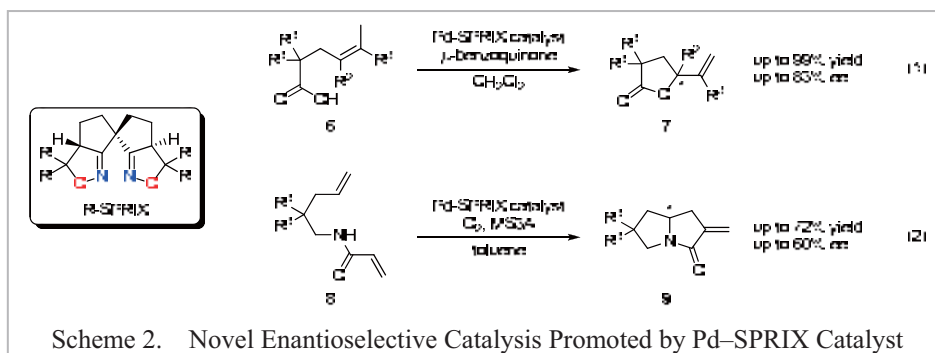
Novel chiral functional molecules were prepared from spirobilactams **2** which were readily available through an enantioselective Pd-catalyzed intramolecular *N*-arylation of malonamides **1**. Optically pure spirobilactams were converted successfully into spirobithiolactams **3**, dipyridines **4**, and bis(aminophosphine) **5** as an effective chiral ligand by conventional synthetic methods (Scheme 1).



Enantioselective Oxidative Cyclization Catalyzed by Pd-SPRIX Complexes

We have developed novel enantioselective cyclizations promoted by a Pd complex bearing a chiral spiro bis(isoxazoline) ligand (SPRIX). Thus, oxidative cyclization of γ,δ -unsaturated carboxylic acids **6** proceeded smoothly in the presence of Pd-SPRIX catalyst to afford γ -lactones **7** in high yields with good enantioselectivities (eq 1). Alkenyl acrylamides **8** participated in the domino cyclization to give 2-methylenetetrahydro-pyrrolizin-3-one derivatives **9** (eq 2). Both the products were expected to be a versatile building block for many biologically active compounds. Noteworthy

is that only a trace amount of the products were formed with the other chiral ligands (Scheme 2).



Human Interface Research for Safety and Security Project

Outline

Human Interface Research for Safety and Security Project is one of two main projects of Materials Science & Technology Research Center for Industrial Creation, MSTeC, which is the newly established cooperative organization with ISIR and the Institute of Multidisciplinary Research for Advanced Materials, Tohoku University from 2005. This project aimed for developing the sustainable technology of human interface for safety and security. This project contains two groups: 1) medical sciences research group and 2) human interface research group. Main research subjects are xenobiotic exporters as novel drug targets, next generation intensity modulated radiation therapy, sophistication and application of knowledge sharing software called OntoGear for secure, adaptive interface by the sensor network and machine learning, and bio-application of nano-structured materials.

Achievements

- Identification of the enzymatic properties of the erythrocyte S1P transporter.
- Identification of the S1P transporter (spns2) that regulates the migration of cardiac precursors.
- Elucidation of intracellular membrane dynamics as well as interaction between host cells and bacteria by using electron tomography.
- The Research of new possibility of the radiation therapy.
- Generation of intensity-modulated electron beam and X-ray for new radiation therapy.
- Sophistication and application of knowledge sharing software called OntoGear for secure, safe, and creative manufacturing support.
- The adaptive interface by the sensor network and machine learning.
- Research on bio-applications of novel nano structures and on integrated operation of the interfaces.

Medical Sciences Research Group

Professor: Akihito YAMAGUCHI

Professor: Yoichi YOSHIDA

Specially Appointed Assistant Professor: Mitsuko NISHINO

Specially Appointed Assistant Professor: Koichi KAN

Outlines

Elucidation of interaction between host cells and bacteria by using electron tomography. Generation of electron beam and X-ray with high spatial and time resolution for new radiation therapy.

Current Research Project

Electron Tomography Revealed the Endoplasmic Reticulum as a Source of Autophagosomal Membranes

Autophagy is a bulk degradation process in eukaryotic cells and plays fundamental roles in cellular homeostasis. Increasing evidence suggest that autophagy plays an important role in microbial defense.

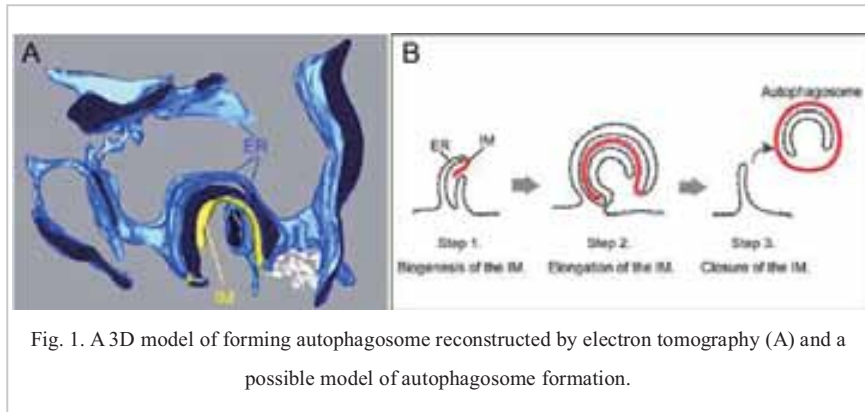


Fig. 1. A 3D model of forming autophagosome reconstructed by electron tomography (A) and a possible model of autophagosome formation.

Autophagy occurs through dynamic membrane rearrangements, initiated by the emergence of a small membrane cysterna called an isolation membrane (IM). The IM encloses portions of the cytoplasm to form a double-membrane autophagosome. Despite much progress in identifying autophagy-related (Atg) genes, the origin and the source of autophagosomal membranes are long-standing questions in the field.

We previously showed that overexpression of an inactive mutant of Atg4B (Atg4B^{C74A}), a protease that processes pro-LC3 paralogues, hampers conversion of LC3-I to LC3-II and causes defects in autophagosome formation in mammalian culture cells. Since overexpression of the Atg4B^{C74A} mutant caused accumulation of an unclosed autophagosomal membrane (isolation membrane), we found it to be a useful tool to study the structure of the isolation membrane in detail. Electron microscopic observation of both control and Atg4B^{C74A} expressing cells suggested that rough endoplasmic reticulum (ER) was associated with isolation membranes. We found that the Atg4B mutant expressing cells caused significant accumulation of ER-associated isolation membranes. Thus, these results suggested importance of the close association of the ER with the isolation membrane during early autophagosome formation. We employed electron tomography to obtain 3-D information for

understanding the spatial relationship between the ER and isolation membranes at high resolution. Electron tomography revealed that the ER-associated IM appears as a subdomain of the ER that formed a cradle encircling the IM, and showed that both ER and isolation membranes were interconnected (Fig. 1). Our results suggested that autophagosomal membrane originate from ER subdomains, and the ER is a membrane source for autophagosome formation.

Generation of electron beam and X-ray with high spatial resolution based on photocathode RF gun for new radiation therapy.

Cause of death due to cancer is increasing in Japan. Particularly, radiation therapy develops remarkably for cancer treatment because of improvement of quality of life. However, normal tissue irradiation in patients can be problem in radiation therapy. In order to reduce the radiation damage in normal tissue, Intensity Modulated Radiation Therapy (IMRT), which can decrease radiation dose to normal tissue in cancer treatment, has been developed.

In order to realize safer radiation therapy, IMRT based on photocathode RF gun linac was proposed. Electron beam and X-ray with high spatial resolution were generated by the linac. Electron beam, which can be feasible for irradiation of cancer in surface layer of skins, was generated successfully. X-ray feasible for cancer in deep layer was also generated using parametric X-ray generation.

Identification of the novel S1P transporter in the mammalian cells.

Sphingosine 1-phosphate (S1P) is a lipid mediator that plays an important role in several cellular functions such as cell migration and apoptosis. S1P is synthesized from the sphingosine by the phosphorylation inside the cells. However, little is known about how S1P is exported from the cells. We are trying to identify the secretion mechanism and to isolate the transporters that are directly transporting S1P molecules.

We identified the novel S1P transporter, Spns2 by analyzing the function of the MFS-type orphan transporters. Functional defect of spns2 caused cardiac bifida phenotype in zebrafish. Spns2 orthologue is presented in the mammals. We demonstrated that human and mouse spns2 have S1P export activity from the cells. This is a first S1P transporter in mammals and this transporter should be a new target for development of drug.

Human Interface Research Group

Professor: Masayuki NUMAO (Group leader), Riichiro MIZOGUCHI,
Hidekazu TANAKA

Specially Appointed Professor: Sunao TAKAFUJI

Specially Appointed Assistant Professor: Ken-ichi FUKUI, Nam Goo CHA

Outlines

Our research interests are foundation software systems and its basis device for development of safe and reliable technology, which include intelligent sensor data analysis methods, knowledge sharing technology for manufacturing support, and Nanoinprint Lithography known as an advantaged forming technique for an integrated circuit.

Current Research Project

Knowledge Sharing And Reuse for Helping Safe & Secure Creative Design And Manufacturing (Mizoguchi, Takafuji)

We developed a model of services and design-support system for SOFC (Solid Oxide Fuel Cell) as well as enhancement of OntoGear tool. Concrete items of our achievement are as follows:

- 1) OntoGear FFN (Functional Forest Navigator)
- 2) A new model of services with ontology of value
- 3) A prototype of a design support system of the integrated process of SOFC
- 4) Evaluation and extension

We have got favorable feedback from users from three different companies who involved in a trial use of OntoGear. A prototype of the English version of OntoGear has been developed. A trial implementation of a new interface of OntoGear tuned for collaborative use has been done.

The final version of OntoGear has been released by MetaMoJi, a new venture company established by Kazunori Ukigawa, the originator of Just System Corporation, with the new name, OntoloGear.



Fig. 1 Integrated model of OntoGear FKE

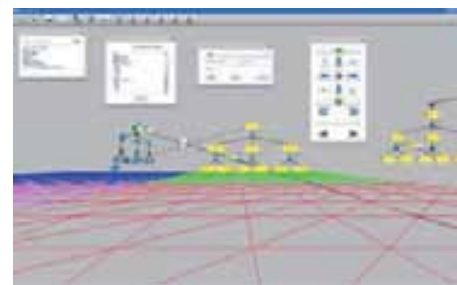


Fig. 2 3D View of OntoGear FFN

Visual Data Mining for Damage Evaluation Support (Numao, Fukui)

- 1) We developed the foundation of Exploratory Data Analysis (EDA) based on visual data mining for supporting investigation of numerous damage events. We improved the clustering performance of damage events by introducing the appropriate

similarity for damage events. Also we evaluated the clustering accuracy using simulated damage events data.

- 2) We confirmed damage progression of SOFC could be inferred from the cluster map obtained by our method. Squeaking of the members during heating, progression of the initial cracks, cracks in the electrolyte, electrode, and glass seal, and also exfoliation of the electrode could be specified.

The results of this research can support the expert to explore numerous damage events of a composite material in general.

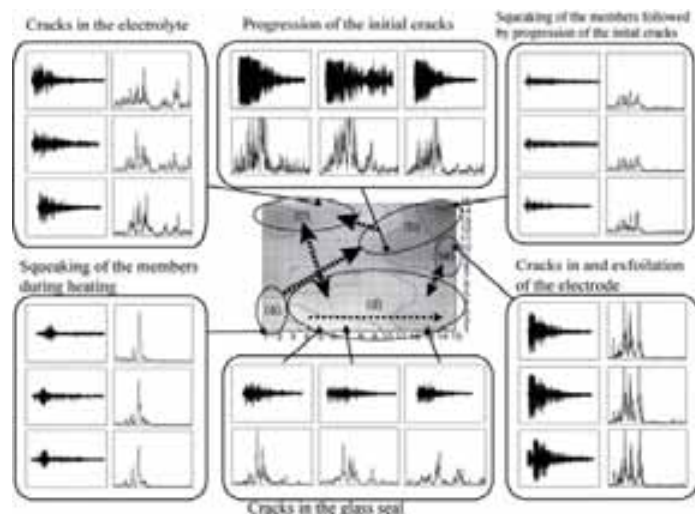


Fig. 3 The foundation of exploratory data analysis for numerous damage events.

Constriction of 3 Dimensional functional oxide Nano superstructures by fusion of thin film growth and nano-imprint lithography. (Cha, Tanaka)

We have successfully established the unique method to fabricate the smaller patterns than original pattern and facilitate the high AR mask with controllability combining the sidewall-etching, sidewall-deposition and ultrasonic process. Using this method, we fabricated the H_2O_2 soluble High aspect ratio Mo nano mask with 100-nm and 60-nm window sizes using a 250-nm square patterned mold and were successfully grown the epitaxial ferromagnetic semiconductor $(Fe,Mn)_3O_4$ nanostructures over 100-nm height

directly on sapphire substrates at 350 °C by PLD process. Our results open a possibility to overcome the resolution limits and provide the simplistic method for fabricating the high AR epitaxial film/multilayer.

It will be advantageous to realize the practical applications not only including to nano-sized the high-density vertical oxide spintronic devices with ferromagnetic, but also and to various functional materials such as nano-sized ferroelectric materials.

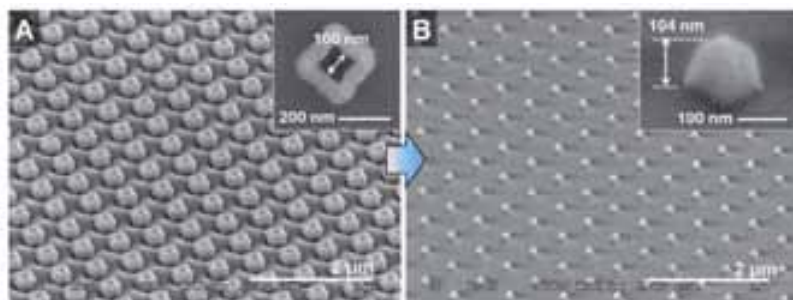


Fig. 4 The fabricated H_2O_2 -soluble Mo hollow nanopillar masks (left) with 100-nm window size, and successfully grew epitaxial FMO ($Fe_{2.5}Mn_{0.5}O_4$) nanostructures over 100-nm in height directly on sapphire substrates at 350°C by a PLD process (right).

Post-Silicon Materials and Devices Research Alliance

Outline

“Post-Silicon Materials and Devices Research Alliance” was started to attempt strategic development of the post-silicon materials and devices as a cooperative research project with Institute of Multidisciplinary Research for Advanced Materials, Tohoku University in fiscal year 2006 and further with Research Institute for Electronic Science, Hokkaido University and Chemical Resources Laboratory, Tokyo Institute of Technology in fiscal year 2007. The alliance consisted of three research groups; Molecular Nano-Electronics research group, New Functional Nano-Electronics research group and Molecular Nano-Mechanics & Bio-Mechanics research group. This project was ended by the end of fiscal year 2009 with great success and next new project “Nano-Macro Materials, Devices and System Research Alliance” is started from fiscal year 2010.

The Post-Silicon Alliance was being run under the Steering Committee of 4 member Institutes. The Committee members from ISIR were Prof. H. Asahi (Chair), Prof. A. Yamaguchi, Prof. T. Kawai, Prof. Y. Hirotsu, and Prof. Y. Aso. The members of this Post-Silicon Alliance from ISIR were as follows.

(1) Molecular Nano-Electronics Research Group)

Prof. Y. Aso (Group Leader), Prof. T. Kawai

(2) New Functional Nano-Electronics Research Group)

Prof. K. Matsumoto (Group Leader), Prof. H. Asahi, Prof. K. Tanimura, Prof. H. Kobayashi

(3) Molecular Nano-Mechanics & Bio-Mechanics Research Group)

Prof. N. Kato (Group Leader), Prof. H. Noji, Prof. K. Nakatani, Prof. T. Washio

Achievements

- Development of functionalized molecular wires
- Single molecular DNA sequencing by STM and identifying single nucleotides by nanogap
- Synthesis of new diluted magnetic semiconductors and observation of novel characteristics
- Carbon nanotube nanomemory for 10 times lower write in and read out voltage
- First bio sensor using graphene monolayer as a channel of FET
- Construction of femtosecond time-resolved transmission electron diffractometer
- Development of defect passivation etch-less cleaning method for SiC and Si devices
- Modulation of 14-3-3 protein functions by fusicoccane diterpene glycosides
- Elucidation on the role of ATP in programmed cell death
- Development of sequence specific DNA-Spin complex
- Estimation method from data obtained in a large scale quantum experiments

Molecular Nano-Electronics Research Group

Professor: Yoshio ASO (Group Leader), Tomoji KAWAI

Outlines

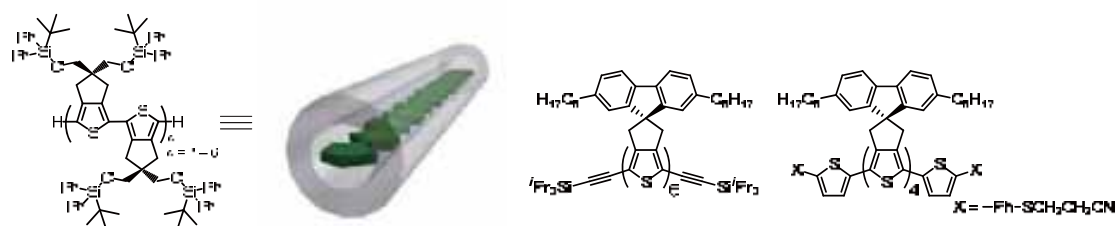
We have been focusing our research on the design, synthesis, and properties of (1) novel extended conjugation systems as active materials for organic electronic devices and (2) nano-scale conjugated molecules for promising functional molecular wires. (Aso)

With the aim of developing a biosensor or a high-speed DNA sequencer, we develop a gating nanopore structure comprising nanoelectrodes combined with solid-state nanopores. This device structure has one pair of electrodes arranged in parallel with the nanopores and another pair arranged orthogonally. We succeeded in identifying single nucleotides by nanogap. (Kawai)

Current Research Project

Insulated Oligothiophene Molecular Wires

It is generally recognized that the elongation of pi-conjugated oligomeric chains induces strong intermolecular pi-pi interactions as well as pi-dimer formation, which result in difficulties in the single-molecular properties. Recently, we have synthesized a series of oligothiophenes covered with *t*-butyldiphenylsilyl groups. The cyclopentathiophene with a spiro-type substituted dioctylfluorene has been newly designed as a monomer unit for encapsulated molecular wire, and then a series of their oligomers up to 12-mer were synthesized. The electronic absorption spectra of oxidized species of these insulated oligothiophenes showed complete blocking of pi-dimer formations unlike usual oligothiophenes. We have also achieved the synthesis of the encapsulated thiophene 6-mers with terminal thiol anchor groups for gold electrodes as well as with terminal ethynyl anchor groups for silicon electrodes.



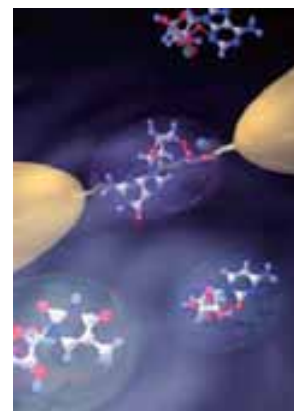
Tripodal Anchoring Compounds

In the field of molecular electronics, it is highly important to connect securely each molecule to a metal electrode and to realize efficient carrier injection. We have newly synthesized tripodal compounds with pyridyl and amino groups. Their monolayers on a gold electrode revealed that the surface coverage of the pyridyl tripodal anchor is smaller in one order compared with tripodal thiol anchor, and that of the amino anchor is comparable to that of tripodal thiol anchor. These results indicate that functional groups having weak adsorption nature can be also connected to gold electrodes by

integrating into the tripodal structure. Moreover, the phenylene-ethynylene compound with tripodal pyridyl anchors showed a good electrical conductivity on the STM break-junction measurement.

Identifying Single Nucleotides by Tunneling Current

Electrical detection of individual nucleotide molecule is accomplished by probing tunneling current across the nanogap electrodes whose gap size precisely controlled to the molecular length of nucleotides at a sub-picometer resolution. We also demonstrate clear statistical discrimination of single nucleotides via the HOMO-LUMO gap related tunneling currents, thereby providing essential scientific basis for the emerging DNA sequencing technology.



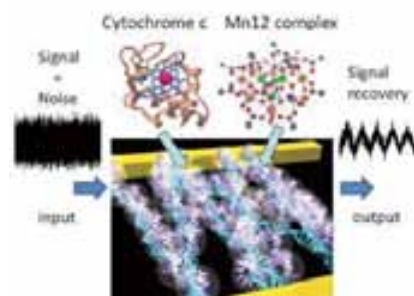
Single molecule Sequencing by Using of Scanning Tunneling Microscopes

We report single-molecule DNA sequencing with a STM by using an oblique pulse-injection method to deposit the molecules onto a copper surface. First, we show that guanine bases have a distinct electronic state that allows them to be distinguished from the other nucleic acid bases. Then, by comparing data on M13mp18, a single-stranded phage DNA, with a known base sequence, the 'electronic fingerprint' of guanine bases in the DNA molecule is identified. These results show that it is possible to sequence individual guanine bases in real long-chain DNA molecules with high-resolution STM imaging and spectroscopy.



Stochastic Resonance Emerging on Self-assembled Molecular Network Devices

We have aimed the emergence of novel device that can induce SR, constructing the molecular network by coupling bio substances and organic molecules with the self-organization. We have used cytochrome c (cyt c) and Mn12 complex including a redox center and DNA (Poly(dA)Poly(dT) DNA or \square -DNA) which can assist the fabrication of cyt c arrays which are charge transport route. Since the redox center in cyt c and Mn12 is insulated, it is difficult to receive the influence of outside environment. Therefore, cyt c and Mn12 arrays that the height of energy barriers is identical one after another are expected to be obtained. The I-V characteristics indicate that each cyt c and Mn12 acts as Coulomb blockade element and the devices show the function of stochastic resonance.



New Functional Nano-Electronics Research Group

Professors: Kazuhiko MATSUMOTO (Group Leader),
Hajime ASAHI, Katsumi TANIMURA, Hikaru KOBAYASHI

Outline

New functional nano-electronics research group treated mainly the semiconductor and their material characteristics, physical evaluation, device performance, etc. are analyzed in details as follows:

The Synthesis and development of III-nitride semiconductor-based room temperature transparent ferromagnetic semiconductors with strong photoemission properties and their application to novel semiconductor nano-spintronics device fabrications were conducted. (Asahi)

Using the carbon nanotube as a treating material, the quantum functional device, field effect transistor, new nanomemory, FET type bio sensor, electrochemical biosensor are developed. Also, the fundamental growth process, such as a chirality control, growth direction control are investigated. The research of graphene bio sensor is the newly developed (Matsumoto).

The aim of our research is to establish the new methods to fabricate highly functional nano-electronic materials and structures by controlling modes of condensation via electronic excitation of solids. (Tanimura)

Electrical characteristics of semiconductor devices are seriously degraded by defect states and metal contaminants although their densities are extremely low. We have developed a method which can passivate defect states and remove metal contaminants at the same time using HCN solutions (Kobayashi).

Current Research Projects

Crystal Growth and Properties of Diluted Magnetic Semiconductors

Successful growth of InGaGdN was achieved aiming at realization of long wavelength emission ferromagnetic semiconductors. In GaGdN/AlGaIn quantum well superlattices, giant red shift of photoluminescence (PL) peak was observed as well as enhancement of magnetization. Results for the existence of magnetic polaron were also observed.

Carbon Nanotube Nano Memory

Owing to the small diameter of the carbon nanotube(CNT), the electric field concentration was induced around the nanotube. Therefore, we could get the higher electric field even at the lower applied voltage. Using this phenomena, CNT was surrounded by two dielectric layers of $\text{Si}_3\text{N}_4/\text{SiO}_2$ for the memory structure. For this carbon nanotube nanomemory, only 2V is necessary for the write in and read out process. This is 10 times smaller value than the conventional planar type memory.

Graphene Bio Sensor

Using the graphene as a channel of the FET, the bio sensor was first fabricated. In the solution, the electrical double layer works as an infinitesimally thin gate dielectric of $\sim 2\text{nm}$, the FEET showed 34times higher transconductance than measured from the backgate electrode. Using these feature, the BSA was introduced in to the solution, and the change of the drain current of the graphene FET was linearly proportional to the concentration of the BSA. Thus, the first graphene biosensor was successful fabricated.

Atomic-scale nanofabrication by tunnelling hole injection from STM chip on III-V semiconductor surfaces

Local structural changes induced by tunnelling-current injection from STM chips onto III-V semiconductor surfaces have been studied. Only hole injection can remove P atoms selectively on InP(110)-(1x1), and injected hole condensation around initially formed P-atomic vacancy results in the formation of one-dimensional vacancy chains via two-hole localization mechanism. It can provide a unique template for forming linear metallic atomic chains on semiconductor surfaces.

Construction of a compact femtosecond time-resolved transmission electron diffractometer for ultrafast structural dynamics on solids

In order to obtain direct ultrafast structural dynamics in excited condensed matters, an ultrafast electron diffractometer with transmission mode has been newly constructed. In contrast to the standard machines with reflection modes in US and Europe, it enables us to measure transmission diffraction, thus providing the best possibility to develop further femtosecond time-resolved electron microscope for real-space imaging. The shortest temporal resolution of 95 fs is now a world record in the temporal resolution.

Defect passivation etch-less cleaning for SiC and Si

We have found that HCN solutions can passivate defect states such as Si dangling bonds by the formation of Si-CN bonds and simultaneously remove metal contaminants completely (i.e., less than $\sim 3 \times 10^9$ atoms/cm²). The defect passivation etch-less cleaning method simply involves immersion of SiC or Si in HCN aqueous solutions with low concentration (e.g., 0.01 %) for a few minutes at room temperature. We have also developed a method of formation of HCN solutions from non-poisonous compounds and a method of decomposition of HCN solutions after use.

Molecular Nano-Mechanics & Bio-Mechanics Research Group

Professors: Nobuo KATO (Group Leader), Hiroyuki NOJI (Group Sub-Leader)
Kazuhiko NAKATANI, Takashi WASHIO

Outlines

With biomechanics of molecular motors, DNA, and other related materials, researches of this group aim at the development of devices functioning with self-organization on the basis of producing new material, nano light processing, nano measurement of extremely weak force, dynamic assessments of nano space. Kato group focused the attention on the photoresponsive gene expression with peptide nucleic acid and modulation of cell signaling by diterpenoid-based or peptide-mimetic type of small molecules. Noji group, in cooperation with the Nagai group of Research Institute for Electronic Science, Hokkaido University and Yoshida group of Chemical Resources Laboratory, Tokyo Institute of Technology, pushed forward a study about elucidation of the energy conversion mechanism of the ATP synthase with single molecule measurement technology and microdevices. Furthermore, they developed a fluorescent probe for ATP and measured dynamics of the ATP density in the cell. Nakatani group studied the photoresponsive molecular glue for DNA and realized the light control of the DNA double strand formation with photoswitchable molecular glue. Washio group studied a method to accurately estimate highly likely state matrices from disturbed and uncertain data including missing values provided by quantum computing experiments.

Current Research Projects

Modulation of the intracellular signaling by small organic molecules

Fusicoccane type of diterpenoids is known to have phyto-hormone like activities through modulation of 14-3-3 protein functions and a similar mechanism of action on their biological activities towards animal cells has been assumed. While combined treatment by a cotylenin analog and interferon caused apoptosis of human lung cancer cells (A549), cells were significantly rescued by co-treatment by siRNA of 14-3-3zeta. This result clearly demonstrated that 14-3-3 protein is involved in the apoptosis induction caused by the combined treatment and fusicoccane diterpenoids could be modulators of cell signals through alteration of 14-3-3 protein functions.

Intracellular ATP imaging

With the aim of direct measurement of the intracellular [ATP] in individual cells, we have developed a ratiometric fluorescent ATP sensor protein (PNAS 2009). The ATP sensor protein was successively expressed in a culture cells such as a human cultured cell and bacteria cells. When apoptosis was induced in human cells, a large decrement in intracellular [ATP] level was reproducibly observed after caspase activation which triggers the catastrophic degradation of cell components. This project has been done under the frame of the collaboration with Nagai lab in Hokkaido University.

Single-molecule study on a rotary molecular motor protein

F₁-ATPase is a rotary molecular motor that makes 120° stepping rotation, each step

driven by a single ATP hydrolysis reaction. We studied on the role of conformational fluctuation on catalytic activity by changing the viscous drag on the rotary motion. It has turned out that substrate dock/undock processes such as ATP-binding and ADP-release are very sensitive to the viscous drag while chemical reaction, i.e. ATP hydrolysis/synthesis is not. These findings suggest substrate docking and undocking processes are largely supported by thermal agitation.

Development of DNA based supramolecular optical switch

We have studied a new method to introduce organic stable spin on to DNA double stranded structure. Organic stable spins have been used in the understanding of biomolecular interaction and structure analyses. Recent progress has been reported on the usage of spins in radical battery based on the redox of organic spins and dynamic nuclear polarization. We have synthesized a mismatch-binding ligands holding organic stable spins, such as TEMPO and nitronylnitroxide and investigated their binding to the mismatched DNA duplex.

Estimation method from data obtained in a large scale quantum experiments

Results of quantum experiments are known to satisfy a mathematical property named positive semi-definiteness due to their background physical nature. This study worked on the development of a method and its algorithm to derive the accurate estimation from the large scale and complex experimental results based on the mathematical property. As a consequence, the feasibility of the accurate estimation by using projection of the large scale experimental results to high dimensional data space has been clarified.

Intelligent Artificial Agents and Information Systems Inspired by Biological System Dynamics

Specially Appointed Assistant Professor: Yasushi Hotta

Outlines

“Intelligent Artificial Agents and Information Systems Inspired by Biological System Dynamics” (“Yuragi Project”) forms the innovation center as the project of the “Formation of Innovation Center for fusion of Advanced Technologies”. In Yuragi Project, in cooperation with participating private companies, we seek to create new intelligent artificial agents and information systems that implement highly flexible functions currently unique to living organisms.

Our strategy for achieving this goal is first to elucidate the mechanisms of expressing function in biological systems via active applications of biodynamics, that is, to understand the intrinsic stochastic and fluctuating nature of biological systems. Specifically, we will measure and analyze “dynamical fluctuations” which make biological functions highly robust and flexible. From this, we will establish new applications based on the novel principles elucidated from biological energy conversion and information processing. Incorporating knowledge from such research, new nano-materials science, information systems science, and robotics will be established. We wish to contribute to the creation of new basic and applied sciences that are capable of responding to the needs of an increasingly information-driven society.

The key concept in Yuragi project is an attractor selection model, where attractor dynamics are modified by the environmental activity under the fluctuation. We reveal the structure of the attractor selection devices inspired by stochastic resonance model, and study the nature of such stochastic devices. Then, nano materials suitable for the attractor selection devices using fluctuation mechanism are developed with the process methods and functions. And also we will develop the novel techniques for the evaluation of dynamical fluctuations.

Current Research Project

Yuragi device is an electronic device which shows neuron-type behavior with stochastic-resonance. We have developed this device and achieved a novel control system based on the attractor dynamics of “Yuragi” phenomenon.

We have developed a Yuragi device to light detectable to mount a light sensor. By using the developed device, we have fabricated a Yuragi oscillator which is a ring connection of the modified Yuragi devices. Studies of the Yuragi oscillator shows that the oscillator can change own oscillation pattern with changing input light intensity.

Furthermore, we have achieved a phototaxis control system which is built up with four the Yuragi oscillators. The system has degree of freedom of two axis motion. By using this system we demonstrated a car robot control, resulting that the control system has characteristics of flexibility and robustness on the control, comparing to logic systems such as PID.

Achievements of Facilities

Workshop

Director Professor: Yasushi YAGI

Technical Staff

Machine Shop: Michiaki KAKUICHI, Masayoshi OHNISHI

Glassworks: Hiroaki MATSUKAWA, Noriyuki OGAWA

Outline

A machine and carpentry shop and a glass factory, which are predecessors of the Workshop, were set up at the same time when the Institute of Scientific and Industrial Research was founded. The machine and carpentry shop and the glass factory were unified to be the Workshop when the Technical Division was established in 1982. Since research fields studied in the institute covers a wide range, many of experimental apparatuses requested to the Workshop are various and novel. The Workshop, which consists of the Machine Shop and the Glassworks, plays an important role in activities of the institute and contributes to them by making and providing such experimental apparatuses.

The Machine Shop performs design and trial manufacture of experimental apparatuses for science and engineering as well as production of experimental tools made of various metals. Requests of experimental apparatuses for ultra high vacuum or ultra low temperature are increasing recently and accordingly we work in closer cooperation with researchers asking such apparatuses from the design phase to respond to the requests and make apparatuses best fit to experimental purposes. A gate-type machining center was introduced in 2002, and a CNC lathe was introduced in 2009, so that we can answer to advanced and difficult requests from researchers. A corner of the machine shop for joint-use, called an open shop, is attached and we coach researchers in technique properly.

The Glassworks performs design and trial manufacture of experimental tools and apparatuses made of various kinds of glass. We develop apparatuses necessary and suitable for experiments and we also devote ourselves to our studies and establishment of technique for improving functions of conventional apparatuses and for providing safer and easier-to-use apparatuses. Since we are recently asked to work with ceramics, we are trying to obtain machines for it. A CNC plain grinding machine was introduced in 2009, so that we can answer to advanced and difficult requests from researchers.

Activities

We renewed a CNC plain grinding machine of the Glassworks. We also equipped with a CNC lathe. Moreover we equipped with peripheral devices and tools for the machining center for precise machining.

The members of the Workshop organized and participated in the national technical meeting and the symposium on glass works for all the engineers and technicians of universities and national laboratories in Japan.

The Glassworks receives staff members of universities in the Kansai area for technical training in glass work and in 2009 it received persons from Kobe University, Osaka Prefecture University and coached them for handing skills and technique down to the next generation. In addition, we coach technique individually for the members of the Institute.

1. Number of jobs

Machine Shop: 200 jobs (210 jobs in the previous year).

Glassworks: 145 jobs (141 jobs).

2. Number of users in the open shop

Machine Shop: 70 users.

Glassworks: 40 users.

3. Number of persons being trained

Machine Shop: 11 persons.

Glassworks: 9 persons, including 7 subjects from the outside.

Laboratory for Radio-isotope Experiments

Professor: Akihito YAMAGUCHI

Outline

This laboratory is specially designed for biochemical and molecular biological experiments using the radioactive compounds labeled with ^3H , ^{14}C , ^{32}P , ^{33}P or ^{35}S . The main equipments are liquid scintillation counters and a bioimaging analyzer, BAS1000. Radioactive compounds are convenient tool for the research in the field of biochemistry, molecular biology, and cell biology. The use of radioisotopes is regulated with the national law for the prevention of radiation hazard. The facilities are inspected regularly with authorities and pass the required standard. Radioisotope users must attend the mandatory education program every year to get the knowledge for the safe use of radioisotopes.

Contributions of the facilities to the research projects are described in the section of each department

Electronic Processing Laboratory

Professor: Hajime ASAHI
Associate Professor: Shigehiko HASEGAWA
Associate Professor: Takuya MATSUMOTO
Associate Professor: Koichi SUDOH
Associate Professor: Kenzo MAEHASHI
Assistant Professor: Yi-Kai ZHOU

Outlines

Electronic Processing Laboratory was established as a sort of device fabrication workshop in 1991. The aim of this laboratory is to contribute to the development of nanotechnology and related researches by setting up the equipment and systems for fabrication, required commonly for the researches related to the areas such as photonic and electronic materials, molecular device materials and organic device materials and by improving process technology for various device materials.

The equipment and systems are a small-size clean room, a double crystal X-ray diffractometer, an atomic force microscope, a digital optical microscope, a photolithography system, a sputter deposition system, a high vacuum evaporation system, an electron beam evaporation system, a reactive ion etching system, a focused ion beam system, a crystal cleaving system, a wire bonding system and personal computers for data analysis

This laboratory is utilized for experimental researches of surface structure analysis and electrode formation, for the measurements of electronic and other properties of various materials and also for the fabrication of photonic, electronic and molecular devices. Guidance to the users to the equipments and systems as well as the daily maintenance and repair of them were conducted. In the year of 2009, the equipment and systems were used about 200 times from 7 laboratories and facilities.

Library

Professor: Yoichi ANDO
Commissioned Staff: Yasuko ONO
Supporting Staff: Kuniko HAMANAKA

Outline

The ISIR Library houses technical books and journals for researchers. Most materials are on open shelves directly available to faculty and students. The library has a reading room with photocopiers on the second floor of the administration building.

The library office offers the following services; orders for books, survey and inquiry of literature, Interlibrary Loan services, photocopy request and so on.

Guide to the Library could be found on its home page
(<http://www.sanken.osaka-u.ac.jp/labs/lib-web/>).

(As of March 31, 2010)

	Number of books	Journals	Newspapers
Japanese	9325	179titles	4 titles
Foreign	25987	563titles	1 title

Academia Industry Relations Office

Director, Specially Appointed Professor: Hirokazu SHIMIZU, Ph.D.

Outlines

The Academia Industry Relations Office (AIR Office) of the Institute of Scientific and Industrial Research (ISIR), is dedicated to reinforcing collaboration between ISIR and the industrial community, thereby combining and developing research potential of the two sectors and promoting activities for new industrial creation and innovation. The AIR Office organizes a variety of activities to inform the industrial community of the ISIR's research efficiently through the interaction with the industrial community such as SANKEN Techno Salon (four times a year) and various Lectures events, and studies on prediction of new industry, novel system of new Industry generation, and intellectual property.

The major activities of AIR Office are: 1) A network development between ISIR and Industry, 2) Responding to inquiries from industry, 3) A liaison between academia and industrial research activities, 4) Creation of complementary opportunities for science and technology progress. AIR Office will make proposals for new business opportunity between academia and industry. New venture business activities and novel industrial products are the vision of AIR Office.

Achievements

Liaison between academia and industrial research activities and Responding to inquiries from industry

- 1) SANKEN Techno Salon: Quarterly seminar and get-together (June 24, 2009, Sep.4, 2009, Nov.20, 2009 and Jan.29, 2010)
- 2) WEB site
- 3) WEB promotion through outsourcing
- 4) Patent Publicity: International Nanotechnology Exhibition (Feb.17-19, 2010)

Supporting Technology Transfer

Study groups for the new industry generation

New Seminar for Industry Sector

“German/Japan, 1st Workshop on “Nanoanalytics“, Feb.15, 2010

AIR-Office Seminar

"Quantum dots Business from University," Nanoco Technologies, May 13, 2009.

Coordination of industry-academia collaborative research and development projects supported by public assistance system

Interactive ISIR's Laboratory Tour

2 times (May 2, 2009 and Dec.9, 2009)

A network development between ISIR and Foreign Parties

Meeting with Fraunhofer Institute, Aug.19, 2009

Meeting with University of Leeds, Oct.22, 2009

Meeting with Seoul Study Mission, Dec.17, 2009

Meeting with Bavarian Cluster Nanotechnology, Feb.14, 2010

Office of Information Network

Professor,Director:	Yoichi ANDO
Professor:	Masayuki NUMAO
Associate Professor:	Yoshinobu KITAMURA
Assistant Professor:	Kunihiro KAIHATSU
Technical Staffs:	Takanori TANAKA, Senjin AIHARA, Yuka OKUMURA
Supporting Staff:	Miyuu SAKAMOTO

Outline

Office of Information Network was inaugurated in March, 1999, to organize the operation of the information network in ISIR, which had been started with support by volunteers, because of the rapid spread of the information network and the growth of its importance in the research environment. The information was constructed as a prototype by the departments in the division of Intelligent System Science in the late 1980's and has been expanded to the whole of ISIR with the development of ODINS (Osaka University Information Network System). Recently it has played an important role in ISIR to release/access the information available in the Internet. Office of Information Network is now supporting researchers and students in the variety areas.

Activities

Office of Information Network have supported conference organizers by creating the web page, providing the on-line registration system, and broadcasting the conference. Total number of conferences was 10.

We produced the video “Introduction to the Icho Festival” and “Introduction to I.S.I.R.”.

And we have offered poster printing services for ISIR researchers. Total number of poster printing was 474.

Network Planning and Design

First Building

Incubation Building

Administrative Building and Kusumoto Building

ODINS Wireless LAN

Public Relations Office

Director Professor: Nobuo KATO
Support Staff: Noriko MATSUMOTO

Outline

Public Relations Office was opened on February 1, 2006. We provide the right information of our Research Institute for the public effectively. The major activities of Public Relations Office are: 1) To collect any required file to generate the basic plan of the publicity, 2) To support editing and issue the Memoirs of ISIR (annual report) and publications, 3) To collect any required document for creating and editing of official WEB of ISIR, 4) To perform Press Release except the subjects related to the section of general affairs, 5) To collect and preserve of any press release related to ISIR.

Technical Division

Head: Takeshi ISHIBASHI

Outlines

The Technical Division was established in 1982 to deal with professional duties providing better service for researchers. In the ISIR organization, the technician group is independent of the management and the research groups. The organization was the first one among similar organizations established in the national universities of Japan. The Division consists of two groups: Group of Machine and Group of Measurement, in which each group has two sections: Section of Machine/Circuit, Section of Glass in Group of Machine and Section of Measurement/Information, Section of Analysis/Data in Group of Measurement. The technicians work at various places: the Comprehensive Analysis Center, the Workshop, the Office of Information Network, the Research Laboratory for Quantum Beam Science and the Nanotechnology Center. The Division gives not only high-quality service to research groups but technical training to the researchers and students. The annual report is published to help and encourage training and activities of the members of the Division. In addition, the Division has started the safety lecture for utilizing various machines in the ISIR since 2004. The Technical Division makes every effort to promote the ISIR more important development under an independent administration system.

Administrative Office (31-March , 2010)

Director : Noboru NAKATA

Facilities Planning Office

Staff : Aya NISHIDA

General Affairs Division

Staffs: Kazutaka TSUMURA
Masahito KAWAZOE
Manabu MAEDA
Akira KAMATANI

Supporting Staffs: Keiko KOJIMA
Yukie YAMADA
Junko HANASHIMA
Mitsuru NISHISAKO
Sachiko MITSUMORI
Kazumi HAYASHI

Research Cooperation Division

Staffs: Katsumi UEDONO
Shigeo KASHIWAKURA
Shizuo TSUNEISHI
Kouichi YAMAMOTO
Yuji SORIHASHI
Akemi KIDA
Satoshi YAMAGUCHI

Supporting Staffs: Mari KONISHI
Masako OSUGI
Tamiko SHINDE
Hiroko YAMAUCHI
Misato KUBO
Kumiko TERADA
Mayuko TSUDA
Ruri MAEKAWA
Shigeo NAGAOKA

List of Achievements

Department of Photonic and Electronic Materials

Original Papers

- [1] Formation of aligned CrN nanoclusters in Cr-delta-doped GaN, Y. K. Zhou, S. Kimura, S. Emura, S. Hasegawa and H. Asahi: *J. Phys.: Condens. Matter.*, 21 (2009) 064216-1 – 064216-4.
- [2] MBE growth and characterization of TlGaInNAs double quantum well structures, D. Krishnamurthy, S. Shanthi, K.M. Kim, Y. Sakai, M. Ishimaru, S. Hasegawa and H. Asahi: *J. Crystal Growth*, 311 (2009) 1733-1738.
- [3] Structural properties of AlCrN, GaCrN and InCrN, S. Kimura, S. Emura, K. Tokuda, Y. K. Zhou, S. Hasegawa and H. Asahi: *J. Crystal Growth*, 311 (2009) 2046-2048.
- [4] Ultra-short-period lateral composition modulation in TlGaInAsN/ TlInP structures, M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato and T. J. Konno: *Appl. Phys. Lett.*, 94 (2009) 153103-1 – 153103-3.
- [5] Influence of native silicon oxides on the growth of GaN nanorods on Si (002), S. Hasegawa, J.U. Seo, K. Uchida, H. Tambo, H. Kameoka, M. Ishimaru and H. Asahi: *Phys. Stat. Sol., C6 (S2)* (2009) S570-S573.
- [6] Crystal growth and characterization of GaCrN nanorods on Si substrate, H. Tambo, S. Kimura, Y. Yamauchi, Y. Hiromura, Y.K.Zhou, S. Emura, S. Hasegawa and H. Asahi: *J. Cryst. Growth*, 311 (2009) 2962-2965.
- [7] Effects of morphologies on field emission characteristics of GaN nanorods grown on Si by MBE, J. U. Seo, S. Hasegawa and H. Asahi: *J. Cryst. Growth*, 311 (2009) 2977-2981.
- [8] Ferromagnetism and Luminescence of Diluted Magnetic Semiconductors GaGdN and AlGdN, S. Emura, M. Takahashi, H. Tambo, A. Suzuki, T. Nakamura, Y.K. Zhou, S. Hasegawa and H. Asahi: *Mater. Res. Soc. Symp. Proc.*, 1111 (2009) 49-60.
- [9] Selective area growth of GaN nanorods on patterned W/SiO₃/Si substrates by RF-MBE, J.U. Seo, S. Hasegawa and H. Asahi: *J. Cryst. Growth*, 311 (2009) 4437- 4441.
- [10] Local Atomic Structure around Ni, Nb, and Zr Atoms in Ni-Nb-Zr-H Glassy Alloys Studied by XAFS Method, H. Oji, K. Handa, J. Ide, T. Honma, S. Yamaura, A. Inoue, N. Umesaki, S. Emura, and M. Fukuhara: *J. Appl. Phys.*, 105 (2009) 113527-1 - 6.
- [11] Broken symmetry of cage surrounding magnetic dopant Cr ion in cubic GaN, S. Emura, K. Tokuda, S. Kobayashi, Y.K. Zhou, S. Hasegawa and H. Asahi: *J. Physics: Conf. Ser.*, 190 (2009) 012102-1 – 012102-4.
- [12] Local Atomic Structure around Ni, Nb, and Zr Atoms in Ni-Nb-Zr-H Glassy Alloys, H. Oji, K. Handa, J. Ide, T. Honma, N. Umesaki, S. Yamaura, M. Fukuhara, A. Inoue and S. Emura: *J. Physics: Conf. Ser.*, 190 (2009) 012075-1 – 012075-4.
- [13] Degradation mechanisms of GaAs PHEMTs under operation in high humidity conditions, T. Hisaka, H. Sasaki, Y. Nogami, K. Hosogi, N. Yoshida, A.A. Villanueva, J.A. del Alamo, S. Hasegawa and H. Asahi: *Microelectronics Reliability*, 49 (2009) 1515-1519.
- [14] Growth and characterization of Fe nanostructures on GaN, Y. Honda, S. Hayakawa, S. Hasegawa and H. Asahi: *Appl. Surf. Sci.*, 256 (2009) 1069-1072.

Books

- [1] Vacuum evaporation method, Molecular beam epitaxy method, H. Asahi: in *Practical Process for Thin Films* (Gijutsu Kyoiku-sha, 2009)(F.Saito, Y.Tagai) H. Asahi .

International Conferences

- [1] Growth and Properties of Gadolinium doped InGaN Grown by Molecular Beam Epitaxy , S.N.M. Tawil, D. Krishnamurthy, R. Kakimi, S. Hasegawa and H. Asahi: *The 12th SANKEN International Symposium*, Osaka, Japan, January 22, 2009.
- [2] Properties of TlInGaAsN/TlInP multi-layers on InP substrates , J.Q. Liu, Y. Tanaka, S. Hasegawa and H. Asahi: *The 12th SANKEN International Symposium*, Osaka, Japan, January 22, 2009.

- [3]Formation of Iron Dots on Gallium Nitride and Their I-V Characteristics , M. Sotani, Y. Honda, S. Hasegawa, and H. Asahi: The 12th SANKEN International Symposium, Osaka, Japan, January 22, 2009.
- [4]Zeeman effect in low-temperature-grown GaDyN , Y. K. Zhou, M. Takahashi, S. Emura, S. Hasegawa and H. Asahi: The 12th SANKEN International Symposium, Osaka, Japan, January 22, 2009.
- [5]Development of Tl-III-V alloys: MBE growth, Properties and Applications (invited), D.Krishnamurthy, S.Hasegawa and H.Asahi: International Conference on Functional Materials for Advanced Technology (ICFMAT-2009), Chennai, India, January 29-30, 2009.
- [6]Improvement in luminescence properties of TlInGaAsN/TlInP multi-layers grown by gas source molecular beam epitaxy , Y. Tanaka, S. Hasegawa, J.Q. Liu, M. Ishimaru and H. Asahi: 21st International Conference on Indium Phosphide and Related Materials, Newport Beach, California, USA, May 10-14, 2009.
- [7]Spontaneous Formation of Ultra-Short-Period Lateral Composition Modulation in TlGaInAsN/TlInP Structures , M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato and T. J. Konno: 21st International Conference on Indium Phosphide and Related Materials, Newport Beach, California, USA, May 10-14, 2009.
- [8]Enhancement of saturation magnetization in GaGdN/AlGaN multiple quantum wells grown by PA-MBE , S. Hasegawa, H. Tani, M. Kin, Y. K. Zhou and H. Asahi: 14th International Conference on Modulated Semiconductor Structures (MSS-14), Kobe, Japan, July 19-24, 2009.
- [9]Growth and characterization of GaGdN/AlGaN heterostructures , M. Kin, S. Hasegawa, D. Abe, and H. Asahi: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, September 1-3, 2009.
- [10]Optical properties of TlInGaAsN/TlGaAs double quantum well structures on GaAs , Y. Sakai, K.M. Kim, S. Hasegawa and H. Asahi: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, September 1-3, 2009.
- [11]MBE growth of GaN with p-type conductivity by Be and Si co-doping , S. Hayashi, S. Hasegawa, F. Yukawa, Y.K. Zhou and H. Asahi: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, September 1-3, 2009.
- [12]Structural and optical properties of rare-earth element Gd doped GaN , H. Tani, S. Hasegawa Y.K. Zhou S. Emura and H. Asahi: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, September 1-3, 2009.
- [13]Large Zeeman splitting in low-temperature-grown GaDyN” , Y. K. Zhou, H. Ichihara, S. Emura, S. Hasegawa and H. Asahi: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka University, Osaka, September 5-6, 2009.
- [14]Growth and Characterization of GaGdN Nanorods , H. Tambo, S. Hasegawa, Y.K. Zhou, S. Emura and H. Asahi: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka University, Osaka, September 5-6, 2009.
- [15]Selective area growth of InP on nano-patterned SiO₂/Si(101) substrates by molecular beam epitaxy , A. Yamano, S. Hasegawa, J. U. Seo, N. S. Ahn and H. Asahi: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka University, Osaka, September 5-6, 2009.
- [16]Broken symmetry of cage surrounding magnetic dopant Cr ion in cubic GaN , S. Emura, K. Tokuda, S. Kobayashi, Y. K. Zhou, S. Hasegawa, and H. Asahi: The 14th International Conference on X-ray Absorption Fine Structure (XAFS14), Camerino, Italy, July 26 – 31, 2009.
- [17]Local atomic structure around Ni, Nb, and Zr atoms in Ni-Nb-Zr-H glassy alloys , H. Oji, K. Handa, J. Ide, T. Honma, N. Umesaki, S. Yamaura, M. Fukuhara, A. Inoue and S. Emura: The 14th International Conference on X-ray Absorption Fine Structure (XAFS14), Camerino, Italy, July 26 – 31, 2009.
- [18]A new metal-ion source with an electron-beam evaporator for surface modification , Masaharu Nunogaki Akihito Shigemoto, Satoshi Sugimoto and Shuichi .Emura: 10th International Conference on Atomically Controlled Surfaces, Interfaces, and Nanostructures (ACSIN10), Granada, Spain, 21 -25

September 2009.

[19]Combination of short-range periodicity and interfacial stress effects on valence band scheme in strained MQW (GaN/AlGaN)_n, S. Emura, H. Tani, M. Kin, Y.K. Zhou, S. Hasegawa and H. Asahi: 8th International Conference on Nitride Semiconductors (ICNS-2009), Jeju Island, Korea, October 18-23, 2009.

[20]Selective area growth of GaN nanorods on Si substrates masked with W by PA-MBE, S. Hasegawa, J.H. Seo and H. Asahi: 8th International Conference on Nitride Semiconductors (ICNS-2009), Jeju Island, Korea, October 18-23, 2009.

[21]Growth and characterization of GaN-based room-temperature ferromagnetic semiconductors for semiconductor spintronics (invited), H. Asahi, S. Hasegawa, Y.K. Zhou and S. Emura: 11th Takayanagi Kenjiro Memorial Symposium, Research Institute of Electronics, Shizuoka University, November 12-13, 2009.

Contributions to International Conferences and Journals

H. ASAHI	21st International Conference on Indium Phosphide and Related Materials (International Steering Committee member)
H. ASAHI	2009 International Conference on Solid State Devices and Materials (Program Committee member)
H. ASAHI	17th International Colloquium on Scanning Probe Microscopy (Publication Committee member)
H. ASAHI	22nd International Conference on Indium Phosphide and Related Materials (International Steering Committee member)
H. ASAHI	3rd International Symposium on Growth of III-Nitrides (International Advisory Committee member)
H. ASAHI	16th International Conference on Molecular Beam Epitaxy (International Advisory Committee member)
H. ASAHI	2010 International Conference on Solid State Devices and Materials (Program Committee member)
H. ASAHI	17th International Conference on Molecular Beam Epitaxy (Organizing Committee Chair, Conference Chair, International Advisory Committee member)
H. ASAHI	Journal of Crystal Growth (Editor)
H. ASAHI	Current Applied Physics (Editorial Board member)
H. ASAHI	J. Materials Science: Materials in Electronics (Editorial Board member)
H. ASAHI	Journal of Ceramic Processing Research (Editor)
H. ASAHI	Journal of Physics: Condensed Matter (Advisory Editorial Board member)
H. ASAHI	e-Journal of Surface Science and Nanotechnology (Advisory Board member)
S. HASEGAWA	Second International Symposium on Growth of III-Nitrides (Financial Committee member)
S. HASEGAWA	22th International Conference on Indium Phosphide and Related Materials (Program Committee member, Steering Committee member)
S. HASEGAWA	14th International Conference on Modulated Semiconductor Structures (Local Arrangements Committee member)
S. HASEGAWA	17th International Conference on Molecular Beam Epitaxy (General Affairs Chair)
S. EMURA	17th International Conference on Molecular Beam Epitaxy (Steering Committee member)
Y.K. ZHOU	17th International Conference on Molecular Beam Epitaxy (Steering Committee member)

Publications in Domestic Meetings

The Japan Society of Applied Physics	28 papers
The Surface Science Society of Japan	1 paper
The Institute of Electronics, Information and Communication Engineers	1 paper
The Vacuum Society of Japan	1 paper
Electronic Materials Symposium	3 papers
PASPS Symposium	1 paper

Academic Degrees		
Doctor Degree for Engineering	Study on formation of GaN nanorods by molecular beam epitaxy and their device application	
Jong-Uk SEO		
Master Degree for Science	Electrical and magnetic properties of GaGdN and GaGdN/AlGaIn heterostructures	
Masane KIN		
Master Degree for Science	Formation of diluted magnetic semiconductor GaGdN multi-quantum well structures and their physical properties	
Hiroatsu TANI		
Master Degree for Science	Study on growth and characterization of TlInGaAsN on InP substrate and its device application	
Jin-Qiang LIU		
Master Degree for Science	Growth of InGaGdN thin films and InGaIn/GaGdN multi-quantum wells and their characterization	
Rina KAKIMI		
Master Degree for Science	Optical properties of TlInGaAsN/TlGaAs double quantum well structures grown on GaAs by MBE	
Yuji SAKAI		
Master Degree for Science	Characterization of magnetic properties of GaN nanodots formed on Fe substrate	
Motoki SOTANI		
Master Degree for Science	MBE growth of Be and Si co-doped GaN and its characterization	
Seiichi HAYASHI		
Master Degree for Science	Study on growth of InP on localized area of Si substrate and its characterization	
Akio YAMANO		
Bachelor Degree for Engineering	STM observation of Fe nanodots grown on GaN(0001) and their characterization of magnetic properties	
Hiroya ICHIHARA		
Bachelor Degree for Engineering	Study on selective growth of InP on nano-inprint formed localized area of Si substrate	
NamSoo AHN		
Grant-in-Aid for Scientific Research		
H. Asahi	Study on Room Temperature Ferromagnetic Nitride Semiconductor Nanostructures and Application to Nanospintronics Devices	¥7,200,000
S. Hasegawa	Developments of spin-dependent ballistic electron emission microscopy and its application to spin injection into semiconductors	¥7,500,000
Y.K. Zhou	Study on control of magnetic properties in ferromagnetic nitride semiconductor nanostructures	¥2,100,000
H. Asahi	Study on Fabrication of InGaIn-Based Long Wavelength Circular Polarized Semiconductor Lasers	¥3,500,000
H. Asahi	Development of properties and functionalities by precise control of rare-earth doping (Y. Fujiwara)	¥30,000,000
Other Research Fund		
S. Hasegawa	Japan Science and Technology Agency	¥2,000,000
Kang-Min KIM	Marubun Research Promotion Foundation	¥1,500,000

Department of Semiconductor Electronics

Original Papers

- [1] Aptamer-Based Label-Free Immunosensors Using Carbon Nanotube Field-Effect Transistors., Kenzo Maehashi, Kazuhiko Matsumoto, Yuzuru Takamura, and Eiichi Tamiya: *Electroanalysis*, 21 (2009) 1285-1290.
- [2] Label-Free Electrical Detection Using Carbon Nanotube-Based Biosensors., Kenzo Maehashi, Kazuhiko Matsumoto: *Sensors*, 9 (2009) 5368-5378.
- [3] Microfluidic and Label-Free Multi-Immunosensors Based on Carbon Nanotube Microelectrodes., Yuichi Tsujita, Kenzo Maehashi, Kazuhiko Matsumoto, Miyuki Chikae, Yuzuru Takamura, and Eiichi Tamiya: *Jpn. J. Appl. Phys.*, 48 (2009) 06FJ02.
- [4] Noise Reduction of Carbon Nanotube Field-Effect Transistor Biosensors by Alternating Current Measurement., Yasuki Yamamoto, Yasuhide Ohno, Kenzo Maehashi, and Kazuhiko Matsumoto: *Jpn. J. Appl. Phys.*, 48 (2009) 06FJ01.
- [5] Electrolyte-Gated Graphene Field-Effect Transistors for Detecting pH and Protein Adsorption., Yasuhide Ohno, Kenzo Maehashi, Yusuke Yamashiro, and Kazuhiko Matsumoto: *Nano Lett.*, 9 (2009) 3318-3322.
- [6] High-Sensitive Biosensors based on High-Performance Carbon Nanotube Field-Effect Transistors., Yasuki Yamamoto, Kenzo Maehashi, Yasuhide Ohno and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 351-361.
- [7] Electrochemical Amperometric Biosensors Based on Directly Synthesized Carbon Nanotube Electrodes, Kenzo Maehashi, Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 363-372.
- [8] Fabrication of room-temperature-operating carbon nanotube single-charge transistors., Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 393-402.
- [9] Single-Charge Sensitivity of Single-Walled Carbon Nanotube Multi-Functional Quantum Transistor., Takafumi Kamimura and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 403-418.
- [10] Gate induced crossover between Fabry-Perot and quantum dot behavior in a single walled carbon nanotube hole transistor., Takafumi Kamimura and Kazuhiko Matsumoto: *J. Appl. Phys.*, 106 (2009) 113718.
- [11] Electrical Detection of Negatively Charged Proteins Using n-Type Carbon Nanotube Field-Effect Transistor Biosensors., Yasuki Yamamoto, Kenzo Maehashi, Yasuhide Ohno, and Kazuhiko Matsumoto: *Jpn. J. Appl. Phys.*, 49 (2010) 02BD10.
- [12] Robust Noise Modulation of Nonlinearity in Carbon Nanotube Field-Effect Transistors., Toshio Kawahara, Satarou Yamaguchi, Kenzo Maehashi, Yasuhide Ohno, Kazuhiko Matsumoto, and Tomoji Kawai: *Jpn. J. Appl. Phys.*, 49 (2010) 02BD11.
- [13] Cobalt Nano Particle Size Dependence of Noise Modulations in Relation to Nonlinearity, Toshio Kawahara, Satarou Yamaguchi, Kenzo Maehashi, Yasuhide Ohno, Kazuhiko Matsumoto, Tomoji Kawai: *e-J. Surf. Sci. Nanotech.*, 8 (2010) 115-120.

Review Papers

- Fabrication of Carbon Nanotube Devices and Application to Biosensors, K. Maehashi, *Journal of the Vacuum, The Vacuum Society of Japan*, 52 (2009), 335-339.
- Label-free electrical detection of biomolecules using carbon nanotube-based biosensors, K. Maehashi, K. Matsumoto, Oyo Buturi, *The Japan Society of Applied Physics*, 78 (2009), 1142-1145.

International Conferences

- [1] Carbon Nanotube Quantum Devices & Bio Sensor Application. (oral), *K. Matsumoto: 215th ECS Meeting, San Francisco, USA, May 24-29, 2009.
- [2] Direction Control of Carbon Nanotube Growth on Corrugated SiO₂ using Casimir Force and its Application to High Current FET. (oral), *K. Matsumoto, S. Iwasaki, T. Kamimura, K. Inoue, T. Kishimoto, Y. Ohno, K. Maehashi: International Symposium on Carbon Nanotube Nanoelectronics,

Matsushima, Japan, June 9 - 12, 2009.

- [3] Robust noise modulation of nonlinearity in carbon nanotube field-effect transistors. (poster), *T. Kawahara, S. Yamaguchi, K. Maehashi, Y. Ohno, K. Matsumoto, T. Kawai: International Symposium on Carbon Nanotube Nanoelectronics, Matsushima, Japan, June 9 - 12, 2010.
- [4] Electrical Detection of Negatively Charged Protein Using n-type Carbon Nanotube Field-Effect Transistor Biosensors. (poster), *Y. Yamamoto, K. Maehashi, Y. Ohno, K. Matsumoto: International Symposium on Carbon Nanotube Nanoelectronics, Matsushima, Japan, June 9 - 12, 2009.
- [5] Horizontally Aligned Single-Walled Carbon Nanotubes on Patterned SiO₂/Si Substrates. (oral), *T. Kishimoto, S. Iwasaki, T. Kamimura, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 51st TMS Electronic Materials Conference, Pennsylvania State University, USA, June 24 - 26, 2009.
- [6] Microfluidic biochips for Label-Free Multi-Immunosensors Based on Carbon Nanotube Arrayed Microelectrodes. (oral), *K. Maehashi, Y. Tsujita, K. Matsumoto: 51st TMS Electronic Materials Conference, Pennsylvania State University, USA, June 24 - 26, 2009.
- [7] Diameter Evaluation of Single-Walled Carbon Nanotubes Using Laser-Irradiated Chemical Vapor Deposition. (poster), *T. Tsuji, K. Inoue, Y. Ohno, K. Maehashi, K. Matsumoto: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [8] Fabrication of a Logic Circuit Using a CNT-FET with SiN_x Passivation Films (poster), *T. Kishimoto, Y. Ohno, K. Maehashi, K. Inoue, and K. Matsumoto: 6th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [9] Sensing Characteristics in Aligned-Carbon Nanotube Field-Effect Transistors. (poster), *Y. Hakamata, T. Ohori, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [10] Fabrication of Carbon Nanotube Field-Effect Transistors-Based Nonvolatile Memory. (poster), *T. Ohori, S. Nagaso, Y. Hakamata, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 8th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [11] Electrical Properties of Graphene Quantum Dot. (poster), *Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, and K. Matsumoto: 9th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [12] Detection in Negatively Charged Proteins Using Carbon Nanotube Field-Effect Transistors with SiN_x Films. (poster), *Y. Yamamoto, K. Maehashi, Y. Ohno, K. Matsumoto: 10th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1 - 3, 2009.
- [13] Application of Carbon Nanotubes to Electronic Devices. (invited), *K. Maehashi: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2009.
- [14] Resonance Raman Scattering in Single-Walled Carbon Nanotubes Using Laser-Irradiated Chemical Vapor Deposition. (poster), *T. Tsuji, K. Inoue, Y. Ohno, K. Maehashi, K. Matsumoto: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2010.
- [15] Integrated Circuits Based on Carbon Nanotube Field-Effect Transistors with SiN_x Passivation Films. (poster), *T. Kishimoto, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2011.
- [16] Nonvolatile Memory Based on Carbon Nanotube Field-Effect Transistors with a Two-Layer Insulating Film. (poster), *T. Ohori, S. Nagaso, Y. Hakamata, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2012.
- [17] Fabrication and Electric Measurements of Graphene Quantum Dots. (poster), *Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2013.

- [18]Fabrication of Aligned-Carbon Nanotube Field-Effect Transistors Based Sensing Devices. (poster), *Y. Hakamata, T. Ohori, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5 - 6, 2014.
- [19]Gate induced Cross-over between Fabry Perot and Quantum Dot Behavior in a Single-Walled Carbon Nanotube Hole-Transistor with Double Gate Structure. (poster), *T. Kamimura, K. Matsumoto: 2009 International Conference on Solid State Device and Materials, Sendai, Japan, October 7 - 9, 2009.
- [20]Electrolyte-Gated Graphene Field-Effect Transistors (oral), *Y. Ohno, K. Maehashi, Y. Yamashiro, K. Matsumoto: 2010 International Conference on Solid State Device and Materials, Sendai, Japan, October 7 - 9, 2009.
- [21]Formation of Quantum Dots in Graphene with Constrictions (oral), *Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 2011 International Conference on Solid State Device and Materials, Sendai, Japan, October 7 - 9, 2009.
- [22]Aptamer-Based Label-Free Immunosensors Using Carbon Nanotube Field-Effect Transistors (oral), *K. Maehashi, K. Matsumoto: IEEE Sensors 2009 Conference, Christchurch, New Zealand, October 25-28, 2009.
- [23]Direction Control of Carbon Nanotube Growth on Corrugated Patterned SiO₂ using Casimir Force and its Application to High Current FET. (oral), *K. Matsumoto, S. Iwasaki, T. Kamimura, K. Inoue, T. Kishimoto, Y. Ohno, K. Maehashi: AVS 56th International Symposium & Exhibition, San Jose, USA, November 8 - 13, 2009.
- [24]Raman scattering of single-walled carbon nanotubes in early growth stages using laser-irradiated chemical vapor deposition. (oral), *T. Tsuji, K. Inoue, Y. Ohno, K. Maehashi, K. Matsumoto: 22st International Microprocesses and Nanotechnology Conference, Hokkaido, November 16 - 19, 2009.
- [25]Aligned single-walled carbon nanotube arrays on patterned SiO₂/Si substrates. (oral), *K. Maehashi, S. Iwasaki, Y. Ohno, T. Kishimoto, K. Inoue, K. Matsumoto: 22st International Microprocesses and Nanotechnology Conference, Hokkaido, November 16 - 19, 2010.
- [26]Logic gates based on carbon nanotube field-effect transistors with SiN_x passivation films. (oral), *T. Kishimoto, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 22st International Microprocesses and Nanotechnology Conference, Hokkaido, November 16 - 19, 2011.
- [27]Single-hole charging and discharging phenomena in carbon nanotube field-effect transistor-based nonvolatile memory. (poster), *T. Ohori, S. Nagaso, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 22st International Microprocesses and Nanotechnology Conference, Hokkaido, November 16 - 19, 2012.
- [28]Graphene quantum dots with two constrictions. (oral), *K. Matsumoto, Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue: International Symposium on Advanced Nanostructures and Nano-Devices, Hawaii, USA, November 30 - December 4, 2009.
- [29]Fabrication of Nanogaps Using Oxidized Film. (poster), *S. Okuda, T. Kishimoto, T. Ohori, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 13th SANKEN International Symposium, Osaka, Japan, January 18 - 19, 2010.
- [30]Sensor Application Based on Graphene Field-Effect Transistors. (poster), *Y. Sofue, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 13th SANKEN International Symposium, Osaka, Japan, January 18 - 19, 2011.
- [31]Diameter Control Growth of Single-Walled Carbon Nanotubes Using Laser-Irradiated Chemical Vapor Deposition. (poster), *T. Tsuji, K. Inoue, Y. Ohno, K. Maehashi, K. Matsumoto: The 13th SANKEN International Symposium, Osaka, Japan, January 18 - 19, 2012.
- [32]Stochastic Resonance in Carbon Nanotube Field-Effect Transistors. (poster), *Y. Hakamata, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 13th SANKEN International Symposium, Osaka, Japan, January 18 - 19, 2013.
- [33]Carbon Nanotube Field-Effect Transistor-Based Nonvolatile Memory. (poster), *T. Ohori, S. Nagaso, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 13th SANKEN International Symposium, Osaka,

Japan, January 18 - 19, 2014.

[34]Constriction-Width Dependence of Electrical Characteristics of Graphene with Constrictions. (poster), *Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 13th SANKEN International Symposium, Osaka, Japan, January 18 - 19, 2015.

Contributions to International Conferences and Journals

K. Maehashi 2009 International Conference on Solid State Device and Materials (Program Committee)

K. Maehashi 22st International Microprocesses and Nanotechnology Conference (Program Committee)

Publications in Domestic Meetings

The Japan Society of Applied Physics 21 papers

The Institute of Electronics, Information and Communication Engineers 3 papers

Academic Degrees

Master Degree of Engineering Diameter-Controlled Growth of Single-Walled Carbon Nanotubes by Laser-Irradiated Cematic Vapor Deposition.

T. Tsuji

Master Degree of Engineering Fabrication of CMOS Inverters Composed of Carbon Nanotube Field-Effect Transistors with SiNx Passivation

T. Kishimoto

Grant-in-Aid for Scientific Research

K. MATSUMOTO Carbon Nanotube-Biosensor ¥25,800,000

K. MATSUMOTO Carbon Nanotube Nano-Electronics ¥1,120,000

Y.Yamamoto Highly sensitive Label-free Multi-biosensors based on Carbon Nanotube Devices ¥700,000

Other Research Fund

K.Matsumoto Japan Science and Technology Agency (CREST) ¥29,900,000

Department of Advanced Electron Devices

Original Papers

[1]Void shape evolution and formation of silicon-on-nothing structures during hydrogen annealing of hole arrays on Si(001), K. Sudoh, H. Iwasaki, R. Hiruta, H. Kuribayashi, R. Shimizu: J. Appl. Phys., 105 083536-1-083536-5.

Publications in Domestic Meetings

The Japan Society of Applied Physics 2 papers

Academic Degrees

Master Degree for Science Studies on Ostwald Ripening of Two-Dimensional Islands on SrTiO₃(001)

M. Okano

Contribution to Research

K. Sudoh Fuji Electric Device Technology Co., Ltd. ¥500,000

Other Research Fund

K. Sudoh Inamori Foundation ¥1,000,000

Department of Intelligent Media

Original Papers

[1]Gait Identification Considering Body Tilt by Walking Direction Changes, Y. Makihara, R. Sagawa, Y. Mukaigawa, T. Echigo, and Y. Yagi: Electronic Letters on Computer Vision and Image Analysis, 8 (1) (2009) 15-26.

[2]Mirror Localization for Catadioptric Imaging System by Observing Parallel Light Pairs, AOKI Nobuya,

- SAGAWA Ryusuke, and YAGI Yasushi: The IEICE transactions on information and systems, J92-D (5) (2009) 661-670.
- [3]Gait-Based Categorization and Feature Analysis of Gender and Age, MANNAMI Hidetoshi, MAKIHARA Yasushi, and YAGI Yasushi: The IEICE transactions on information and systems, J92-D (8) (2009) 1373-1382.
- [4]Shape from Grid Pattern Based on Coplanarity Constraints for One-shot Scanning, Ryo Furukawa, Hiroshi Kawasaki, Ryusuke Sagawa, Yasushi Yagi: IPSJ Transactions on Computer Vision and Applications, 1 (2009) 139--157.
- [5]Adaptive Mean-Shift Tracking with Auxiliary Particles, Junqiu Wang, Yasushi Yagi: IEEE Transactions on Systems, Man and Cybernetics -Part B, 39 (6) (2009) 1578-1589.
- [6]Highly Robust Estimator Using a Casedependent Residual Distribution Model, Ngo Trung Thanh, Hajime Nagahara, Ryusuke Sagawa, Yasuhiro Mukaigawa, Masahiko Yachida, Yasushi Yagi: IPSJ Transactions on Computer Vision and Applications, 1 (2009) 260–276.
- [7]Integrability-based Free-form Mirror Design, K.Kondo, Y.Mukaigawa, Y.Yagi: IPSJ Transactions on Computer Vision and Applications, 1 (2009) 158–173.
- [8]Analysis of Subsurface Scattering based on Dipole Approximation, Y.Mukaigawa, K.Suzuki, Y.Yagi: IPSJ Transactions on Computer Vision and Applications, 1 (2009) 128–138.
- [9]Rapid BRDF Measurement by Composing Multiple Illumination, TAGAWA Seiichi, MUKAIGAWA Yasuhiro, and YAGI Yasushi: The IEICE transactions on information and systems, J92-D (8) (2009) 1393-1402.
- [10]Tracking and segmentation using Min-Cut with consecutive shape priors, Junqiu Wang, Yasushi Yagi: Paladyn. Journal of Behavioral Robotics, Versita, co-published with Springer-Verlag GmbH, 1 (1) (2010) 73-86.
- [11]Real-time Estimation of Fast Egomotion with Feature Classification using Compound Omnidirectional Vision Sensor, Ngo Trung Thanh, Yuichiro Kojima, Hajime Nagahara, Ryusuke Sagawa, Yasuhiro Mukaigawa, Masahiko Yachida, Yasushi Yagi: IEICE Transactions on Information and Systems, E93-D (1) (2010) 152-166.
- Review Papers
- Computer Vision and Image Media, Y. Yagi, Manufacture and technology, Manufacturing technology Organization, 62[2] (2010), 35-37.
- Books
- [1]Advanced Sensing Technology(J. Matsubara, F. Matsuno, M. Inami, I. Noda, K. Oosuga) H. Nagawara, R. Sagawa, “Robot Informatics Handbook”, Nano Optonics Energy, 2010.
- [2]Generic Image Processing Tool and Database(J. Matsubara, F. Matsuno, M. Inami, I. Noda, K. Oosuga) R. Sagawa, “Robot Informatics Handbook”, Nano Optonics Energy, 2010.
- [3]Computer Vision: Overview(J. Matsubara, F. Matsuno, M. Inami, I. Noda, K. Oosuga) Y. Yagi, “Robot Informatics Handbook”, Nano Optonics Energy, 2010.
- [4]Vision-based Navigation of Mobile Robot(J. Matsubara, F. Matsuno, M. Inami, I. Noda, K. Oosuga) T. Anezaki, Y. Yagi, “Robot Informatics Handbook”, Nano Optonics Energy, 2010.
- International Conferences
- [1]An Adaptive-Scale Robust Estimator for Motion Estimation (oral), Thanh Trung Ngo, Hajime Nagahara, Ryusuke Sagawa, Yasuhiro Mukaigawa, Masahiko Yachida, Yasushi Yagi: 2009 IEEE International Conference on Robotics and Automation, Kobe, Japan, May, 2009.
- [2]Characteristic Gait Animation Synthesis from Single View Silhouette (poster), Shinsuke Nakamura, Masashi Shiraiishi, Shigeo Morishima, Mayu Okumura, Yasushi Makihara, Yasushi Yagi: SIGGRAPH 2009, New Orleans, Louisiana, USA, Aug, 2009.
- [3]Dense 3D Reconstruction Method Using a Single Pattern for Fast Moving Object (poster), Ryusuke

Sagawa, Yuya Ohta, Yasushi Yagi, Ryo Furukawa, Naoki Asada, Hiroshi Kawasaki: IEEE 12th International Conference on Computer Vision, Miami, Florida, USA, Jun., 2009.

[4]Elastic Convolved ICP for the Registration of Deformable Objects (poster), Ryusuke Sagawa, Kiyotaka Akasaka, Yasushi Yagi, Henning Hamer, Luc Van Gool: 2009 IEEE 12th International Conference on Computer Vision Workshops (3DIM2009), Kyoto, Japan, Oct. 2009.

[5]Adaptive-Scale Robust Estimator using Distribution Model Fitting (poster), Thanh Trung Ngo, Hajime Nagahara, Ryusuke Sagawa, Yasuhiro Mukaigawa, Masahiko Yachida, Yasushi Yagi: 9th Asian Conference on Computer Vision, Xi'an, China, Sep. 2009.

[6]People tracking and segmentation using efficient shape sequences matching (poster), Junqiu Wang, Yasushi Yagi, Yasushi Makihara: 9th Asian Conference on Computer Vision, Xi'an, China, Sep. 2009.

[7]The Online Gait Measurement for the Audience-Participant Digital Entertainment (oral), Mayu Okumura, Yasushi Makihara, Shinsuke Nakamura, Shigeo Morishima, Yasushi Yagi: Invited Workshop on Vision Based Human Modeling and Synthesis in Motion and Expression, Xi'an, China, Sep. 2009.

[8]Wearable Imaging System for Capturing Omnidirectional Movies from a First-person Perspective (oral), K.Kondo, Y.Mukaigawa, Y.Yagi: VRST2009, Kyoto, Japan, Nov., 2009.

[9]Image Stabilization Algorithm for Video with Large Image Fluctuation (oral), Yamada, M.Kimura, J.Ohmiya, J.Tagawa, T.N.Thanh, Y.Mukaigawa, Y.Yagi: ICCE2009, Las Vegas, Navata, USA, Jan., 2009.

Contributions to International Conferences and Journals

Y. YAGI IEEE Robotics and Automation Society ICRA2009 (Editor)
 Y. YAGI IEEE Robotics and Automation Society ICRA2009 (Technical visit chair)
 Y. YAGI CVPR2009 (Program committee)
 Y. YAGI IROS 2009 (Associate Editor)
 Y. YAGI International Journal of Automation and Computing (Editorial committee)
 Y. YAGI ICRA2010 (Program committee)
 Y. YAGI OMNIVIS 2010 (Program committee)
 Y. YAGI ICPR2010 (Technical Programme Committee)
 Y. YAGI IEEE Robotics and Automation Society ICRA2010 (Editor)
 Y. YAGI International Journal of Computer Vision (Editorial Board)
 Y. YAGI IPSJ Computer Vision and Applications (Associate Editor in Chief)
 Y. MUKAIGAWA CVPR2010 (Review committee)
 Y. MUKAIGAWA ICPR2010 (Technical Programme Committee)
 Y. MUKAIGAWA ECCV2010 (Program committee)
 Y. MUKAIGAWA ICCV2009 (Review committee)
 Y. MUKAIGAWA PSVIT2010 (AREA CHAIR)

Publications in Domestic Meetings

Meeting on Image Recognition and Understanding 2009	7 papers
IPSJ SIG-CVIM	2 papers
The institute of Electrical Engineering of Japan	1 paper
52th Symposium of automatic control association	1 paper
Joint workshop of IIS and ISIR	1 paper
IPSJ SIG-CVIM	1 paper
IEICE TG-PRMU	1 paper
IEICE TG-MI	1 paper

Academic Degrees

PhD Degrees for Information Science Calibration of Known-shape Mirror by Observing Parallel Light

N. Aoki

PhD Degrees for Engineering Outlier Detection for Robust Parameter Estimation Against Multi-modeled/structured Data

T.N. Trung

Master Degree for Toward Omni-Confocal Imaging

Information Science

S. Tagawa

Master Degree for Information Science Dense 3D Reconstruction of Fast Moving Object by One-shot Scanning

Y. Ohta

Master Degree for Information Science Calibration of Bireflectional Compound Omnidirectional Camera by Observing Parallel Light Pairs

Y. Nishide

Master Degree for Information Science Gait Recognition using Period-based Phase Synchronization for Low Frame-rate Videos

A. Mori

Master Degree for Information Science Tracking Folds in Endoscopic Image Sequences using 3D Edge Detector

N.D. Tan

Grant-in-Aid for Scientific Research

Y. Yagi Wearable Omnidirectional Stereo Surveillance System ¥6,526,000

Y. Yagi Wearable ambient surveillance by lensless omnidirectional sensor and its application to schoolchild crime prevention ¥46,150,000

Y. Mukaigawa Inverse rendering of translucent objects ¥7,540,000

Y. Mukaigawa Measurement of 8-D reflectance field using a polyhedral mirror ¥1,300,000

R. Sagawa Research on spherical-view image using an omnidirectional medical endoscope ¥1,560,000

R. Sagawa Development of super fast 3D shape measurement system and its application ¥10,790,000

Y. Makihara Research on Gait Identification based on Multi-view Matching using an Omnidirectional Camera ¥1,300,000

Entrusted Research

Y. Yagi JSPS Investigation on academic trend on perceptual information processing ¥3,200,000

Y. Yagi Honda R&D Co, Ltd. Research and development on image processing technology ¥5,500,000

Y. Yagi Panasonic Co., Ltd. Research on high dynamic range imaging ¥5,040,000

Y. Yagi Panasonic Co., Ltd. Development of super wide-view single camera for measuring distance and position ¥5,250,000

Y. Yagi Fuji Film Resaerch on omnidirectional attachment ¥1,306,000

Contribution to Research

Y. Mukaigawa Artificial Intelligence Reaserch Promotion Foundation ¥700,000

Y. Mukaigawa Microsoft Research ¥1,200,000

Department of Reasoning for Intelligence

Original Papers

[1]A direct method for estimating a causal ordering in a linear non-Gaussian acyclic model, S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: Proceedings of 25th Conference on Uncertainty in Artificial Intelligence, (2009) 506-513.

[2]Change-point detection in time-series data by direct density-ratio estimation, Y. Kawahara and M. Sugiyama: Proceedings of the 2009 SIAM International Conference on Data Mining, (2009) 389-400.

[3]Submodularity cuts and applications, Y. Kawahara, K. Nagano, K. Tsuda and J. Bilmes: Advances in Neural Information Processing Systems, 22 (2009) 916-924.

[4]Optimization of Budget Allocation for TV Advertising, K. Ichikawa, K. Yada, N. Nakachi, T. Washio: Proceedings of KES2009: 13th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems, (2009) 270-277.

[5]Highly efficient and Accurate EDM Estimation and Its Application to Range Queries, K. Kido, H. Kuwajima, T. Washio: Information Processing Society of Japan (IPSJ) Journal, 50 (5) (2009) 1493–1505.

[6]Modelling deposit outflow in financial crises: application to branch management and customer relationship management, K. Yada, T. Washio, Y. Ukai: International Journal of Advanced Intelligence Paradigms, 2 (2,3) (2009) 254-270.

Books

[1]New Frontiers in Applied Data Mining, PAKDD 2008 International Workshops(S. Chawla, T. Washio, S. Minato, S. Tsumoto, T. Onoda, S. Yamada, A. Inokuchi) S. Chawla, T. Washio, S. Minato, S. Tsumoto, T. Onoda, S. Yamada, A. Inokuchi, “New Frontiers in Applied Data Mining, PAKDD 2008 International Workshops”, Springer, LNAI5433 (LNAI5433) 2009.

[2]Special Issue on Data-Mining and Statistical Science(T. Washio) T. Washio, “New Generation Computing, Computing Paradigms and Computational Intelligence”, Springer, 27[4] (27[4]) 2009.

[3]Advances in Machine Learning(Z.H. Zhou, T. Washio) Z.H. Zhou, T. Washio, “Advances in Machine Learning, Proceedings of First Asian Conference on Machine Learning, ACML 2009”, Springer, LNAI5828 (LNAI5828) 2009.

International Conferences

[1]Identification of an exogenous variable in a linear non-Gaussian structural equation model (oral), S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: 4th International Workshop on Data-Mining and Statistical Science (DMSS2009), Kyoto, Japan, July 7-8, 2009.

Contributions to International Conferences and Journals

- | | |
|-----------|---|
| T. Washio | The 9th SIAM International Conference on Data Mining (SDM09) (Program Committee Area Chair) |
| T. Washio | PAKDD: Pacific-Asia Conference on Knowledge Discovery and Data Mining (Steering Committee) |
| T. Washio | The fifteenth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD-2009) (Program Committee) |
| T. Washio | The first Again Conference on Machine Learning (ACML-2009) (Program Chair) |
| T. Washio | 7th International Workshop on Mining and Learning with Graphs (MLG-2009) (Program Committee) |
| T. Washio | The 18th ACM Conference on Information and Knowledge Management (CIKM 2009) (Program Committee) |
| T. Washio | 2009 IEEE International Conference on Data Mining (ICDM09) (Program Committee) |
| T. Washio | The Twelfth International Conference on Discovery Science (DS09) (Program Committee) |
| T. Washio | First International Workshop on Learning and Mining for Robotics (LEMIR 2009) (Program Committee) |
| T. Washio | Knowledge and Information Systems: Special Issue on Selected Papers of The 12th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2008) (Guest Editor) |
| T. Washio | New Generation Computing: Special Issue on Selected Papers of The 3rd International Workshop on Data Mining and Statistical Science (DMSS2008) (Guest Editor) |
| T. Washio | International Journal of Knowledge and Web Intelligence (IJKWI) (Editorial Board) |
| T. Washio | 27th International Conference on Machine Learning (ICML-10) (Program Committee) |
| T. Washio | 11th Pacific Rim International Conference on Artificial Intelligence (PRICAI 2010) (Special Session Chair) |

T. Washio	19th European Conference on Artificial Intelligence (ECAI 2010) (Program Committee)	
T. Washio	The Thirteenth International Conference on Discovery Science (DS2010) (Program Committee)	
T. Washio	SIAM Conference on Data Mining (SDM2011) (Program Chair)	
T. Washio	ICDM 2010, the 10th IEEE International Conference on Data Mining (Program Committee)	
A. Inokuchi	2009 Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program Committee)	
A. Inokuchi	2009 Asian Conference on Machine Learning (Program Committee)	
A. Inokuchi	2009 International Workshop on Data-Mining and Statistical Science (Workshop co-chairs)	
A. Inokuchi	2009 SIAM International Conference on Data Mining (Program Committee)	
A. Inokuchi	2009 IADIS European Conference on Data Mining 2010 (Program Committee)	
A. Inokuchi	2010 Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program Committee)	
A. Inokuchi	IEICE Transactions on Information and Systems, Special Section on Data Mining and Statistical Science. (Editorial Board)	
A. Inokuchi	International Journal of Applied Evolutionary Computation (Editorial Review Board)	
Y. Kawahara	2009 Asian Conference on Machine Learning (Program Committee)	
	Publications in Domestic Meetings	
	The 23th Annual Conference of The Japanese Society for Artificial Intelligence	6 papers
	Domestic Conference on Data Mining and Statistical Mathematics	1 paper
	Japanese Joint Statistical Meeting	1 paper
	Space Sciences and Technologies Conference	1 paper
	National Conference of Information Processing Society of Japan	2 papers
	Special Interest Group of AI Application in Finance	1 paper
	Special Interest Group of Fundamental Problem in Artificial Intelligence	1 paper
	Academic Degrees	
Master Degree for Engineering	Study on Graph Classification Based on Optimizing Graph Spectra	
V. D. Nguyen	Master Degree for Engineering	
	Study on probabilistic expectation for high dimensional data	
H. H. Nguyen	Bachelor Degree for Engineering	
	A causal structure search method by using non-Gaussianity and background information	
T. Inazumi	Bachelor Degree for Engineering	
	A fast graph sequence mining technique by using closed sequence pattern mining principle	
T. Kishimoto	Bachelor Degree for Engineering	
	Characterization of a probabilistic expectation method for high dimensional data	
S. Matsuda	Grant-in-Aid for Scientific Research	
T. Washio	Development of Causal Structure Mining Method for Large Scale Dimensional Data and Construction of Knowledge Base on Gene Functional Relations	¥10,400,000
T. Washio	Establishment of Knowledge Mining and Modeling Principles for Large Scale Dimensional Time Series and Its Application to Commercial Ubiquitous Data	¥2,400,000

T. Washio	Study on an estimation method for large PSD matrix from incomplete data and its application to quantum computation experiments	¥1,300,000
A. Inokuchi	Development of Method for Mining Local and Characteristic Patterns from Changing Graph Structured Data	¥2,080,000
S. Shimizu	Discovering hidden causal structures in data with many more variables than observations.	¥1,430,000
Y. Kawahara	Algorithms and computational-architectures for change detections in large-scale data	¥1,534,000
Contribution to Research		
T. Washio	FUJITSU LABORATORIES LIMITED	¥1,000,000
T. Washio	The Asian Office of Aerospace Research and Development	¥7,267,000
Y. Kawahara	JFE 21 Century Foundation	¥2,000,000
Other Research Fund		
A. Inokuchi	Japan Science and Technology Agency	¥15,600,000

Department of Knowledge Systems

Original Papers

- [1]The water falls but the waterfall does not fall: New perspectives on objects, processes and events, Antony Galton and Riichiro Mizoguchi: *Journal of Applied Ontology*, 4 (2) (2009) 71-107.
- [2]A Functional Ontology of Artifacts, Riichiro Mizoguchi and Yoshinobu Kitamura: *The Monist - An Int'l Quarterly J. of General Philosophical Inquiry*, 92 (3) (2009) 387-402.
- [3]Distributed reasoning with ontologies and rules in order-sorted logic programming, Ken Kaneiwa and Riichiro Mizoguchi: *Journal of Web Semantics: Science, Services and Agents on the World Wide Web*, 7 (3) (2009) 252-270.
- [4]Using Ontological Engineering to Organize Learning/Instructional Theories and Build a Theory-Aware Authoring System, Yusuke Hayashi, Jacqueline Bourdeau and Riichiro Mizoguchi: *International Journal of Artificial Intelligence in Education*, 19 (2) (2009) 211-252.
- [5]An Ontology Engineering Approach to the Realization of Theory-Driven Group Formation, Seiji Isotani, Akiko Inaba, Mitsuru Ikeda and Riichiro Mizoguchi: *International Journal of Computer-Supported Collaborative Learning*, 4 (4) (2009) 445-478.
- [6]Content-Oriented Approach to Organization of Theories and Its Utilization : Organizing Learning/Instructional Theories and Building a Theoryaware Authoring System Based on Ontological Engineering(AI Frontier), Yusuke Hayashi, Jacqueline Bourdeau and Riichiro Mizoguchi: *Transactions of the Japanese Society for Artificial Intelligence*, 24 (5) (2009) 351-375.
- [7]Toward Knowledge Structuring of Sustainability Science Based on Ontology Engineering, Terukazu Kumazawa, Osamu Saito, Kouji Kozaki, Takanori Matsui and Riichiro Mizoguchi: *Sustainability Science*, 4 (1) (2009) 99-116.

Review Papers

Learning and Instructional Activity Design based on Ontological Engineering, R. MIZOGUCHI, Y. HAYASHI, *Journal of the Japanese Society for Artificial Intelligence*, Ohmsha, 25[2] (2010), 240-249.

Books

- [1]Semantic Web Technologies for e-learning(Darina Dicheva, Riichiro Mizoguchi and Jim Greer) Darina Dicheva, Riichiro Mizoguchi and Jim Greer, "Semantic Web Technologies for e-learning", IOS Press, 2009.
- [2]Inside a Theory-aware Authoring System(Darina Dicheva, Riichiro Mizoguchi and Jim Greer) Riichiro Mizoguchi, Yusuke Hayashi and Jacqueline Bourdeau, "Semantic Web Technologies for e-learning", IOS Press, 2009.
- [3]An Ontology-Based Test Generation System(Darina Dicheva, Riichiro Mizoguchi and Jim Greer) Larisa N. Soldatova and Riichiro Mizoguchi, "Semantic Web Technologies for e-learning", IOS Press,

2009.

[4]Artificial Intelligence in Education: Building Learning Systems that Care: From Knowledge Representation to Affective Modelling (proc.of AIED2009)(Vania Dimitrova, Riichiro Mizoguchi, Benedict du Boulay and Art Graesser) Vania Dimitrova, Riichiro Mizoguchi, Benedict du Boulay and Art Graesser, “Artificial Intelligence in Education: Building Learning Systems that Care: From Knowledge Representation to Affective Modelling (proc.of AIED2009)”, IOS Press, 2009.

[5]Interdisciplinary Ontology, Vol.3, Proceedings of the Third Interdisciplinary Ontology Meeting(Barry Smith, Riichiro Mizoguchi and Sumio Nakagawa) Barry Smith, Riichiro Mizoguchi and Sumio Nakagawa, “Interdisciplinary Ontology, Vol.3, Proceedings of the Third Interdisciplinary Ontology Meeting”, Keio University, 2010.

International Conferences

[1]Some Ontological Distinctions of Function based on the Role Concept (oral), Yoshinobu Kitamura, Riichiro Mizoguchi: ASME 2009 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2009).

[2]An Ontological Approach to Support Teachers in Designing Instruction Using ICT (oral), Toshinobu Kasai, Kazuo Nagano, and Riichiro Mizoguchi: 17th International Conference of Computers in Education (ICCE'09), pp. 11-18.

[3]Towards Better Understanding of Learning/Instructional Design Knowledge with Strategy-centered Structuring (oral), Yusuke Hayashi, Jacqueline Bourdeau and Riichiro Mizoguchi: 17th International Conference of Computers in Education (ICCE'09), pp. 91-98.

[4]Toward a Learning/Instruction Process Model for Facilitating Instructional Design Cycle (oral), Yusuke Hayashi, Seiji Isotani, Jacqueline Bourdeau and Riichiro Mizoguchi: 9th IFIP World Conference on Computers in Education (WCCE2009), pp. 138-147.

[5]An Advanced Clinical Ontology (oral), Riichiro Mizoguchi, Hiroko Kou, Jun Zhou, Kouji Kozaki, Ken Imai and Kazuhiko Ohe: International Conference on Biomedical Ontology (ICBO), pp.119-122.

[6]Ontology Mapping of PATO to YATO for the improvement of interoperability of quality description (poster), Hiroshi Masuya, Nobuhiko Tanaka, Kazunori Waki, Tatsuya Kushida, Kouji Kozaki and Riichiro Mizoguchi: International Conference on Biomedical Ontology (ICBO), p.180.

[7]Dynamic is-a Hierarchy Generation from a Clinical Medical Ontology (poster), Hiroko Kou, Jun Zhou, Mamoru Ohta, Kouji Kozaki, Ken Imai, Kazuhiko Ohe and Riichiro Mizoguchi: Software Demonstration in International Conference on Biomedical Ontology (ICBO).

[8]Structuring Learning/Instructional Strategies through a State-based Modeling (oral), Yusuke Hayashi, Jacqueline Bourdeau and Riichiro Mizoguchi: 14th International Conference on Artificial Intelligence in Education (AIED2009), pp. 215-222.

[9]Looking into collaborative learning: design from macro- and micro-script perspectives (oral), Eloy David Villasclaras-Fernandez, Seiji Isotani, Yusuke Hayashi and Riichiro Mizoguchi: 14th International Conference on Artificial Intelligence in Education (AIED2009), pp. 231-238.

Contributions to International Conferences and Journals

- | | |
|--------------|--|
| R. MIZOGUCHI | Semantic Web Science Association (Vice-president) |
| R. MIZOGUCHI | International Journal of Web Semantics (Editors-in-Chief) |
| R. MIZOGUCHI | International Artificial Intelligence in Education Society (Executive Committee) |
| R. MIZOGUCHI | Asia-Pacific Society for Computers in Education(APSCE) (Board member) |
| R. MIZOGUCHI | The Agent-Based Systems for Human Learning and Entertainment Workshop (ABSHLE'09) (PC member) |
| R. MIZOGUCHI | The 17 th International Conference on Computers in Education (ICCE2009) Conf. on AIED/ITS & Adaptive Learning (PC member) |
| R. MIZOGUCHI | 6th International Conference on Formal Ontology in Information Systems (FOIS 2010) (Program Co-Chair) |
| R. MIZOGUCHI | The 18 th International World Wide Web Conference (WWW2009) Semantic/Data |

	Web Track (PC member)	
R. MIZOGUCHI	The 14th International Conference on Artificial Intelligence in Education (AIED2009) (PC member)	
R. MIZOGUCHI	The 7 th International Workshop on Applications of Semantic Web Technologies for E-Learning (SWEL' 09) (Workshop Organizers)	
R. MIZOGUCHI	The second IEEE International Conference on Semantic Computing (ICSC2008) (PC member)	
R. MIZOGUCHI	The 8th Intl. Conf. on Ontologies, DataBases, and Applications of Semantics (ODBASE2009) (PC member)	
R. MIZOGUCHI	The 4 th European Conference on Technology Enhanced Learning (EC-TEL 2009) (PC member)	
R. MIZOGUCHI	The Fifth International Conference on Knowledge Capture (K-CAP09) (PC member)	
R. MIZOGUCHI	The 6 th European Semantic Web Conference (ESWC2009) (PC member)	
R. MIZOGUCHI	The 4th Workshop on Formal Ontologies Meet Industry (FOMI 2009) (PC member)	
R. MIZOGUCHI	The 2009 IEEE International Conference on Information Reuse and Integration (IEEE IRI-2009) (PC member)	
R. MIZOGUCHI	18th International Conference On User Modeling, Adaptation, and Personalization (UMAP2009) (Doctoral Consortium Chair)	
R. MIZOGUCHI	IEEE Transactions on Learning Technologies (Associate editor)	
R. MIZOGUCHI	International Journal of Applied Ontology (Editorial board)	
R. MIZOGUCHI	Research and Practice in Technology Enhanced Learning (Editorial board)	
R. MIZOGUCHI	International Journal of Artificial Intelligence in Education (Editorial board)	
R. MIZOGUCHI	Frontiers in AI and Application (Editorial board)	
R. MIZOGUCHI	International Journal of Web Engineering and Technology (Editorial board)	
R. MIZOGUCHI	Journal on Web Semantics (Editors-in-Chief)	
R. MIZOGUCHI	Journal of Educational Technology & Society (Editorial board)	
R. MIZOGUCHI	Asian Semantic Web Conference (Steering committee chair)	
Y. KITAMURA	The 4th Asian Semantic Web Conference (ASWC2009) (PC member)	
Y. KITAMURA	International Journal of Advanced Engineering Informatics (Editorial board)	
Y. KITAMURA	ASME Journal of Computing and Information Science in Engineering (Associate editor)	
K. KOZAKI	The 4th Asian Semantic Web Conference (ASWC2009) (PC member)	
Y. HAYASHI	The 17 th International Conference on Computers in Education (ICCE2009) Conf. on AIED/ITS & Adaptive Learning (PC member)	
Y. HAYASHI	The 17 th International Conference on Computers in Education (ICCE2009) Conf. on Advanced Learning Technologies, Open Contents, & Standards (PC member)	
Y. HAYASHI	The 7 th Seventh International Workshop on Ontologies and Semantic Web for E-Learning (SWEL2009) (PC member)	
Y. HAYASHI	The 14th International Conference on Artificial Intelligence in Education (AIED2009) (PC member)	
M. SASAJIMA	The 5 th International Conference on Autonomic and Autonomous Systems(ICAS 2009) (PC member)	
M. SASAJIMA	International conference on Internet and Multimedia Systems and Applications (IMSA 2009) (PC member)	
M. SASAJIMA	1st Workshop on Social Networks and Social Media Mining on the Web (SNSMW2010) (PC Chair)	
Publications in Domestic Meetings		
	The Japanese Society for Artificial Intelligence	15 papers
	The Japan Society of Mechanical Engineers	4 papers
	Japanese Society for Information and Systems in Education	2 papers
	Japan Society for Educational Technology	3 papers
Academic Degrees		
Master Degree in	Ontological consideration on essential properties of services	

Engineering

K. Sumita

Master Degree in Engineering Investigation on classification criteria of concepts and their mappings for functional ontology

S. Segawa

Master Degree in Engineering Development and Evaluation of Ontology Exploration Tool for Overlooking Domain-knowledge

T. Hirota

Doctor Degree in Engineering An Ontological Engineering Approach to Computer-Supported Collaborative Learning --From Theory to Practice--

S. Isotani

Grant-in-Aid for Scientific Research

R. MIZOGUCHI Building a Theory-aware and Standard-compliant Knowledge Server ¥13,780,000

K. KOZAKI Application Platform for Multi-Dimension Knowledge Structuring based on Ontological Engineering ¥3,380,000

M. SASAJIMA Research on modeling users' daily activities for improvement of mobile internet services ¥1,950,000

Y. HAYASHI Building a practical-knowledge repository for good circulation of knowledge between theory and practice in learning contents design ¥1,300,000

Entrusted Research

R. MIZOGUCHI The University of Tokyo Research on development of a medical knowledge database for medical information systems; Design of a semantic relational model ¥14,300,000

R. MIZOGUCHI The University of Tokyo Biofuel Use Strategies for Sustainable Development; Restructuring problems of biofuel use by using Ontology and developing policy-making supporting tools. ¥1,847,000

Contribution to Research

R. MIZOGUCHI Daiwa Can ¥650,000

R. MIZOGUCHI Oki Data Corporation ¥500,000

Y. KITAMURA Niigata Mechatronics co., Ltd. ¥180,000

Y. KITAMURA Niigata Machine Techno co., Ltd. ¥650,000

Y. KITAMURA Niigata Machine Techno co., Ltd. ¥650,000

Cooperative Research

R. MIZOGUCHI Justsystem Corporation ¥20,000,000

R. MIZOGUCHI TOYOTA Info Technology Center Co., Ltd. ¥3,000,000

Department of Architecture for Intelligence

Original Papers

[1]A New Method of Fast Compression of Program Code for OTA Updates in Consumer Devices, Ryozo Kiyohara, Satoshi Mii, Mitsuhiro Matsumoto, Numao Masayuki, and Satoshi Kurihara: IEEE Transactions on Consumer Electronics, 55 (2) (2009) 812-817.

[2]Probabilistic Strategy in Award Phase of Large-Scale Contract Net Protocol, Toshiharu Sugawara, Satoshi Kurihara, Toshio Hirotsu, and Kensuke Fukuda: The Transactions of the Institute of Electronics, Information and Communication Engineers D, J92-D (11) (2009) 1840-1850.

[3]Estimation of Sensor-Network Topology Using Pheromonal Model, Kensuke Takahashi, Satoshi

Kurihara, Toshio Hirotsu, and Toshiharu Sugawara: The Transactions of the Institute of Electronics, Information and Communication Engineers D, J92-D (11) (2009) 1851-1860.

[4]Constructing a Traffic Information Providing System Utilizing Multi-Source Information, Hiroshi Tamaki, Junji Yano, Kouji Kagawa, Tetsuo Morita, Masayuki Numao, and Satoshi Kurihara: Transactions of Japanese Society for Artificial Intelligence, 25 (3) (2010) 394-399.

[5]Utility based Q-learning to facilitate cooperation in Prisoner's Dilemma games, Koichi Moriyama: Web Intelligence and Agent Systems, 7 (3) (2009) 233-242.

[6]Learning-Rate Adjusting Q-Learning for 2×2 Symmetric Games, Koichi Moriyama: The Transactions of the Institute of Electronics, Information and Communication Engineers D, J92-D (11) (2009) 1819-1826.

Books

[1]Positing a Growth-Centric Approach in Empathic Ambient Human-System Interaction(Zdzislaw S. Hippe and Juliusz L. Kulikowski) Roberto Legaspi, Ken-ichi Fukui, Koichi Moriyama, Satoshi Kurihara, and Masayuki Numao, "Human-Computer Systems Interaction, Backgrounds and Applications, Advances in Soft Computing", Springer, 2009.

International Conferences

[1]Constructive Adaptive User Interfaces Based on Brain Waves (oral), *Masayuki Numao, Takayuki Nishikawa, Toshihito Sugimoto, Satoshi Kurihara, and Roberto Legaspi: Proc. 13th International Conference on Human-Computer Interaction (HCI2009) (Lecture Notes in Computer Science 5611), pp.596-605, San Diego, CA, USA, July 2009.

[2]Relational Mining for Brains -Dopamine Antagonist Molecules and a Brain Computer Interface (invited), *Masayuki Numao: Osaka University - De La Salle University Science and Technology Congress, De La Salle University, Philippines. Sep. 2009.

[3]Human Behavior Mining (invited), *Satoshi Kurihara: Osaka University - De La Salle University Science and Technology Congress, De La Salle University, Philippines. Sep. 2009.

[4]Traffic Congestion Forecasting based on Pheromone Communication Model for Intelligent Transport Systems (oral), *Satoshi Kurihara, Hiroshi Tamaki, Masayuki Numao, Kouji Kagawa, Junji Yano, and Tetsuo Morita: Proc. IEEE Congress on Evolutionary Computation (CEC'09), Trondheim, Norway. pp. 2879-2884. May 18-21 2009.

[5]Traffic Congestion Forecasting based on Ant Model for Intelligent Transport Systems (oral), *Satoshi Kurihara, Hiroshi Tamaki, Masayuki Numao, Kouji Kagawa, Junji Yano, and Tetsuo Morita: The Third International Workshop on Emergent Intelligence in Networked Agents (WEIN09) (workshop at AAMAS2009), Budapest, Hungary. May 10-15 2009.

[6]Learning-Rate Adjusting Q-learning for Two-Person Two-Action Symmetric Games (oral), *Koichi Moriyama: Proc. 3rd KES Symposium on Agent and Multi-Agent Systems - Technologies and Applications (KES-AMSTA 2009) (Lecture Notes in Artificial Intelligence 5559). Uppsala, Sweden. pp. 223-232. June 3-5 2009.

[7]Estimating relevance of items on basis of proximity of user groups on blogspace (oral), *Shin-ya Sato, Kensuke Fukuda, Toshio Hirotsu, Satoshi Kurihara, and Toshiharu Sugawara: Proc. the 2009 IEEE/WIC/ACM International Conference on Web Intelligence (WI'09), Milano, Italy. pp. 157-164. Sep. 15-18 2009.

[8]Estimation of Sensor Network Topology using Ant Colony Optimization (oral), *Kensuke Takahashi, Satoshi Kurihara, Toshio Hirotsu, Shin-ya Sato, and Toshiharu Sugawara: Proc. the 9th International Conference on Adaptive and Natural Computing Algorithms, (Lecture Notes in Computer Science 5495). Kuopio, Finland. pp. 263-272. April 23-25 2009.

[9]Modelling Digital Natives in Social Learning Environments (oral), *Inventado, P.S., Legaspi, R., and Suarez, M.: Proc. the 17th International Conference on Computers in Education (ICCE2009), Hong Kong. pp. 199-201. Nov. 30 - Dec. 4 2009.

[10]Adaptive AI in a Fighting Videogame (poster), *Simon E. Ortiz B., Koichi Moriyama, Mitsuhiro Matsumoto, Ken-ichi Fukui, Satoshi Kurihara, and Masayuki Numao: The 13th SANKEN International Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Jan. 2010.

[11]Applying a Cost-effective and Efficient Data-centric Approach to the Physiology-Affect Relations Modeling Domain (poster), *Roberto Legaspi, Ken-ichi Fukui, Koichi Moriyama, Satoshi Kurihara, Masayuki Numao, and Merlin Suarez: The 13th SANKEN International Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Jan. 2010.

[12]Addressing the Problems of Data-Centric Physiology-Affect Relations Modeling (oral), *Roberto Legaspi, Ken-ichi Fukui, Koichi Moriyama, Satoshi Kurihara, Masayuki Numao, and Merlin Suarez: Proc. International Conference on Intelligent User Interfaces (IUI-10), Hong-Kong. pp. 21-31. Feb. 7-10 2010.

[13]A Light-weight Autonomous Power Saving Method for Wireless Sensor Networks (oral), *Toshio Hirotsu, Shinnosuke Nishitani, Hirotake Abe, Kyoji Umemura, Kensuke Fukuda, Satoshi Kurihara, and Toshiharu Sugawara: Proc. 6th International Conference on Autonomic and Autonomous Systems, Cancun, Mexico. pp. 188-193. Mar. 7-13 2010.

[14]Tracking and Modelling the Behavior of Students in Learning Online (oral), *Inventado, P. S., Suarez, M. T., and Legaspi, R.: Proc. the 10th Philippine Computing Science Congress, Manila, Philippine. pp. 235-240. Mar. 5-6 2010.

Contributions to International Conferences and Journals

M. Numao	New Generation Computing (Area Editor)
M. Numao	The 4th Japanese French Frontiers of Science (Expert Committee)
M. Numao	The 13th SANKEN International Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium (Executive Committee)
M. Numao	The 1st International Workshop on Empathic Computing (Workshop Co-chair)
M. Numao	The Twelfth International Conference on Discovery Science (DS'09) (Program Committee)
M. Numao	The Thirteenth International Conference on Discovery Science (DS'10) (Program Committee)
M. Numao	Pacific Rim Knowledge Acquisition Workshop (PKAW'10) (Program Committee)
M. Numao	Workshop on Web Personalization and Recommender Systems (WebPRES'10) (Program Committee)
S. Kurihara	The 3rd International Workshop on Emergent Intelligence in Networked Agents (WEIN09) (Organizing Committee)
S. Kurihara	International Conference on Principles of Practice in Multi-Agent Systems (PRIMA'09) (Industrial Chair)
S. Kurihara	The 2009 IEEE/WIC/ACM International Conference on Intelligent Agent Technology / International Conference on Web Intelligence (IAT/WI'09) (Program Committee)
S. Kurihara	IEEE 9th International Conference on Computer and Information Technology (CIT'09) (Program Committee)
S. Kurihara	Sixth International Conference on Networked Sensing Systems (INSS'09) (Program Committee)
S. Kurihara	The 2nd IEEE International Symposium on Ubisafe Computing (UbiSAFE'09) (Program Committee)
S. Kurihara	The Fifth International Conference on Autonomic and Autonomous System (ICAS'09) (Program Committee)
S. Kurihara	10th International Workshop on Multi-Agent-Based Simulation (Program Committee)
S. Kurihara	International Journal of Knowledge and Web Intelligence (Editorial board member)
K. Moriyama	International Journal of Organizational and Collective Intelligence (International

Editorial Review Board Member)

Publications in Domestic Meetings	
Annual Conference of The Japanese Society for Artificial Intelligence (JSAI)	7 papers
Multimedia, Distributed, Cooperative, and Mobile Symposium	1 paper
Fuzzy System Symposium	1 paper
HAI Symposium	1 paper
SIG GI, Information Processing Society of Japan(IPSJ)	1 paper
The Institute of Electronics, Information and Communication Engineers (IEICE)	2 papers
General Conference	
SIG KBS, The Japanese Society of Artificial Intelligence (JSAI)	1 paper

Academic Degrees

Master Degree for Information Science Damage Pattern Extraction on Solid Oxide Fuel Cells

S. Akasaki

Master Degree for Information Science An Interesting Opponent for Fighting Videogames: Using AI to Adapt the Agent to the User

S. Ortiz

Grant-in-Aid for Scientific Research

S. Kurihara Proposal of top-down controllable multi-agent coordination algorithm ¥1,300,000

Entrusted Research

S. Kurihara Ministry of Internal Affairs and Communications Formulation of The Inter Ubiquitous Information Communication Infrastructure ¥4,524,000

S. Kurihara Japan Science and Technology Agency Overlay-network Search Oriented for Information about Town Events ¥1,500,000

Cooperative Research

S. Kurihara Sumitomo Electric Industries, Ltd. ¥1,950,000

Other Research Fund

M. Numao Kayamori Foundation of International Science Advancement ¥900,000

Original Papers

[1]Effect of high-dimensional entanglement of Laguerre-Gaussian modes in parametric downconversion, D.Kawase, Y.Miyamoto, M.Takeda, K.Sasaki and S.Takeuchi: J. Opt. Soc. Am. B, 26 (4) (2009) 797-804.

[2]Dynamical Analysis of Triplet Lifetime of Single Molecules by a Photon Interdetection Time Analysis Method, T.Chiba, H.Fujiwara, J.Hotta, S.Takeuchi, and K.Sasaki: J.Phys.Chem.C, 113 (27) (2009) 11652-11656.

[3]Nonlinear optical phase shift obtained from two-level atoms confined in a planar microcavity, H.Oka, H.Fujiwara, S.Takeuchi and K.Sasaki: J.Appl.Phys., 107 (5) (2010) 054310/1-6.

Review Papers

Optical Quantum Circuits - Toward The Realization of Quantum Computers and Quantum Metrology, S. Takeuchi, Photonics alliance, JAPAN INDUSTRIAL PUBLISHING CO., LTD., 20[10] (2009), 15-20.

How to Learn a Subject out of Your Speciality : Physics for Students of Information Science, S. Takeuchi, Journal of IEICE, IEICE, 92[12] (2009), 1076-1078.

Realization of optical quantum circuits -an entanglement filter-, S. Takeuchi, R. Okamoto, Applied physics, The Japan Society of Applied Physics, 79[2] (2010), 125-129.

International Conferences

[1]Experimental realization of an optical entanglement filter (invited), R.Okamoto, J.L.O'Brien, H.F.Hofmann, T.Nagata, K.Sasaki, S.Takeuchi: CLEO/Europe-EQEC 2009.

[2]Realization of optical quantum circuits - an entanglement filter - (invited), S.Takeuchi: 18th INTERNATIONAL LASER PHYSICS WORKSHOP(LPHYS'09).

- [3]Highly-pure heralding single-photon sources for linear optics quantum computation , M.Tanida, T.Nagata, R.Okamoto, K.Sasaki and S,Takeuchi: 18th INTERNATIONAL LASER PHYSICS WORKSHOP (LPHYS'09).
- [4]Analysis of input-output characteristic of fiber-coupled microsphere laser using rate equation models , H.Takashima, M.Takahashi, H.Fujiwara, K.Sasaki and S.Takeuchi: International workshop on photons and spins in nanostructures (IWPSN).
- [5]Toward high-fidelity operation of linear-optics quantum gates , T.Nagata, R.Okamoto, K.Sasaki, and S.Takeuchi: International Workshop on Photons and Spins in Nanostructures (IWPSN).
- [6]Analysis of errors in linear-optics C-NOT gates (oral), T.Nagata, R.Okamoto, K.Sasaki, and S.Takeuchi: SPIE Optics + Photonics Quantum Communications and Quantum Imaging VII.
- [7]Realization of optical quantum circuits: an entanglement filter (invited), R.Okamoto, J.O'Brien, H.Hofmann, T. Nagata, K. Sasaki, S. Takeuchi: SPIE Optics+Photonics.
- [8]Experimental realization of an optical entanglement filter (oral), R.Okamoto, J.L.O'Brien, H.F.Hofmann, T.Nagata, K.Sasaki, S.Takeuchi: International Symposium on Quantum Nanophotonics and Nanoelectronics(ISQNN).
- [9]Toward the realization of the strong coupling between a Diamond NV center and a microsphere resonator with a tapered fiber , M.Fujiwara, K.Toubaru, H.Takashima, T.Asai, and S.Takeuchi: International Symposium on Quantum Nanophotonics and Nanoelectronics(ISQNN).
- [10]Toward the realization of the strong coupling between a Diamond NV center and a microsphere resonator with a tapered fiber , M.Fujiwara, H.Takashima, K.Toubaru, H.-Q.Zhao, K.Sasaki and S.Takeuchi: 13th SANKEN International Symposium 2010.
- [11]Highly-pure heralding single-photon sources for linear optics quantum computation , M.Tanida, T.Nagata, R.Okamoto, K.Sasaki and S,Takeuchi: 13th SANKEN International Symposium 2010.
- [12]Photonic Quantum Circuits and its application (invited), S.Takeuchi: SPIE Photonics West.
- [13]Highly-pure heralding single-photon sources for linear optics quantum computation , M.Tanida, T.Nagata, R.Okamoto, K.Sasaki and S,Takeuchi: International Symposium on Joint Research Network for Advanced Material and Devices"彫".
- [14]NV-center investigation in diamond nano granules by laser scanning confocal microscopy , H.-Q. Zhao, M. Fujiwara, H. Takashima, K. Sasaki, and S. Takeuchi: International Symposium on Joint Research Network for Advanced Material and Devices"彫".

Contributions to International Conferences and Journals

S. Takeuchi SPIE Photonics+Optics, Quantum communications and Quantum Imaging (Program Committee member) (Program Committee member)

S. Takeuchi Nonlinear optics Quantum optics (Editorial Board)

Publications in Domestic Meetings

The Physical Society of Japan 7 papers

Quantum Information Technology Symposium 2 papers

Others 6 papers

Academic Degrees

Doctor Degree for A study on the realization of quantum circuits using multi-photon interference and Electronics for its application to metrology Informatics

T. Nagata

Grant-in-Aid for Scientific Research

S. Takeuchi Realization and application of spatio-temporally single mode single photon source using group velocity engineering. ¥10,400,000

S. Takeuchi Realization of quantum cybernetics using photonic quantum circuits ¥7,100,000

R. Okamoto	Demonstration of a quantum shutter		¥3,380,000
M. Fujiwara	Ultrahigh-sensitive single molecular detection of photosynthetic light-harvesting complexes by using microsphere resonator		¥1,090,000
Entrusted Research			
S. Takeuchi	MIC-SCOPE	Researches on the realization of Highly efficient solid state quantum phase gate for photons	¥16,343,000
S. Takeuchi	JST-CREST	Toward the realization of monocycle entangled photons for novel nonlinear quantum optics	¥11,900,000
S. Takeuchi	Mitsubishi Electric		¥1,820,000

Department of Quantum Functional Materials

Original Papers

[1]Diamagnetism and Cooper pairing above T_c in cuprates, L. Li, Y. Wang, S. Komiyama, S. Ono, Y. Ando, G. D. Gu, and N. P. Ong: Phys. Rev. B, 81 (5) (2010) 054510/1-9.

[2]Zn-impurity effects on quasiparticle scattering in La_{2-x}Sr_xCuO₄ studied by angle-resolved photoemission spectroscopy, T. Yoshida, S. Komiyama, XJ. Zhou, K. Tanaka, A. Fujimori, Z. Hussain, ZX. Shen, Y. Ando, H. Eisaki, and S. Uchida: Phys. Rev. B, 80 (24) (2009) 245113/1-7.

[3]Josephson scanning tunneling microscopy: A local and direct probe of the superconducting order parameter, H. Kimura, RP. Barber, S. Ono, Y. Ando, and RC. Dynes: Phys. Rev. B, 80 (14) (2009) 144506/1-16.

[4]Deviation from the Wiedemann-Franz law induced by nonmagnetic impurities in overdoped La_{2-x}Sr_xCuO₄, XF. Sun, B. Lin, X. Zhao, L. Li, S. Komiyama, I. Tsukada, and Y. Ando: Phys. Rev. B, 80 (10) (2009) 104510/1-7.

[5]X-Ray Absorption Spectra Reveal the Inapplicability of the Single-Band Hubbard Model to Overdoped Cuprate Superconductors, DC. Peets, DG. Hawthorn, KM. Shen, YJ. Kim, DS. Ellis, H. Zhang, S. Komiyama, Y. Ando, GA. Sawatzky, RX. Liang, DA. Bonn, and WN. Hardy: Phys. Rev. Lett., 103 (8) (2009) 087402/1-4.

[6]Universal versus Material-Dependent Two-Gap Behaviors of the High-T_c Cuprate Superconductors: Angle-Resolved Photoemission Study of La_{2-x}Sr_xCuO₄, T. Yoshida, M. Hashimoto, S. Ideta, A. Fujimori, K. Tanaka, N. Mannella, Z. Hussain, ZX. Shen, M. Kubota, K. Ono, S. Komiyama, Y. Ando, H. Eisaki, and S. Uchida: Phys. Rev. Lett., 103 (3) (2009) 037004/1-4.

[7]Far-Infrared Absorption and the Metal-to-Insulator Transition in Hole-Doped Cuprates, S. Lupi, D. Nicoletti, O. Limaj, L. Baldassarre, M. Ortolani, S. Ono, Y. Ando, and P. Calvani: Phys. Rev. Lett., 102 (20) (2009) 206409/1-4.

[8]Comment on "Low-temperature phonon thermal conductivity of single-crystalline Nd₂CuO₄: Effects of sample size and surface roughness", XF. Sun, and Y. Ando: Phys. Rev. B, 79 (17) (2009) 176501/1-3.

[9]Possibility of magnetic-field-induced reconstruction of the Fermi surface in underdoped cuprates: Constraints from infrared magneto-optics, A. D. LaForge, A. A. Schafgans, S. V. Dordevic, W. J. Padilla, K. S. Burch, Z. Q. Li, K. Segawa, S. Komiyama, Y. Ando, J. M. Tranquada, and D. N. Basov: Phys. Rev. B, 81 (6) (2010) 064510/1-7.

[10]Magnetic and Transport Properties of FeAs Single Crystals, K. Segawa, and Y. Ando: J. Phys. Soc. Jpn., 78 (10) (2009) 104720/1-3.

[11]Universal critical behavior in single crystals and films of YBa₂Cu₃O_{7-d}, H. Xu, S. Li, SM. Anlage, CJ. Lobb, MC. Sullivan, K. Segawa, and Y. Ando: Phys. Rev. B, 80 (10) (2009) 104518/1-11.

[12]Non-Oxide Ceramic Nanocomposites with Multifunctionality, T. Kusunose, and T. Sekino: Key Eng. Mater., 403 (2) (2009) 45-48.

[13]Facile One-Pot Synthesis and Characterization of Novel Nanostructured Organic Dispersible

- Polyaniline, Y. Han, T. Kusunose, and T. Sekino: *Polym. Sci. Ser. B*, 47 (10) (2009) 1024-1029.
- [14]A study of Conductive Elastomer Composites Reinforced with Sulfonic Acid Doped Polyaniline Coated Titanium Dioxide, Y. Han, T. Kusunose, and T. Sekino: *J. Ceram. Process. Res.*, 10 (2) (2009) 208-211.
- [15]CTAB-Assisted Synthesis of Size- and Shape-Controlled Gold Nanoparticles in SDS Aqueous Solution, S. Moon, T. Kusunose, T. Sekino: *Mater. Lett.*, 63 (23) (2009) 2038-2040.
- [16]Easy Synthesis of a Nanostructured Hybrid Array Consisting of Gold Nanoparticles and Carbon Nanotubes, S. Moon, T. Kusunose, S. Tanaka, and T. Sekino: *Carbon*, 47 (12) (2009) 2924-2932.
- [17]Translucent $\text{Al}_2\text{O}_3/\text{LaAl}_{11}\text{O}_{18}$ Composite, I. Yamashita, K. Tsukuma, T. Kusunose: *J. Am. Ceram. Soc.*, 92 (9) (2009) 2136-2138.
- [18]Influence of Ionic Sizes of Rare Earths on Thermoelectric Properties of Perovskite-type Rare Earth Cobalt Oxides RCoO_3 (R = Pr, Nd, Tb, Dy), H. Hashimoto, T. Kusunose, and T. Sekino: *J. Alloy. Compd.*, 484 (1-2) (2009) 246-248.
- [19]Effects of Strontium Ion Doping on the Thermoelectric Properties of Dysprosium Cobalt Oxide, H. Hashimoto, T. Kusunose, and T. Sekino: *Mater. Trans.*, 51 (2) (2010) 404-407.
- [20]Temperature Dependence of Electrical and Thermal Properties for Perovskite-type Rare Earth Cobalt Oxide Solid Solutions $\text{Pr}_{1-x}\text{Tb}_x\text{CoO}_3$ and Their Metal-insulator Transition Behavior, H. Hashimoto, T. Kusunose, and T. Sekino: *J. Alloy. Compd.*, 494 (1-2) (2010) L3-L6.
- [21]Direct mapping of the spin-filtered surface bands of a three-dimensional quantum spin Hall insulator, A. Nishide, A. A. Taskin, Y. Takeichi, T. Okuda, A. Kakizaki, T. Hirahara, K. Nakatsuji, F. Komori, Y. Ando, and I. Matsuda: *Phys. Rev. B*, 81 (4) (2010) 04139/1-4.
- [22]Quantum oscillations in a topological insulator $\text{Bi}_{1-x}\text{Sb}_x$, A. A. Taskin, and Y. Ando: *Phys. Rev. B*, 80 (8) (2009) 085303/1-6.

Review Papers

Peculiar physical properties of copper-oxide high-temperature superconductors: clues for elucidating the superconductivity mechanism, Y. Ando, *Materia Japan*, Bulletin of the Japan Institute of Metals, 1 (2010), 7-12.

Patents

- [1]Synthesis of $\beta\text{-Si}_3\text{N}_4$ Nanowire and Its Resin Composite T. Kusunose, M. Yamazaki, JP2009-212490
- [2]Electrically Conductive Zirconia Ceramics T. Kusunose, H. Ohnishi, H. Naka, JP2009-104085
- [3]Silicon Carbide Based Ceramic Composites and Their Fabrication Methods T. Kusunose, K. Niihara, T. Segawa, P4312293

International Conferences

- [1]Transport and Magnetic Studies of the Topological Insulator Bi-Sb (invited), *Y. Ando: International Workshop on Novel Topological States in Condensed Matter Physics, Hong Kong, China, June 23, 2009.
- [2]Electron-Hole Asymmetry in an Ambipolar Cuprate (invited), *Y. Ando: Emergence of Inhomogeneous Phases in Strongly Correlated Electron Systems (Glassy '09), Paris, France, July 2, 2009.
- [3]Unusual Transport and Magnetic Properties of a Topological Insulator Bi-Sb (oral), *Y. Ando, and A. A. Taskin: 6th International Symposium on High Magnetic Field Spin Science in 100T: Application of High Magnetic Field for Condensed Matter and Material Sciences, Sendai, Japan, December 7, 2009.
- [4]Quantum Oscillations in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y. Ando, and A. A. Taskin: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.
- [5]Anomalous magnetic-field-angle dependence of the magnetoresistance in PbS in the quantum transport regime (poster), *K. Eto, A. A. Taskin, K. Segawa, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.

- [6]Study of the novel superconductivity in Cu-intercalated Bi_2Se_3 (poster), *Z. Ren, A. A. Taskin, K. Segawa, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.
- [7]Anomalous Magnetotransport in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y.Ando, and A. A. Taskin: Workshop on Exotic Insulating State of Matter, Johns Hopkins Univ., Baltimore, USA, January 14-16, 2010.
- [8]Quantum Oscillations in a Topological Insulator Bi-Sb (invited), *Y. Ando: American Physical Society March Meeting, Portland, USA, March 15, 2010.
- [9]Spatial modulations of electronic states in the pseudogap phase of cuprates: ordering or interference (oral), *C. Parker, A. Pushp, A. Pasupathy, K. Gomes, S. Ono, Y. Ando, J. Wen, Z. Xu, and G. Gu : American Physical Society March Meeting, Portland, USA, March 15, 2010.
- [10]Exfoliated Thin Crystals: A New Platform For Exploring Cuprate Physics (oral), *L. Sandilands, G. Chugunov, S. Ono, P. Kim, Y. Ando, and K. Burch: American Physical Society March Meeting, Portland, USA, March 17, 2010.
- [11]Universal critical behavior in single crystals and films of $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ (oral), *S. M. Anlage, H. Xu, S. Li, C.J. Lobb, M.C. Sullivan, K. Segawa, and Y. Ando: American Physical Society March Meeting, Portland, USA, March 17, 2010.
- [12]Transport properties of the Mott-insulating $\text{YBa}_2\text{Cu}_3\text{O}_{6.03}$ single crystals (poster), *K. Segawa, and Y. Ando: 9th International Conference on Materials and Mechanisms of Superconductivity (M2S-IX), Tokyo, Japan, September 8, 2009.
- [13]Electron-hole asymmetry in the doping dependence of the Neel temperature in an Y-123 system (poster), *K. Segawa, and Y. Ando: Gordon Research Conference on Superconductivity, Hong Kong, China, June 8, 2009.
- [14]Structural Ceramic Nanocomposites with Multifunctionality (invited), *T. Kusunose, T. Sekino, and K. Niihara: The 11th International Symposium on Eco-Materials Processing and Design (ISEPD2010), Sakai, Japan, January 9-12, 2010.
- [15]Thermoelectric Properties of Perovskite-type Rare Earth Cobalt Oxide Solid Solutions (poster), *H. Hashimoto, T. Kusunose, S. Tsukuda, T. Sekino, and S. Tanaka: The Second French Research Organizations-Tohoku University Joint Workshop on Frontier Materials (Frontier 2009), Sendai, Japan, December, 2009.
- [16]Thermoelectric Properties of Perovskite-type Rare Earth Cobalt Oxides with A-site Substitution (poster), *H. Hashimoto, T. Kusunose, S. Tsukuda, T. Sekino, and S. Tanaka: International Symposium on Multifunctional Ceramic Materials Based on Nanotechnology (ISMCN2010), Tokyo, Japan, March, 2010.
- [17]Effect of Carbon Content on Synthesis of SiC/BN Nanocomposite Powders by Carbothermal Reduction - Nitridation of Borosilicate Glass (poster), *T. Kusunose, T. Sekino, Y. Ando: The Third International Conference on the Science and Technology for Advanced Ceramics (STAC-3).
- [18]Oscillatory Angular Dependence of Magnetoresistance in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (poster), *A. A. Taskin, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.
- [19]Oscillatory Angular Dependence of Magnetoresistance in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (poster), *A. A. Taskin, and Y. Ando: Workshop on Exotic Insulating State of Matter, Johns Hopkins Univ., Baltimore, USA, January 14-16, 2010.

Contributions to International Conferences and Journals

Y. Ando EPL-Europhysics Letters (Co-editor)

Publications in Domestic Meetings

Japanese Physical Society 65th Annual Meeting

3 papers

Japanese Physical Society 2009 Autumn Meeting

7 papers

Ceramics Society of Japan Meeting

2 papers

Academic Degrees		
Doctor of Philosophy for Engineering	Morphological Control of Self-Assembled Au Nanoparticles and Development of Their Nanohybrids with Carbon Nanotubes	
S. Moon		
Doctor of Philosophy for Engineering	Studies on Thermoelectric Properties of Perovskite-type Rare Earth Cobalt Oxide-based Ceramics	
H. Hashimoto		
Master Degree for Engineering	Magnetotransport Properties of Low-Carrier-Density Degenerate Semiconductor PbS Single Crystals	
K. Eto		
Bachelor Degree for Engineering	Single Crystal Growth of High-Temperature Superconducting Cuprate in Ambipolar Doped 123 System	
R. Yoshida		
Bachelor Degree for Engineering	High-Quality Single Crystal Growth of Chalcogenide Narrow-Gap Semiconductor	
S. Wada		
Grant-in-Aid for Scientific Research		
Y.Ando	Mott Insulator and Spin Hall Insulator: Elucidating the Physics of Nontrivial Insulators	¥26,500,000
Y.Ando	Search for Quantum Oscillations in a La-based Cuprate	¥2,100,000
K. Segawa	Study on the PIN junction in the parent material of the high-temperature cuprate superconductors	¥1,950,000
T. Kusunose	Control of Electrical Conductivity of Non-oxide Ceramics by Grain Boundary Phase	¥13,780,000
Contribution to Research		
T. Kusunose	Denki Kagaku Kogyo Co., Ltd.	¥950,000
T. Kusunose	Nippon Tungsten Co., Ltd.	¥500,000
T. Kusunose	Ferrotec Ceramics Corporation	¥1,000,000
Cooperative Research		
Y.Ando	Central Research Institute of Electric Power Industry	¥1,000,000
T. Sanken	Mitsubishi Chemical Corporation	¥2,410,000
Other Research Fund		
Y.Ando	US AFRL Asian Office of Aerospace Research and Development, Special Grant	¥5,350,000
T. Kusunose	The Murata Science Foundation	¥1,000,000

Department of Semiconductor Materials and Processes

Original Papers

- [1] Passivation of defect states in surface and edge regions on pn-junction Si solar cells by use of hydrogen cyanide solutions, M. Takahashi, T. Shishido, H. Iwasa, and H. Kobayashi: *Cent. Eur. J. Phys.*, 7 (2009) 227-231.
- [2] On the topographic and optical properties of SiC/SiO₂ surfaces, S. Jurecka, M. Jureckova F. Chovanec, H. Kobayashi, M. Takahashi, M. Mikula, E. Pincik,: *Cent. Eur. J. Phys.*, 7 (2009) 321-326.
- [3] Acoustic spectroscopy and electrical characterization of SiO₂/Si structures with ultrathin SiO₂ layers formed by nitric acid oxidation, P. Bury, H. Kobayashi, M. Takahashi, K. Imamura, P. Sidor, F. Cernobila: *Cent. Eur. J. Phys.*, 7 (2009) 237-241.
- [4] Ultrathin SiO₂ layer with an extremely low leakage current density formed in high concentration nitric acid, W.-B. Kim, Asuha, T. Matsumoto, and H. Kobayashi: *J. Appl. Phys.*, 105 (2009) 103709/1-6.

[5]Low temperature formation of SiO₂ thin films by nitric acid oxidation of Si (NAOS) and application to thin film transistor (TFT), T. Matsumoto, Asuha, W.-B. Kim, M. Yamada, S. Imai, and H. Kobayashi, Low temperature formation of SiO₂ thin films by nitric acid oxidation of Si (NAOS) and application to thin film transistor (TFT): Microelectron. Eng., 86 (2009) 1939-1941.

[6]Removal of charging on SiO₂/Si structure during photoelectron spectroscopy measurements by metal overlayer, W.-B. Kim, M. Nishiyama, and H. Kobayashi: J. Electron. Spectros. Related Phenom., 176 (2010) 8-12.

[7]Nitric acid oxidation of Si (NAOS) method at 120°C: HNO₃ concentration dependence, K. Imamura, M. Takahashi, Asuha, Y. Hirayama, S. Imai, and H. Kobayashi: J. Appl. Phys., 107 (2010) 054503/1-5.

[8]Ultrathin SiO₂ layer with a low leakage current density formed with approximately 100% nitric acid vapor, Nanotechnology, W.-B. Kim, T. Matsumoto, and H. Kobayashi, Nanotechnology, 21 (2010) 115202/1-7.

Patents

[1]Semiconductor device and method for manufacturing H. Kobayashi, JP2009-204471

[2]Method for manufacturing insulating coat and semiconductor device and manufacturing equipment for semiconductor device H. Kobayashi, JP2010-30776

[3]Imprinting mold and semiconductor device, and method for manufacturing semiconductor device H. Kobayashi, JP2010-29643

[4]Semiconductor device and method for manufacturing S. Imai, T. Shimatani, H. Kobayashi, JP2010-058973

International Conferences

[1]Defect passivation etch-less cleaning method for improvement of Si solar cell characteristics (invited), H. Kobayashi: The 6th International Conference on High-Performance Ceramics.

[2]Nitric acid oxidation of Si method for fabrication of Si/SiO₂ structure at 120 °C and its application to thin film transistors (invited), H. Kobayashi: VI International Workshop on Semiconductor Surface Passivation.

[3]Defect Passivation Etch-less Cleaning for Semiconductor Devices: Zero Emission Process (invited), H. Kobayashi: International Symposium on Advanced Ceramics and Technology for Sustainable Energy Application.

[4]Nitric acid oxidation of Si (NAOS) method for the formation of gate oxides in TFT (invited), H. Kobayashi: Progress in Surface, Interface and Thin Film Science 2009.

[5]Semiconductor surface cleaning by ppm order-defect passivation etchless solutions (invited), M. Takahashi: VI International Workshop on Semiconductor Surface Passivation, Zakopane.

[6]Local structures around nickel contaminants on SiO₂ surfaces and mechanism of nickel removal by dilute hydrocyanic acid aqueous solutions (invited), M. Takahashi: Progress in Surface, Interface and Thin Film Science 2009.

[7]Nitric acid oxidation of Al thin film to form Al₂O₃/Al structure at room temperature (invited), T. Matsumoto: Progress in Surface, Interface and Thin Film Science 2009, Florence.

[8]Low temperature formation of SiO₂ thin films by nitric acid oxidation of Si (NAOS) and application to thin film transistor (TFT) (oral), T. Matsumoto, W.-B. Kim, T. Yanase, Y. Fukaya, Asuha, M. Takahashi and H. Kobayashi: INFOS2009.

[9]Low temperature formation of ultrathin SiO₂ films on Si surfaces for gate oxide of transistors by nitric acid oxidation of Si (NAOS) method (oral), M.K. Mazumder, W.-B. Kim, Asuha, T. Matsumoto and H. Kobayashi: The 17th Conference of Crystal Growth and Epitaxy.

[10]Stacked gate oxide in thin film transistors (TFTs) formed by the nitric acid oxidation of Si (NAOS) method (poster), T. Matsumoto, M. Yamada, H. Tsuji, S. Imai, S. Terakawa and H. Kobayashi: The 5th Handai Nanoscience and Nanotechnology International Symposium.

[11]Nitric acid oxidation of Si (NAOS) method to form gate insulators in Si devices at 120°C (poster), T. Matsumoto, W.-B. Kim, T. Yanase, Y. Fukaya, Asuha, M. Takahashi and H. Kobayashi: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.

[12]Electrical and physical properties of ultrathin (≤ 1.5 nm) SiO₂ layer fabricated with high concentration nitric acid (HNO₃) (poster), W.-B. Kim: Progress in Surface, Interface and Thin Film Science 2009.

[13]Low temperature fabrication of thick SiO₂ layer using modified nitric acid oxidation of silicon (NAOS) method (poster), Y. Fukaya: Progress in Surface, Interface and Thin Film Science 2009.

Contributions to International Conferences and Journals

H. Kobayashi Applied Surface Science (Chief Editor)

H. Kobayashi Progress in Surface, Interface and Thin Film Science 2009 (Organizing Committee)

Publications in Domestic Meetings

The Japan Society of Applied Physics Annual Meeting 6 papers

The Physical Society of Japan Annual Meeting 3 papers

The Surface Science Society of Japan Annual Meeting 1 paper

Academic Degrees

Doctor Degree for Science Physical properties and electrical characteristics of ultrathin SiO₂/Si structure fabricated by chemical method at low temperatures

W.-B. Kim

Master Degree for Science Low reflectivity at Si surfaces fabricated by imprinting method with metal catalysts

A. Ohnaka

Master Degree for Science Formation of SiO₂/Si structure by the method of nitric acid vapor oxidation of Si at low temperature and application to semiconductor devices

S. Tanaka

Master Degree for Science Removal of Cu on SiO₂ surfaces by use of HCN aqueous solution with extremely low concentration

Y. Higashi

Grant-in-Aid for Scientific Research

H. Kobayashi Low temperature formation of SiO₂/Si structure by nitric acid oxidation with using surface nano-pores ¥17,810,000

Entrusted Research

H. Kobayashi Japan Science and Technology Agency Low temperature formation of TFT gate oxide layers and lower power consumption by the nitric acid oxidation method ¥82,224,000

Department of Metallic Materials Process

Original Papers

[1]Fabrication of Lotus-Type Porous Cobalt and Silicon through Decomposition of Moisture, H. Onishi, S. Ueno, S.K. Hyun and H. Nakajima: Metallurgical and Materials Transactions A, 40 (2) (2009) 438-443.

[2]Fabrication of Lotus-Type Porous Al-Si Alloys Using the Continuous Casting Technique, J.S. Park, S.K. Hyun, S. Suzuki, H. Nakajima: Metallurgical and Materials Transactions A, 40 (2) (2009) 406-414.

[3]Fabrication of Lotus-type Porous Aluminum through Thermal Decomposition Method, S.Y. Kim, J.S. Park, H. Nakajima: Metallurgical and Materials Transactions A, 40 (4) (2009) 937-942.

[4]Compressive deformation behavior of porous γ -TiAl with directional pores, T. Ide, M. Tane, H. Nakajima: Materials Science and Engineering A, 508 (1-2) (2009) 220-225.

[5]In vivo osteocompatibility of lotus-type porous nickel-free stainless steel in rats, K. Alvarez, S.-K. Hyun, T. Nakano, Y. Umakoshi, H. Nakajima: Materials Science and Engineering C, 29 (4) (2009) 1182-1190.

- [6]Fabrication of Lotus-type Porous Aluminum Utilizing Decomposition of Moisture, M. Tane, H. Nakajima: *Materials Transactions*, 50 (6) (2009) 1477-1481.
- [7]Transition in the Nanoporous Structure of Iron Oxides during the Oxidation of Iron Nanoparticles and Nanowires, R. Nakamura, G. Matsubayashi, H. Tsuchiya, S. Fujimoto, H. Nakajima: *Acta Materialia*, 57 (14) (2009) 4261-4266.
- [8]Diffusion in Intermetallic Compounds and Fabrication of Hollow Nanoparticles through Kirkendall Effect, H. Nakajima, R. Nakamura: *Journal of Nano Research (Proceedings of 4th International Conference on Diffusion in Solids and Liquids, DSL2008)*, 7 (2009) 1-10.
- [9]An Effect of Addition of NiO Powder on Pore Formation in Porous Nickel, H. Onishi, S. Ueno, H. Nakajima: *Journal of the Japan Institute of Metals*, 73 (8) (2009) 618-621.
- [10]Formation of Oxide Nanotubes via Oxidation of Fe, Cu and Ni Nanowires and Their Structural Stability: Difference in Formation and Shrinkage Behavior of Interior Pores, R. Nakamura, G. Matsubayashi, H. Tsuchiya, S. Fujimoto, H. Nakajima: *Acta Materialia*, 57 (17) (2009) 5046-5052.
- [11]Metallic Scaffolds for Bone Regeneration, K. Alvarez , H. Nakajima: *Materials*, 2 (2009) 790-832.
- [12]Fabrication of Lotus-type Porous Carbon Steel via Continuous Zone Melting and Its Mechanical Properties, M . Kashiwara, H . Yonetani , T. Kobi, S. K. Hyun, S. Suzuki, H. Nakajima: *Materials Science and Engineering A*, 524 (1-2) (2009) 112-118.
- [13]The Uncertainty in SCHF-DT Thermal Conductivity Measurements of Lotus-Type Porous Copper, H. Chiba, T. Ogushi, H. Nakajima, S. Ueno, K. Torii, T. Tomimura: *Advanced Engineering Materials*, 11 (10) (2009) 848-851.
- [14]Fabrication of Porous Metals with Directional Pores through Thermal Decomposition of Chromium Nitride, T.Wada, T.Ide, H. Nakajima: *Metallurgical and Materials Transactions A*, 40 (13) (2009) 3204-3209.
- [15]Formation of a Nano-hole via Oxidation of Metal Nanoparticles, R. Nakamura, H. Nakajima, H. Mori: *Defect and Diffusion Forum*, 289-292 (2009) 649-656.
- [16]Shrinkage of Hollow Nanoparticles of Oxides of Cu and Ni at High Temperatures, R. Nakamura, H. Nakajima, H. Mori: *Defect and Diffusion Forum*, 289-292 (2009) 673-678.
- [17]Structure Change and Improvement of the Mechanical Properties of Lotus-type Porous Copper by ECAE Process, J. Lobos, S. Suzuki, H. Utsunomiya, H. Nakajima: *Materials Science Forum*, 620-622 (2009) 757-760.
- [18]Fabrication of Porous Metals with Directional Pores Through Solidification of Gas-dissolved Melt, H. Nakajima, T. Ide, S.-Y. Kim: *Materials Science Forum*, 620-622 (2009) 785-790.
- [19]Fabrication of Lotus-type Porous Carbon Steel by Continuous Casting Technique and Application to Machine Tools, M. Kashiwara, H. Yonetani, S. Suzuki, S.Y. Kim, H. Nakajima: *Proceedings of International Symposium on Cellular Metals for Structural and Functional Applications(CELLMET2008)*, (2009) 89-94.
- [20]Lotus-type Porous Ni-free Stainless Steel Biomaterial Produced by Continuous Zone Melting Technique, K. Alvarez, H. Nakajima: *Proceedings of International Symposium on Cellular Metals for Structural and Functional Applications(CELLMET2008)*, (2009) 301-306.
- [21]Effects of Static Magnetic Field and Gas Atmosphere on Solidification of Silicon by Electromagnetic Levitation, S. Ueno, H. Kobatake, H. Fukuyama, S. Awaji, H. Nakajima: *Journal of Physics: Conference Series*, 165 (2009) 012020.
- [22]Fabrication of porous aluminium with directional pores through thermal decomposition method, H. Nakajima, S. Y. Kim, J. S. Park: *Journal of Physics: Conference Series*, 165 (2009) 012063.
- [23]Fabrication of lotus-type porous copper through thermal decomposition of titanium hydride, T. Ide H. Nakajima: *Journal of Physics: Conference Series*, 165 (2009) 012064.

- [24]Fabrication of Porous Magnesium with Directional Pores through Thermal Decomposition of Magnesium Hydride, M. Tane, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012065.
- [25]Fabrication of lotus-type porous aluminum using thermal decomposition of magnesium hydroxide, J. S. Park, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012066.
- [26]Fabrication of a lotus-type porous Al-Si alloy by continuous casting with a thermal decomposition method, T.B. Kim, S. Suzuki, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012067.
- [27]Fabrication of Al-Cu alloy with elongated pores by continuous casting technique, S. Suzuki, T.B. Kim, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012068.
- [28]Structure change and improvement of the mechanical properties of a lotus-type porous copper by wire-brushing, J. Lobos, S. Suzuki, H. Nakajima, Y. S. Ji, H. Fujii, D. Terada, N. Tsuji: Journal of Physics: Conference Series, 165 (2009) 012070.
- [29]Mechanical property of lotus-type porous carbon steel fabricated by continuous casting method, Y. Kawamura, S. Suzuki, S.Y. Kim, H. Nakajima, M. Kashihara, H. Yonetani: Journal of Physics: Conference Series, 165 (2009) 012071.
- [30]Structural Stability of Hollow Oxide Nanoparticles at High Temperatures, R. Nakamura, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012072.
- [31]Effect of Additive Method and Additive Amount of Titanium Hydride on Pore Formation of Lotus-type Porous Copper Fabricated by Thermal Decomposition Method, T. Ide, H. Nakajima: Journal of Japan Research Institute for Advanced Copper-base Materials and Technologies, 48 (2009) 96-99.
- [32]Formation of Hollow Structures via Oxidation of Cu Nanoparticles and Nanowires and Structural Stability of Hollow Oxides, R. Nakamura, G. Matsubayashi, H. Tsuchiya, S. Fujimoto, H. Nakajima: Journal of Japan Research Institute for Advanced Copper-base Materials and Technologies, 48 (2009) 300-303.
- [33]The effect of microstructure on the pore morphology in Al-Mg-Si alloys fabricated by unidirectional solidification, T.B. Kim, S. Suzuki, H. Nakajima: Journal of Japan Institute of Light Metals, 59 (2009) 678-684.

Review Papers

Anisotropic Mechanical Properties of Lotus-Type Porous Metals, H. Nakajima, M. Tane, S. K. Hyun, H. Seki, IUTAM Bookseries 12(Proceedings of the IUTAM Symposium on Mechanical Properties of Cellular Materials), Springer Science+Business Media B.V, (2009), 43-50.

Books

- [1]Diffusion in Materials(M. Koiwa) M. Koiwa, H. Nakajima, "Diffusion in Materials", Uchida Rokakuho Publishing Co., Ltd, 2009.
- [2]Metallic Porous Materials(S. Kitagawa) H. Nakajima, "Porous materials designed by nanoscience", CMC Publishing CO.,LTD, 2010.

Patents

- [1]Method for manufacturing porous body, H. Nakajima, Korea 10-0887651
- [2]Method for manufacturing porous body, H. Nakajima, Canada 2378825
- [3]Heat Sink, H. Nakajima, H. Chiba, T. Ogushi, JP4458872

International Conferences

- [1]Fabrication of Hollow Nano Particles of Metallic Oxides Through Oxidation Process (invited), *H. Nakajima, R. Nakamura: International Conference on PROCESSING & MANUFACTURING OF ADVANCED MATERIALS Processing, Fabrication, Properties, Applications (Thermec' 2009), Berlin, Germany, Aug.25-29, 2009.
- [2]Investigation Of The Mechanical Properties Of Lotus-Type Porous Carbon Steel Made By Continuous Zone Melting Technique (oral), *T. Kujime, H. Nakajima: International Conference on PROCESSING &

MANUFACTURING OF ADVANCED MATERIALS Processing, Fabrication, Properties, Applications (Thermec' 2009), Berlin, Germany, Aug.25-29, 2009.

[3]High Strain Rate Compression Behaviour of Porous Iron with Directional Pores (oral), *M. Tane, T. Kawashima, K. Horikawa, H. Kobayashi, H. Nakajima: European Congress on Advanced Materials and Processes (Euromat 2009), Glasgow, UK, Sep. 7-10, 2009.

[4]Recent advances in the research on cellular metals in Asia (invited), *H. Nakajima, M. Tane, S. Suzuki, T. Ide, S. Ueno: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[5]Formation of Hollow and Porous Oxides through Oxidation of Metal Nanoparticles (invited), *H. Nakajima, R. Nakamura: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[6]Improvement of the strength of porous copper with directional pores (oral), *J. Lobos, S. Suzuki, H. Utunomiya, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[7]Fabrication of carbon steel with directional pores by continuous casting technique and their mechanical properties (poster), *S. Suzuki, Y. Kawamura, M. Kashihara, H. Yonetani, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[8]Fabrication of Al-Cu alloys with directional pores by continuous casting technique (poster), *S.Suzuki, T.B.Kim, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[9]Standardization of method for thermal conductivity test of porous metals (poster), *H. Nakajima, K. Torii, T. Ogushi, H. Chiba, F. Ono: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.

[10]Elastic and Plastic Deformation Behaviors of Lotus-type Porous Metals (invited), *M. Tane, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[11]Dynamic Compression Behavior of Lotus-type Porous Iron (poster), *M. Tane, T. Kawashima, K. Horikawa, H. Kobayashi, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[12]Effect of Foaming Temperature on Pore Morphology of Al/AlN Composite Foam Fabricated by Melt Foaming Method (poster), *Y.H. Song, M. Tane, T. Ide, Y. Seimiya, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[13]Effect of Transfer Velocity on Porosity of Lotus-type Porous Aluminum Fabricated by Continuous Casting Technique (poster), *Y. Iio, T. Ide, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[14]Fabrication of Lotus-type Porous Iron by Thermal Decomposition Method (poster), *T. Ide, T Wada, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[15]Formation of Hollow and Porous Nanostructures of Iron Oxides via Oxidation of Iron Nanoparticles and Nanowires (poster), *R. Nakamura, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[16]Formation of Oxide Nanotubes and Bamboo-like Structures via Oxidation of Cu, Fe and Ni Nanowires (poster), *G. Matsubayashi, R. Nakamura, H. Tsuchiya, S. Fujimoto, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[17]Pore Growth Direction of Lotus-type Porous Copper Fabricated by Continuous Casting Technique (poster), *S. Suzuki, J.S. Park, K. Sugihara, H. Nakajima: The 11th the International Symposium on

Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[18]Effect of Addition of NiO Powder on Pore Formation in Lotus-type Porous Carbon Steel Fabricated by Continuous Casting (poster), *M. Kashihara, H. Yonetani, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[19]Fabrication of Lotus-type Porous Al-Ti Alloys using the Continuous Casting Technique (poster), *T.B. Kim, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[20]Anisotropic Growth of Pores in Lotus-type Porous Magnesium (poster), *K. Sugihara, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[21]Consideration of Pore Diameter Distribution on Heat Transfer Capacity of Lotus-type Porous Copper Heat Sink for Air Cooling (poster), *H. Chiba, T. Ogushi, S. Ueno, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.

[22]An Effect of Transfer Velocity on Porosity of Lotus-type Porous Aluminum Fabricated by Continuous Casting Technique (poster), *T. Ide, Y. Iio and H. Nakajima: The 13th SANKEN International Symposium 2009, Izumisano, Japan, Jan. 18-19, 2010.

Contributions to International Conferences and Journals

H. Nakajima	Sixth International Conference on Porous Metals and Metal Foaming Technology(MetFoam2009) (International Advisory Board Member)
H. Nakajima	High Temperature Materials and Process (Editorial Board Member)
H. Nakajima	Diffusion and Defect Data (Editorial Board Member)
H. Nakajima	Materials Science Foundations (Editorial Board Member)
H. Nakajima	International Conference on New Frontiers of Process Science and Engineering in Advanced Materials (Organizing Committee Member)
H. Nakajima	6th International Conference on Diffusion in Solids and Liquids (Organizing Committee Member)
H. Nakajima	International Conference on Eco-Materials Processing and Design 2010 (Organizing Committee Member)
H. Nakajima	3rd International Symposium on Cellular Metals for Structural and Functional Applications (Program Committee)
H. Nakajima	International Conference on Advanced Structure and Functional Materials Design (Organizing Committee Member)
H. Nakajima	THERMEC 2009 International Conference on Advanced Materials (International Advisory Board Member)

Publications in Domestic Meetings

The Japan Institute of Metals	22 papers
The Japan Institute of Light Metals	4 papers
The Japan Copper and Copper Alloys Research Association	2 papers
Japan Heat Transfer Symposium	4 papers

Academic Degrees

Doctor Degree for Engineering	Development Research of High-Performance Heat Sink with use of Lotus-type Porous Copper
H. Chiba Master Degree for Engineering	Analysis of Tensile Deformation of Lotus-type Porous Copper Using Acoustic Emission Method
R. Okamoto Master Degree for Engineering	Fabrication of Lotus-type Porous Magnesium by Controlling Pore Growth Directions
K. Sugihara	

Master Degree for Engineering	Fabrication of Nanotubes using Vacancy Clustering and Elucidation of their Foaming Mechanism		
G. Matsubayashi			
Grant-in-Aid for Scientific Research			
H. Nakajima	Fabrication of novel nano-hollow sphere metals and metallic nano-tube and elucidation of physical properties		¥10,010,000
H. Nakajima	Development of unidirectionally porous metals using metal-gas compounds and application for electronic and medical materials		¥2,300,000
S. Suzuki	Fabrication of lotus metals consisting of two different metals using continuous casting technique with multiple molds		¥650,000
M. Tane	Development of beta-phase titanium alloys with low Young's modulus		¥2,080,000
R. Nakamura	Formation of Nanoporous Structures through Crystallization of Amorphous Oxides		¥3,250,000
T. Ide	Fabrication of lotus-type porous metal through thermal decomposition of gas compound by continuous casting technique		¥1,820,000
Entrusted Research			
H. Nakajima	Japan Science and Technology Agency	Development of unidirectionally lotus-type porous aluminum with high air-cooling power	¥2,000,000
H. Nakajima, S. Suzuki, M. Ishimaru	Small and Medium Enterprise Agency, Strategic Innovation of Fundamental Technologies	Combined Process of Rolling and Forging for High Silicon Containing Stainless Steels	¥2,310,000
H. Nakajima	Mori Seiki Co. Ltd.	Investigation for process of manufacture of lotus carbon steel (2008-2010)	¥11,550,000
Contribution to Research			
H. Nakajima	The Japan Institute of Light Metals		¥250,000
H. Nakajima	FukudaHiroshiSyoten CO.,LTD		¥500,000
Cooperative Research			
H. Nakajima	Toyota Motor Corporation		¥4,400,000
Other Research Fund			
S. Suzuki	The light Metal Educational Foundation Inc.	Grant for International Exchange	¥200,000
H. Nakajima	Japan Society for the Promotion of Science	Joint Research Project under the Japan-Korea Basic Scientific Cooperation Program	¥800,000
M. Tane	Kansai Research Foundation for Technology Promotion		¥1,000,000
M. Tane	JSPS Travel Grant for Attending International Meetings		¥346,000

Department of Advanced Interconnection Materials

Original Papers

[1]Room-Temperature Sintering Process of Ag Nanoparticle Paste, D. Wakuda, K. S. Kim, K. Suganuma: IEEE T. Compon. Pack. T., 32 (3) (2009) 627-632.

[2]Microstructural Changes of the Ag-Epoxy ICA/Sn Interface in a High-Humidity environment, S. S. Kim, K. S. Kim, S. Kim, K. Suganuma: J. Electron. Mater., 38 (6) (2009) 896-901.

[3]Eco-fabrication of metal nanoparticle related materials by home electric appliances, Y. Hayashi, M. Inoue, I. Narita, K. Suganuma, H. Takizawa: Mater. Sci. Forum, 620-622 (2009) 185-188.

[4]Electrical properties of isotropic conductive adhesives composed of silicone-based elastomer binders containing Ag particles, M. Inoue, H. Muta, S. Yamanaka, K. Suganuma: J. Electron. Mater., 38 (2009)

2013-2022.

[5] Influential factors in determining the adhesive strength of ACF joints, M. Inoue, K. Suganuma: *J. Mater. Sci.: Materials in Electronics*, 20 (2009) 1247-1254.

[6] Effects of multi-modal filler size distributions on thermal conductivity of electrically conductive adhesives containing micro and nanoparticles, M. Inoue, J. Liu: *J. Jpn. Inst. Electronics Packaging*, 2 (2009) 125-133.

[7] Variations in polymeric structures of ferroelectric poly(vinylidene fluoride) films during annealing at various temperatures, M. Inoue, Y. Tada, K. Suganuma, H. Ishiguro: *J. Appl. Polymer Sci.*, 111 (2009) 2837-2847.

[8] Optically Transparent Nanofiber Paper, M. Nogi, S. Iwamoto, A. N. Nakagaito, and H. Yano: *Advanced Materials*, 21 (2009) 1595-1598.

[9] Preparation of Chitin Nanofibers with a Uniform Width as α -Chitin from Crab Shells, S. Ifuku, M. Nogi, K. Abe, M. Yoshida, M. Morimoto, H. Saimoto, and H. Yano: *Biomacromolecules*, 10 (2009) 1584-1588.

[10] Optically Transparent Nanofiber Sheets by Deposition of Transparent Materials: A Concept for a Roll-to-Roll Processing, M. Nogi and H. Yano: *Appl. Phys. Lett.*, 94 (2009) 233117.

[11] Optimization of the Mechanical Performance of Bacterial Cellulose/Poly(L-lactic) Acid Composites, F. Quero, M. Nogi, H. Yano, K. Abdulsalami, S. M. Holmes, B. H. Sakakini, and S. J. Eichhorn: *ACS Applied Materials & Interfaces*, 2 (2010) 321-330.

[12] Microstructure and mechanical properties of bacterial cellulose/chitosan porous scaffold, T. T. Nge, M. Nogi, H. Yano, J. Sugiyama: *Cellulose*, 17 (2010) 349-363.

[13] The 21st Century Paper Using Cellulose Nanofibers, M. Nogi, H. Yano: *J. Jpn. Soc. Colour Mater*, 82 (2009) 351-356.

[14] Review: current international research into cellulose nanofibers and nanocomposites, S. J. Eichhorn, A. Dufresne, M. Aranguren, N. E. Marcovich, J. R. Capadona, S. J. Rowan, C. Weder, W. Thielemans, M. Roman, S. Renneckar, W. Gindl, S. Veigel, J. Keckes, H. Yano, K. Abe, M. Nogi, A. N. Nakagaito, A. Mangalam, J. Simonsen, A. S. Benight, A. Bismarck, L. A. Berglund, T. Peijs: *J. Mater. Sci.*, 45 (2010) 1-33.

[15] Displays from transparent films of natural nanofibers, A. N. Nakagaito, M. Nogi, H. Yano: *MRS Bulletin*, 35 (3) (2010) 214-218.

Review Papers

Trend of Ink jet technology, K. Suganuma, *Denshi Gijutu*, 22[12] (2009), 91-98.

History and current issues in lead-free soldering, K. Suganuma, *つうしん*, 64 (2009), .

Current issues and challenges in printed electronics, *Green Technology*, K. Suganuma, *Clean Technology*, 19[9] (2009), 6-12.

Reliability of conductive adhesives in electronics packaging, K. Suganuma, *TEST*, 13 (2009), 3-6.

Boron Nitride Nanocage Clusters, Nanotubes, Nanohorns, Nanoparticles, and Nanocapsules, . Nishiwaki, K. Suganuma, M. Inoue, K. Hiraga, T. Matsuda, M. Hirabayashi, H. Tokoro, S. Fujii, M. Gonda, M. Nishijima, T. Hirai, V. Belosludov, and Y. Kawazoe, *B-C-N Nanotubes and Related Nanostructures*, Springer, NY, (2009), 150-194.

All of the new coating process, *Converting Technical Institute*, , *Converting Technical Institute*, (2009), 106-108.

New silicon Nitride ceramic materials, *JSPS the 124th committee on ADANCED CERAMICS*, H, Uchida Rokakuho Pub. Co. Ltd., (2009), 217-227.

Brand-new transparent nanomaterials made from bio-nanofibers, M. Nogi, K. Abe, S. Iwamoto, H. Yano, *WEB Journal, ACTRY-M*, 102 (2009), 28-30.

Transparent Nanofiber paper -21st century paper-, M. Nogi, A. Norio Nakagaito, H. Yano, Sustainable Humanosphere, Bulletin of research institute for sustainable humanosphere Kyoto university, KyotoUniversity, 5(7) (2009), .

The foldable transparent substrates from cellulose nanofibers, M.Nogi, K.Abe, S.Iwamoto, H.Yano, New Glass, New Glass Forum, 25(1) (2009), 12-15.

Books

[1]Reliability Improvements for Environmentally Conscious Electronics Packaging Technology, edited by K. Suganuma, CMC Publishing CO.,LTD. K.Suganuma, “CMC Publishing Co.,Ltd.” , 344 (O) P.

[2]Electronic materials for high valu-added products M.Nogi,H.Yano, “CMC Publishing CO.,LTD”, 2009, 229-242 (O) P.

Patents

[1]Conductive adhesive as solder replacement and circuit therewith K. Suganuma, Y. Shirai, K. Suzuki, JP2010-59426

[2]Silver β -ketocarboxylate, metallic silver manufacturing material thereof, and application of silver thereof K. Suganuma, S. Yamaguchi, M. Hatamura, JP2009-221222

[3]Storage-stable inks containing β -ketocarboxylic acid silver salts, kits therefor, and forming method of wiring using them K. Suganuma, M. Hatamura, T. Matsumoto, M. Kawazome, JP2009-197133

[4]Silver containing conductive paste K. Suganuma, K.S. Kim, D.S. Kim, JP2009-170277

[5]Semiconductor devices having adhesive layers comprising laminated porous layers and joining layers and their fabrication K. Suganuma, G. Izuta, K.S. Kim, D.S. Kim, JP2009-164208

[6]Semiconductor devices and their fabrication by bonding under application of acceleration K. SUGANUMA, G. Izuta, K.S. Kim, D.S. Kim, JP2009-164203

[7]Fabrication of Ag nano particles K. SUGANUMA, J. Jiu, K.S. Kim, JP2009-155674

[8]Laminated solder material, soldering method using the same, and solder junction K. SUGANUMA, G. Izuta, S. Murai, JP2009-142890

[9]Inks containing β -ketocarboxylic acid silver salts, kits for them, and formation of wiring using them K. SUGANUMA, M. Hatamura, K.S. Kim, T. Matsumoto, M. Kawazome, JP2009-114232

[10]Method for connecting terminals with high reliability, connected structure, and resin pastes therefor K. SUGANUMA, K. Otsuka, JP2009-99708

[11]Nanofiber sheets and its fabrication methods. T. Nogi, K. Yano, JP2010-7010

International Conferences

[1]Effects of Zn-containing Flux on the Joint Strength and Microstructure of Sn-3.5Ag Soldering on an Electroless Ni-Au Surface Finish (oral), H. Sakurai, A. Baated, K. Lee, S. Kim, K.S. Kim, K. SUGANUMA: 2010 TMS Annual Meeting & Exhibition, Washington State Convention & Trade Center, Seattle, Washington, USA, Feb.14-18 (2010).

[2]Low temperature wiring with Ag inks-New beta-ketocarboxylate Ag inks for 100 °C curing (oral), M. Kawazome, K. S. Kim, K. SUGANUMA: 9th Nanotechnology Conference (IEEE NANO 2009), Genoa, Italy, July 28-30 (2009) 7-9.

[3]Time-dependent sintering properties of Ag nanoparticle paste for room temperature bonding (oral), D. Wakuda, K. S. Kim, K. SUGANUMA: 9th Nanotechnology Conference (IEEE NANO 2009), Genoa, Italy, July 28-30 (2009) 498-501.

[4]Ink-jet Printing of Ag Nanoparticle and Ag carboxylate Inks on Papers (oral), M. Kawazome, K. S. Kim, K. SUGANUMA: 59th Electronic Components & Technology Conference (ECTC 2009), San Diego, CA, USA, May 26-29 (2009) 1325-1329.

[5]Properties of Ag Nanoparticle Paste for Room Temperature Bonding (oral), D. Wakuda, K. S. Kim, K. SUGANUMA: 59th Electronic Components & Technology Conference (ECTC 2009), San Diego, CA, USA,

May 26-29 (2009) 1557-1562.

[6]Room Temperature Sintering and Bonding with Ag Nanoparticle Paste (oral), D. Wakuda, K. S. Kim, K. Suganuma: 2009 International Conference on Electronics Packaging (ICEP2009), Kyoto International Conference Center, Kyoto, Japan, April 14-16 (2009).

[7]Thermal conductivity of electrically conductive adhesives containing fillers with multi-modal particle size distributions (oral), *M. Inoue, J. Liu: International Conference on Electronics Packaging 2009, Kyoto International Conference Center, Kyoto, Japan, April 14-16 (2009).

[8]Eco-fabrication of noble metal nanoparticles by metal oxide and home electronics appliances (oral), Y. Hayashi, *M. Inoue, I. Narita, K. Toisawa, T. Yamada, Y. Sekiguchi, H. Takizawa, K. Suganuma: International Conference on Electronics Packaging 2009, Kyoto International Conference Center, Kyoto, Japan, April 14-16 (2009).

[9]Stretchable human Interface using conductive silicone elastomer containing silver fillers (oral), *M. Inoue, K. Suganuma, H. Ishiguro: The 13th IEEE International Symposium on Consumer Electronics.

[10]FEM simulation of bimodal and trimodal thermally conductive adhesives (oral), *N. Nabiollahi, J. Liu, Z. Hilli, Y. Zhang, Y. Cong, Z. Cheng, M.Inoue: IEEE Nano 2009, Genoa, Italy, July 28-30 (2009).

[11]Carbon Nanofibers from Prawn Shells (poster), *M. Nogi, and H. Yano: Proceedings of The 11th International Conference on Chitin and Chitosan & The 8th Asia-Pacific chitin and Chitosan Symposium, Taipei, Taiwan, Sep 6-9, 2009).

[12]Preparation of Chitin Nanofibers with a Uniform Width as α -Chitin from Crab Shells (oral), *S. Ifuku, M. Nogi, K. Abe, M. Yoshioka, M. Morimoto, H. Saimoto, and H. Yano: Proceedings of The 11th International Conference on Chitin and Chitosan & The 8th Asia-Pacific chitin and Chitosan Symposium, Taipei, Taiwan, Sep 6-9, 2009).

Contributions to International Conferences and Journals

K.Suganuma HDP-ISEPT (International Advisory Board)

K.Suganuma International Symposium on Tin whisker

M. INOUE International Conference on Electronics Packaging 2009 (Organizing Committee)

Publications in Domestic Meetings

24th JIEP Annual Meeting	3 papers
19th Micro-Electronic Symposium	2 papers
49th Copper & Copper Alloy Symposium	1 paper
Japan Institute of Metals, Fall Meeting	1 paper
MicroElectronics Symposium 2009	1 paper
Polymer Materials Forum 2009	1 paper
The Japan Wood Research Society	1 paper
The cellulose society of Japan	1 paper
The Wood Carbonization Research Society	1 paper
2010 Annual Meeting of The Ceramic Society of Japan	1 paper
22nd Fall Meeting of The Ceramic Society of Japan	1 paper

Academic Degrees

Doctor Degree for Engineering Novel method for room temperature sintering and wiring of Ag nanoparticle paste for Printed electronics

D. Wakuda

Doctor Degree for Engineering Study on countermeasures for problems caused by dissolution and solidification of Sn-Ag-Cu system lead-free solder alloy in electronics packaging

G. Izuta

Master Degree for Science Inkjet printing of conductive silver tracks on polymer substrates and silver microcapsules

C.J. Kim

Master Degree for Science Decomposition process of β -ketocarboxylic acid silver ink below 100°C and its wiring characteristics

T. Kuwana	Master Degree for Science	Performance characterization of printed line for radio identification device with Ag-Nano paste	
N. Komoda	Grant-in-Aid for Scientific Research		
K. Suganuma		Mechanism elucidation and prevention of Sn whisker growth for aerospace electronics	¥23,400,000
M. Nogi		Fabrication of the low CTE and high transparent nanocomposites by 3D structure of bacterial cellulose nanofiber networks	¥1,100,000
D.Wakuda		Room temperature sintering of metallic nanoparticle paste	¥0
Entrusted Research			
K.Suganuma	Reliability Center for Electronic Components of Japan	Standardization of conductive adhesive testing methods	¥1,950,000
K.Suganuma	NEC Co.Ltd.	Development of interconnecting technology using conductive Adhesives	¥525,000
Contribution to Research			
K.Suganuma		DaiselChemical Industries,Ltd	¥500,000
K.Suganuma		Toray Engineering Co.,Ltd	¥500,000
K.Suganuma		C.Uyemura & Co.,Ltd	¥1,000,000
K.Suganuma		Bando Chemical Industries , Ltd	¥500,000
K.Suganuma		Toppan Forms Co.Ltd	¥2,800,000
K.Suganuma		Showa Denko K.K.	¥2,000,000
K.Suganuma		Sharp Co.	¥400,000
Cooperative Research			
K.Suganuma	Taiwan Textile Institute	Reserch	¥6,114,000
K.Suganuma	Simens	AG	¥0

Department of Excited Solid-State Dynamics

Original Papers

- [1]Ultrafast relaxation of highly excited electrons in Si: Roles of the L-X intervalley scattering, T. Ichibayashi, S. Tanaka, and K. Tanimura: Phys. Rev. B, in press.
- [2]Models of intrinsic defects in graphite: accounting for Van der Waals interactions, G. Teobaldi, H. Ohnishi, K. Tanimura, and A. L. Shluger: Carbon, in press.
- [3]Theoretical study of Graphite-Diamond phase transtion and formation of Diaphite, H. Ohnishi, K. Tanimura, K. Nasu: Solid-state physics, 44 257-265.
- [4]Femtosecond pulse radiolysis and femtosecond electron diffraction, J. Yang, K. Kan, T. Kondoh, Y. Yoshida, K. Tanimura, and J. Urakawa: Nucl. Instrum. Method A, in press.

Books

- [1]Nano-scale sp²-sp³ conversion by visible lights irradiation and photoinduced phase transitions(Molecular electronic and related materials-Control and probe with light) L.Radosinski, K. Nasu, J.Kanazaki, K.Tanimura, A.Radosz and T. Luty, "Molecular electronic and related materials-Control and probe with light", Transworld Research Network, 2010.

International Conferences

- [1]Ultrafast dynamics of photo-injected surface-valence holes and laser-induced electronic bond rupture on Si(111)-(7x7) (oral), J. Kanasaki, T. Ichibayashi, and K. Tanimura: 12th International Workshop on Desorption Induced by Electronic Transitions.
- [2]Femtosecond time-resolved photoemission study on dynamcal relaxation of photo-injected valence

Publications in Domestic Meetings		
Particle Accelerator Society Meeting		9 papers
Academic Degrees		
Master Degree for Science	Time Domain Analysis of the FEL Micropulse using a Michelson Interferometer	
K. Furuhashi		
Grant-in-Aid for Scientific Research		
R. Kato	Development of the slice emittance monitor for high-brightness electron beams	¥2,730,000
S. Kashiwagi	Development of coherent light source based on the interaction between electron beam and laser undulator field	¥1,430,000
Other Research Fund		
G. Isoyama	Collaboration and supporting program for universities of the High Energy Accelerator Research Organization	¥20,000,000
R. Kato	Collaboration and supporting program for universities of the High Energy Accelerator Research Organization	¥500,000

Department of Beam Materials Science

Original Papers

- [1]Intramolecular electron transfer processes in CuB-deficient cytochrome bo studied by pulse radiolysis, K. Kobayashi, S. Tagawa, and T. Mogi: *J. Biochem.*, 145 (2009) 685-691.
- [2]Electron transfer Processes in Subunit I Mutants of Cytochrome bo Quinol Oxidase from *Escherichia coli*, K. Kobayashi, S. Tagawa, and T. Mogi: *Biosci. Biotechnol. Biochem.*, 73 (2009) 1599-1603.
- [3]Structural basis of interprotein electron transfer for nitrite reduction in denitrification, M. Nojiri, H. Koteishi, T. Nakagami, K. Kobayashi, T. Inoue, K. Yamaguchi, and S. Suzuki: *Nature*, 462 (2009) 117-120.
- [4]Importance of conserved Lys83 residue of *Zea mays* cytochrome b561 for ascorbate-specific transmembrane electron transfer as revealed by site-directed mutagenesis studies, N. Nakanishi, M. Rahman, Y. Sakamoto, T. Takigami, K. Kobayashi, H. Hori, T. Hase, Sam-Y. Park, M. Tsubaki: *Biochemistry*, 48 (2009) 10665-10678.
- [5]Dynamics of Delocalized Charges of Radical Anion in A•T DNA Duplexes, R. Yamagami, K. Kobayashi, and S. Tagawa: *Chem. Eur. J.*, 45 (2009) 12201-12203.

Publications in Domestic Meetings

Japan Radiation Chemistry Meeting		4 papers
Japan Biochemistry Meeting		4 papers
Japan Biomolecule Meeting		1 paper

Academic Degrees

Doctor Degree for Engineering	Study on Proton Dynamics and Reaction of Acid Generators with Thermalized Electrons in Acid Generation Processes in Thin Resist Films	
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K. Naysuda

Master Degree for Engineering	Pulse Radiolysis Study on Early Processes in Radiation Chemistry of Fluoronaphthalene	
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S. Ikeda

Master Degree for Engineering	Stability of Radical Anions of Fluorinated Benzene Derivatives	
-------------------------------	--	--

S. Higashino

Department of Molecular Excitation Chemistry

Original Papers

- [1]Sequence-independent and rapid long-range charge transfer through DNA, K. Kawai, H. Kodaera, Y.

- Osakada, and T. Majima: *Nature Chem.*, 1 (2) (2009) 156-159.
- [2]“Signal-On” Detection of DNA Charge Transfer at the Single Molecule Level, T. Takada, Y. Takeda, M. Fujitsuka, and T. Majima: *J. Am. Chem. Soc. (Commun.)*, 131 (19) (2009) 6656-6657.
- [3]Emission Mechanism of Doubly *Ortho*-linked Quinoxaline/Diphenylfluorene or *cis*-Stilbene/Fluorene Hybrid Compounds Based on the Transient Absorption and Emission Measurements during the Pulse Radiolysis, Y. Wei, S. Samori, S. Tojo, M. Fujitsuka, J.-S. Lin, C.-T. Chen, and T. Majima: *J. Am. Chem. Soc.*, 131 (19) (2009) 6698–6707.
- [4]Photochemical Reactivity of Gold Cluster; Dependence of Size and Spin Multiplicity, M. Sakamoto, T. Tachikawa, M. Fujitsuka, and T. Majima: *Langmuir*, 25 (24) (2009) 13888–13893.
- [5]Emission from Regioisomeric Bis(phenylethynyl)benzenes during Pulse Radiolysis, S. Samori, S. Tojo, M. Fujitsuka, T. Ryhding, A. G. Fix, B. M. Armstrong, M. Haley, and T. Majima: *J. Org. Chem.*, 74 (10) (2009) 3776–3782.
- [6]Fullerol-Titania Charge Transfer Mediated Photocatalysis Working under Visible Light, Y. Park, N. J. Singh, K. S. Kim, T. Tachikawa, T. Majima, and W. Choi: *Chem. Eur. J.*, 15 (41) (2009) 10843-10850.
- [7]Comparing electroluminescence efficiency and photoluminescence quantum yield of fluorene-based π -conjugated copolymers with narrow band-gap comonomers, J. Han, J. An, C. Im, N. S. Cho, H. K. Shim, and T. Majima: *J. Photochem. Photobiol. A*, 205 (2-3) (2009) 98-103.
- [8]Important factors for the radiolysis-induced emission intensity of aromatic hydrocarbons, S. Samori, S. Tojo, M. Fujitsuka, and T. Majima: *J. Photochem. Photobiol. A*, 205 (2-3) (2009) 179-185.
- [9]Carbon-doped TiO₂ Photocatalyst Synthesized without Using an External Carbon Precursor and the Visible Light Activity, Y. Park, H. Park, W. Kim, T. Tachikawa, T. Majima, and W. Choi: *Appl. Catal. B*, 91 (1-2) (2009) 355-361.
- [10]Long-Range Charge Transfer through DNA by Replacing Adenine with Diaminopurine, K. Kawai, H. Kodera, and T. Majima: *J. Am. Chem. Soc.*, 132 (2) (2010) 627-630.
- [11]Evaluating Host-Guest Interactions in a Metal-Organic Framework Using a Polarity-Sensitive Probe, J. R. Choi, T. Tachikawa, M. Fujitsuka, and T. Majima: *J. Phys. Chem. Lett.*, 1 (7) (2010) 1101-1106.
- [12]Electron Transfer in the Supramolecular Donor-Acceptor Dyad of Zinc Hemiporphycene, M. Fujitsuka, H. Shimakoshi, S. Tojo, L. Cheng, D. Maeda, Y. Hisaeda, and T. Majima: *J. Phys. Chem. A*, 114 (12) (2010) 4156-4162.
- [13]Solvent-Polarity Dependence of Electron Transfer Kinetics in a CdSe/ZnS Quantum Dot-Pyromellitimide Conjugate, S.-C. Cui, T. Tachikawa, M. Fujitsuka, and T. Majima: *J. Phys. Chem. C*, 114 (2) (2010) 1217-1225.
- [14]Synthesis of a Novel Sn(IV) Porphycene-Ferrocene Triad Linked by Axial Coordination and Solvent Polarity Effect in Photoinduced Charge Separation Process, D. Maeda, H. Shimakoshi, M. Abe, M. Fujitsuka, T. Majima, and Y. Hisaeda: *Inorg. Chem.*, 49 (6) (2010) 2872-2880.
- [15]Probing Photocatalytic Active Sites on a Single Titanosilicate Zeolite with Redox-Responsive Fluorescent Dye, T. Tachikawa, S. Yamashita, and T. Majima: *Angew. Chem. Int. Ed.*, 49 (2) (2010) 432-435.
- [16]Photochemical Fabrication of Silver Nanostructure at Solid-liquid Interface Using the Recyclable Photosensitized Reduction Process, M. Sakamoto, S. S. Kim, K. Furusho, and T. Majima: *Phys. Chem. Chem. Phys.*, 12 (2) (2010) 365-372.
- Review Papers
- Development of Reaction Mechanistic Studies Based on Radiation Chemistry, M. Fujitsuka, T. Majima, *Radiation Chemistry*, Japanese Society of Radiation Chemistry, 87 (2009), 14-22.
- Photochemistry of New Supramolecules with Imides, M. Fujitsuka, A. Sugimoto, T. Majima, *Journal of Synthetic Organic Chemistry*, The Society of Synthetic Organic Chemistry, Japan, 67[4] (2009), 328-336.
- Foerster Theory, M. Fujitsuka, T. Majima, *Journal of Synthetic Organic Chemistry*, The Society of

Synthetic Organic Chemistry, Japan, 67[4] (2009), 400.

Marcus Theory, M. Fujitsuka, T. Majima, Journal of Synthetic Organic Chemistry, The Society of Synthetic Organic Chemistry, Japan, 67[4] (2009), 400.

Preparation of Gold Nanoparticles from Photochemical Reaction: 3D Fabrication Using Two-color Two-laser Irradiation, M. Sakamoto, T. Majima, Chemistry, Kagaku-Dojin, 64[5] (2009), 23-28.

Photochemistry Using Two-color Two-laser Irradiation: Application to 3D Fabrication, M. Sakamoto, T. Majima, Journal of Japan Laser Processing Society, Japan Laser Processing Society, 16[2] (2009), 147-151.

Single-Molecule Fluorescence Imaging of TiO₂ Photocatalytic Reactions, T. Tachikawa and T. Majima, Langmuir (Feature Article), American Chemical Society, 25[14] (2009), 7791-7802.

Photo-induced charge separation in DNA and photosensitized DNA damage, K. Kawai, Photochemistry, The Japanese Photochemistry Association, 40 (2009), 171-174.

Readout of DNA information using charge transfer rate, K. Kawai, Chemistry & Chemical Industry, The Chemical Society of Japan, 62 (2009), 1088-1090.

Books

[1] Kinetics of Long-Range Oxidative Electron Transfer through DNA (Marc M. Greenberg) K. Kawai and T. Majima, "Radicals in Nucleic Acids, Volume 2 in the Wiley Series of Reactive Intermediates in Chemistry and Biology", John Wiley & Sons, Inc., 2009.

Patents

[1] Detection Method of SNP T. Majima, K. Kawai, JP2010-9822

International Conferences

[1] Photochemical formation of Gold Clusters and Nanoparticles in Polymer Matrix (invited), T. Majima: 5th Hnadai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1-3, 2009.

[2] Photochemical Reactions of Gold Clusters (invited), T. Majima: Langmuir Symposium, Tsukuba, Japan, September 14, 2009.

[3] Beam-induced molecular chemistry (invited), T. Majima: International Meeting on Interdisciplinary Chemistry 2009, Gunma, Japan, September 18-19, 2009.

[4] Kinetic Studies of Long-Range Hole Transfer through DNA (oral), *K. Kawai, and T. Majima: 6th International Symposium on Nucleic Acids Chemistry, Takayama, Japan, September 27-October 1, 2009.

[5] Interfacial Electron Transfer Dynamics of Solar Materials Studied by Single-Particle Fluorescence Measurement (invited), T. Majima: 1st WCU International Workshop on Dye-sensitized and Organic Solar Cells, Jochiwon, Korea, October 13, 2009.

[6] TiO₂ Photocatalysts for Green Technology (invited), T. Majima: Korean Chemical Society Meeting, Deajeon, Korea, October 29-30, 2009.

[7] Interfacial Electron Transfer Dynamics in a Single CdTe Quantum Dot-Pyromellitimide Conjugate (invited), T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[8] Electron Transfer in Supramolecular Donor-Acceptor Dyad of Zinc Porphycene (invited), *M. Fujitsuka, H. Shimakoshi, S. Tojo, D. Maeda, Y. Hisaeda, and T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[9] DNA Electronics (poster), T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[10] Photochemistry of Gold Clusters (invited), T. Majima: 1st International Forum on Photoenergy Future (IFPF), Choeran, Korea, December 11-13, 2009.

[11] DNA Electronics (oral), T. Majima: 2009 Asian Symposium on Organic Materials for Electronics and

Photonics (ASOMP 2009) and The 7th International OLED and PLED Materials Workshop, Taipei, Taiwan, December 13-15, 2009.

[12]Electron Transfer in Supramolecular Donor-Acceptor Dyad of Porphyrin Isomers towards Efficient Photo-Energy Conversion Systems (poster), M. Fujitsuka and *T. Majima: 13th SANKEN International Symposium, Osaka, Japan, January 19-20, 2010.

Contributions to International Conferences and Journals

T. MAJIMA 2009 Korea-Japan Symposium on Frontier Photoscience (Organizing Chair)
T. MAJIMA FIRST WORKSHOP OF COLLEGE OF SCIENCE AND TECHNOLOGY, KOREA UNIVERSITY AND SANKEN, OSAKA UNIVERSITY (Organizing Chair)
T. MAJIMA Second WORKSHOP OF COLLEGE OF SCIENCE AND TECHNOLOGY, KOREA UNIVERSITY AND SANKEN, OSAKA UNIVERSITY (Organizing Committee)
T. MAJIMA 2010 WORKSHOP OF COLLEGE OF SCIENCE, National Taiwan University and SANKEN, OSAKA UNIVERSITY (Organizing Committee)
T. MAJIMA Langmuir (Senior Editor)
T. MAJIMA ACS Applied Materials and Interfaces (Editorial Board)

Publications in Domestic Meetings

The 31th Japan Photobiology and Photomedicine Meeting 1 paper
The Photobiology Association of Japan Meeting 1 paper
The 23rd symposium on Biofunctional Chemistry 1 paper
Photochemistry Meeting 2009 5 papers
The 52th Radiation Chemistry Meeting 1 paper
Catalyst Meeting 1 paper
The 90th Japan Chemical Society Meeting 8 papers

Academic Degrees

Master Degree for Science Studies on charge separation and charge transfer in DNA

H. Kodera

Master Degree for Science Studies on excess charge transfer in DNA

H. Nishidera

Grant-in-Aid for Scientific Research

T. Majima Nanoscience of Photofunctionalized DNA ¥7,800,000
M. Fujitsuka Development of Molecular Devices Triggered by the Formation of the Higher Excited States ¥11,700,000
M. Fujitsuka Kinetics of photochemical ultrafast processes in polymer chains ¥1,700,000
K. Kawai Reading out the DNA sequence information by measuring the charge separation lifetime ¥2,470,000
T. Tachikawa Mechanistic study on the TiO₂ photocatalytic reactions by single-particle kinetic analysis and applications of TiO₂-based nanocomposites ¥3,640,000
S.-C. Cui Application of quantum dot nanocomplex to the photoelectric conversion device based on single molecule photochemistry ¥1,200,000

Department of Synthetic Organic Chemistry

Original Papers

[1]One-pot Preparation of Chiral Dinuclear Vanadium(V) Complex, S. Takizawa, D. Rajesh, T. Katayama, H. Sasai: Synlett, (10) (2009) 1667-1669.

[2]Ir-Catalyzed Oxidative Desymmetrization of meso-Diols, T. Suzuki, K. Ghazati, T. Katoh, H. Sasai: Org. Lett., 11 (19) (2009) 4286-4288.

[3]Enantioselective Intramolecular Oxidative Aminocarbonylation of Alkenylureas Catalyzed by Palladium-Spiro Bis(isoxazoline) Complexes, T. Tsujihara, T. Shinohara, K. Takenaka, S. Takizawa, K.

Onitsuka, M. Hatanaka, H. Sasai: *J. Org. Chem.*, 74 (24) (2009) 9274-9279.

[4] Total Synthesis of Chloropeptin II (Complestatin) and Chloropeptin I, J. Garfinkle, S. F. Kimball, J. Trzuppek, S. Takizawa, H. Shimamura, M. Tomishima, D. L. Boger: *J. Am. Chem. Soc.*, 131 (44) (2009) 16036-16038.

[5] Synthesis and Structural Characterization of a Series of Mono-O-(diphenylphosphinobenzyl)calix[6]arenes with and without tert-Butyl Moieties at the Upper Rim, T. Fujihara, S. Kubouchi, Y. Obora, M. Tokunaga, K. Takenaka, Y. Tsuji: *Bull. Chem. Soc. Jpn.*, 82 (9) (2009) 1187-1193.

Review Papers

Development of Acid-Base Organocatalysts for Enantioselective aza-Morita-Baylis-Hillman (aza-MBH) Reactions via Dual Activation Mechanism, S. Takizawa, *YAKUGAKU ZASSHI*, The Pharmaceutical Society of Japan, 129[10] (2009), 1201-1210.

Halogen free high purity epoxy compounds, J. Ichihara, *Kogyo Zairyo*, THE NIKKAN KOGYO SHIMBUN,LTD., 58[1] (2010), 60-61.

A Meta-Selective Aromatic Substitution Reaction via C-H Bond Activation, K. Takenaka, *Kagaku*, Kagaku-dojin Publishing Company, INC, 64[10] (2009), 65-66.

Books

[1] Acid-base organocatalysts for aza-MBH reactions (K. Maruoka) H. Sasai, S. Takizawa, "Evolving organocatalysts", Kagaku-dojin Publishing Company, INC, 2009.

Patents

[1] Oxidation of polymers with hydrogen peroxide J. Ichihara, JP2009-115073

[2] Preparation of epoxy compounds J. Ichihara, JP2010-1256

[3] Solid Phase Reaction System for Oxidation J. Ichihara, S. Yamaguchi, US Patent 12/524667; Korea Patent, 10-2009-7015095 (PCT/JP2008/051376)

International Conferences

[1] Enantioselective Pd^{II}/Pd^{IV} Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: 15th IUPAC International Symposium on Organometallic Chemistry Directed toward Organic Synthesis (OMCOS 15), Glasgow, UK, July 26-30, 2009.

[2] Oxidative Desymmetrization of Diols by Iridium Catalyst (poster), *T. Suzuki, K. Ghazati, K. Suzuki, T. Kato, H. Sasai: 15th IUPAC International Symposium on Organometallic Chemistry Directed toward Organic Synthesis (OMCOS 15), Glasgow, UK, July 26-30, 2009.

[3] Exploring a New Paradigm in Immobilization of Multicomponent Asymmetric Catalyst (oral), *H. Sasai, S. Takizawa, M. L. Patil, K. Marubayashi: The 14th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis, Stockholm, Sweden, September 13-18, 2009.

[4] Enantioselective Oxidative Coupling Reaction of 2-Naphthol Derivatives Using Dinuclear Vanadium Complexes (poster), *R. Doss, S. Takizawa, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS), Osaka, Japan, November 6-8, 2009.

[5] Iridium-Catalyzed Oxidative Desymmetrization of meso-Diols (poster), *K. Ghazati, S. Takatani, T. Kato, T. Suzuki, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS), Osaka, Japan, November 6-8, 2009.

[6] Enantioselective Oxidative 6-Endo-Trig Cyclizations Catalyzed by Palladium(II)-Spiro Bis(isoxazoline) Complex (poster), *S. C. Mohanta, Y. Tanigaki, M. L. Patil, C. V. L. Rao, K. Takenaka, S. Takizawa, T. Suzuki, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS), Osaka, Japan, November 6-8, 2009.

[7] Enantioselective Pd^{II}/Pd^{IV} Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11), Kyoto, Japan, November 9-13, 2009.

- [8]Enantioselective Oxidative Coupling of 2-Naphthols Using Dinuclear Vanadium(V) Catalysts (poster), *R. Doss, S. Takizawa, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11), Kyoto, Japan, November 9-13, 2009.
- [9]Iridium-Catalyzed Oxidative Desymmetrization of meso-Diols (poster), *K. Ghazati, S. Takatani, T. Kato, H. Sasai, T. Suzuki: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11), Kyoto, Japan, November 9-13, 2009.
- [10]Enantioselective Oxidative 6-Endo-Trig Cyclizations Catalyzed by Palladium(II)-Spiro Bis(isoxazoline) Complex (poster), *S. C. Mohanta, Y. Tanigaki, M. L. Patil, C. V. L. Rao, K. Takenaka, S. Takizawa, T. Suzuki, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11), Kyoto, Japan, November 9-13, 2009.
- [11]Development of Enantioselective Organocatalyzed Domino Reactions (poster), *S. Takizawa, N. Inoue, K. Kiriyama, S. Hirata, S. Murakami, T. Nguyen, T. Suzuki, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11), Kyoto, Japan, November 9-13, 2009.
- [12]Oxidative Desymmetrization of Diols by Iridium Catalyst (poster), *T. Suzuki, K. Ghazati, K. Katoh, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Japan, January 18-19, 2010.
- [13]Enantioselective Pd^{II}/Pd^{IV} Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Japan, January 18-19, 2010.
- [14]Novel Enantioselective Domino Reactions Promoted by Acid-Base Organocatalysts (poster), *S. Takizawa, N. Inoue, S. Hirata, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Japan, January 18-19, 2010.
- [15]Exploring a New Paradigm in Immobilization of Asymmetric Catalysts (invited), *H. Sasai, S. Takizawa, D Rajesh: 239th ACS National Meeting & Exposition, San Francisco California USA, March 21-25, 2010.
- [16]Thermoprofiles on the formation of Fluoridated Hydroxyapatite from tricalcium Bis(orthophosphate) (poster), *K. Sakamoto, J. Ichihara, S. Yamaguchi, I. Fujihara: International Conference on Fluorine Chemistry '09 Kyoto, Kyoto, Japan, May 20-22, 2009.
- [17]Fluorapatite-Assisted Oxidation of Sulfide Aiming at Green Process (poster), *J. Ichihara, Y. Takai, S. Yamaguchi: International Conference on Fluorine Chemistry '09 Kyoto, Kyoto, Japan, May 20-22, 2009.
- [18]Use of Fluorapatite in Oxidative Dehydration of Terpene (poster), *J. Ichihara: International Conference on Fluorine Chemistry '09 Kyoto, Kyoto, Japan, May 20-22, 2009.

Contributions to International Conferences and Journals

- H. SASAI 2010 The 7th International Symposium on the Chemistry and Biological Chemistry of Vanadium (Organizing Committee)
- H. SASAI The 11th International Kyoto Conference on New Aspects of Organic Chemistry (Organizing Committee)

Publications in Domestic Meetings

Annual Meeting of The Chemical Society of Japan	6 papers
Symposium on Molecular Chirality	3 papers
Symposium on Organometallic Chemistry	2 papers
Symposium on Organic Reaction	2 papers
Summer Symposium of The Japanese Society for Process Chemistry	1 paper
Symposium on Organocatalysis	1 paper
Symposium on Organic Synthesis	1 paper
Medicinal Chemistry Symposium	1 paper

Academic Degrees			
Master Degree for Science	Development of Asymmetric Allylic Substitution Reaction Catalyzed by Planar-Chiral Cyclopentadienyl-Ruthenium Complex		
N. Kanbayashi			
Master Degree for Science	Synthesis of Novel Chiral Compounds Based on Spirobilactams		
K. Sugimoto			
Master Degree for Science	Novel Enantioselective Pd(II/IV) Catalytic Cyclization of Alkenyl Diols		
Y. Hakoi			
Master Degree for Science	Enantioselective Chlorinative Cyclization of Enynes via Pd(II/IV) Catalysis		
S. Hashimoto			
Master Degree for Science	Studies on Enantioselective Domino Reactions Using Organocatalysts		
S. Hirata			
Doctor Degree for Science	Enantioselective aza-Morita-Baylis-Hillman (aza-MBH) Domino Reactions Promoted by Bifunctional Organocatalysts		
N. Inoue			
Doctor Degree for Science	Preparation of Optically Pure BINOL Derivatives Using Chiral Dinuclear Vanadium Complexes and Their Applications to Asymmetric Catalysis		
D. Rajesh			
Entrusted Research			
H. Sasai	Japan Science and Technology Agency (JST)	Development of Novel Enantioselective Catalysis via Pd(II)/Pd(IV) Cycle	¥2,000,000
J. Ichihara	Japan Science and Technology Agency (JST)	Preparation of Halogen-free High Purity Epoxy Compounds	¥2,000,000
Contribution to Research			
J. Ichihara	Kyodo Printing Co.		¥800,000
Other Research Fund			
H. Sasai	The Uehara Memorial Foundation		¥5,000,000
S. Takizawa	The Noguchi institute		¥2,000,000
S. Takizawa	Takeda Science Foundation		¥3,000,000

Department of Regulatory Bioorganic Chemistry

Original Papers

- [1]The effect of linker length on binding affinity of a photoswitchable molecular glue for DNA, C. Dohno, S. Uno, S. Sakai, M. Oku, K. Nakatani: *Bioorg. Med. Chem.*, 17 (2009) 2536-2543.
- [2]Synthesis and Reaction of DNA Oligomers Containing Modified Cytosines Related to Bisulfite Sequencing, Y. Oka, T. Peng, F. Takei, K. Nakatani: *Org. Lett.*, 11 (2009) 1377-1379.
- [3]Photoswitchable Unsymmetrical Ligand for DNA Hetero-Mismatches, C. Dohno, T. Yamamoto, K. Nakatani: *Eur. J. Org. Chem.*, - (2009) 4051-4058.
- [4]Small molecule affecting the replication of trinucleotide repeat d(GAA)_n, H. He, M. Hagihara, K. Nakatani: *Chem. Eur. J.*, 15 (2009) 10641-10648.
- [5]A Light-Driven, Supramolecular Optical Switch, S. Uno, C. Dohno, H. Bittermann, V. L. Malinovskii, R. Häner, K. Nakatani: *Angew. Chem. Int. Ed.*, 48 (2009) 7362-7365.
- [6]Recognition of Mismatched Base Pairs in DNA, K. Nakatani: *Bull. Chem. Soc. Chem.*, 82 (2009) 1055-1069.

- [7]Secondary Structure-Inducible Ligand Fluorescence Coupled with PCR, F. Takei, M. Igarashi, M. Hagihara, Y. Oka, Y. Soya, K. Nakatani: *Angew. Chem. Int. Ed.*, 48 (2009) 7822-7824.
- [8]Programmed Assembly of Organic Radicals on DNA, K. Maekawa, S. Nakazawa, H. Atsumi, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: *Chem. Commun.*, 46 (2010) 1247-1249.
- [9]A Reverse Transcriptase Stop Assay Revealed Diverse Quadruplex Formations in UTRs in mRNA, H. Hagihara, K. Yoneda, H. Yabuuchi, Y. Okuno, K. Nakatani: *Bioorg. Med. Chem. Lett.*, 20 (2010) 2350-2353.
- [10]Fluorescent Indicator-Displacement Assay for Ligand-RNA Interactions, J. Zhang, S. Umemoto, K. Nakatani: *J. Am. Chem. Soc.*, 132 (2010) 3660-3661.
- [11]Transformation of cytosine to uracil in single-stranded DNA via their oxime sulfonates, Y. Oka, F. Takei, K. Nakatani: *Chem. Commun.*, 46 (2010) 3378-3380.
- [12]Non-covalent assembly of TEMPO radicals pair-wise embedded on a DNA duplex, H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: *Chem. Lett.*, 39 (2010) 556-557.

Patents

- [1]The method and the reagent kit for detecting single nucleotide polymorphisms K. Nakatani, F. Takei, M. Hagihara, JP2010-054658

International Conferences

- [1]DNA cross-linking that is targeted to amino group in natural base (poster), Shibata. T, Dohno. C, Nakatani. K: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.
- [2]In vitro selection of RNA aptamers that can bind to synthetic GFP chromophore analogues (poster), Masaki Hagihara, Keisuke Yoneda, Kazuhiko Nakatani: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.
- [3]DNA cross-link generated by a novel modified DNA containing a formyl group (poster), Shibata. T, Dohno. C, Nakatani. K: The sixth International Symposium on Nucleic Acids Chemistry.
- [4]Reaction of cytosine with bisulfite and hydroxylamine. (poster), Oka, Yoshimi; Takei, Fumie; Nakatani, Kazuhiko: The sixth International Symposium on Nucleic Acids Chemistry.
- [5]Light-Driven Light-Switching DNA Device (poster), Chikara Dohno, Shin-nosuke Uno, Holger Bittermann, Vladimir L. Malinovskii, Robert Häner, Kazuhiko Nakatani: IKCOC-11.
- [6]DNA-Labeling by Secondary Structure Inducible Ligand Fluorescence (poster), Fumie Takei, Masako Igarashi, Masaki Hagihara, Yoshimi Oka, Yoshihiro Soya, Kazuhiko Nakatani: IKCOC-11.
- [7]DNA crosslink on natural base by a formyl group-containing DNA (poster), Shibata. T, Dohno. C, Nakatani. K: 13th SANKEN International Symposium 2010.
- [8]Spin labeling of DNA by using radical-containing mismatch binding ligands (poster), Hiroshi Atsumi, Kensuke Maekawa, Diasuke Shiomi, Kazunobu Sato, Takeji Takui, and Kazuhiko Nakatani: 13th SANKEN International Symposium 2010.
- [9]The motion between (CGG)_n containing hairpin DNA and G-G mismatch binding molecule (poster), Changfeng Hong, Masaki Hagihara, Kazuhiko Nakatani: 13th SANKEN International Symposium 2010.
- [10]The Development of The Displacement Assay, Screening Method for Detecting the RNA-ligand Interactions (2) (poster), Shiori Umemoto, Masaki Hagihara, Kazuhiko Nakatani: 13th SANKEN International Symposium 2010.
- [11]Secondary Structure Inducible Ligand Fluorescence coupled with PCR (invited), Kazuhiko Nakatani: 2nd Roundtable on Chemical Biology of Nucleic Acid and Carbohydrates.
- [12]Integrated Polymerase Chain Reaction (PCR) by Novel Chemical labeling (invited), Kazuhiko Nakatani: The 14th Japan-Korea Seminar on Organic Chemistry.

Publications in Domestic Meetings

4th Annual Meeting of Japanese Society for Chemical Biology		1 paper
Joint Symposium of Biorelevant Chemistry		3 papers
5th CREST symposium		3 papers
Combinatorial Chemistry and Chemical Biology toward A New Paradigm for Drug Discovery		1 paper
48th Annual Meeting of the Society of Electron Spin Science and Technology		1 paper
65th Finechemicals meeting		1 paper
90th annual meeting of chemical society of Japan		12 papers
Academic Degrees		
Bachelor of Science	Stabilization of a specific DNA secondary structure by novel tetrameric naphthyridine derivatives	
I. Kohyama		
Master Degree for Science	Development of an artificial DNA containing defined hydrophobic regions	
M. Okazaki		
Master Degree for Science	Switching of DNA functions by photoresponsive mismatch binding ligands	
S. Sakai		
Master Degree for Science	Discrimination of methylated nucleobases using a modified DNA containing a formyl group	
T. Shibata		
Master Degree for Science	Synthesis and evaluation of novel DNA binding ligand	
M. Imamura		
Grant-in-Aid for Scientific Research		
K. Nakatani	Regulation of DNA Structure and Function Based on the Stabilization of DNA Duplex	¥12,350,000
F. Takei	Development of SNP detection method with modified PCR primers	¥1,300,000
M. Hagihara	In vivo screening of novel ribozyme	¥2,080,000
C. Dohno	Discrimination of methylated nucleobases by a novel modified DNA forming Schiff base	¥2,080,000
C. Dohno	Photoresponsive RNA-binding ligands for regulation of RNA functions	¥10,790,000
Y. Oka	Development of a quantitative bisulfite sequencing	¥1,078,000
K. Maekawa	Molecular spin computing on DNA as a designable template	¥800,000
S. Umemoto	Developing a new method to search RNA binding ligands and its application	¥700,000
Entrusted Research		
K. Nakatani	Japan Science and Technology Agency, CREST	Development of High throughput screening method of drug compound binding to target RNA
		¥17,477,000
Contribution to Research		
K. Nakatani	The Uehara Memorial Foundation	¥3,000,000
C. Dohno	Sumitomo Foundation	¥1,080,000
Cooperative Research		
K. Nakatani	Nitto Kasei Co., LTD.	¥840,000
K. Nakatani	Takeda Pharmaceutical company	¥1,000,000
Other Research Fund		
M. Hagihara	The International Human Frontier Science Program	¥8,137,000

Department of Organic Fine Chemicals

Original Papers

- [1] Structurally simple inhibitors of lanosterol 14 α -demethylase are efficacious in a rodent model of acute Chagas Disease, P. K. Suryadevara, S. Olepu, J. W. Lockman, J. Ohkanda, M. Karimi, C. L. M. J. Verlinde, J. M. Kraus, J. Schoepe, W. C. Van Voorhis, A. D. Hamilton, F. S. Buckner, and M. H. Gelb: *J. Med. Chem.*, 52 (12) (2009) 3703-3715.
- [2] Transannular proton transfer in the cyclization of geranylgeranyl diphosphate to fusicoccadiene, a biosynthetic intermediate of fusicoccins, T. Toyomasu, M. Tsukahara, H. Kenmoku, M. Anada, H. Nitta, J. Ohkanda, W. Mitsuhashi, T. Sassa, and N. Kato: *Org. Lett.*, 11 (14) (2009) 3044-3047.
- [3] Functional analyses of cytochrome P450 genes responsible for the early steps of brassicicene C biosynthesis, M. Hashimoto, Y. Higuchi, S. Takahashi, H. Osada, T. Sakaki, T. Toyomasu, T. Sassa, N. Kato, and T. Dairi: *Bioorg. Med. Chem. Lett.*, 19 (19) (2009) 5640-5643.
- [4] Protein surface recognition by dendritic ruthenium(II) tris(bipyridine) complexes, J. Ohkanda, R. Satoh, and N. Kato: *Chem. Commun.*, (45) (2009) 6949-6951.
- [5] Broad and potent anti-influenza virus spectrum of epigallocatechin-3-O-gallate-monopalmitate, K. Kaihatsu, S. Mori, H. Matsumura, T. Daidoji, C. Kawakami, H. Kurata, T. Nakaya and N. Kato: *J. Mol. Gen. Med.*, 4 (2) (2009) 195-197.
- [6] Antioxidant and antiviral activities of silybin fatty acid conjugates, R. Gažák, K. Purchartová, P. Marhol, L. Živná, P. Sedmera, K. Valentová, N. Kato, H. Matsumura, K. Kaihatsu and V. Kren: *E. J. Med. Chem.*, 45 (5) (2010) 1059-1067.
- [7] Regulation of duplex DNA strand displacement by visible light sensitive bis-peptide nucleic acid, S. Sawada, I. Imada, N. Kato and K. Kaihatsu: *Nucleic Acids Symp. Ser.*, 53 (2009) 285-286.
- [8] Inhibition of influenza virus infection by targeting genome conserved region with non-natural nucleic acid, T. Takahashi, T. Ohzawa, S. Sawada, N. Kato, N. Goto, S. Nakamura, T. Yasunaga and K. Kaihatsu: *Nucleic Acids Symp. Ser.*, 53 (2009) 191-192.

Review Papers

- Module assembly: Design of protein surface-directed inhibitors, J. Ohkanda, *Peptide Newsletter Japan*, The Japanese Peptide Society, 72 (2009), 4-9.
- Design of organic agents for disrupting protein-protein interactions, J. Ohkanda, *Bulletin of Naito Memorial Foundation*, The Naito Memorial foundation, 84 (2009), 55.
- Double whammy-type antimalarial agents for chloroquine-resistant *P. falciparum*, J. Ohkanda, *Pharmacia*, The Pharmaceutical Society of Japan, 46 (2010), 80-81.

Patents

- [1] Membrane fusion inhibitor K. Kaihatsu, S. Mori, T. Daidoji, S. Myake, N. Kato, PCT/JP2009/051721
- [2] Antibacterial agents K. Kaihatsu, Y. Matsumoto, JP2009-178747
- [3] 12-Deoxyfusococcin derivatives that carry modified sugar and therapeutic uses thereof N. Kato, T. Inoue, Y. Maruyama, H. Nitta, Y. Honma, T. Sassa, PCT/JP2010/051537

International Conferences

- [1] Bipyridine metal complexes for protein surface recognition, *J. Ohkanda, K. Fujii, Y. Yamaguchi, and N. Kato: Gordon Research Conference, Bioorganic Chemistry, New Hampshire, USA, June 14-19, 2009.
- [2] Dual prenyltransferase inhibitors for simultaneous recognition of active site and exterior protein surface, *S. Machida, N. Kato, and J. Ohkanda: International Workshop of Biofunctional Chemistry for Young Scientists, Hyogo, Japan, July 22-24, 2009.
- [3] Design and functional evaluation of dual prenyltransferase inhibitors for simultaneous recognition of active site and exterior protein surface, *S. Machida, N. Kato, K. Harada, and J. Ohkanda: 238th American Chemical Society National Meeting, Washington DC, USA, August 16-20, 2009.
- [4] Module assembly for protein surface recognition: Prenyltransferase inhibitors for simultaneous targeting of interior and exterior protein surfaces (invited), *J. Ohkanda: 2nd Swiss-Japan Biomolecular

Chemistry Symposium 2009, Komaba, Tokyo, Japan, September 11-12, 2009.

[5]Cell-based evaluation of farnesyltransferase inhibitors for simultaneous targeting of active site and protein surface , *S. Machida, N. Kato, K. Harada, and J. Ohkanda: 2nd Swiss-Japan Biomolecular Chemistry Symposium 2009, Komaba, Tokyo, Japan, September 11-12, 2009.

[6]Synthesis and biological evaluation of ketoclofazone analogues as antimicrobial agents targeting 1-Deoxyxylulose 5-phosphate synthase , *D. Hayashi, N. Kato, and J. Ohkanda: 28th Conference on Combinatorial Chemistry, Japan (JCCF28), Osaka, Japan, September 24-25, 2009.

[7]Cell-based evaluation of dual prenyltransferase inhibitors that simultaneously recognize protein active site and identical surface structure , *S. Machida, N. Kato, K. Harada, and J. Ohkanda: 13th SANKEN International Symposium 2010, Osaka, Japan, January 18-19, 2010.

[8]Application of Novel Tea Catechin Derivatives for Anti-Influenza Drug and Materials , *K. Kaihatsu: 8th International BioExpo2009, Tokyo, Japan, July 2-4, 2009.

[9]Regulation of Duplex DNA Strand Displacement by Visible Light Sensitive Bis-Peptide Nucleic Acid , *S. Sawada, N. Kato, and K. Kaihatsu: International Workshop of Biofunctional Chemistry for Young Scientists, Hyogo, Japan, July 22-24, 2009.

[10]Synthesis and Evaluation of Novel Tea Catechin Derivative as Anti-influenza Viral Agents (invited), *K. Kaihatsu: BIT Life Sciences' 2nd Annual World Summit of Antivirals, Beijing, China, July 18-20, 2009.

[11]Regulation of DNA Displacement by Using Visible Light Sensitive Azobenzene Tethered Bis-Peptide Nucleic Acid , *S. Sawada, K. Kaihatsu and N. Kato: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5-6, 2009.

[12]Anti-Avian Influenza Activity of Epigallocatechin-3-O-Gallate Fatty Acid Monoesters , *K. Kaihatsu, S. Mori, H. Matsumura, T. Daidoji, T. Nakaya and N. Kato: The 2nd annual Oxford avian influenza conference, BirdFlu2009, Oxford, UK, September 9-10, 2009.

[13]Regulation of Duplex DNA Strand Displacement by Visible Light Sensitive Bis-Peptide Nucleic Acid , *S. Sawada, I. Imada, N. Kato, K. Kaihatsu: The Sixth International Symposium on Nucleic Acid Chemistry, 36th Symposium on Nucleic Acid Chemistry, Gifu, Japan, September 27-31, October 1, 2009.

[14]Inhibition of Influenza Virus Infection by Targeting Genome Conserved Region with Non-Natural Nucleic Acid , *T. Takahashi, T. Ohzawa, S. Sawada, N. Kato, N. Goto, S. Nakamura, T. Yasunaga and K. Kaihatsu: The Sixth International Symposium on Nucleic Acid Chemistry, 36th Symposium on Nucleic Acid Chemistry, Gifu, Japan, September 27-31, October 1, 2009.

[15]Synthesis and Evaluation of Photochromic Properties of Heteroatom-Substituted Azobenzene Derivatives , *S. Sawada, K. Kaihatsu, and N. Kato: 13th SANKEN International Symposium 2010, Osaka, Japan, January 18-19, 2010.

[16]Influenza Virus Inhibitory Effect of Epigallocatechin-3-O-Gallate Fatty Acid Derivatives , *K. Kaihatsu and N. Kato: 13th SANKEN International Symposium 2010, Osaka, Japan, January 18-19, 2010.

[17]In Ovo Influenza Virus-Inhibitory Effect of Novel Tea Catechin Derivatives , *K. Kaihatsu and N. Kato: International Symposium of Joint Research Network on Advanced Materials and Devices, Hokkaido, Japan, March 25-26, 2010.

[18]Augmenting sensitivity of cancer cells to novel antitumor fusicoccin derivative (ISIR-042) by hypoxia , *Y. Honma, M. Akimoto, K. Takenaga, T. Sassa and N. Kato: AACR - NCI - EORTC International Conference: Molecular Targets and Cancer Therapeutics, Boston, USA, November 15-19, 2009.

[19]Synthetic Study of a Mycolic acid , *Y. Haranosono and N. Kato: International Workshop of Biofunctional Chemistry for Young Scientists, Hyogo, Japan, July 22-24, 2009.

[20]Development of Novel Differentiation Inducer Based on Fusicoccin Diterpene Glycosides , *Y. Maruyama, T. Inoue, Y. Honma, T. Sassa, and N. Kato: International Workshop of Biofunctional

Chemistry for Young Scientists, Hyogo, Japan, July 22-24, 2009.

[21] Treatment of Fusicoccane Diterpene Glycosides Combined with Interferon Leads to Apoptosis via Induction of Death Receptor 5 Expression, *T. Inoue, M. Yabu, and N. Kato: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5-6, 2009.

[22] The Study on Anti-cancer Activity of Fusicoccane Diterpene Glycosides-Synthetic Lethality in Combination Use with Interferon, *Y. Haranosono, T. Inoue, H. Nitta, Y. Honma, T. Sassa, and N. Kato: 13th SANKEN International Symposium 2010, Osaka, Japan, January 18-19, 2010.

[23] Studies on the Development of Anticancer Fusicoccin Derivatives Which Synergize with Interferon- α , *T. Inoue, H. Nitta, J. Ohkanda, and N. Kato: International Symposium of Joint Research Network on Advanced Materials and Devices, Hokkaido, Japan, March 25-26, 2010.

Contributions to International Conferences and Journals

N. KATO	Combinatorial Chemistry and Chemical Biology toward A New Paradigm for Drug Discovery (CCCB) (Organizing Committee)
J. OHKANDA	Switzerland-Japan Biomolecular Chemistry Symposium (Organizing Committee)
J. OHKANDA	Combinatorial Chemistry and Chemical Biology toward A New Paradigm for Drug Discovery (CCCB) (Organizing Committee)
K. KAIHATSU	Journal of Antiviral and Antiretrovirus (Editorial Board)

Publications in Domestic Meetings

The 90th of Annual Meeting of the Chemical Society of Japan	6 papers
130th Annual Meeting of the Pharmaceutical Society of Japan	1 paper
Annual Meeting of Japan Society for Biosci. Biotechnol. Agrochem. 2010	1 paper
51st Symposium on the Chemistry of Natural Products	1 paper
68th Annual Meeting of the Japanese Cancer Association	1 paper
39th Symposium on Heterocyclic Chemistry	1 paper
4th Annual Meeting of Japanese Society for Chemical Biology	1 paper
5th Host-Guest Chemistry Symposium	1 paper
35th Forum of Organic Reaction	1 paper
58th Polymer Science Symposium	1 paper
12nd Biomolecular Chemistry Symposium	1 paper
130th Medicinal Chemistry Meeting	1 paper
The 57th Annual Meeting of Japanese Society of Chemotherapy	1 paper
The 13th Japanese Symposium on the Chemistry of Biocatalysis	1 paper
The 5th Bio Optics Workshop	1 paper
Others	2 papers

Academic Degrees

Doctor of Philosophy	Studies on the Development of Anticancer Fusicoccin Derivatives which Synergize with Interferon- α
T. Inoue Doctor of Philosophy	Design, Synthesis, and Functional Evaluation of Prenyltransferase Inhibitors for Simultaneous Recognition of Interior and Exterior Protein Surfaces
S. Machida Master Degree for Science	Phosphopeptide-dependent 14-3-3 ζ Fluorescent Labeling by Fusicoccins
A. Kawamura Master Degree for Science	Development of 4-Carbamoylimidazolium 5-Olate as a Chemotherapeutics for Myelodysplastic Syndrome
C. Kondo Master Degree for Science	Inhibition of influenza virus infection by targeting genome conserved sequence with peptide nucleic acid
T. Takahashi Master Degree for	Synthesis and Biological Evaluation of Ketoclozazole Analogues as

Science	Antimicrobial Agents Targeting 1-Deoxyxylulose 5-Phosphate Synthase		
D. Hayashi	Synthesis and Biological evaluation of 16-O-Substituted Fusicoccin Derivatives		
Master Degree for Science			
M. Yabu	Synthesis of Guanidium-containing Prenyltransferase Inhibitors		
Bachelor of Science			
C. Oura	Grant-in-Aid for Scientific Research		
T. Inoue	Forward and Reverse Chemogenomics on 14-3-3 Proteins		¥900,000
Y. Higuchi	Chemical biology for understanding the functions of 14-3-3 protein		¥600,000
Entrusted Research			
N. Kato	Program for Promotion of Fundamental Studies in Health Sciences (NIBIO)	Development of New Anti-cancer Agents Based on the Differentiation-inducing Diterpene Glycoside	¥24,000,000
N. Kato	Biomedical Kansai: Applied Research Projects	Drug Development for Myelodysplastic Syndrome	¥14,000,000
K. Kaihatsu	NEDO (Industrial technology research and development projects) Foundation for Science Researches	Development of Screening Systems for Anti-RNA Virus Drugs Using Novel Tea Catechin Derivatives	¥16,250,000
K. Kaihatsu	Program for Promotion of Fundamental Studies in Health Sciences (NIBIO)	Rapid Diagnosis of Influenza Virus Strains by Triplex Forming Peptide Nucleic Acid	¥20,000,000
Contribution to Research			
N. Kato	MBR Co., Ltd.		¥250,000
J. Ohkanda	Eisai Co., Ltd.		¥1,200,000
J. Ohkanda	The Hayashi Memorial Foundation for Female Natural Scientists		¥150,000
J. Ohkanda	The Naito Memorial Foundation		¥3,000,000
Cooperative Research			
N. Kato	TMRC Co., Ltd.		¥2,500,000
N. Kato	Japan BCG Laboratory		¥2,000,000
Other Research Fund			
K. Kaihatsu	NPO Kinki Bio-Industry Development		¥2,000,000

Department of Structural Molecular Biology

Original Papers

- [1]Bionanocapsule-based enzyme-antibody conjugates for enzyme-linked immunosorbent assay, M. Iijima, T. Matsuzaki, H. Kadoya, S. Hatahira, S. Hiramatsu, G.M. Jung, K. Tanizawa, S. Kuroda: *Anal. Biochem.*, 396 (2) (2010) 257-261.
- [2]Accumulation of Polyubiquitinated Proteins by Overexpression of RBCC Protein Interacting with Protein Kinase C2, a Splice Variant of Ubiquitin Ligase RBCC Protein RBCK1 Interacting with Protein Kinase C1, N. Yoshimoto, K. Tatematsu, T. Okajima, K. Tanizawa, S. Kuroda: *FEBS Journal*, 276 (21) (2009) 6375-6385.
- [3]Human eosinophil cationic protein enhances stress fiber formation in Balb/c 3T3 fibroblasts and differentiation of rat neonatal cardiomyocytes, T. Fukuda, M. Iwata, M. Kitazoe, T. Maeda, D. Salomon, S. Hirohata, K. Tanizawa, S. Kuroda, M. Seno: *Growth Factors*, 27 (4) (2009) 228-236.
- [4]Novel antibacterial compounds specifically targeting the essential WalR response regulator, Y. Gotoh,

A. Doi, E. Furuta, S. Dubrac, Y. Ishizaki, M. Okada, M. Igarashi, N. Misawa, H. Yoshikawa, T. Okajima, T. Msadek, R. Utsumi: *J. Antibiot. (Tokyo)*, 63 (3) (2010) 127-134.

[5] Walkmycin B targets Walk (YycG), a histidine kinase essential for bacterial cell growth, A. Okada, M. Igarashi, T. Okajima, N. Kinoshita, M. Umekita, R. Sawa, K. Inoue, T. Watanabe, A. Doi, A. Martin, J. Quinn, Y. Nishimura, R. Utsumi: *J. Antibiot. (Tokyo)*, 63 (2) (2010) 89-94.

[6] A protein-protein interaction map of trypanosome ~20S editosomes, A. Schnauffer, M. Wu, Y. J. Park, T. Nakai, J. Deng, R. Proff, W. G. Hol, K. D. Stuart: *J. Biol. Chem.*, 285 (8) (2010) 5282-5295.

Review Papers

Mechanism of Biogenesis of Quinone Cofactor Derived from Tryptophan Residue with Intra-peptidyl Cross-link Structure, T. Okajima, K. Tanizawa, Kagaku-to-Seibutsu, Japan Society for Bioscience, Biotechnology, and Agrochemistry, 47[8] (2009), 522-524.

Books

[1] Bio-Nanocapsule-Liposome Conjugates for In Vivo Pinpoint Drug and Gene Delivery T. Kasuya, J.-H. Jung, R. Kinoshita, Y. Goh, T. Matsuzaki, M. Iijima, N. Yoshimoto, K. Tanizawa, S. Kuroda, "Methods in Enzymology", Academic Press, 464 (2009) 147-166.

[2] Cofactors of Amine Oxidases: Copper Ion and Its Substitution and the 2,4,5-Trihydroxyphenylalanine Quinone (Chapter 3)(G. Floris, B. Mondovi) S. Suzuki, T. Okajima, K. Tanizawa, M. Mure, "Copper Amine Oxidases: Structures, Catalytic Mechanisms, and Role in Pathophysiology", CRC Press, Taylor & Francis Group, (2009) 19-38.

[3] Mechanism of TPQ Biogenesis in Prokaryotic Copper Amine Oxidase (Chapter 8)(G. Floris, B. Mondovi) T. Okajima, K. Tanizawa, "Copper Amine Oxidases: Structures, Catalytic Mechanisms, and Role in Pathophysiology", CRC Press, Taylor & Francis Group, (2009) 103-118.

[4] Pin Point Drug and Gene Delivery System Using Hollow Bionano Particle(M. Ueda) S. Kuroda, K. Tanizawa, M. Seno, M. Ueda, "Nanobiotechnology -New Materials, Processes, and Devices- (Biotechnology Series)", CMC Press, (2009) 285-294.

International Conferences

[1] Reductive Half-reaction of Bacterial Copper Amine Oxidase is Controlled by the Conformational Change of the Topaquinone Cofactor (poster), T. Okajima, A. Hamaguchi, T. Nakai, K. Tanizawa: International Symposium of Joint Research Network on Advanced Materials and Devices, Chitose, Hokkaido, Japan, March 25-26, 2010.

[2] Reductive Half-reaction of Bacterial Copper Amine Oxidase is Controlled by the Conformational Change of the Topaquinone Cofactor (poster), T. Okajima, A. Hamaguchi, T. Nakai, K. Tanizawa: Memorial Symposium for the Establishment of Network Joint Research Center for Advanced Materials and Devices, Suita, Osaka, Japan, March 24, 2010.

[3] X-ray Crystallographic Evidence for Conformational Change of Topaquinone in the Reductive Half-reaction of Copper Amine Oxidase from *Arthrobacter globiformis* (poster), A. Hamaguchi, T. Okajima, T. Nakai, K. Tanizawa: Gordon Research Conference on Protein Cofactors, Radicals and Quinones, Ventura, CA, USA, January 24-29, 2010.

[4] Acid-Base Chemistry in the Reductive Half-Reaction of Copper Amine Oxidase from *Arthrobacter globiformis* (poster), T. Murakawa, H. Hayashi, T. Okajima, K. Tanizawa: Gordon Research Conference on Protein Cofactors, Radicals and Quinones, Ventura, CA, USA, January 24-29, 2010.

[5] X-ray Crystallographic Evidence for Conformational Change of Topaquinone in the Reductive Half-reaction of Bacterial Copper Amine Oxidase (poster), T. Okajima, A. Hamaguchi, T. Nakai, K. Tanizawa: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium -Industrial Green Science and Technology, Izumisano, Osaka, Japan, January 18-19, 2010.

[6] Structural bases for the specific interactions between the E2 and E3 components of the *Thermus thermophilus* 2-oxo acid dehydrogenase complexes (poster), T. Nakai: International Symposium of Joint Research Network on Advanced Materials and Devices, Chitose, Hokkaido, Japan, March 25-26, 2010.

Contributions to International Conferences and Journals

K. Tanizawa	Journal of Biochemistry (Chief Editor in Biochemistry)	
K. Tanizawa	Journal of Nutritional Science and Vitaminology (Associate Editor)	
K. Tanizawa	Federation of Asian and Oceanian Biochemists and Molecular Biologists (Delegate of Japan)	

Publications in Domestic Meetings

Annual Meeting of the Molecular Biology Society of Japan (MBM2009)	1 paper
Annual Meeting of the Japanese Biochemical Society	4 papers
Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry	1 paper
Annual Meeting of the Biophysical Society of Japan	1 paper
Annual Meeting of Protein Science Society of Japan	1 paper

Academic Degrees

Master Degree for Science	Functional Analysis of Signal Sequence in the α Subunit of Quinohemoprotein Amine Dehydrogenase
---------------------------	--

Y. Takaishi

Master Degree for Science	Mechanism of Formation of Semiquinone Radical Intermediate in the Copper-containing Amine Oxidase Catalytic Reaction
---------------------------	--

A. Hamaguchi

Master Degree for Frontier Biosciences	Chemical Structure Analysis of Quinohemoprotein Amine Dehydrogenase Subunits by FT-MS
--	---

A. Tanimura

Grant-in-Aid for Scientific Research

K. Tanizawa	Mechanism of Biogenesis and Catalytic Function of Peptidyl Built-in Quinone Cofactors	¥2,210,000
T. Okajima	Structural Basis for Activation of Glutamate-gated Chloride Channel by Binding Macrocyclic Lactones	¥1,690,000
T. Matsuzaki	Elucidation of Infection Mechanism of Hepatitis B Virus Using Bionanocapsule	¥2,730,000

Entrusted Research

T. Okajima	Bio-oriented Technology Research Advancement Institution (BRAIN)	Development of Drugs Inhibiting Bacterial Signal Transduction Based on X-ray Crystal Structures	¥5,100,000
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Contribution to Research

K. Tanizawa	Japan Foundation for Applied Enzymology	¥1,000,000
K. Tanizawa	Vitamin B Research Committee	¥150,000

Department of Cell Membrane Biology

Original Papers

[1]Electron tomography reveals the endoplasmic reticulum as a membrane source for autophagosome formation, M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: *Autophagy*, 6 (1) (2010) 301-303.

[2]A subdomain of the endoplasmic reticulum forms a cradle for autophagosome formation, M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: *Nature Cell Biology*, 11 (12) (2009) 1433-1437.

[3]H-NS modulates multidrug resistance of *Salmonella enterica* serovar Typhimurium by repressing multidrug efflux genes *acrEF*, K. Nishino, M. Hayashi-Nishino, Akihito Yamaguchi: *Antimicrob. Agents Chemother.*, 53 (8) (2009) 3541-3543.

[4]Characterization of the ATP-dependent sphingosine-1-phosphate transporter in rat erythrocytes, N. Kobayashi, N. Kobayashi, A. Yamaguchi, T. Nishi: *J. Biol. Chem.*, 284 (32) (2009) 21192-21200.

[5]Role of the AraC/XylS family regulator YdeO in multidrug resistance of *Escherichia coli*, K. Nishino,

Y. Senda, M. Hayashi-Nishino, A. Yamaguchi: J. Antibiot., 62 (5) (2009) 251-257.

[6]Regulation and physiological function of multidrug efflux pumps in *Escherichia coli* and *Salmonella*, K. Nishino, E. Nikaido, A. Yamaguchi: Biochim. Biophys. Acta-Proteins and Proteomics, 1794 (5) (2009) 834-43.

Review Papers

The Sphingolipid Transporter Spns2 Functions in Migration of Zebrafish Myocardial Precursors, A. Kawahara, T. Nishi, A. Yamaguchi, N. Mochizuki, CELL TECHNOLOGY, Gakken Medical Shujunsha Co., Ltd., 28[4] (2009), 390-391.

Regulation of the AcrAB multidrug efflux pump in *Salmonella enterica* serovar Typhimurium, E. Nikaido, I. Shirosaka, A. Yamaguchi, K. Nishino, Recent Advances in Clinical Pharmacology, Japan Research Foundation for Clinical Pharmacology, 30[29] (2009), 77-84.

Books

[1]Chemotherapeutics(A. Yamaguchi) A. Yamaguchi, “The forefront of antibiotic”, KYOTO HIROKAWA, 2010.

International Conferences

[1]Regulation of multidrug efflux pumps in *Escherichia coli* (poster), *Yamasaki, S., M. Nishino-Hayashi, A. Yamaguchi, and K. Nishino.: The 10th Japan-Korea International Symposium on Microbiology, Yokohama, Japan, March 26, 2010.

[2]Mechanism of the sphingosine 1-phosphate export from the cells (poster), *T. Nishi, Y. Hisano, N. Kobayashi, S. Kawasaki-Nishi, A. Yamaguchi: International Symposium of Joint Research Network on Advanced Materials and Devices, “Chou”, Hokkaido, Japan, March 25-26, 2010.

[3]Crystal structure of the substrate binding form of multidrug exporter AcrB (poster), *R. Nakashima, K. Sakurai, A. Yamaguchi: International Symposium of Joint Research Network on Advanced Materials and Devices, “Chou”, Hokkaido, Japan, March 25-26, 2010.

[4]Effects of NlpE overproduction on the induction of xenobiotic transporters involved in multidrug resistance in *Escherichia coli* (poster), *S. Yamasaki, M. Nishino-Hayashi, A. Yamaguchi, K. Nishino: The 13th SANKEN International Symposium, Osaka, Japan, January 18, 2010.

[5]Identification of the transporter that export sphingosine 1-phosphate from the cells (invited), *A. Yamaguchi: 11th International Conference - Cancun, Mexico, October 25-28, 2009.

[6]Autophagy and the Endoplasmic Reticulum (invited), *M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: 5th International Symposium on Autophagy Meeting, Otsu, Japan, September 24-28, 2009.

[7]Membrane-damaging activity of Phe-Arg- β -Naphthylamide in *Escherichia coli* (poster), *Y. Matsumoto, K. Hayama, R. Iino, K. Nishino, H. Noji, A. Yamaguchi: 49th ICAAC, Interscience Conference on Antimicrobial Agents and Chemotherapy, San Francisco, USA, September 12-15, 2009.

[8]Roles of xenobiotic transporters in bacterial drug resistance and virulence (poster), *K. Nishino, A. Yamaguchi: The Awaji International Forum on Infection and Immunity, Hyogo, Japan, September 8-11, 2009.

[9]Characterization of the ATP dependent sphingosine-1-phosphate (S1P) transporter in rat erythrocytes (poster), *N. Kobayashi, N. Kobayashi, T. Nishi, A. Yamaguchi: The 5th Takeda Science Foundation Symposium on PharmaSciences “Bioactive Lipid Molecules and Transporters”, Tokyo, Japan, May 25, 2009.

Contributions to International Conferences and Journals

A. YAMAGUCHI Journal of Bacteriology (Editorial Board Member)

Publications in Domestic Meetings

The 130 th Annual Meeting of the Pharmaceutical Society of Japan	2 papers
The 83 rd Annual Meeting of Japanese Society for Bacteriology	2 papers
The 44 th Annual Meeting of the Pseudomonas Aeruginosa Infection Society	1 paper

The 35 th Annual Meeting of Japan Bioenergetics Group		2 papers
31 st Symposium on Biomembrane-Drug Interaction		6 papers
The 57 th Annual Meeting of the Japanese Society of Chemotherapy, Western Japan Division		1 paper
The 19 th Annual Meeting of Japanese Association of Cardiovascular Pharmacology		1 paper
The 47 th Annual Meeting of the Biophysical Society of Japan		2 papers
The 82 nd Annual Meeting of the Japanese Biochemical Society		6 papers
11 th Annual Meeting for the Society of Evolutionary Studies, Japan		1 paper
The 52 nd Annual Meeting of the Japanese Society for Neurochemistry		1 paper
The 57 th Annual Meeting of the Japanese Society of Chemotherapy		2 papers
The 61 st Annual Meeting of the Japan Society for Cell Biology		1 paper
The 4 th Annual Meeting of the Japan Transporter Research Association		3 papers
The 9 th Annual Meeting of the Protein Society of Japan		1 paper
Academic Degrees		
Master Degree for Pharmaceutical Sciences	Roles of bacterial xenobiotic transporters in immune evasion	
T. Ueda		
Master Degree for Pharmaceutical Sciences	Study on mechanism of multidrug resistance in <i>Salmonella enterica</i> serovar Typhimurium	
I. Shirosaka		
Master Degree for Pharmaceutical Sciences	Evolutionary Studies on bacterial drug exporters	
M. Tanaka		
Master Degree for Pharmaceutical Sciences	Functional analysis of human spinster-like protein 3; a homologue of sphingosine 1-phosphate transporter, spns2	
M. Murata		
Doctor Degree for Pharmaceutical Sciences	Search for sphingosine 1-phosphate(S1P) efflux transporters and identification of a novel S1P transporter, Spns2	
Y. Hisano		
Grant-in-Aid for Scientific Research		
A. Yamaguchi	Structures, functions, regulations and physiological roles of xenobiotic exporters	¥21,580,000
T. Nishi	Identification of the sphingosine 1-phosphate transporters and its diverse physiological roles	¥1,040,000
T. Nishi	Comprehensive analysis of the export mechanism of bioactive lipids from the cells and identification of the universal mechanism of the bioactive lipid transporters	¥9,750,000
S. Nishi	Elucidation of control mechanisms of proton pump activity responding to environmental signals	¥800,000
E. Nikaido	Regulatory network of multidrug transporters reveals their physiological role in <i>Salmonella</i> virulence	¥600,000
Y. Hisano	Identification and physiological role of the sphingosine-1-phosphate export system in mouse platelets	¥600,000
Entrusted Research		
A. Yamaguchi	National Institute of Biomedical Innovation	Development of novel inhibitors that counteract infectious diseases by drug resistant bacteria
		¥84,000,000

A. Yamaguchi	The Naito Foundation Subsidy for Promotion of Specific Research Projects	Identification and investigation of the sphingosine-1-phosphate efflux transporters	¥1,500,000
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Department of Biomolecular Energetics

Original Papers

- [1]Biomolecular Nano-Flow-Sensor to Measure Near-Surface Flow, Lee S-W, Kinoshita H, Noji H, Fujii T, Yamamoto T: *Nanoscale Res Lett.*, 5 (2010) 296-301.
- [2]Protein assay using diffusion effect in single molecule micro-TAS, Nakayama T, Namura M, Tabata KV, Noji H, Yokokawa R: *Lab on a Chip*, 9 (2009) 3567-3573.
- [3]Acceleration of the ATP-binding rate of F₁-ATPase by forcible forward rotation, Iko, Y., Tabata, K.V., Sakakihara, S., Nakashima, T., Noji, H.: *FEBS Lett.*, 583 (2009) 3187-3191.
- [4]Visualization of cargo concentration by COPII minimal machinery in a planar lipid membrane, Tabata, K.V., Sato, K., Ide, T., Nishizaka, T., Nakano, A., Noji, H: *EMBO J.*, 28 (2009) 3279-3289.
- [5]Visualization of ATP levels inside single living cells with fluorescence resonance energy transfer-based genetically encoded indicators, Imamura, H., Huynh Nhat, K.P., Togawa, H., Saito, K., Iino, R., Kato-Yamada, Y., Nagai, T., Noji, H.: *Proc Natl Acad Sci U S A.*, 106 (2009) 15651-15656.
- [6]Single-molecule study on the temperature-sensitive reaction of F₁-ATPase with a hybrid F₁ carrying a single β (E190D), Enoki, S., Watanabe, R., Iino, R., Noji, H.: *J Biol Chem.*, 284 (2009) 23169-23176.
- [7]Mechanism of inhibition by C-terminal α -helices of the ϵ subunit of Escherichia coli F_oF₁-ATP synthase, Iino, R., Hasegawa, R., Tabata, K.V., Noji, H.: *J Biol Chem.*, 284 (2009) 17457-17464.
- [8]Single-biomolecule observation with micro one-way valves for rapid buffer exchange, Hirono-Hara, Y., Noji, H., Takeuchi, S: *J Appl. Phys.*, 105 (2009) 102016.

Review Papers

- Bioimaging towards the study of trans-hierarchical interplay in biological systems, H. Noji, T. Nagai, *PROTEIN, NUCLEIC ACID AND ENZYME, KYORITSU SHUPPAN CO., LTD*, 54[15] (2009), 1913-1917.
- Imaging of intracellular ATP using novel fluorescent probes, H. Imamura, H. Noji, *PROTEIN, NUCLEIC ACID AND ENZYME, KYORITSU SHUPPAN CO., LTD*, 54[15] (2009), 1937-1944.
- Single-molecule analysis in Biophysics, H. Noji, *Chemistry & Chemical Industry, The Chemical Society of Japan*, 62[10] (2009), 1082-1084.
- Single-molecule assay of biological reaction in femtoliter chamber array, Iino R., Lam L., Tabata K. V., Rondelez Y., *Japanese Journal of Applied Physics, Japan Society of Applied Physics*, 48 (2009), 08JA04-1-5.

Books

- [1]Supramolecular molecular motor in biomembrane - A rotary energy conversion machine of the cell: ATP synthase(T. Kokubu) R. Iino, K. Tabata, H. Noji, "Supramolecular Science and Technology - From Basics to Innovations", NTS, (4[1-1]) 2009.

International Conferences

- [1]36-degree stepping rotation of F_oF₁-ATP synthase (oral), *Hiroyuki Noji, Ryota Iino: International Symposium "Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes" (Kyoto, Japan), 2009/9/8-10.
- [2]Direct observation of steps in c-ring rotation of Escherichia coli F_oF₁-ATP synthase (oral), *Ryota Iino: *WBMA '09*(Osaka, Japan), 2009/12/15-17.
- [3]Completion of the chemomechanical coupling scheme of F₁-ATPase: Pi-release and torque generation (invited), *Hiroyuki Noji: *WBMA '09*(Osaka, Japan), 2009/12/15-17.
- [4]Imaging of Intracellular ATP Using FERT-Based Indicators (invited), *Hiroyuki Noji: International

Symposium of Joint Research Network on Advanced Materials and Devices “彫” (Hotel-NIDOM Hokkaido), 2010/3/25.

[5] Torque measurements of F_1 -ATPase using non-equilibrium fluctuation theories (poster), *Kumiko Hayashi, Hiroshi Ueno, Ryota Iino, Hiroyuki Noji: International Symposium on “Reaction Dynamics of Many-Body Chemical Systems” (Kyoto, Japan), 2009/6/22-24.

[6] Development of fluorescent indicators capable of measuring ATP under acidic condition (poster), *Masahiro Nakano, Hiromi Imamura, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[7] Angle Dependency of ATP binding Event in V_1 -ATPase (poster), *Naciye Esmâ Uner, Masahiro Nakano, Daichi Okuno, Ken Yokoyama, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[8] The completion of chemo-mechanical coupling scheme of F_1 -ATPase; The determination of the timing of Pi-release (poster), *Rikiya Watanabe, Hiroshi Ueno, Ryota Iino, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[9] On the relationship between global conformational flexibility of F_1 -ATPase ϵ subunit and its affinity to ATP (poster), *Kim Phuong Huynh Nhat, Hiroko Togawa, Hiromi Imamura and Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[10] Single-Molecule Study on the Temperature-sensitive Reaction of F_1 -ATPase with a Hybrid F_1 Carrying a Single β (E190D) (poster), *Sawako Enoki, Rikiya Watanabe, Ryota Iino, and Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[11] Single-Molecule Measurement of Kinetic Parameters of F_1 -ATPase Enclosed in Water-in-Oil Microchamber Array (poster), *Suguru Ararki, Ryota Iino, Shouichi Sakakihara, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[12] Interaction between C Terminus Domain of β Subunit and γ Subunit of F_1 -ATPase (poster), *Mizue Tanigawara, Kazuhito V. Tabata, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[13] Torque measurements of F_1 -ATPase by using the fluctuation theorem (poster), *Kumiko Hayashi, Hiroshi Ueno, Ryota Iino and Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[14] 36° Steps in ATP-driven Rotation of Escherichia coli F_0F_1 -ATP Synthase (poster), *Ryota Iino, Khék-Chian Tham, Kazuhito V. Tabata, Hiroshi Ueno, and Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[15] The Development of Genome Replaced Bacteria for Production of Useful Substances (poster), *Kumiko Arata, Kazuhito V. Tabata, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[16] Development of a Force-Clamping System to Study the Torque Generation Mechanism of F_1 -ATPase (poster), *Huijuan You, Ryota Iino, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[17] Development, Manipulation, and Biological Application of the Water-in-Oil Microchamber Array Accessible from Outside (poster), *Ryota Iino, Shouichi Sakakihara, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[18] Simple Dark-field Microscopy with Nanometer Spatial Precision and Microsecond Temporal

- Resolution (poster), *Hiroshi Ueno, So Nishikawa Ryota Iino, Kazuhito V. Tabata, Shouichi Sakakihara, Toshio Yanagida and Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.
- [19] Stiffness of γ Subunit of F_1 -ATPase (poster), *Daichi Okuno, Ryota Iino, Rie Hasegawa, Hiroyuki Noji: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.
- [20] Preparation and Biological Application of Water-In-Oil Microchamber Array Formed on Hydrophobic/Hydrophilic Patterned Surface (poster), *R. Iino, S. Sakakihara, H. Noji: μ TAS 2009 (Jeju Korea), 2009/11/1-5.
- [21] Fluctuation theorem applied to F_1 -ATPase (poster), *Kumiko Hayashi, H. Noji: WBMA’ 09 (Osaka, Japan), 2009/12/15-17.
- [22] Development of a force-clamping system to study the torque generation mechanism of F_1 -ATPase (poster), *Huijuan You, H. Noji: WBMA’ 09 (Osaka, Japan), 2009/12/15-17.
- [23] Simple Dark-Field Microscopy with Nanometer Spatial Precision and Microsecond Temporal Resolution (poster), Hiroshi Ueno, So Nishikawa, *Ryota Iino, Kazuhito V. Tabata, Shouichi Sakakihara, Toshio Yanagida, Hiroyuki Noji: The 3rd International Symposium “Molecular Science of Fluctuations toward Biological Functions” (Nagoya, Japan), 2009/12/20-21.
- [24] Fluctuation theorem applied to F_1 -ATPase (poster), *Kumiko Hayashi, Hiroshi Ueno, Ryota Iino, Hiroyuki Noji: Biophysical Society 54th Annual Meeting (San Francisco (USA)), 2010/2/24.
- [25] The role of Pi-release as the main torque generating step of F_1 -ATPase (poster), *Rikiya Watanabe, Hiroshi Ueno, Ryota Iino, Hiroyuki Noji: Biophysical Society 54th Annual Meeting (San Francisco (USA)), 2010/2/24.
- [26] Single-Molecule Imaging of Ion-Transporting Rotary Motor Protein (poster), *Ryota IINO: International Symposium of Joint Research Network on Advanced Materials and Devices “彫” (Hotel-NIDOM Hokkaido), 2010/3/25.

Contributions to International Conferences and Journals

- H. Noji International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Organizing Committee)
- H. Noji International symposium of Post-Silicon Materials and Devices Research Alliance Project (Organizing Committee)

Publications in Domestic Meetings

- | | |
|--|-----------|
| Biophysical Society of Japan | 11 papers |
| Protein Science Society of Japan | 3 papers |
| The Japanese Biochemical Society | 2 papers |
| Japan Bioenergetics Group | 2 papers |
| Japan Society for Bioscience, Biotechnology, and Agrochemistry | 1 paper |

Academic Degrees

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|-------------------------------|--|
| Doctor Degree for Engineering | Elucidation of the chemomechanical coupling scheme of F_1 -ATPase |
| R. Watanabe | |
| Master Degree for Engineering | The effect of the critical residues; \square R364, \square E190, \square K164, for ATP hydrolysis on F_1 -ATPase |
| Y. Matsukage | |
| Master Degree for Engineering | Development of exchange procedure of hole genome DNA in bacteria |
| K. Arata | |
| Master Degree for Engineering | Mechanical Modulation of ATP Binding Affinity of V_1 -ATPase |
| Nasice Esma Uner | |

Grant-in-Aid for Scientific Research			
H. Noji	Innovative nanoscience of supermolecular motor proteins working in biomembranes	¥14,100,000	
H. Noji	Rotational mechanism of FoF1-ATP synthase	¥45,300,000	
R. Iino	Visualization of the rotary motion of the ATP synthase by single-molecule techniques and microdevices.	¥2,990,000	
K. Hayashi	Construction of statistical mechanics on proteins by using protein simulations	¥800,000	
R. Iino	Development of an ultra-high speed optical microscope for the investigation of correlation between the conformational fluctuation and the performance of motor proteins	¥3,640,000	
Entrusted Research			
H. Noji	Japan Science and Technology Agency	Single-molecular Mechanochemistry of Artificial molecules	¥6,500,000
Contribution to Research			
R. Iino	NAGASE Science Technology Development	¥2,500,000	
R. Iino	Kowa Life Science Foundation	¥1,000,000	
Cooperative Research			
H. Noji	Japan Science and Technology Agency	¥12,850,000	

Department of Functional Nanomaterials and Nanodevices

Original Papers

- [1]X-ray absorption magnetic circular dichroism of (La,Ce)MnO₃ thin films, T. Yanagida, Y. Saitoh, Y. Takeda, A. Fujimori, H. Tanaka, T. Kawai: Phys. Rev. B, 79 (2009) 132405.
- [2]Controlled Fabrication of Epitaxial (Fe,Mn)3O₄ Artificial Nanowire Structures and their Electric and Magnetic Properties, K. Goto, H. Tanaka, T. Kawai: Nano Letters, 9 (2009) 1962-1966.
- [3]Magnetic properties of the integrated (Fe,M)3O₄ (M=Mn and Zn) nano array structures in large area prepared by Nanoimprint lithography with Mo lift-off technique S.Yamanaka, N. Suzuki, B. K. Lee, H. Y. Lee, H. Tanaka, T. Kawai Solid State Commun., 149 (2009) 729-733. (May, 2009), S.Yamanaka, N. Suzuki, B. K. Lee, H. Y. Lee, H. Tanaka, T. Kawai: Solid State Commun., 149 (2009) 729-733.
- [4]Interfacial interactions between calcined hydroxyapatite nanocrystals and substrates, M. Okada, K. Furukawa, T. Serizawa, Y. Yanagisawa, H. Tanaka, T. Kawai, T. Furuzono: Langmuir, 25 (2009) 6300-6306.
- [5]Magnetoresistance and Microstructure of Magnetite Nanocrystals Dispersed in Indium-Tin Oxide Thin Films, K. Okada, S. Kohiki, M. Mitome, H. Tanaka, M. Arai, M. Mito, H. Deguchi: ACS Applied Materials & Interfaces, 1 (2009) 1893-1898.
- [6]Direct fabrication of integrated 3D Au nanobox arrays by sidewall deposition with controllable heights and thicknesses, N.-G. Cha, B. K. Lee, T. Kanki, H. Y. Lee, T. Kawai, H. Tanaka: Nanotechnology, 20 (2009) 395301.
- [7]Specific surface effect on transport properties of NiO/MgO heterostructured nanowires, K. Oka, T. Yanagida, K. Nagashima, H. Tanaka, S. Seki, Y. Honsho, M. Ishimaru, A. Hirata, T. Kawai: Appl. Phys. Lett., 95 (2009) 133110.
- [8]Mn 2p core-level spectra of La_{1-x}Ba_xMnO₃ thin films using hard x-ray photoelectron spectroscopy: Relation between electronic and magnetic states, S. Ueda, H. Tanaka, E. Ikenaga, J. J. Kim, T. Ishikawa, T. Kawai, K. Kobayashi: Phys. Rev. B, 80 (2009) 092402.
- [9]Fabrication of Single Crystalline (La,Ba)MnO₃ Nanodot Array by Mo/SiO_x Lift-Off Technique, N. Suzuki, H. Tanaka, T. Kawai: Jpn. J. Appl. Phys., 48 (2009) 116511.

Patents

- [1]Semiconductor Junction device H. Tanaka, T. Kawai, P4326968

[2]Comparator, noise generator and stochastic resonance device T. Kanki, Y. Hotta, N. Asakawa, T. Kawai, H. Tanaka, PCT/JP2009/ 67261

International Conferences

[1]Control of Metal-Insulator Transition at Room Temperature on W doped VO₂ Thin Films (poster), *H. Takami, T. Kanki, N.G. Cha, H. Tanaka: The Korean Physical Society Fall Meeting, 2009.10. 21-23, Korea, ChangWon.

[2]Control of Metal-Insulator Transition Temperature in W-doped VO₂ Thin Films and Investigation of Their Electronic Properties (poster), *H. Takami, T. Kanki, S. Ueda, N.G. Cha, H. Tanaka: 13th SANKEN International Symposium 2010, 2010.1.18-19, Osaka, Japan.

[3]Direct Fabrication of an 80-nm Integrated Fe_{2.5}Mn_{0.5}O₄ (FMO) Nanocrystal Arrays in Large Area Using a Hollow Nanopillar Metal Mask for High Temperature (poster), *N.G. Cha, T. Kanki, H. Tanaka: 2009 MRS Fall Meeting, 2009.11.30-12.4, Boston, USA.

[4]Fabrication of the Epitaxially grown Fe_{2.5}Mn_{0.5}O₄ (FMO) Nanocrystal Arrays in Large Area Using a Hollow Mo Nanopillar Metal Mask (poster), *N.G. Cha, T. Kanki, H. Tanaka: 13th SANKEN International Symposium 2010, 2010.1.18-19, Osaka, Japan.

[5]Functional oxide nano-electronics (invited), *H. Tanaka, T. Kawai: 7th International Nanotechnology Symposium (Nano fair 2009), 2009.5.26-27, Dresden, Germany.

[6]Surface Nanopatterning for Spintronics (invited), *H. Tanaka: 7th New England International Nanomanufacturing Workshop, 2009.6.18-19, Boston, USA.

[7]Construction of 3D transition metal oxide nano superstructures and their physical properties toward device application (invited), *H. Tanaka, N.G. Cha, S. Yamanaka, T. Kanki, T. Kawai: International Symposium on Sputtering and Plasma Processes (ISSP) 2009, 2009.7.8-10, Kanazawa, Japan.

[8]Controlled Fabrication of Epitaxial Magnetic Oxide Artificial Nano-Constriction Structures and their Giant Magnetoresistive properties at room temperature (oral), *H. Tanaka: 16th International Workshop on Oxide Electronics (WOE 16), 2009.10.4-7, Tarragona, Spain.

[9]Controlled Fabrication of Epitaxial Functional Oxide Artificial Nano-wire and Nano-dot Structures and their giant properties (invited), *H. Tanaka: CNR-INFM-LAMIA Seminar, 2009.10.9, Genova, Italy.

[10]Controlled Fabrication of Complex Oxide Epitaxial Artificial Nano-wire and Nano-dot Structures and Their Giant Properties (invited), *H. Tanaka: The Korean Physical Society Fall Meeting, 2009.10. 21-23, Korea, ChangWon.

[11]Controlled Fabrication of Epitaxial Ferromagnetic Oxide Artificial Nano-Constriction Structures and their Giant Magnetoresistive Properties at Room Temperature (oral), *H. Tanaka, K. Goto, T. Kawai: 2009 MRS Fall Meeting, 2009.11.30-12.4, Boston, USA.

[12]Enhancement of Spin Polarization in (Fe, Zn) 3O₄ Ferromagnetic Oxide Nano Dot Diodes (oral), S. Yamanaka, T. Kawai, *H. Tanaka: 2009 MRS Fall Meeting, 2009.11.30-12.4, Boston, USA.

[13]Functional Oxide Nano Spintronics (invited), *H. Tanaka: International Conference on Magnetism and Advanced Materials(ICMAM-2010), 2010.3.3-7, Dhaka, Bangladesh.

[14]Noise-induced enhancement of signal transfer in vanadium dioxide by stochastic resonance (oral), *T. Kanki, Y. Hotta, N. Asakawa, T. Kawai, H. Tanaka: 16th International Workshop on Oxide Electronics (WOE 16), 2009.10.4-7, Tarragona, Spain.

[15]Stochastic Resonance in Vanadium Dioxide: Toward Creation of Bio-mimetic Devices with Neuronal Signal Processing (invited), *T. Kanki: CNR-INFM-LAMIA Seminar, 2009.10.9, Genova, Italy.

[16]Enhancement of Information Transfer by Noise using Nonlinear Electronic Property in Vanadium Dioxide Thin Films (poster), *T. Kanki, Y. Hotta, N. Asakawa, T. Kawai, H. Tanaka: 5th Handai Nanoscience and Nanotechnology International Symposium, 2009.9.1-3, Osaka, Japan.

[17]Enhancement of Signal Transfer by Noise in VO₂ Thin Films: Towards creation of bio-mimetic signal processors with extreme energy-saving using ambient noise energy (poster), *T. Kanki, Y. Hotta, N.

Asakawa, T. Kawai, H. Tanaka: 13th SANKEN International Symposium 2010, 2010.1.18-19, Osaka, Japan.

Publications in Domestic Meetings

2009 JSAP Fall Meeting	4 papers
2010 JSAP Spring Meeting	5 papers
The 6th Technological exchange workshop, Sputtering and Plasma Process Sub-Division The Vacuum Society of Japan	1 paper
Collaborative research project type S, The Research Institute of Electrical Communication, Tohoku University, Human mimetic Telecommunication system	1 paper
The Symposium of Frontier nano-device technology committee No. 151, Japan Society for the Promotion of Science	1 paper
The 28th Spin Electronics Workshop, The Magnetics Society of Japan	1 paper
The Physical Society of Japan the 65th Annual Meeting	1 paper

Grant-in-Aid for Scientific Research

H. Tanaka	Novel Nano-electronics based on Strongly Correlated Oxides	¥29,900,000
T. Kanki	Creation of novel photoinduced-magnetic oxide materials and application to spintronic devices	¥910,000
T. Kanki	Creation of novel electronic materials and devices with bio-functionalities	¥10,790,000

Entrusted Research

H. Tanaka	National Institute for Materials Science	Development of Hard X-ray Photoemission Microscope for 3 Dimensional Chemical State Analysis	¥1,300,000
H. Tanaka	Japan Society for the Promotion of Science	Fabrication of Nano-scale Oxide Heterostructures by Combination of Top-down and Bottom-up Nanotechnologies	¥1,200,000
H. Tanaka	Japan Science and Technology Agency	Development of sustainable oxide semiconductor spintronics devices	¥2,000,000
T. Kanki	Japan Science and Technology Agency	Development of low voltage-driven comparator and noise generator for creation of bio-mimetic devices	¥2,000,000

Other Research Fund

H. Tanaka	New Energy and Industrial Technology Development Organization	¥1,300,000
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Department of Advanced Nanofabrication

Original Papers

- [1] Breaking time-resolution limits in pulse radiolysis, J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida, S. Tagawa: *Radiat. Phys. Chem.*, 78 (2009) 1164-1168.
- [2] 100-femtosecond MeV electron source for ultrafast electron diffraction, J. Yang, K. Kan, N. Naruse, Y. Yoshida, K. Tanimura, J. Urakawa: *Radiat. Phys. Chem.*, 78 (2009) 1106-1111.
- [3] Pulse radiolysis study of ion-species effects on the solvated electron in alkylammonium ionic liquids, T. Kondoh, A. Asano, J. Yang, K. Norizawa, K. Takahashi, M. Taguchi, R. Nagaishi, R. Katoh, Y. Yoshida: *Radiat. Phys. Chem.*, 78 (2009) 1157-1160.
- [4] Pulse radiolysis study of trapped electron in MgSO₄·7H₂O single crystal, K. Norizawa, T. Kondoh, J. Yang, A. Ogata, Y. Yoshida: *Radiat. Phys. Chem.*, 78 (2009) 1153-1156.
- [5] Collective Energy Loss of Attosecond Electron Bunches, A. Ogata, T. Kondoh, K. Norizawa, J. Yang, Y. Yoshida: *Jpn. J. Appl. Phys.*, 48 (2009) 056002.
- [6] Improvement of an S-band RF gun with a Cs₂Te photocathode for the KEK-ATF, N. Terunuma, A. Murata,

- M. Fukuda, K. Hirano, Y. Kamiya, T. Kii, M. Kuriki, R. Kuroda, H. Ohgaki, K. Sakaue, M. Takano, T. Takatomi, J. Urakawa, M. Washio, Y. Yamazaki, J. Yang: Nucl. Instrum. Method A, 613 (2009) 1-8.
- [7]Development of Modulated Electron Beam for Intensity Modulated Radiation Therapy (IMRT) on a Photocathode Electron Gun, T. Kondoh, J. Yang, K. Kan, Y. Yoshida: RADIATION CHEMISTRY, 88 (2009) 28-32.
- [8]Theoretical Study on Chemical Gradient Generated in Chemically Amplified Resists Based on Polymer Deprotection upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa, S. Tagawa: Appl. Phys. Express, 2 (5) (2009) 056503.
- [9]Difference of Spur Distribution in Chemically Amplified Resists upon Exposure to Electron Beam and Extreme Ultraviolet Radiation, T. Kozawa, K. Okamoto, A. Saeki, S. Tagawa: Jpn. J. Appl. Phys., 48 (5) (2009) 056508.
- [10]Bottom Extreme-Ultraviolet- Sensitive Coating for Evaluation of the Absorption Coefficient of Ultrathin Film, H. Hijikata, T. Kozawa, S. Tagawa, S. Takei: Appl. Phys. Express, 2 (6) (2009) 066503.
- [11]Effect of Molecular Structure on Depth Profile of Acid Generator Distribution in Chemically Amplified Resist Films, T. Fukuyama, T. Kozawa, K. Okamoto, S. Tagawa, M. Irie, T. Mimura, T. Iwai, J. Onodera, I. Hirose, T. Koganesawa, K. Horie: Jpn. J. Appl. Phys., 48 (6) (2009) 06FC03.
- [12]Correlation between C37 Parameters and Acid Yields in Chemically Amplified Resists upon Exposure to 75 keV Electron Beam, K. Natsuda, T. Kozawa, K. Okamoto, A. Saeki, S. Tagawa: Jpn. J. Appl. Phys., 48 (6) (2009) 06FC05.
- [13]Dynamics of Radical Cation of Poly(4-hydroxystyrene) and Its Copolymer for Extreme Ultraviolet and Electron Beam Resists, K. Okamoto, M. Tanaka, T. Kozawa, S. Tagawa: Jpn. J. Appl. Phys., 48 (6) (2009) 06FC06.
- [14]Reactivity of Halogenated Resist Polymer with Low-Energy Electrons, H. Yamamoto, T. Kozawa, A. Saeki, S. Tagawa, T. Mimura, H. Yukawa, J. Onodera: Jpn. J. Appl. Phys., 48 (6) (2009) 06FC09.
- [15]Relationship between Resolution, Line Edge Roughness, and Sensitivity in Chemically Amplified Resist of Post-Optical Lithography Revealed by Monte Carlo and Dissolution Simulations, A. Saeki, T. Kozawa, S. Tagawa: Appl. Phys. Express, 2 (7) (2009) 075006.
- [16]Image Formation in Chemically Amplified Resists upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa, S. Tagawa: J. Photopolym. Sci. Technol., 22 (6) (2009) 51-58.
- [17]Effect of Polymer Protection and Film Thickness on Acid Generator Distribution in Chemically Amplified Resists, T. Fukuyama, T. Kozawa, H. Yamamoto, S. Tagawa, M. Irie, T. Mimura, T. Iwai, J. Onodera, I. Hirose, T. Koganesawa, K. Horie: J. Photopolym. Sci. Technol., 22 (6) (2009) 105-109.
- [18]Normalized Image Log Slope with Secondary Electron Migration Effect in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, S. Tagawa: Appl. Phys. Express, 2 (9) (2009) 095004.
- [19]Origin of frequency-dependent line edge roughness: Monte Carlo and fast Fourier-transform studies, A. Saeki, T. Kozawa, S. Tagawa: Appl. Phys. Lett., 95 (2009) 103106.
- [20]Effects of Flare on Latent Image Formation in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, S. Tagawa: Jpn. J. Appl. Phys., 48 (9) (2009) 095005.
- [21]Exposure Dose Dependence of Chemical Gradient in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, S. Tagawa: Jpn. J. Appl. Phys., 48 (10) (2009) 106504.
- [22]Latent Image Created Using Small-Field Exposure Tool for Extreme Ultraviolet Lithography, T. Kozawa, H. Oizumi, T. Itani, S. Tagawa: Jpn. J. Appl. Phys., 48 (10) (2009) 106506.
- [23]Evaluation of Chemical Gradient Enhancement Methods for Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, H. Oizumi, T. Itani, S. Tagawa: Jpn. J. Appl. Phys., 48 (12) (2009) 126004.

Review Papers

New applications of radiation beams, Y. Yoshida, Radiation for industry, Japanese Society of Radiation

Chemistry, 124 (2009), 1-2.

Study on Materials and Processes of Chemically Amplified Resists for Electron Beam and Extreme Ultraviolet Lithography, T. Kozawa, Radiation Chemistry, Japanese Society of Radiation Chemistry, 87 (2009), 2-13.

Optical Modulation of Electron Beam by the Digital Micro Mirror Device for the Radiation Therapy based on the Photocathode RF Gun, T. Kondoh, Radiation Chemistry, Japanese Society of Radiation Chemistry, 88 (2009), 28-32.

International Conferences

[1]From Solvated Electron to Hydrated Electron in Ionic Liquids by Controlling Water Content (poster), *T. Kondoh, J. Yang, K. Norizawa, Y. Yoshida, R. Nagaishi, M. Taguchi, K. Takahashi, R. Katoh: Radiation Chemistry in the 21st Century, Notre Dame, USA, July 12-15, P48, 2009.

[2]Femtosecond pulse radiolysis study: Observations of solvation process in water and of geminate ion recombination in alkane in femtosecond time scale (poster), *J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida: Radiation Chemistry in the 21st Century, Notre Dame, USA, July 12-15, P48, 2009.

[3]Femtosecond Time-Resolved Stroboscope for Study of Nanofabrication Process (poster), *J. Yang, T. Kondoh, K. Kan, K. Norizawa, Y. Yoshida: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, Japan, September 1-3, P1-12, 2009.

[4]Effect of Coexist-Water on Solvated Electron in Ionic Liquids for Formation of Nano Particle (poster), *T. Kondoh, J. Yang, K. Norizawa, Y. Yoshida, R. Nagaishi, M. Taguchi, K. Takahashi, R. Katoh: 5th Handai Nanoscience and Nanotechnology International Symposium, Osaka University, Osaka, Japan, September 1-3, P1-12, 2009.

[5]Femtosecond pulse radiolysis and femtosecond electron diffraction (invited), *J. Yang, K. Kan, T. Kondoh, N. Naruse, Y. Yoshida, K. Tanimura, J. Urakawa: International Workshop on Ultrashort Electron & Photon Beams: Techniques & Applications, Xi'an, China, September 7-11, 2009.

[6]Collective Energy Loss of Attosecond Electron Bunches (poster), *A. Ogata, T. Kondoh, K. Norizawa, J. Yang, Y. Yoshida, S. Kashiwagi: International Workshop on Ultrashort Electron & Photon Beams: Techniques & Applications, Xi'an, China, September 7-11, 2009.

[7]Primary process of radiation chemistry for green nanotechnology (oral), *Y. Yoshida: The 13th Sanken International Symposium, Kansai, Jan. 18-19, 2010.

[8]Spatial resolution of intensity-modulated electron beam generated with photocathode rf gun linac (poster), *K. Kan, T. Kondoh, J. Yang, K. Norizawa, T. Kozawa, Y. Yoshida: The 13th Sanken International Symposium, Kansai, Jan. 18-19, 2010.

[9]Femtosecond time-resolved spectroscopy based on a femtosecond electron beam and a femtosecond laser light (poster), *J. Yang, T. Kondoh, K. Kan, K. Norizawa, Y. Yoshida: The 13th Sanken International Symposium, Kansai, Jan. 18-19, 2010.

[10]Femtosecond pulse radiolysis study of geminate ion recombination in n-dodecane (poster), *T. Kondoh, J. Yang, K. Kan, K. Norizawa, A. Ogata, Y. Yoshida, S. Tagawa: The 13th Sanken International Symposium, Kansai, Jan. 18-19, 2010.

[11]Pulse radiolysis study of Hydrated Electron in MgSO₄ Aqueous Solution with scavenger (poster), *K. Norizawa, T. Kondoh, J. Yang, K. Kan, Y. Yoshida: The 13th Sanken International Symposium, Kansai, Jan. 18-19, 2010.

[12]Femtosecond photocathode electron gun for time-resolved electron diffraction (invited), *J. Yang, N. Naruse, Y. Murooka, Y. Yoshida, K. Tanimura, J. Urakawa: Particle Accelerator Conference (PAC09), Vancouver, Canada, May 4-8, 2009.

[13]Applications of femtosecond electron beam: femtosecond pulse radiolysis and femtosecond electron diffraction (invited), *J. Yang: The 1st joint Asian accelerator workshop: accelerator techniques and their applications, Beijing, China, Dec. 21-23, 2009.

[14]Ultrafast electron diffraction (invited), *J. Yang: 3rd ILC Asian R&D Seminar under Core-University

Program: Advanced Accelerator Workshop 2010, Mumbai, India, March 9-10, 2010.

[15]Optical Modulation of Electron Beam by the Digital Micro Mirror Device for the Radiation Therapy based on the Photocathode RF Gun (poster), *T. Kondoh, H. Kashima, J. Yang, K. Kan, K. Norizawa, A. Ogata, Y. Yoshida, T. Tagawa: 12th SANKEN International Symposium 7th Nanotechnology Center International Symposium 2nd MSTeC International Symposium, Osaka, JAPAN, January 22, 2009.

[16]Dissolution kinetics and deprotection reaction in chemically amplified resists upon exposure to extreme ultraviolet radiation (poster), H. Yamamoto, T. Kozawa, S. Tagawa, T. Mimura, T. Iwai, J. Onodera: SPIE Advanced Lithography, Proc. SPIE 7273, 72731X (2009).

[17]Evaluation of alcoholic hydroxyl derivatives for chemically amplified extreme ultraviolet resist (poster), K. Furukawa, T. Kozawa, S. Tagawa: SPIE Advanced Lithography, Proc. SPIE 7273, 72731Y (2009).

[18]Development Status and Future Prospect of Extreme Ultraviolet Resists (invited), T. Kozawa: 2009 International Workshop on EUV Lithography, Honolulu, Hawaii, USA, July 13-17, 2009.

[19]Dependence of Acid Yield on Polymer Structure in EUV Chemically Amplified Resist (poster), H. Yamamoto, T. Kozawa, S. Tagawa, T. Iwai, J. Onodera: 2009 International Workshop on EUV Lithography, Honolulu, Hawaii, USA, July 13-17, 2009.

[20]Monte Carlo Simulation of Chemical Intermediates in CARs (oral), A. Saeki, T. Kozawa, S. Tagawa: 2009 International Workshop on EUV Lithography, Honolulu, Hawaii, USA, July 13-17, 2009.

[21]Image Formation in Chemically Amplified Resists upon Exposure to Extreme Ultraviolet Radiation (invited), T. Kozawa, S. Tagawa: 26th International Conference of Photopolymer Science and Technology (ICPST-26) Conference, Chiba, Japan, June 30 - July 3, 2009, A-06.

[22]Modeling and simulation of chemically amplified resists for EUV lithography (invited), T. Kozawa, S. Tagawa: 7th Fraunhofer IISB Lithography Simulation Workshop, Hersbruck, Germany, Sep. 25–27, 2009.

[23]Relationship Between Pattern Collapse and Deprotection Intermediate Region (invited), T. Kozawa, H. Oizumi, T. Itani, S. Tagawa: IEUVI Resist TWG Meeting, Prague, Czech Republic, Oct. 18, 2009.

[24]Study on Depth Profile of Acid Generator Distribution in Poly(4-hydroxystyrene) films by Using X-ray Photoemission Spectroscopy (XPS) (poster), H. Yamamoto, T. Kozawa, S. Tagawa: EUV Symposium, Prague, Czech Republic, Oct. 18-23, 2009.

[25]Bottom Extreme-Ultraviolet-Sensitive Coating for Evaluation of the Absorption Coefficient of Ultrathin Film (poster), H. Hijikata, T. Kozawa, S. Tagawa, S. Takei: EUV Symposium, Prague, Czech Republic, Oct. 18-23, 2009.

[26]Latent Image Created using Selete Small-Field Exposure Tool for Extreme Ultraviolet Lithography (poster), T. Kozawa, H. Oizumi, T. Itani, S. Tagawa: EUV Symposium, Prague, Czech Republic, Oct. 18-23, 2009.

[27]Relationship between Normalized Image Log Slope (NILS) and Chemical Gradient in Chemically Amplified Extreme Ultraviolet Resists –Effect of Secondary Electron Migration Migration (poster), T. Kozawa, S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

[28]Effect of Direct Excitation of Acid Generators upon Exposure to Extreme Ultraviolet Radiation (poster), H. Yamamoto, T. Kozawa, S. Tagawa, T. Hirayama, T. Iwai, K. Sato: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

[29]Short-Lived Intermediates of Fluorinated Benzene Derivatives Generated upon Exposure to Ionizing Radiation (poster), S. Higashino, K. Okamoto, A. Saeki, T. Kozawa, S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

[30]Dynamics of Radical Cation of Protected Poly(4-Hydroxystyrene)s for EUV and Electron Beam Resists (oral), K. Okamoto, M. Tanaka, T. Kozawa, S. Tagawa, T. Sumiyoshi: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

[31]Study on Radiation Chemistry of Fluoronaphthalene for Extreme Ultraviolet Resists (oral), S. Ikeda, K. Okamoto, H. Yamamoto, A. Saeki, T. Kozawa, S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

[32]Simulation Studies on Relationship between Resolution, Line Edge Roughness, and Sensitivity in Chemically Amplified Resists of Electron Beam Lithography (oral), A. Saeki, T. Kozawa, S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference, Sapporo, Japan, Nov. 16-19, 2009.

Contributions to International Conferences and Journals

J. Yang	The 1st International Particle Accelerator Conference (!PAC10), Kyoto, Japan, May 24-28, 2010 (Local Organizing Committee)
T. Kozawa	22nd International Microprocesses and Nanotechnology Conference (Steering Committee)
T. Kozawa	22nd International Microprocesses and Nanotechnology Conference (Vice Chair of Paper Committee)
T. Kozawa	22nd International Microprocesses and Nanotechnology Conference (Section head of Paper Committee)
T. Kozawa	2009 EUVL Workshop (Technical Steering Committee)
T. Kozawa	2009 EUV Symposium (Steering Committee)

Publications in Domestic Meetings

Particle Accelerator Society of Japan	4 papers
Atomic Energy Society of Japan	6 papers
Japanese Society of Radiation Chemistry	7 papers
Physics Society of Japan	1 paper
High Brightness Radio Frequency Electron Gun Meeting	4 papers
Takasaki Quantum Beam Science Symposium	1 paper
High LET Radiation Meeting	2 papers

Grant-in-Aid for Scientific Research

Y. Yoshida	Attosecond and femtosecond pulse radiolysis study	¥58,890,000
T. Kozawa	Study on nanoscale chemical reaction for the establishment of scientific foundation of ultrafine patterning using extreme ultraviolet radiation	¥5,720,000
T. Kozawa	Study on the size of thermalized electron in condensed matter	¥1,000,000
Cooperative Research		
J. Yang	Extreme Ultraviolet Lithography System Development Association: EUVA	¥1,800,000
T. Kozawa	Nissan Chemical Industries, LTD	¥1,000,000
T. Kozawa	Selete	¥1,000,000

Department of Nanocharacterization for Nanostructures and Functions

Original Papers

- [1]Ultrashort-period lateral composition modulation in TlInGaAsN/TlInP structures, M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato, T. J. Konno: Appl. Phys. Lett., 94 (2009) 153103(1)-153103(3).
- [2]Transmission electron microscopy study of an electron-beam-induced phase transformation of niobium nitride, J. H. Won, J. A. Valdez, M. Naito, M. Ishimaru, K. E. Sickafus: Scripta Mater., 60 (2009) 799-802.
- [3]stage of the crystallization in amorphous Fe-Si layer: Formation and growth of metastable α -FeSi₂, M. Naito, M. Ishimaru: Nucl. Instrum. Meth. B, 267 (2009) 1290-1293.
- [4]Damage profile and ion distribution of slow heavy ions in compou, Y. Zhang, I.-T. Bae, K. Sun, C. M. Wang, M. Ishimaru, Z. Zhu, W. Jiang, W. J. Weber: J. Appl. Phys., 105 (2009) 104901(1)-104901(12).
- [5]Influence of native silicon oxides on the growth of GaN nanorods on Si(001), S. Hasegawa, J.-U. Seo, K. Uchida, H. Tambo, H. Kameoka, M. Ishimaru, H. Asahi: phys. stat. sol. (c), 6 (2009) S570-S573.
- [6]Thermoelectric characterization of (Ga,In)₂Te₃ with self-assembled two-dimensional vacancy planes,

S. Yamanaka, M. Ishimaru, A. Charoenphakdee, H. Matsumoto, and K. Kurosaki: J. Electronic Mater., 38 (2009) 1392-1396.

[7] Ion-beam-induced chemical disorder in GaN, M. Ishimaru, Y. Zhang, W. J. Weber: J. Appl. Phys., 106 (2009) 053513(1)-053513(4).

[8] Specific surface effect on transport properties of NiO/MgO heterostructured nanowires, K. Oka, T. Yanagida, K. Nagashima, H. Tanaka, S. Seki, Y. Honsho, M. Ishimaru, A. Hirata, T. Kawai: Appl. Phys. Lett., 95 (2009) 133110(1)-133110(3).

[9] Effect of periodicity of the two-dimensional vacancy planes on the thermal conductivity of bulk Ga₂Te₃, C.-E. Kim, K. Kurosaki, M. Ishimaru, D.-Y. Jung, H. Muta, S. Yamanaka: phys. stat. sol. (RRL), 3 (2009) 221-223.

[10] Electron microscopy study of L₁₀-FePtCu nanoparticles synthesized at 613K, Y. Hirotsu, H. W. Ryu, K. Sato, M. Ishimaru: J. Microsc., 236 (2009) 94-99.

[11] Formation process of β-FeSi₂ from amorphous Fe-Si synthesized by ion implantation: Fe concentration dependence, M. Naito, M. Ishimaru: J. Microsc., 236 (2009) 123-127.

[12] Fabrication of Ni quantum cross devices with a 17 nm junction and their current-voltage characteristics, H. Kaiju, K. Kondo, A. Ono, N. Kawaguchi, J. H. Won, A. Hirata, M. Ishimaru, Y. Hirotsu, A. Ishibashi: Nanotechnology, 21 (2010) 015301(1)-015301(6).

[13] Spontaneous formation of ultra-short-period lateral composition modulation in TlInGaAsN/TlInP structures, M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato, T. J. Konno: Proc. 21st Int'l Conf. Indium Phosphide and Related Materials, (2009) 253-254.

[14] Improvement in luminescence properties of TlInGaAsN/TlInP multi-layers grown by gas source molecular beam epitaxy, Y. Tanaka, S. Hasegawa, J.Q. Liu, M. Ishimaru, H. Asahi: Proc. 21st Int'l Conf. Indium Phosphide and Related Materials, (2009) 259-253.

[15] Irradiation-induced amorphous structures studied by electron diffraction radial distribution function analysis, M. Ishimaru, M. Naito, A. Hirata: Proc. Microscopy and Microanalysis 2009, (2009) 1346-1347.

Review Papers

Spontaneous nano-scale phase separation in TlInGaAsN/TlInP quantum wells, M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato, T. J. Konno, Materia, The Japan Institute of Metals, 48 (2009), 591.

International Conferences

[1] Spontaneous formation of ultra-short-period lateral composition modulation in TlInGaAsN/TlInP structures (Oral), M. Ishimaru, Y. Tanaka, S. Hasegawa, H. Asahi, K. Sato, T. J. Konno: 2009 Int'l Conf. Indium Phosphide and Related Materials, Newport Beach, CA, USA (May 10-14, 2009).

[2] Irradiation-induced amorphous structures studied by electron diffraction radial distribution function analysis (Oral), M. Ishimaru, M. Naito, A. Hirata: Microscopy and Microanalysis 2009, Richmond, Virginia, USA (July 26-30, 2009).

Contributions to International Conferences and Journals

M. Ishimaru Japanese Journal of Applied Physics (Associate Editor)

M. Ishimaru 8th Japan-Polish Joint Seminar on Micro and Nano Analysis (Organizer)

Publications in Domestic Meetings

The Japan Institute of Metals 2 papers

The Japanese Society of Microscopy 4 papers

The Japan Society of Applied Physics 1 paper

Academic Degrees

Master Degree for Engineering Electrochemically-induced structural changes of anode silicon for lithium ion battery

Y. Nishiyama

Entrusted Research

M. Ishimaru NEDO (Advanced Nano-structure Analysis for the ¥2,500,000

	Materials Technology Utilizing Glassy Metals for Commercial Uses)	Evaluation of Mechanical Properties in Glassy Metals	
M. Ishimaru	Ministry of Economy	Structural Characterization of Severe Deformed Stainless Steel	¥500,000

Department of Theoretical Nanotechnology

Original Papers

- [1]Electronic structure and electrical resistivity of α -boron under high pressure, K. Shirai, H. Dekura, and Y. Yanase: J.Phys. Soc. Jpn., 78 (2009) 084714-084723.
- [2]Superconductivity research on boron solids and an efficient doping method, K. Shirai, H. Dekura, and A. Masagao: J. Phys.:Conf. Ser., 176 (2009) 012001-012018.
- [3]Metallization of α -boron by hydrogen doping, H. Dekura, K. Shirai, and A. Yanase: J. Phys.:Conf. Ser., 176 (2009) 012005-012016.
- [4]Possibility of defect in α -boron, H. Dekura, K. Shira, and A. Yanase: J. Phys.:Conf. Ser., 176 (2009) 012004-012010.
- [5]Control of impurity diffusion in silicon by IR laser excitation, K. Shrai, K. Matsukawa, T. Moriwaki, and Y. Ikemoto: Physica B, 404 (2009) 4685-4688.
- [6]Fermi surface and metallic properties of graphite at high pressures, N. Nakae, J. Ishisada, K. Shirai, and A. Yanase: J. Phys. Chem. Solids, 78 (2010) 418-422.
- [7]Metallicity of boron carbides at high ressure, H. Dekura, K. Shirai, and A. Yanase: J. Phys.: Conf. Ser., 215 (2010) 012117 -012122.
- [8]Theoretical investigation on synthesizing BC₅ crystal, N. Nakae, J. Ishisada, K. Shirai, and A. Yanase: J. Phys.: Conf. Ser., 215 (2010) 012116 -012122.
- [9]Facts around the discovery of a new phase of boron, K. Shirai: The Review of High Pressure Science and Technology, 19 (4) (2009) 304-308.
- [10]Termination dependence of surface stacking at 4H-SiC(0001)-1x1: Density functional thoery calculations, H. Hara, Y. Morikawa, Y. Sano, and K. Yamauchi: Phys. Rev. B, 79 (2009) 153306-1-4.
- [11]First-principles study of the pentacene/Cu(111) interface: Adsorption states and vacuum level shifts, K. Toyoda, Y. Nakano, I. Hamada, K.H. Lee, S. Yanagisawa, and Y. Morikawa: J. Electron Spectorosc. Relat. Phenom., 174 (2009) 78-84.
- [12]Theoretical study of benzene on noble metal surfaces: Adsorption states and vacuum level shifts, K. Toyoda, Y. Nakano, I. Hamada, K.H. Lee, S. Yanagisawa, and Y. Morikawa: Surf. Sci., 603 (2009) 2912-2922.
- [13]Present status and future subjets of first-principles-based simulations for chemical reactions, T. Ikeda, M. Boero, Y. Morikawa: Journal of the Physical Society of Japan, 64 (2009) 256-262.

International Conferences

- [1]Superconductivity of icosahedron-based semiconducting boron (oral), *K. Shirai and H. Dekura: 15th International Symposium on Intercalation Compounds, May 11-15, 2009, Beijing, China.
- [2]Fermi surface and metallic properties of grahite at high pressure (poster), *N. Nakae, J. Ishisada, K. Shirai and Y. Yanase: 15th International Symposium on Intercalation Compounds, May 11-15, 2009, Beijing, China.
- [3]First-principle molecular dynamics simulations of chemical reactions at water/metal interfaces (oral), *Y. Morikawa: The 8th Japan-France Workshop on Nanomaterials, June 15-17, 2009, National Institute for Materials Science, Tsukuba, Japan.
- [4]Dynamics of reorientation of single lattice vacancy in silicon (poster), J. Ishisada and *K. Shirai: 25th International Conference on Defects in Semiconductors, July 20-24, 2009, St. Petersburg, Russia.

K. Shirai	Renesas Electronics Corporation	¥0,000
Other Research Fund		
K. Shirai	Japan Society for the Promotion of Science	¥150,000

Department of Soft Nanomaterials

Original Papers

- [1] Photovoltaic Performance and Charge Carrier Mobility of Dendritic Oligothiophene Bearing Perylene Bis(dicarboximide) Groups, Y. Ie, T. Uto, A. Saeki, S. Seki, S. Tagawa, Y. Aso: *Synth. Met.*, 159 (9-11) (2009) 797-801.
- [2] STM Fluorescence of Porphyrin Enhanced by a Strong Plasmonic Field and Its Nanoscale Confinement in an STM Cavity, H. W. Liu, R. Nishitani, T. Z. Han, Y. Ie, Y. Aso, H. Iwasaki: *Phys. Rev. B*, 79 (12) (2009) 125415-1-6.
- [3] Electronegative Oligothiophenes Having Difluorodioxocyclopentene-annelated Thiophenes as Solution-processable n-Type OFET Materials, Y. Ie, M. Okabe, Y. Umemoto, H. Tada, Y. Aso: *Chem. Lett.*, 38 (5) (2009) 460-461.
- [4] Completely Encapsulated Oligothiophenes up to 12-mer, Y. Ie, A. Han, T. Otsubo, Y. Aso: *Chem. Commun.*, (21) (2009) 3020-3023.
- [5] Synthesis of Tripodal Anchor Units Bearing Selenium Functional Groups and Their Adsorption Behaviour on Gold, Y. Ie, T. Hirose, A. Yao, T. Yamada, N. Takagi, M. Kawai, Y. Aso: *Phys. Chem. Chem. Phys.*, 11 (25) (2009) 4949-4951.
- [6] Temperature Effects on Quasi-isolated Conjugated Polymers as Revealed by Temperature-Dependent Optical Spectra of 16-mer Oligothiophene Diluted in a Solid Matrix, K. Kanemoto, I. Akai, M. Sugisaki, H. Hashimoto, T. Karasawa, N. Negishi, Y. Aso: *J. Chem. Phys.*, 130 (23) (2009) 234909-1-7.
- [7] Synthesis, Properties, and FET Performance of Rectangular Oligothiophene, Y. Ie, T. Hirose, Y. Aso: *J. Mater. Chem.*, 19 (43) (2009) 8169-8175.
- [8] Comprehensive Evaluation of Electron Mobility for Trifluoroacetyl-Terminated Electronegative Conjugated Oligomer, Y. Ie, M. Nitani, T. Uemura, Y. Tominari, J. Takeya, Y. Honsho, A. Saeki, S. Seki, Y. Aso: *J. Phys. Chem. C*, 113 (39) (2009) 17189-17193.
- [9] Intrachain Photoluminescence Dynamics of a Long Oligothiophene at Room Temperature, K. Kanemoto, M. Sugisaki, H. Hashimoto, I. Akai, T. Karasawa, N. Negishi, Y. Aso: *J. Luminescence*, 129 (12) (2009) 1845-1848.
- [10] Air-Stable n-Type Organic Field-Effect Transistors Based on Carbonyl-Bridged Bithiazole Derivatives, Y. Ie, M. Nitani, M. Karakawa, H. Tada, Y. Aso: *Adv. Funct. Mater.*, 20 (6) (2010) 907-913.

Review Papers

Electronics Application of Oligothiophene Derivatives, Y. Aso, *POLYMERS*, The Society of Polymer Science, Japan, 58[11] (2009), 801-804.

Patents

- [1] Fullerene Derivatives, Their Semiconducting Materials, and Their Semiconducting Thin Films T. Nagai, Y. Tanaka, Y. Aso, Y. Ie, T. Nozawa, JP2009-279903
- [2] Fullerene Derivatives, Their N-type Semiconducting Materials, and Their N-type Semiconducting Thin Films T. Nagai, Y. Tanaka, T. Irita, Y. Aso, Y. Ie, M. Karakawa, JP2009-279902
- [3] Nitrogen-containing Fused-Ring Compounds, Nitrogen-containing Fused-Ring Polymers, and Organic Thin Films and Organic Thin-Film Devices Y. Aso, Y. Ie, M. Ueta, M. Ueda, JP2010-047852
- [4] Nitrogen-containing Fused-Ring Compounds, Organic Thin Films, and Organic Thin-Film Devices Y. Aso, Y. Ie, M. Nitani, M. Ueda, JP2010-049171
- [5] Polymers, Their Organic Thin Films, and Their Organic Thin-Film Devices Y. Ie, A. Yoshimura, Y. Aso, M. Ueda, PCT-JP2010-053797
- [6] Fluorinated Polymers and Their Organic Thin Films Y. Aso, Y. Ie, M. Nitani, M. Ueda,

Chemical Society of Japan		5 papers	
Symposium on Main Element Chemistry		1 paper	
Fluorine Conference of Japan		1 paper	
Symposium on Fundamental Organic Chemistry		2 papers	
symposium on macromolecules		1 paper	
the Japan Society of Applied Physics and related societies		1 paper	
Academic Degrees			
Master Degree for Science	Development and Evaluation of Oligothiophenes Having Fullerene and Perfluoroalkyl Groups		
T. Nozawa			
Bachelor Degree for Science	Synthesis and Properties of Novel Conjugated Compounds Having Carbonyl Bridgings and Thiazole Rings		
M. Ueta			
Grant-in-Aid for Scientific Research			
Y. Aso	Emergence of Highly Elaborated π -Space and its Function	¥4,550,000	
Y. Aso, M. Karakawa	Functions of Highly Elaborated π -Space Based on the Synthesis of Extended π -Electron Systems and Application to Electronics	¥4,420,000	
Y. Ie	Development of Insulated Oligothiophene Molecular Wires Bearing Tripodal Anchor Units at Terminal Position	¥2,200,000	
Entrusted Research			
Y. Ie	The New Energy and Industrial Technology Developing Organization (NEDO) of Japan	Development of n-Type and Ambipolar Organic Semiconductors Based on Novel Molecular Design	¥8,840,000
Contribution to Research			
Y. Ie	Nissan Science Foundation	¥2,000,000	
Y. Ie	Kansai Research Foundation	¥950,000	
Cooperative Research			
Y. Aso, Y. Ie	SUMITOMO CHEMICAL	¥1,012,000	
Y. Aso, Y. Ie	DAIKIN INDUSTRIES, Ltd.	¥2,750,000	

Department of Bio-Nanotechnology

Original Papers

- [1] Identifying Molecular Signatures in Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi, K. Shoji, K. Yokota and T. Kawai: *Nanoscale*, 1 (2009) 164-170.
- [2] Molecular vibrations in metal-single-molecule-metal junctions, K. Yokota, M. Taniguchi and T. Kawai: *Chemical Physics Letters*, 487 (4-6) (2009) 268-271.
- [3] Single-Molecule Junctions with Strong Molecule-Electrode Coupling, M. Taniguchi, M. Tsutsui, K. Shoji, H. Fujiwara and T. Kawai: *Journal of the American Chemical Society*, 131 (40) (2009) 14146-14147.
- [4] Inelastic Electron Tunneling Spectroscopy of Single-Molecule Junctions Using Mechanically Controllable Break Junction, M. Taniguchi, M. Tsutsui, K. Yokota and T. Kawai: *Nanotechnology*, 20 (43) (2009) 434008-434015.
- [5] Fabrication of the Gating Nanopore, M. Taniguchi, M. Tsutsui, K. Yokota and T. Kawai: *Applied Physics Letters*, 95 (2009) 123701(1-3).
- [6] Replica Mold for Nanoimprint Lithography from a Novel Hybrid Resin, B. K. Lee, L.-Y. Hong, H. Y. Lee, D.-P. Kim and T. Kawai: *Langmuir*, 25 (19) (2009) 11768-11776.
- [7] Nanoarrays of Tethered Lipid Bilayer Rafts on Poly(vinyl alcohol) Hydrogels, B. K. Lee, H. Y. Lee, P. N. Kim, K. Y. Suh, T. Kawai: *Lab on a chip*, 9 (2009) 132-139.
- [8] Quantitative Evaluation of Metal-Molecule Contact Stability at the Single-Molecule Level, M. Tsutsui,

- M. Taniguchi and T. Kawai: *Journal of the American Chemical Society*, 13 (30) (2009) 10552-10556.
- [9]Atomistic Mechanics and Formation Mechanism of Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi and T. Kawai: *Nano Letters*, 9 (6) (2009) 2433-2439.
- [10]Transverse Field Effects on DNA-Sized Particle Dynamics, M. Tsutsui, M. Taniguchi and T. Kawai: *Nano Letters*, 9 (4) (2009) 1659-1662.
- [11]Roles of Lattice Cooling on Local Heating in Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi, K. Yokota, and T. Kawai: *Appl. Phys. Lett.*, 96 (2010) 103110-103112.
- [12]Identifying Single Nucleotides by Tunnelling Current, M. Tsutsui, M. Taniguchi, K. Yokota, and T. Kawai: *Nature Nanotechnology*, 5 (2010) 286-290.
- [13]Metal–molecule interfaces formed by noble metal–chalcogen bonds for nanoscale molecular devices, K. Yokota, M. Taniguchi, and T. Kawai: *J. Phys. Chem. C.*, 114 (2010) 4044-4050.
- [14]Insulated Molecular Wire with Highly Conductive pi-Conjugated Polymer Core, J. Terao, Y. Tanaka, S. Tsuda, N. Kambe, M. Taniguchi, T. Kawai, A. Saeki and S. Seki: *Journal of the American Chemical Society*, 131 (50) (2009) 18046–18047.
- [15]Atomic Force Microscopy Imaging of Supramolecular Organization of Hyaluronan and Its Receptor CD44, T. Murai, H. Hokonohara, A. Takagi and T. Kawai: *Ieee Transactions on Nanobioscience*, 8 (4) (2009) 294-299.
- [16]Liposomes and Lipid Membranes on a Flat Hydrogel Substrate Observed by Atomic Force Microscopy, A. Takagi, H. Hokonohara and T. Kawai: *Journal of Physiological Sciences*, 59 (2009) 441-441.
- [17]Flat hydrogel substrate for atomic force microscopy to observe liposomes and lipid membranes, A. Takagi, H. Hokonohara and T. Kawai: *Analytical and Bioanalytical Chemistry*, 395 (7) (2009) 2405-2409.
- [18]Nanoarrays of Tethered Lipid Bilayer Rafts on Poly(vinyl alcohol) Hydrogels, B. K. Lee, H. Y. Lee, P. N. Kim, K. Y. Suh, T. Kawai: *Lab on a chip*, 9 (2009) 132-139.
- [19]Experimental Observation of Bulk Band Dispersions in the Oxide Semiconductor ZnO Using Soft X-Ray Angle-Resolved Photoemission Spectroscopy, M. Kobayashi, G. S. Song, T. Kataoka, Y. Sakamoto, A. Fujimori, T. Ohkochi, Y. Takeda, T. Okane, Y. Saitoh, H. Yamagami, H. Yamahara, H. Saeki, T. Kawai and H. Tabata: *Journal of Applied Physics*, 105 (12) (2009) 122403(1-4).
- [20]Electrostatic Force Microscopy: Imaging DNA and Protein Polarizations One by One, E. Mikamo-Satoh, F. Yamada, A. Takagi, T. Matsumoto and T. Kawai: *Nanotechnology*, 20 (14) (2009) 145102(6pp).
- [21]Electrostatic Force Spectroscopy on Insulating Surfaces: the Effect of Capacitive Interaction., A. Takagi, F. Yamada, T. Matsumoto and T. Kawai: *Nanotechnology*, 20 (36) (2009) 365501(7pp).
- [22]Profiling of Gene-dependent Translational Progress in Cell-free Protein Synthesis by Real-space Imaging, E. Mikamo-Satoh, A. Takagi, HiroTanaka, T. Matsumoto, T. Nishimura and T. Kawai: *Anal. Biochem.*, 394 (2) (2009) 275-280.
- [23]Partial Sequencing of a Single DNA Molecule with a Scanning Tunnelling Microscope, Hiroyuki Tanaka and Tomoji Kawai: *Nature Nanotechnology*, 4 (8) (2009) 518.
- [24]Rapid Fabrication of Teflon Micropores for Artificial Lipid Bilayer Formation, Mitsunori Kitta, Hiroyuki Tanaka and Tomoji Kawai: *Biosensors and Bioelectronics*, 25 (4) (2009) 931.
- [25]Profiling of Gene-Dependent Translational Progress in Cell-Free Protein Synthesis by Real-Space Imaging, Eriko Mikamo-Satoh, Akihiko Takagi, Hiroyuki Tanaka, Takuya Matsumoto, Tsutomu Nishimura and Tomoji Kawai: , 394 (12) (2009) 275.
- [26]Network of Tris(porphyrinato)cerium(III) Arranged on the Herringbone Structure of an Au(111) Surface, Hiroyuki Tanaka, Tomohiro Ikeda, Kousei Yamashita, Masayuki Takeuchi, Seiji Shinkai and Tomoji Kawai: *Langmuir*, 26 (1) (2010) 210.

- [27]Unipolar resistive switching characteristics of room temperature grown SnO₂ thin films, K. Nagashima, T. Yanagida, K. Oka and T. Kawai: Appl. Phys. Lett., 94 (2009) 242902.
- [28]Crucial role of doping dynamics on transport properties of Sb-doped SnO₂ nanowires, A. Klamchuen, T. Yanagida, K. Nagashima, S. Seki, K. Oka, M. Taniguchi and T. Kawai: Appl. Phys. Lett., 95 (2009) 053105.
- [29]Specific surface effect on transport properties of NiO/MgO heterostructured nanowires, K. Oka, T. Yanagida, K. Nagashima, H. Tanaka, S. Seki, Y. Honsho, M. Ishimaru, A. Hirata and T. Kawai: Appl. Phys. Lett., 95 (2009) 133110.
- [30]Interfacial effect on metal/oxide nanowire junctions, K. Nagashima, T. Yanagida, A. Klamchuen, M. Kanai, K. Oka, S. Seki and T. Kawai: Appl. Phys. Lett., 96 (2010) 073110.
- [31]Resistive Switching Multistate Nonvolatile Memory Effects in a Single Cobalt Oxide Nanowire, K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi, T. Kawai, J.-S. Kim and B. H. Park: Nano Lett., 10 (2010) 1359-1363.
- [32]Enhancement of initial permeability due to Mn substitution in polycrystalline Ni_{0.50-x}Mn_xZn_{0.50}Fe₂O₄, A. K. M. Hossain, T. S. Biswas, S. T. Mahmud, T. Yanagida, H. Tanaka and T. Kawai: J. Magn. Magn. Mater., 321 (2009) 81-87.
- [33]Influence of Mg and Cr Substitution on Structural and Magnetic Properties of Polycrystalline Ni_{0.50}Zn_{0.50-x-y}Mn_xCr_yFe₂O₄, A. K. M. Hossain, T. S. Biswas, S. T. Mahmud, T. Yanagida, H. Tanaka and T. Kawai: Mater. Chem. Phys., 113 (2009) 172-178.
- [34]ZnO Nanowire Morphology Control in Pulsed Laser Deposition, A. Marcu, M. Goyat, T. Yanagida and T. Kawai: J. Optoelectron Adv. Mater., 11 (2009) 421-424.
- [35]X-ray Absorption Magnetic Circular Dichroism of La_{0.7}Ce_{0.3}MnO₃ Thin Films, T. Yanagida, Y. Saitoh, Y. Takeda, A. Fujimori, H. Tanaka and T. Kawai: Phys. Rev. B, 79 (2009) 132405.
- [36]Novel Mechanochemical Process for Synthesis of Magnetite Nanoparticles using Coprecipitation Method, T. Iwasaki, K. Kosaka, T. Yabuuchi, S. Watano, T. Yanagida and T. Kawai: Adv. Powder Technol., 20 (2009) 521-528.
- [37]Size control of Magnetite Nanoparticles in Hydrothermal Synthesis by Coexistence of Lactate and Sulfate Ions, N. Mizutani, T. Iwasaki, S. Watano, T. Yanagida and T. Kawai: Curr. Appl. Phys., 10 (2010) 801-806.
- [38]Novel Environmentally Friendly Synthesis of Superparamagnetic Magnetite Nanoparticles using Mechanochemical Effect, T. Iwasaki, K. Kosaka, S. Watano, T. Yanagida and T. Kawai: Mater. Res. Bull., 45 (2010) 481-485.
- [39]Investigation of Structural and Magnetic Properties of Polycrystalline Ni_{0.50}Zn_{0.50-x}Mg_xFe₂O₄ Spinel Ferrites, A. K. M. Hossain, T. S. Biswas, T. Yanagida, H. Tanaka, H. Tabata and T. Kawai: Mater. Chem. Phys., 120 (2010) 461-467.
- [40]Magnetic Cu-Ni (core-shell) Nanoparticles in a One-pot Reaction under Microwave Irradiation, T. Yamauchi, Y. Tsukahara, T. Sakata, H. Mori, T. Yanagida, T. Kawai and Y. Wada: Nanoscale, 2 (2010) 515-523.

Books

- [1]Preparation for organic molecular samples(H. Shigekawa, M. Yoshimura, A. Kawazu) T.Matsumoto, "Scanning Probe Microscopy; Experimental Physics Series", Kyoritsu Shuppan, 6 (6) 2009.
- [2]Supramolecuar nanoelectronics(T. Kunitake) T.Matsumoto, "Supramolecular Science &Technology", NTS, 2009.

Patents

- [1]Field effect transistor and making method T. Kawai, M. Taniguchi, I. Fukui, US 7,557,392 B2
- [2] H. Y. Lee, T. Kawai, J. W. Park, J. M. Kim, H. S. Jung, 4324707
- [3]THE MANUFACTURE METHOD OF HIGH DURABLE REPLICA MOLD FOR

- NANOLOTHOGRAPHY T. Kawai, H. Y. Lee, B. K. Lee, N. Y. Hong, D. P. Kim, 2009-0006902 (Korea)
- [4] B. K. Lee, H. Y. Lee, T. Kawai, N. Y. Hong, D. P. Kim, 2009-0006902
- [5] Probe device T. Matsumoto, T. Kawai, 4452278
- [6] Polymer fixation making substrate obtained by process of manufacture and this method of polymer fixation making substrate Hiroyuki Tanaka, T. Kawai, 2005-046665
- [7] Formation technique of plane lipid double film Hiroyuki Tanaka, M. Kitta, T. Kawai, 2010-32567
- [8] Fabrication Method of Non-volatile Resistive Switching Memory Device T. Yanagida, T. Kawai, K. Nagashima, K. Oka, JP2009-168919
- International Conferences
- [1] Heterostructured Oxide Nanowires and Their Interface Properties (invited), T. Kawai: Materials Research Society, San Francisco, California, USA, 2009.04.14-16.
- [2] Nanoarray of Biomolecules with a Nanoimprinted Inert Hydrogels for Developing Nanobiosensor (invited), T. Kawai: Nanomeeting 2009, Minsk, Belarus, 2009.05.26-29.
- [3] Composite nanostructures using transition metal oxide nanowires, T. Kawai: 15th International Conference on Composite Structures (ICCS15), Porto, Portugal, 2009.06.15-17.
- [4] Non-Volatile Resistive Memory Effects in Oxide Nanowires, T. Kawai: 16th International Workshop on Oxide Electronics, Catalonia, Spain, 2009.10.04-07.
- [5] Green NanoScience and Nanotechnology for the Energy Saving and Human Health (invited), T. Kawai: 2009 International Conference on Nano Science and Nano Technology (GJ-NST 2009), Muan, Korea, 2009.11.05-06.
- [6] Multiferroic Properties in Metal Oxide Nanowires Toward Giant Magnetoresistance and Resistive RAM Application (invited), T. Kawai: The 2nd APCTP Workshop on Multiferroic, Taipei, Taiwan, 2010.01.08-10.
- [7] Fabrication and magnetic properties of one and two dimensional metal oxides (invited), T. Kawai: 11th(2010) Joint MMM-Intermag Conference, Washington, District Of Columbia, USA, 2010.01.18-22.
- [8] Magnetism in Nanostructured Metal Oxide Materials, T. Kawai: International Conference on Magnetism & Advanced Materials (ICMAM-2010), Dhaka, Bangladesh, 2010.03-07.
- [9] Electrostatic Force Microscopy / Spectroscopy on Insulating Substrates: Effect of Capacitive Interactions in Vacuum and Water (oral), *T. Matsumoto, M. Kawano, A. Takagi¹, F. Yamada¹, E.M.-Satoh¹, T. Kawai: 17th International Colloquium on Scanning Probe Microscopy (ICSPM17), Atagawa, Japan, Dec.10-12, 2009.
- [10] Nanotester: Imaging the Current Pathway of Soft Material (invited), *T. Matsumoto: Germany / Japan, 1st Workshop on "Nanoanalytics, Osaka, Japan, Feb.15, 2010.
- [11] Identification of Single Nucleotides Using Gating Nanopores, M. Taniguchi: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Japan, 2010.01.18-19.
- [12] Partial sequencing of a single DNA molecule with a scanning tunnelling microscope (invited), *Hiroyuki Tanaka and T. Kawai: 17th International Colloquium on Scanning Probe Microscopy (ICSPM17).
- [13] Non-volatile Memory Effect in Heterostructured Nanowires of Transition Metal Oxides (invited), K. Nagashima, T. Yanagida, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.
- [14] Metal Oxide Nanowires: Synthesis, Properties and Non-volatile Memory Applications (invited), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.
- [15] Non-volatile Unipolar Memory Switching in TiO₂ Heteronanowire (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.

- [16]Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.
- [17]Metal Oxide Nanowires: Synthesis, Nano-properties and Device Applications (oral), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.
- [18]Mechanism of Nonvolatile Bipolar Resistive Memory Switching in MgO/Co₃O₄ Nanowire and Multi-storage Memory Application (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [19]Crucial Role of Doping Dynamics on Transport Properties of Sb-doped SnO₂ Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, S. Seki, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [20]Non-volatile Resistive Memory Switching in Individual MgO/NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [21]Mechanism of Resistive Switching in MgO/Co₃O₄ Nanowires for Non-volatile Memory Applications (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: International Symposium on post silicon materials and devices research alliance project.
- [22]Resistive Switching Phenomena in MgO/Co₃O₄ Core/shell Nanowires (poster), K. Nagashima, T. Yanagida, K. Oka, T. Kawai, J.-S. Kim and B. H. Park: 16th International Workshop on Oxide Electronics.
- [23]Non-volatile Resistive Switching in Individual MgO/NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, T. Kawai, J.-S. Kim and B. H. Park: 16th International Workshop on Oxide Electronics.
- [24]Self-Assembling Oxide Nanowires: Growth Mechanisms and the Impact on Transport Properties of Impurity-Doped Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, K. Oka and T. Kawai: 16th International Workshop on Oxide Electronics.
- [25]Non-volatile Memory Switching using Atomically Controlled MgO/Co₃O₄ Heterostructured Nanowires (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: Second International Symposium on Atomically Controlled Fabrication Technology.
- [26]Extraction of Localized Non-volatile Memory Switching using MgO/Cobalt Oxide Heterostructured Nanowire (poster), K. Nagashima, T. Yanagida, K. Oka, A. Klamchuen, M. Taniguchi and T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [27]Impurity induced mesostructures of Sb-doped SnO₂ Nanowires (poster), A. Klamchuen, T. Yanagida, M. Kanai, K. Nagashima, K. Oka, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [28]Redox Reactions of Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, A. Klamchuen, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [29]Heterostructured Oxide Nanowires and Their Interface Properties (invited), T. Kawai and T. Yanagida: Material Research Society Spring Meeting.
- [30]Composite Nanostructures using Transition Metal Oxide Nanowires (oral), T. Kawai, T. Yanagida, K. Nagashima and K. Oka: 15th International Conference on Composite Structures.
- [31]Iron Oxide Shell Layer Morphology in PLD (oral), A. Marcu, T. Yanagida and T. Kawai: European Material Research Society.
- [32]Particles Flux Limitations in Nanostructures Growing Using PLD/VLS Technique (oral), A. Marcu, T. Yanagida, C. Grigoriu and T. Kawai: 10th International Balkan Workshop on Applied Physics, Constanta.

- [33]Study on Nucleation Seeds for Pulsed Laser Ablation Oxide Materials (oral), A. Marcu, T.Yanagida, A.Mihailescu, C.Grigoriu and T.Kawai: ROMOPTO 2009.
- [34]Non-Volatile Resistive Switching Memory Effects In Single Oxide Nanowire (invited), T. Yanagida and T.Kawai: WCU International Conference on Quantum Phases and Devices.
- [35]Addressable Lipid Rafts Nanoarrays for Advanced Nanomedicine (invited), H. Y. Lee: Special invited seminar, Microbiochip Center, Hanyang University, Seoul, Korea, 2009.04.23.
- [36]Addressable Lipid Rafts Nanoarrays for Advanced Nanomedicine (invited), H. Y. Lee: Special invited seminar, Deviiion of Marin Molecular Biotechnology, Kangung University, Kangung, Korea, 2009.04.28.
- [37]Bio-Nanodevices using QCM (invited), H. Y. Lee: QCM Research Workshop; Research of molecular interaction by QCM ~from biomolecules to materials, Tokyo, Japan, 2009.09.25.
- [38]Biomimetic Nanowell Array Chip based on Digital Signal toward Nanomedicine (invited), H. Y. Lee: The second Korea-Israel Workshop on “Cells & Molecules, Chips & sensors: innovative platforms for interfacing biology”, The Hebrew University of Jerusalem, Israel, 2009.10.26.
- [39]Artificial Cell Membrane Nanoarrays Toward Advanced Nanomedicin (invited), H. Y. Lee: 1st WCU Workshop on "Quantum Physics and Devices", KonKuk university, Seoul, Korea, 2009.10.28.
- [40]Biomedical NanoDevice System Toward Nontoxic Diagnostics and Therapeutics (invited), H. Y. Lee: Special invited seminar, Pusan university, Pusan, Korea, 2009.11.11.
- [41]Addressable Nanoarrays of Tethered Lipid Bilayer Rafts for Advanced Nanomedicine (poster), H. Y. Lee: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Japan, 2010.01.18-19.
- [42]Minute Signal Detection of Biomelecules Toward Advanced Nanobiodevices (invited), H. Y. Lee: 1st WCU&NCRC Co-Workshop on "Sensors& their application for human interface system", Sungkyunkwan university, Suwon, Korea, 2010.2.24.
- [43]Nanobiosensor Toward Nanomedicine (invited), H. Y. Lee: Special invited seminar, Center for Materials and Processes of Self-Assembly, KookMin university, Seoul, Korea, 2010.3.19.
- [44]Nanowell Array Biodevices Integrated Top-down and Bottom-up Technology (invited), H. Y. Lee: Nano-Bio based Fusion Technology Conference, Boston, USA, 2009.06.18-19.

Contributions to International Conferences and Journals

T. Kawai	International Conference on Superlattices, Nanostructures and Nanodevices (ICSNN) in 2010 (International Advisory Committee)
T. Kawai	International Symposium on Surface Science -Focusing on Nano-, Green, and Biotechnologies- (ISSS-6) (International Program Advisory Board)
T. Kawai	CIMTEC 2010 12th International Ceramics Congress Symposium CI Magnetic and Transport Properties of Oxides (International Advisory Board)
T.Matsumoto	The 6th International Symposium on Surface Science and Nanotechnology (Program Committee)

Publications in Domestic Meetings

CSJ Annual Meeting	1 paper
The Physical Society of Japan Annual Meeting	6 papers
The Japan Society of Applied Physics Annual Meeting	17 papers
The Surface Science Society of Japan Annual Meeting	6 papers
The Biophysical Society of Japan Annual Meeting	2 papers
Symposium on Macromolecules	1 paper
Annual Meeting of JSMS	2 papers
JSCC Symposium	1 paper
The Society of Chemical Engineers, Japan	1 paper
The Society of Powder Technology, Japan	1 paper
Others	6 papers

Academic Degrees			
Doctor Degree for Science	Studies on construction and transport properties of novel metal oxide nanowires towards non-volatile resistive switching memory		
K. Nagasima			
Master Degree for Science	Charge transport in self-assembled network of huge molecule.		
Y. Segawa			
Master Degree for Science	Force spectroscopy in liquid using frequency-shift mode AFM		
M. Kawano			
Master Degree for Science	Single atom/molecule conductance measurements of gold and [Ni(dmit) ₂]- in vacuum and solutions		
K. Morimoto			
Doctor Degree for Science	Studies on metal-molecule interfaces and conductive properties for single-molecule junctions		
K. Yokota			
Master Degree for Science	Single molecule and real time measurements of ion channel opening and shutting by mechanostimulation with artificial lipid membrane and atomic force microscope		
M. Kitta			
Bachelor	Allergen detection using nano-fluidic devices		
T. Noda			
Grant-in-Aid for Scientific Research			
T. Kawai	Emergence in Chemistry		¥14,690,000
T. Kawai			¥21,840,000
T. Kawai			¥20,150,000
T. Matsumoto	Emergence of self-organized molecular system with top-down nanoelectdes		¥10,500,000
T. Matsumoto	Analysis of molecular recognition in liquid by pulse-modulated attractive force microscopy		¥3,400,000
T. Matsumoto	Nanoscale hopping conduction through self-organized molecular array with DNA templates		¥1,300,000
M. Taniguchi	Creation of Ballistic Conductance Organic Molecules		¥910,000
M. Taniguchi	Development of DNA Sequencer Using Gating Solid-State Nanopore		¥10,920,000
M. Taniguchi	Creation of Metal-Molecule Interface Suitable for High Conductive Single-Molecule Junctions		¥2,300,000
T. Yanagida	Fabrication and evaluation of oxide heterostructured nanowires		¥1,170,000
Entrusted Research			
T. Kawai	Funding Program for World-Leading Innovative R&D on Science and Technology	Research and Development of Innovative Nanobiodevices Based on Single-Molecule Analysis -Ultra-fast Single-Molecule-DNA Sequencing, Ultra-Low-Concentration Virus Detection, and Ultra-Sensitive Biomolecule Monitoring-	¥0
T. Kawai	MEXT(The Ministry of Education, Culture, Sports, Science and Technology)	Handai Multi-Functional Nanofoundry	¥108,000,000
T. Kawai	MEXT(The Ministry of	Intelligent Artificial Agents and	¥6,392,000

T. Kawai	Education, Culture, Sports, Science and Technology) MEXT(The Ministry of Education, Culture, Sports, Science and Technology)	Information Systems Inspired by Biological Systems Dynamics Project Molecular and System Life Science	¥3,515,000
M. Taniguchi	JST	Creation of Ultra-High Integrated Molecular devices Using Self-Organized Interconnect Method	¥8,560,000
Hiroyuki Tanaka	Japan Science and Technology Agency	Nanopore-based single-molecule DNA sequencing	¥15,926,000
T. Yanagida	SCOPE	Study on Nonvolatile memory using network structures of inorganic/organic heterostructures	¥12,074,000
T. Yanagida	JST	Fabrication of nonvolatile memory by oxide nanowires	¥32,630,000
Lee Heayeon	JST	Development of new nanoprocessing technology using a nano replica mold for the practical use of nanobiodevice	¥2,000,000
Cooperative Research			
T. Matsumoto	AIST		¥0
T. Matsumoto	University of Hyogo		¥0
T. Matsumoto	AIST		¥0
M. Taniguchi	Grad. School. Eng. Kyoto Univ.		¥0
M. Taniguchi	Grad. School. Sci. Tokyo Metro. Univ.		¥0
M. Taniguchi	Dept. Basic Sci. Univ. of Tokyo		¥0
M. Taniguchi	ISSP, Univ. of Tokyo		¥0
M. Taniguchi	Panasonic		¥2,596,000
H. Tanaka	Network Center for Molecular and System Life Sciences, Graduate School of Frontier Biosciences, Osaka University		¥0
H. Tanaka	Department of Chemistry, Graduate School of Science and Engineering, Tokyo Metropolitan University,		¥0
H. Tanaka	Macromolecules Group, Organic Nanomaterials Center (ONC), National Institute for Materials Science (NIMS)		¥0
Other Research Fund			
T. Yanagida	Hosokawa Powder Technology Foundation		¥700,000

Department of Nanotechnology for Environmental and Energy Applications

Original Papers

[1] Direct mapping of the spin-filtered surface bands of a three-dimensional quantum spin Hall insulator, A. Nishide, A. A. Taskin, Y. Takeichi, T. Okuda, A. Kakizaki, T. Hirahara, K. Nakatsuji, F. Komori, Y. Ando, and I. Matsuda: Phys. Rev. B, 81 (4) (2010) 04139/1-4.

[2] Quantum oscillations in a topological insulator $\text{Bi}_{1-x}\text{Sb}_x$, A. A. Taskin, and Y. Ando: Phys. Rev. B, 80 (8) (2009) 085303/1-6.

International Conferences

[1] Transport and Magnetic Studies of the Topological Insulator Bi-Sb (invited), *Y. Ando: International Workshop on Novel Topological States in Condensed Matter Physics, Hong Kong, China, June 23, 2009.

[2] Unusual Transport and Magnetic Properties of a Topological Insulator Bi-Sb (oral), *Y. Ando, and A. A. Taskin: 6th International Symposium on High Magnetic Field Spin Science in 100T: Application of High Magnetic Field for Condensed Matter and Material Sciences, Sendai, Japan, December 7, 2009.

- [3]Quantum Oscillations in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y. Ando, and A. A. Taskin: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.
- [4]Study of the novel superconductivity in Cu-intercalated Bi_2Se_3 (poster), *Z. Ren, A. A. Taskin, K. Segawa, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.
- [5]Anomalous Magnetotransport in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y. Ando, and A. A. Taskin: Workshop on Exotic Insulating State of Matter, Johns Hopkins Univ., Baltimore, USA, January 14-16, 2010.
- [6]Quantum Oscillations in a Topological Insulator Bi-Sb (invited), *Y. Ando: American Physical Society March Meeting, Portland, USA, March 15, 2010.

Contributions to International Conferences and Journals

Y. Ando EPL-Europhysics Letters (Co-editor)

Publications in Domestic Meetings

Japanese Physical Society 65th Annual Meeting 1 paper

Japanese Physical Society 2009 Autumn Meeting 2 papers

Grant-in-Aid for Scientific Research

Y. Ando Mott Insulator and Spin Hall Insulator: Elucidating the Physics of Nontrivial Insulators ¥26,500,000

Y. Ando Search for Quantum Oscillations in a La-based Cuprate ¥2,100,000

Cooperative Research

Y. Ando Central Research Institute of Electric Power Industry ¥1,000,000

Other Research Fund

Y. Ando US AFRL Asian Office of Aerospace Research and Development, Special Grant ¥5,350,000

Department of Nano-Intelligent Systems

Original Papers

[1]A direct method for estimating a causal ordering in a linear non-Gaussian acyclic model, S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: Proceedings of 25th Conference on Uncertainty in Artificial Intelligence, (2009) 506-513.

[2]Change-point detection in time-series data by direct density-ratio estimation, Y. Kawahara and M. Sugiyama: Proceedings of the 2009 SIAM International Conference on Data Mining, (2009) 389-400.

[3]Submodularity cuts and applications, Y. Kawahara, K. Nagano, K. Tsuda and J. Bilmes: Advances in Neural Information Processing Systems, 22 (2009) 916-924.

[4]Optimization of Budget Allocation for TV Advertising, K. Ichikawa, K. Yada, N. Nakachi, T. Washio: Proceedings of KES2009: 13th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems, (2009) 270-277.

[5]Highly efficient and Accurate EDM Estimation and Its Application to Range Queries, K. Kido, H. Kuwajima, T. Washio: Information Processing Society of Japan (IPSJ) Journal, 50 (5) (2009) 1493-1505.

[6]Modelling deposit outflow in financial crises: application to branch management and customer relationship management, K. Yada, T. Washio, Y. Ukai: International Journal of Advanced Intelligence Paradigms, 2 (2,3) (2009) 254-270.

Books

[1]New Frontiers in Applied Data Mining, PAKDD 2008 International Workshops(S. Chawla, T. Washio, S. Minato, S. Tsumoto, T. Onoda, S. Yamada, A. Inokuchi) S. Chawla, T. Washio, S. Minato, S. Tsumoto, T. Onoda, S. Yamada, A. Inokuchi, "New Frontiers in Applied Data Mining, PAKDD 2008 International Workshops", Springer, LNAI5433 (LNAI5433) 2009.

[2]Special Issue on Data-Mining and Statistical Science(T. Washio) T. Washio, "New Generation Computing, Computing Paradigms and Computational Intelligence", Springer, 27[4] (27[4]) 2009.

[3]Advances in Machine Learning(Z.H. Zhou, T. Washio) Z.H. Zhou, T. Washio, “Advances in Machine Learning, Proceedings of First Asian Conference on Machine Learning, ACML 2009”, Springer, LNAI5828 (LNAI5828) 2009.

International Conferences

[1]Identification of an exogenous variable in a linear non-Gaussian structural equation model (oral), S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: 4th International Workshop on Data-Mining and Statistical Science (DMSS2009), Kyoto, Japan, July 7-8, 2009.

Contributions to International Conferences and Journals

- T. Washio The 9th SIAM International Conference on Data Mining (SDM09) (Program Committee Area Chair)
- T. Washio PAKDD: Pacific-Asia Conference on Knowledge Discovery and Data Mining (Steering Committee)
- T. Washio The fifteenth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD-2009) (Program Committee)
- T. Washio The first Again Conference on Machine Learning (ACML-2009) (Program Chair)
- T. Washio 7th International Workshop on Mining and Learning with Graphs (MLG-2009) (Program Committee)
- T. Washio The 18th ACM Conference on Information and Knowledge Management (CIKM 2009) (Program Committee)
- T. Washio 2009 IEEE International Conference on Data Mining (ICDM09) (Program Committee)
- T. Washio The Twelfth International Conference on Discovery Science (DS09) (Program Committee)
- T. Washio First International Workshop on Learning and Mining for Robotics (LEMIR 2009) (Program Committee)
- T. Washio Knowledge and Information Systems: Special Issue on Selected Papers of The 12th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2008) (Guest Editor)
- T. Washio New Generation Computing: Special Issue on Selected Papers of The 3rd International Workshop on Data Mining and Statistical Science (DMSS2008) (Guest Editor)
- T. Washio International Journal of Knowledge and Web Intelligence (IJKWI) (Editorial Board)
- T. Washio 27th International Conference on Machine Learning (ICML-10) (Program Committee)
- T. Washio 11th Pacific Rim International Conference on Artificial Intelligence (PRICAI 2010) (Special Session Chair)
- T. Washio 19th European Conference on Artificial Intelligence (ECAI 2010) (Program Committee)
- T. Washio The Thirteenth International Conference on Discovery Science (DS2010) (Program Committee)
- T. Washio SIAM Conference on Data Mining (SDM2011) (Program Chair)
- T. Washio ICDM 2010, the 10th IEEE International Conference on Data Mining (Program Committee)
- A. Inokuchi 2009 Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program Committee)
- A. Inokuchi 2009 Asian Conference on Machine Learning (Program Committee)
- A. Inokuchi 2009 International Workshop on Data-Mining and Statistical Science (Workshop co-chairs)
- A. Inokuchi 2009 SIAM International Conference on Data Mining (Program Committee)
- A. Inokuchi 2009 IADIS European Conference on Data Mining 2010 (Program Committee)
- A. Inokuchi 2010 Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program Committee)
- A. Inokuchi IEICE Transactions on Information and Systems, Special Section on Data Mining

	and Statistical Science. (Editorial Board)	
A. Inokuchi	International Journal of Applied Evolutionary Computation (Editorial Review Board)	
Y. Kawahara	2009 Asian Conference on Machine Learning (Program Committee)	
Publications in Domestic Meetings		
	The 23th Annual Conference of The Japanese Society for Artificial Intelligence	6 papers
	Domestic Conference on Data Mining and Statistical Mathematics	1 paper
	Japanese Joint Statistical Meeting	1 paper
	Space Sciences and Technologies Conference	1 paper
	National Conference of Information Processing Society of Japan	2 papers
	Special Interest Group of AI Application in Finance	1 paper
	Special Interest Group of Fundamental Problem in Artificial Intelligence	1 paper
Academic Degrees		
Master Degree for Engineering	Study on Graph Classification Based on Optimizing Graph Spectra	
V. D. Nguyen		
Master Degree for Engineering	Study on probabilistic expectation for high dimensional data	
H. H. Nguyen		
Bachelor Degree for Engineering	A causal structure search method by using non-Gaussianity and background information	
T. Inazumi		
Bachelor Degree for Engineering	A fast graph sequence mining technique by using closed sequence pattern mining principle	
T. Kishimoto		
Bachelor Degree for Engineering	Characterization of a probabilistic expectation method for high dimensional data	
S. Matsuda		
Grant-in-Aid for Scientific Research		
T. Washio	Development of Causal Structure Mining Method for Large Scale Dimensional Data and Construction of Knowledge Base on Gene Functional Relations	¥10,400,000
T. Washio	Establishment of Knowledge Mining and Modeling Principles for Large Scale Dimensional Time Series and Its Application to Commercial Ubiquitous Data	¥2,400,000
T. Washio	Study on an estimation method for large PSD matrix from incomplete data and its application to quantum computation experiments	¥1,300,000
A. Inokuchi	Development of Method for Mining Local and Characteristic Patterns from Changing Graph Structured Data	¥2,080,000
S. Shimizu	Discovering hidden causal structures in data with many more variables than observations.	¥1,430,000
Y. Kawahara	Algorithms and computational-architectures for change detections in large-scale data	¥1,534,000
Contribution to Research		
T. Washio	FUJITSU LABORATORIES LIMITED	¥1,000,000
T. Washio	The Asian Office of Aerospace Research and Development	¥7,267,000
Y. Kawahara	JFE 21 Century Foundation	¥2,000,000
Other Research Fund		
A. Inokuchi	Japan Science and Technology Agency	¥15,600,000
Department of Nanodevices for Medical Applications		

Original Papers

[1]Biomolecular Nano-Flow-Sensor to Measure Near-Surface Flow, Lee S-W, Kinoshita H, Noji H, Fujii T, Yamamoto T: *Nanoscale Res Lett.*, 5 (2010) 296-301.

[2]Protein assay using diffusion effect in single molecule micro-TAS, Nakayama T, Namura M, Tabata KV, Noji H, Yokokawa R: *Lab on a Chip*, 9 (2009) 3567-3573.

[3]Acceleration of the ATP-binding rate of F₁-ATPase by forcible forward rotation, Iko, Y., Tabata, K.V., Sakakihara, S., Nakashima, T., Noji, H.: *FEBS Lett.*, 583 (2009) 3187-3191.

Review Papers

Bioimaging towards the study of trans-hierarchical interplay in biological systems, H. Noji, T. Nagai, *PROTEIN, NUCLEIC ACID AND ENZYME, KYORITSU SHUPPAN CO., LTD*, 54[15] (2009), 1913-1917.

Imaging of intracellular ATP using novel fluorescent probes, H. Imamura, H. Noji, *PROTEIN, NUCLEIC ACID AND ENZYME, KYORITSU SHUPPAN CO., LTD*, 54[15] (2009), 1937-1944.

Single-molecule analysis in Biophysics, H. Noji, *Chemistry & Chemical Industry, The Chemical Society of Japan*, 62[10] (2009), 1082-1084.

Single-molecule assay of biological reaction in femtoliter chamber array, Iino R., Lam L., Tabata K. V., Rondelez Y., *Japanese Journal of Applied Physics, Japan Society of Applied Physics*, 48 (2009), 08JA04-1-5.

International Conferences

[1]36-degree stepping rotation of F₀F₁-ATP synthase (oral), *Hiroyuki Noji, Ryota Iino: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes” (Kyoto, Japan), 2009/9/8-10.

[2]Completion of the chemomechanical coupling scheme of F₁-ATPase: Pi-release and torque generation (invited), *Hiroyuki Noji: *WBMA '09*(Osaka, Japan), 2009/12/15-17.

[3]Imaging of Intracellular ATP Using FERT-Based Indicators (invited), *Hiroyuki Noji: International Symposium of Joint Research Network on Advanced Materials and Devices “彫” (Hotel-NIDOM Hokkaido), 2010/3/25.

Grant-in-Aid for Scientific Research

H. Noji	Innovative nanoscience of supermolecular motor proteins working in biomembranes	¥14,100,000
H. Noji	Rotational mechanism of FoF ₁ -ATP synthase	¥45,300,000
R. Iino	Visualization of the rotary motion of the ATP synthase by single-molecule techniques and microdevices.	¥2,990,000
K. Hayashi	Construction of statistical mechanics on proteins by using protein simulations	¥800,000
R. Iino	Development of an ultra-high speed optical microscope for the investigation of correlation between the conformational fluctuation and the performance of motor proteins	¥3,640,000

Department of Nanotechnology for Industrial Applications

Original Papers

[1]Enhanced leakage current properties of Ni-doped Ba_{0.6}Sr_{0.4}TiO₃ thin films driven by modified band edge state., S. Hyungtak, Y.-B. Kim, G. Lucovsky, II-D. Kim, K.-B. Chung, H. Kobayashi, and D.-K. Choi: *J. Appl. Phys.*, 107 (2010) 024109/1-7.

Laboratory of Microbiology & Infections Diseases

Original Papers

[1]H-NS modulates multidrug resistance of *Salmonella enterica* serovar Typhimurium by repressing multidrug efflux genes *acrEF*, K. Nishino, M. Hayashi-Nishino, Akihito Yamaguchi: *Antimicrob. Agents Chemother.*, 53 (8) (2009) 3541-3543.

[2]Role of the AraC/XylS family regulator YdeO in multidrug resistance of *Escherichia coli*, K. Nishino, Y. Senda, M. Hayashi-Nishino, A. Yamaguchi: J. Antibiot., 62 (5) (2009) 251-257.

[3]Regulation and physiological function of multidrug efflux pumps in *Escherichia coli* and *Salmonella*, K. Nishino, E. Nikaido, A. Yamaguchi: Biochim. Biophys. Acta-Proteins and Proteomics, 1794 (5) (2009) 834-43.

Review Papers

Roles of drug efflux pumps in bacterial multidrug resistance and virulence, K. Nishino, Reviews & Topics on Surface Science and Technology Avant-Gardes, 広信社, 47 (2009), 235-245.

Regulation of the AcrAB multidrug efflux pump in *Salmonella enterica* serovar Typhimurium, E. Nikaido, I. Shirotsuka, A. Yamaguchi, K. Nishino, Recent Advances in Clinical Pharmacology, Japan Research Foundation for Clinical Pharmacology, 30[29] (2009), 77-84.

Regulatory network of the AcrAB multidrug transporter in *Salmonella enterica*, E. Nikaido, R. Nakashima, K. Sakurai, I. Shirotsuka, A. Yamaguchi, K. Nishino, Jpn. J. Bacteriol., Bacteriology Society of Japan, 65[1] (2010), 72.

Virulence and drug resistance roles of bacterial multidrug efflux systems, K. Nishino, Proceedings of the symposium on biological membrane, Japanese Pharmaceutical Society, (2009), .

Electron tomography revealed a subdomain of the endoplasmic reticulum as a cradle for autophagosome formation, M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, K. Nishino, T. Yoshimori, A. Yamamoto, Proceedings of the symposium on biological membrane, Japanese Pharmaceutical Society, (2009), .

The localization study of a bacterial efflux transporter, T. Hirata, A. Kitamura, K. Nishino, A. Yamaguchi, Proceedings of the symposium on biological membrane, Japanese Pharmaceutical Society, (2009), .

Regulation mechanism of *Salmonella* AcrAB multidrug efflux pump in response to extracellular signals, E. Nikaido, I. Shirotsuka, R. Nakashima, A. Yamaguchi, K. Nishino, Proceedings of the symposium on biological membrane, Japanese Pharmaceutical Society, (2009), .

International Conferences

[1]Regulation of multidrug efflux pumps in *Escherichia coli* (poster), *Yamasaki, S., M. Nishino-Hayashi, A. Yamaguchi, and K. Nishino.: The 10th Japan-Korea International Symposium on Microbiology, Yokohama, Japan (2010/3/26).

[2]Green Microbiology: Development of novel therapeutic strategies to tackle multidrug-resistant pathogens. (poster), *K. Nishino: The 13th SANKEN International Symposium (18 Jan. 2010, Osaka).

[3]Effects of NlpE overproduction on the induction of xenobiotic transporters involved in multidrug resistance in *Escherichia coli* (poster), *S. Yamasaki, M. Nishino-Hayashi, A. Yamaguchi, K. Nishino: The 13th SANKEN International Symposium (18 Jan. 2010, Osaka).

[4]Membrane-damaging activity of Phe-Arg- β -Naphthylamide in *Escherichia coli* (poster), *Y. Matsumoto, K. Hayama, R. Iino, K. Nishino, H. Noji, A. Yamaguchi: 49th ICAAC, Interscience Conference on Antimicrobial Agents and Chemotherapy (12-15 Sep. 2009 SanFrancisco).

[5]Roles of xenobiotic transporters in bacterial drug resistance and virulence (poster), *K. Nishino, A. Yamaguchi: The Awaji International Forum on Infection and Immunity (8-11 Sep. 2009, Hyogo).

[6]Physiological functions of multidrug efflux pumps in *Salmonella* (invited), *K. Nishino: The 10th Japan-Korea International Symposium on Microbiology, Yokohama, Japan (2010/3/26).

[7]Function and regulation of multidrug efflux pumps in *E. coli* and *Salmonella* (invited), *K. Nishino: School of Biological Sciences Seminar at the University of Hong Kong.

[8]Unexpected role of multidrug efflux pumps in *Salmonella* virulence (invited), *K. Nishino: 3rd Symposium on Antimicrobial Resistance in Animals and the Environment.

Contributions to International Conferences and Journals

K. NISHINO 3rd Symposium on Antimicrobial Resistance in Animals and the Environment

(Co-chair)

Publications in Domestic Meetings

The 130 th Annual Meeting of the Pharmaceutical Society of Japan	1 paper
The 83 rd Annual Meeting of Japanese Society for Bacteriology	2 papers
The 44 th Annual Meeting of the Pseudomonas Aeruginosa Infection Society	1 paper
31 st Symposium on Biomembrane-Drug Interaction	4 papers
The 57 th Annual Meeting of the Japanese Society of Chemotherapy, Western Japan Division	1 paper
The 82 nd Annual Meeting of the Japanese Biochemical Society	4 papers
11 th Annual Meeting for the Society of Evolutionary Studies, Japan	1 paper
The 57 th Annual Meeting of the Japanese Society of Chemotherapy	2 papers
The 61 st Annual Meeting of the Japan Society for Cell Biology	1 paper
The 9 th Annual Meeting of the Protein Society of Japan	1 paper

Academic Degrees

Master Degree for Pharmaceutical Sciences
Roles of bacterial xenobiotic transporters in immune evasion

T. Ueda

Master Degree for Pharmaceutical Sciences
Study on mechanism of multidrug resistance in *Salmonella enterica* serovar Typhimurium

I. Shirosaka

Master Degree for Pharmaceutical Sciences
Evolutionary Studies on bacterial drug exporters

M. Tanaka

Grant-in-Aid for Scientific Research

K. Nishino Roles of orphan transporters in multidrug-resistant bacteria and development of therapeutic strategies to control infectious diseases ¥12,350,000

K. Nishino Studies on immune evasion systems in bacterial genome ¥3,800,000

Entrusted Research

K. Nishino PRESTO, Japan Science and Technology Agency Roles of xenobiotic transporters in cellular physiology ¥14,300,000

Contribution to Research

K. Nishino Senri Life Science Foundation ¥1,000,000

K. Nishino Asahi Glass Foundation ¥2,000,000

K. Nishino Nkajima Foundation ¥5,000,000

K. Nishino Takeda Science Foundation ¥3,000,000

K. Nishino Naito Foundation ¥3,000,000

K. Nishino Waksman Foundation of Japan ¥1,000,000

K. Nishino Research Foundation for Pharmaceutical Sciences ¥1,000,000

K. Nishino Life Science Foundation ¥1,000,000

K. Nishino Astellas Foundation for Research on Metabolic Disorders ¥1,000,000

Cooperative Research

K. Nishino Fine Co. ¥5,000,000

K. Nishino Daiichi Sankyo Co. ¥0

Laboratory of Atomic Scale Materials Processing

Original Papers

[1]Unipolar resistive switching characteristics of room temperature grown SnO₂ thin films, K. Nagashima, T. Yanagida, K. Oka and T. Kawai: Appl. Phys. Lett., 94 (2009) 242902.

[2]Crucial role of doping dynamics on transport properties of Sb-doped SnO₂ nanowires, A. Klamchuen,

- T. Yanagida, K. Nagashima, S. Seki, K. Oka, M. Taniguchi and T. Kawai: Appl. Phys. Lett., 95 (2009) 053105.
- [3] Specific surface effect on transport properties of NiO/MgO heterostructured nanowires, K. Oka, T. Yanagida, K. Nagashima, H. Tanaka, S. Seki, Y. Honsho, M. Ishimaru, A. Hirata and T. Kawai: Appl. Phys. Lett., 95 (2009) 133110.
- [4] Interfacial effect on metal/oxide nanowire junctions, K. Nagashima, T. Yanagida, A. Klamchuen, M. Kanai, K. Oka, S. Seki and T. Kawai: Appl. Phys. Lett., 96 (2010) 073110.
- [5] Resistive Switching Multistate Nonvolatile Memory Effects in a Single Cobalt Oxide Nanowire, K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi, T. Kawai, J.-S. Kim and B. H. Park: Nano Lett., 10 (2010) 1359-1363.
- [6] Enhancement of initial permeability due to Mn substitution in polycrystalline $\text{Ni}_{0.50-x}\text{Mn}_x\text{Zn}_{0.50}\text{Fe}_2\text{O}_4$, A. K. M. Hossain, T. S. Biswas, S. T. Mahmud, T. Yanagida, H. Tanaka and T. Kawai: J. Magn. Magn. Mater., 321 (2009) 81-87.
- [7] Influence of Mg and Cr Substitution on Structural and Magnetic Properties of Polycrystalline $\text{Ni}_{0.50}\text{Zn}_{0.50-x-y}\text{Mn}_x\text{Cr}_y\text{Fe}_2\text{O}_4$, A. K. M. Hossain, T. S. Biswas, S. T. Mahmud, T. Yanagida, H. Tanaka and T. Kawai: Mater. Chem. Phys., 113 (2009) 172-178.
- [8] ZnO Nanowire Morphology Control in Pulsed Laser Deposition, A. Marcu, M. Goyat, T. Yanagida and T. Kawai: J. Optoelectron Adv. Mater., 11 (2009) 421-424.
- [9] X-ray Absorption Magnetic Circular Dichroism of $\text{La}_{0.7}\text{Ce}_{0.3}\text{MnO}_3$ Thin Films, T. Yanagida, Y. Saitoh, Y. Takeda, A. Fujimori, H. Tanaka and T. Kawai: Phys. Rev. B, 79 (2009) 132405.
- [10] Novel Mechanochemical Process for Synthesis of Magnetite Nanoparticles using Coprecipitation Method, T. Iwasaki, K. Kosaka, T. Yabuuchi, S. Watano, T. Yanagida and T. Kawai: Adv. Powder Technol., 20 (2009) 521-528.
- [11] Size control of Magnetite Nanoparticles in Hydrothermal Synthesis by Coexistence of Lactate and Sulfate Ions, N. Mizutani, T. Iwasaki, S. Watano, T. Yanagida and T. Kawai: Curr. Appl. Phys., 10 (2010) 801-806.
- [12] Novel Environmentally Friendly Synthesis of Superparamagnetic Magnetite Nanoparticles using Mechanochemical Effect, T. Iwasaki, K. Kosaka, S. Watano, T. Yanagida and T. Kawai: Mater. Res. Bull., 45 (2010) 481-485.
- [13] Investigation of Structural and Magnetic Properties of Polycrystalline $\text{Ni}_{0.50}\text{Zn}_{0.50-x}\text{Mg}_x\text{Fe}_2\text{O}_4$ Spinel Ferrites, A. K. M. Hossain, T. S. Biswas, T. Yanagida, H. Tanaka, H. Tabata and T. Kawai: Mater. Chem. Phys., 120 (2010) 461-467.
- [14] Magnetic Cu-Ni (core-shell) Nanoparticles in a One-pot Reaction under Microwave Irradiation, T. Yamauchi, Y. Tsukahara, T. Sakata, H. Mori, T. Yanagida, T. Kawai and Y. Wada: Nanoscale, 2 (2010) 515-523.

Patents

- [1] Fabrication Method of Non-volatile Resistive Switching Memory Device T. Yanagida, T. Kawai, K. Nagashima, K. Oka, JP2009-168919

International Conferences

- [1] Non-volatile Memory Effect in Heterostructured Nanowires of Transition Metal Oxides (invited), K. Nagashima, T. Yanagida, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.
- [2] Metal Oxide Nanowires: Synthesis, Properties and Non-volatile Memory Applications (invited), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.
- [3] Non-volatile Unipolar Memory Switching in TiO_2 Heteronanowire (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.
- [4] Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured

- Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.
- [5]Metal Oxide Nanowires: Synthesis, Nano-properties and Device Applications (oral), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.
- [6]Mechanism of Nonvolatile Bipolar Resistive Memory Switching in MgO/Co₃O₄ Nanowire and Multi-storage Memory Application (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [7]Crucial Role of Doping Dynamics on Transport Properties of Sb-doped SnO₂ Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, S. Seki, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [8]Non-volatile Resistive Memory Switching in Individual MgO/NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.
- [9]Mechanism of Resistive Switching in MgO/Co₃O₄ Nanowires for Non-volatile Memory Applications (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: International Symposium on post silicon materials and devices research alliance project.
- [10]Resistive Switching Phenomena in MgO/Co₃O₄ Core/shell Nanowires (poster), K. Nagashima, T. Yanagida, K. Oka, T. Kawai, J.-S. Kim and B. H. Park: 16th International Workshop on Oxide Electronics.
- [11]Non-volatile Resistive Switching in Individual MgO/NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, T. Kawai, J.-S. Kim and B. H. Park: 16th International Workshop on Oxide Electronics.
- [12]Self-Assembling Oxide Nanowires: Growth Mechanisms and the Impact on Transport Properties of Impurity-Doped Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, K. Oka and T. Kawai: 16th International Workshop on Oxide Electronics.
- [13]Non-volatile Memory Switching using Atomically Controlled MgO/Co₃O₄ Heterostructured Nanowires (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: Second International Symposium on Atomically Controlled Fabrication Technology.
- [14]Extraction of Localized Non-volatile Memory Switching using MgO/Cobalt Oxide Heterostructured Nanowire (poster), K. Nagashima, T. Yanagida, K. Oka, A. Klamchuen, M. Taniguchi and T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [15]Impurity induced mesostructures of Sb-doped SnO₂ Nanowires (poster), A. Klamchuen, T. Yanagida, M. Kanai, K. Nagashima, K. Oka, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [16]Redox Reactions of Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, A. Klamchuen, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [17]Heterostructured Oxide Nanowires and Their Interface Properties (invited), T. Kawai and T. Yanagida: Material Research Society Spring Meeting.
- [18]Composite Nanostructures using Transition Metal Oxide Nanowires (oral), T. Kawai, T. Yanagida, K. Nagashima and K. Oka: 15th International Conference on Composite Structures.
- [19]Iron Oxide Shell Layer Morphology in PLD (oral), A. Marcu, T. Yanagida and T. Kawai: European Material Research Society.
- [20]Particles Flux Limitations in Nanostructures Growing Using PLD/VLS Technique (oral), A. Marcu, T. Yanagida, C. Grigoriu and T. Kawai: 10th International Balkan Workshop on Applied Physics, Constanta.

[21]Study on Nucleation Seeds for Pulsed Laser Ablation Oxide Materials (oral), A. Marcu, T.Yanagida, A.Mihailescu, C.Grigoriu and T.Kawai: ROMOPTO 2009.

[22]Non-Volatile Resistive Switching Memory Effects In Single Oxide Nanowire (invited), T. Yanagida and T.Kawai: WCU International Conference on Quantum Phases and Devices.

Publications in Domestic Meetings

The Japan Society of Applied Physics	5 papers
The Society of Chemical Engineers, Japan	1 paper
The Society of Powder Technology, Japan	1 paper
Emergence in Chemistry Symposium	1 paper

Grant-in-Aid for Scientific Research

T.Yanagida Fabrication and evaluation of oxide heterostructured nanowires ¥1,170,000

Entrusted Research

T.Yanagida	SCOPE	Study on Nonvolatile memory using network structures of inorganic/organic heterostructures	¥12,074,000
T.Yanagida	JST	Fabrication of nonvolatile memory by oxide nanowires	¥32,630,000

Other Research Fund

T.Yanagida Hosokawa Powder Technology Foundation ¥700,000

Beam Application Frontier Research Laboratory

Original Papers

[1]Theoretical Study on Chemical Gradient Generated in Chemically Amplified Resists Based on Polymer Deprotection upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa and S. Tagawa: Appl. Phys. Express, 2 (2009) 056503/1-056503/3.

[2]Difference of Spur Distribution in Chemically Amplified Resists upon Exposure to Electron Beam and Extreme Ultraviolet Radiation, T. Kozawa, K. Okamoto, A. Saeki, and S. Tagawa: Jpn. J. Appl. Phys., 48 (2009) 056508/1-056508/4.

[3]Dynamics of Radical Cation of Poly(4-hydroxystyrene) and Its Copolymer for Extreme Ultraviolet and Electron Beam Resists, K. Okamoto, M. Tanaka, T. Kozawa, and S. Tagawa: Jpn. J. Appl. Phys., 48 (2009) 06FC06/1-06FC06/4.

[4]Relationship between Resolution, Line Edge Roughness, and Sensitivity in Chemically Amplified Resist of Post-Optical Lithography Revealed by Monte Carlo and Dissolution Simulations, A. Saeki, T. Kozawa, and S. Tagawa: Appl. Phys. Express, 2 (2009) 075006/1-075006/3.

[5]Normalized Image Log Slope with Secondary Electron Migration Effect in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa and S. Tagawa: Appl. Phys. Express, 2 (2009) 095004/1-095004/3.

[6]Origin of Frequency-Dependent Line Edge Roughness: Monte Carlo and Fast Fourier-Transform Studies, A. Saeki, T. Kozawa, and S. Tagawa: Appl. Phys. Lett, 95 (2009) 103106/1-103106/3.

[7]Effects of Flare on Latent Image Formation in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa and S. Tagawa: Jpn. J. Appl. Phys., 48 (2009) 095005/1-095005/5.

[8]Exposure Dose Dependence of Chemical Gradient in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa and S. Tagawa: Jpn. J. Appl. Phys., 48 (2009) 106504/1-106504/5.

[9]Image Formation in Chemically Amplified Resists upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa and S. Tagawa: J. Photopolym. Sci. Technol., 22 (2009) 51-58.

[10]Charge Transport Properties of Hexabenzocoronene Nanotubes by Field Effect: Influence of the Oligoether Side Chains on the Mobility, Y. Yamamoto, W. Jin, T. Fukushima, T. Minari, K. Tsukagoshi, A. Saeki, S. Seki, S. Tagawa and T. Aida: Chem. Lett., 38 (2009) 888-889.

[11]Impact of Side-Chain Length on Alternating Current Mobility of Charge Carriers in Regioregular

- Poly(3-alkylthiophene) Films, A. Saeki, S.-i. Ohsaki, Y. Koizumi, S. Seki, and S. Tagawa: *Synth. Met.*, 159 (2009) 1800-1803.
- [12] Unusual Side-Chain Effects on Charge-Carrier Lifetime in Discotic Liquid Crystals, J. Motoyanagi, Y. Yamamoto, A. Saeki, M. A. Alam, A. Kimoto, A. Kosaka, T. Fukushima, S. Seki, S. Tagawa, and T. Aida: *Chem. Asian J.*, 4 (2009) 876-880.
- [13] Conformational Relaxation of σ -Conjugated Polymer Radical Anion on Picosecond Scale, Y. Ohnishi, A. Saeki, S. Seki, and S. Tagawa: *J. Chem. Phys.*, 130 (2009) 204907/1-204907/6.
- [14] Anisotropic Electron Transport Properties in Sumanene Crystal, T. Amaya, S. Seki, T. Moriuchi, K. Nakamoto, T. Nakata, H. Sakane, A. Saeki, S. Tagawa, and T. Hirao: *J. Am. Chem. Soc.*, 131 (2009) 408-409.
- [15] Evaluation of Chemical Gradient Enhancement Methods for Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, H. Oizumi, T. Itani, and S. Tagawa: *Jpn. J. Appl. Phys.*, 48 (2009) 126004/1-126004/5.
- [16] Dynamics of the Delocalized Charges of a Radical Anion in A center dot T DNA Duplexes, R. Yamagami, K. Kobayashi, and S. Tagawa: *Chem. Eur. J.*, 15 (2009) 12201-12203.
- [17] Latent Image Created Using Small-Field Exposure Tool for Extreme Ultraviolet Lithography, T. Kozawa, H. Oizumi, T. Itani, and S. Tagawa: *Jpn. J. Appl. Phys.*, 48 (2009) 106506/1-106506/5.
- [18] Sugar Nanowires Based on Cyclodextrin Prepared by Single Particle Nanofabrication Technique, S. Watanabe, A. Asano, S. Seki, M. Sugimoto, M. Yoshikawa, S. Tagawa, S. Tsukuda, and S. Tanaka: *Radiat. Phys. Chem.*, 78 (2009) 1071-1075.
- [19] Breaking time-resolution limits in pulse radiolysis, J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida, and S. Tagawa: *Radiat. Phys. Chem.*, 78 (2009) 1164-1168.
- [20] Electron Transfer Processes in Subunit I Mutants of Cytochrome bo Quinol Oxidase in Escherichia Coli, K. Kobayashi, S. Tagawa, and T. Mogi: *Biosci. Biotechnol. Biochem.*, 73 (2009) 1599-1603.
- [21] Removal of Ion Implanted Resists with Various Acceleration Energy using Wet Ozone, Y. Goto, T. Maruoka, M. Yamamoto, H. Horibe, E. Kusano, T. Miura, M. Kekura, and S. Tagawa: *J. Photopolym. Sci. Technol.*, 22 (2009) 321-324.
- [22] Effect of Polymer Protection and Film Thickness on Acid Generator Distribution in Chemically Amplified Resists, T. Fukuyama, T. Kozawa, H. Yamamoto, S. Tagawa, M. Irie, T. Mimura, T. Iwai, J. Onodera, I. Hirose, T. Koganesawa, and K. Horie: *J. Photopolym. Sci. Technol.*, 22 (2009) 105-109.
- [23] Formation of Hybrid Nano-structures by Ion Beam Irradiation to the Sol-Gel Film, S. Tsukuda, S. Seki, M. Sugimoto, A. Idesaki, S. Tagawa, and S. Tanaka: *J. Photopolym. Sci. Technol.*, 22 (2009) 245-248.
- [24] Removal of Ion-Implanted Photoresists Using Wet Ozone, M. Yamamoto, Y. Goto, T. Maruoka, H. Horibe, T. Miura, E. Kusano, and S. Tagawa: *J. Electrochem. Soc.*, 156 (2009) H505-H511.
- [25] Relationship between the Thermal Hardening of Ion-Implanted Resist and the Resist Removal Using Atomic Hydrogen, T. Muraoka, Y. Goto, M. Yamamoto, H. Horibe, E. Kusano, K. Takao, and S. Tagawa: *J. Photopolym. Sci. Technol.*, 22 (2009) 325-328.
- [26] Nano-fabrication and Functionalization of Crosslinked PTFE Using Focused Ion Beam, Y. Takasawa, N. Fukutake, K. Okamoto, A. Oshima, S. Tagawa, and M. Washio: *J. Photopolym. Sci. Technol.*, 22 (2009) 341-345.
- [27] Effect of Molecular Structure on Depth Profile of Acid Generator Distribution in Chemically Amplified Resist Films, T. Fukuyama, T. Kozawa, K. Okamoto, S. Tagawa, M. Irie, T. Mimura, T. Iwai, J. Onodera, I. Hirose, T. Koganesawa, and K. Horie: *Jpn. J. Appl. Phys.*, 48 (2009) 06FC03/1-06FC03/4.
- [28] Correlation between C-37 Parameters and Acid Yields in Chemically Amplified Resists upon Exposure to 75 keV Electron Beam, K. Natsuda, T. Kozawa, K. Okamoto, A. Saeki, and S. Tagawa: *Jpn. J. Appl. Phys.*, 48 (2009) 06FC05/1-06FC05/4.

- [29]Reactivity of Halogenated Resist Polymer with Low-Energy Electrons, H. Yamamoto, T. Kozawa, A. Saeki, S. Tagawa, T. Mimura, H. Yukawa, and J. Onodera: *Jpn. J. Appl. Phys.*, 48 (2009) 06FC09/1-06FC09/3.
- [30]Bottom Extreme-Ultraviolet-Sensitive Coating for Evaluation of the Absorption Coefficient of Ultrathin Film, H. Hijikata, T. Kozawa, S. Tagawa, and S. Takei: *Appl. Phys. Express*, 2 (2009) 066503/1-066503/3.
- [31]Intramolecular Electron Transfer Processes in Cu-B-deficient Cytochrome bo Studied by Pulse Radiolysis, K. Kobayashi, S. Tagawa, and T. Mogi: *J. Biochem.*, 145 (2009) 685-691.
- [32]Photoresist Removal Using Atomic Hydrogen Generated by Hot-Wire Catalyzer and Effects on Si-Wafer Surface, M. Yamamoto, H. Horibe, H. Umemoto, K. Takao, E. Kusano, M. Kase, and S. Tagawa: *Jpn. J. Appl. Phys.*, 48 (2009) 026503/1-026503/7.
- [33]Removal Characteristics of Resists Having Different Chemical Structures by Using Ozone and Water, H. Horibe, M. Yamamoto, Y. Goto, T. Miura, and S. Tagawa: *Jpn. J. Appl. Phys.*, 48 (2009) 026505/1-026505/4.

International Conferences

- [1]Positron and EUV (Extreme Ultraviolet) Beam Applications to Resist Materials (invited), S. Tagawa: 15th International Conference on Positron Annihilation.
- [2]Picosecond and Nanosecond Pulse Radiolysis Studies on Dynamics of Radical Cations of Poly(4-hydroxystyrene) and Its Copolymer for Extreme ultraviolet and electron beam resists in comparison with polystyrene related polymers (invited), K. Okamoto, M. Tanaka, K. Natsuda, T. Kozawa, and S. Tagawa: The 26th Miller Conference on Radiation Chemistry.
- [3]Tribute to Dr. Hiroshi Ito (invited), S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.
- [4]Monte Carlo Simulation of Chemical Intermediates in CARs (Oral), A. Saeki, T. Kozawa, and S. Tagawa: 2009 International Workshop on EUV Lithography.
- [5]Computational Study on Nanometer-scale Side-Wall Roughness in Chemically Amplified Resists of Next-Generation Lithography (Oral), A. Saeki, T. Kozawa, and S. Tagawa: 42nd IUPAC Congress.
- [6]Simulation Studies on Relationship between Resolution, Line Edge Roughness, and Sensitivity in Chemically Amplified Resists of Electron Beam Lithography (Oral), A. Saeki, T. Kozawa, and S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.
- [7]Hole Dynamics in Poly(4-Hydroxystyrene) and its Copolymer (Oral), K. Okamoto, M. Tanaka, T. Kozawa, and S. Tagawa: The 12th SANKEN International Symposium.
- [8]Image Formation in Chemically Amplified Resists upon Exposure to Extreme Ultraviolet Radiation (Oral), T. Kozawa, and S. Tagawa: 26th International Conference of Photopolymer Science and Technology (ICPST-26) Conference.
- [9]Modeling and simulation of chemically amplified resists for EUV lithography (invited), T. Kozawa, and S. Tagawa: 7th Fraunhofer IISB Lithography Simulation Workshop.
- [10]Dynamics of Radical Cation of Protected Poly(4-Hydroxystyrene)s for EUV and Electron Beam Resists (Oral), K. Okamoto, M. Tanaka, T. Kozawa, S. Tagawa, and T. Sumiyoshi: 22nd International Microprocesses and Nanotechnology Conference.
- [11]Simulation Studies on Relationship between Resolution, Line Edge Roughness, and Sensitivity in Chemically Amplified Resists of Electron Beam Lithography (Oral), A. Saeki, T. Kozawa, and S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.
- [12]Study on Radiation Chemistry of Fluoronaphthalene for Extreme Ultraviolet Resists (Oral), S. Ikeda, K. Okamoto, H. Yamamoto, A. Saeki, T. Kozawa, and S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.
- [13]Short-Lived Intermediates of Fluorinated Benzene Derivatives Generated upon Exposure to Ionizing

Radiation , S. Higashino, K. Okamoto, A. Saeki, T. Kozawa, and S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.

[14]Radiation Chemistry of Aromatic and Halogenated Non-chemically Amplified Resists for Electron Beam and Extreme Ultraviolet Lithography (invited), H. Yamamoto, K. Okamoto, A. Saeki, T. Kozawa, and S. Tagawa: 11th Pacific Polymer conference 2009.

[15]Dependence of Acid Yield on Polymer Structure in EUV Chemically Amplified Resist , H. Yamamoto, T. Kozawa, S. Tagawa, T. Iwai, and J. Onodera: 2009 International Workshop on EUV Lithography.

[16]Study on Depth Profile of Acid Generator Distribution in Poly(4-hydroxystyrene) films by Using X-ray Photoemission Spectroscopy (XPS) , H.Yamamoto, T. Kozawa, and S. Tagawa: 2009 international symposium on Extreme Ultraviolet and immersion Lithography.

[17]Effect of Direct Excitation of Acid Generators upon Exposure to Extreme Ultraviolet Radiation , H.Yamamoto, T. Kozawa, S. Tagawa, T. Hirayama, T. Iwai, and K. Sato: 22nd International Microprocesses and Nanotechnology Conference.

[18]Acid Generation Processes in Halogenated Aromatic Polymer films for Electron Beam and Extreme Ultraviolet Lithography , H. Yamamoto, T. Kozawa, A. Saeki, S. Tagawa, T. Iwai, and J. Onodera: 11th Pacific Polymer conference 2009.

[19]Relationship between Normalized Image Log Slope (NILS) and Chemical Gradient in Chemically Amplified Extreme Ultraviolet Resists –Effect of Secondary Electron Migration , T. Kozawa, and S. Tagawa: 22nd International Microprocesses and Nanotechnology Conference.

Contributions to International Conferences and Journals

S. TAGAWA	22nd International Microprocesses and Nanotechnology Conference (Organizing Committee member)
M. ENDO	The 26th International Conference of Photopolymer Science and Technology (Organizing Committee member)
M. ENDO	22nd International Microprocesses and Nanotechnology Conference ((Program Committee member)

Publications in Domestic Meetings

Atomic Energy Society of Japan	1 paper
The Japan Society of Applied Physics	3 papers
The Chemical Society of Japan	1 paper
The Society of Polymer Science, Japan	2 papers
Japanese Society of Radiation Chemistry	3 papers

Grant-in-Aid for Scientific Research

A. Saeki	Nanometer-scale dynamics of charge carriers in organic semiconductors by using radiations and microwave	¥6,370,000
K. Enomoto	Synthesis of Conducting Graft Polymers with a Hydrogen-Bond Network and Applications to Anhydrous Fuel Cell Membranes	¥2,340,000
H. Yamamoto	Elucidation and control of Nano-topography mechanism in ultrafine fabrication	¥1,820,000

Entrusted Research

S. Tagawa	JST CREST	Research on resist for ultrafine fabrication and development of process simulator	¥130,650,000
S. Tagawa	SELETE	Proposal of reaction mechanism and resist design for next generation EUV resist	¥3,000,000

Cooperative Research

S. Tagawa	JST PREST		¥1,090,000
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Department of Disease Glycomics (SEIKAGAKU CORPORATION - Endowed Chair)

Original Papers

[1]From the gamma-glutamyl cycle to the glycan cycle: a road with many turns and pleasant surprises., N. Taniguchi: J. Biol. Chem., 284 (50) (2009) 34469-34478.

- [2]Physiological and glycomic characterization of *N*-acetylglucosaminyltransferase-IVa and -IVb double deficient mice., S. Takamatsu, A. Antonopoulos, K. Ohtsubo, D. Ditto, Y. Chiba, D.T. Le, H.R. Morris, S.M. Haslam, A. Dell, J.D. Marth and N. Taniguchi: *Glycobiology*, 20 (4) (2010) 485-497.
- [3]α2,6-Sialic Acid on Platelet Endothelial Cell Adhesion Molecule (PECAM) Regulates Its Homophilic Interactions and Downstream Antiapoptotic Signaling, S. Kitazume, R. Imamaki, K. Ogawa, Y. Komi, S. Futakawa, S. Kojima, Y. Hashimoto, J.D. Marth, J.C. Paulson and N. Taniguchi: *J. Biol. Chem.*, 285 (9) (2010) 6515-6521.
- [4]Comparison of methods for profiling *O*-glycosylation: Human Proteome Organization Human Disease Glycomics/Proteome Initiative multi-institutional study of IgA1., Y. Wada, A. Dell, S.M. Haslam, B. Tissot, K. Canis, P. Azadi, M. Bäckström, C.E. Costello, G.C. Hansson, Y. Hiki, M. Ishihara, H. Ito, K. Kakehi, N. Karlsson, C.E. Hayes, K. Kato, N. Kawasaki, K.H. Khoo, K. Kobayashi, D. Kolarich, A. Kondo, C. Lebrilla, M. Nakano, H. Narimatsu, J. Novak, M.V. Novotny, E. Ohno, N.H. Packer, E. Palaima, M.B. Renfrow, M. Tajiri, K.A. Thomsson, H. Yagi, S.Y. Yu and N. Taniguchi: *Mol. Cell Proteomics*, 9 (4) (2010) 719-727.
- [5]Core fucosylation of *E*-cadherin enhances cell-cell adhesion in human colon carcinoma WiDr cells., D. Osumi, M. Takahashi, E. Miyoshi, S. Yokoe, S.H. Lee, K. Noda, S. Nakamori, J. Gu, Y. Ikeda, Y. Kuroki, K. Sengoku, M. Ishikawa and N. Taniguchi: *Cancer Sci.*, 100 (5) (2009) 888-895.
- [6]Core fucose and bisecting GlcNAc, the direct modifiers of the *N*-glycan core: their functions and target proteins., M.Takahashi, Y.Kuroki, K.Ohtsubo, N.Taniguchi: *Carbohydr. Res.*, 344 (12) (2009) 1387-1390.
- [7]Prologue for reflections and perspectives., N.Taniguchi: *J. Biochem.*, 146 (1) (2009) 1.
- [8]7th HUPO World Congress: the human disease glycomics/proteomics initiative (HGPI) session 17 August 2008, Amsterdam, The Netherlands., N.Taniguchi, J.M.Pierce: *Proteomics*, 9 (7) (2009) 1738-1741.
- International Conferences
- [1]Role of glycans in diseases biomarker and treatment (invited), N.Taniguchi: the International Medical Conference for the 60th Anniversary of Kyun Hee University May 10, 2009.
- [2]Role of Glycan in Disease: biomarker Discovery and Therapeutics (invited), N.Taniguchi: FEBS Advanced Lecture Course, Matrix Pathobiology, Signaling and Molecular Targets July 11-16, 2009.
- [3]Glycomics in disease biomarker discovery and treatment (plenary), N.Taniguchi: Pre Conference on CNHUPO6, July 27, 2009.
- [4]Core fucose and bisecting GlcNAc, the direct modifiers of *N*-glycan core, their functions and target protein. (plenary), N.Taniguchi: CNHUPO6 July 28-31, 2009.
- [5]Role of glycans in disease and therapeutics (invited), N.Taniguchi: 21st IUBMB & 12th FAOBMB International Congress of Biochemistry and Molecular Biology, Aug 2-7, 2009.
- [6]Roles of branched *N*-glycans in disease and therapeutics (oral), N.Taniguchi: Austria/Japan Seminar on Comparative Glycobiology and Developmental Biology, Sep. 20-22, 2009.
- [7]Glycomics approach for disease mechanism, biomarker discovery and therapeutics (plenary), N.Taniguchi: HUPO 8th Annual World Congress, Sep. 27-30, 2009.
- [8]"Glycan cycle" and the role of branched *N*-glycan in cell surface signaling, biomarker discovery and therapeutics (plenary), N.Taniguchi: 20th Joint Glycobiology Meeting, Nov. 8-10, 2009.
- [9]Role of "Glycan cycle" in disease; lessons from functional glycomics. (invited), N.Taniguchi: 20th International Symposium on Glycoconjugates, Nov. 29-Dec. 4, 2009.
- [10]The Role of Fut8 in the Pathogenesis of Chronic Obstructive Lung Disease (COPD) (oral), N.Taniguchi: 11th HGPI Meeting, Mar. 4-5, 2010.
- [11]Pancreatic Beta Cell Glycosylation Integrates Diet and Gene Expression in the Pathogenesis of Type 2 Diabetes. (oral), K.Ohtsubo: 11th HGPI Meeting, Mar. 4-5, 2010.
- [12]Pancreatic β Cell-Targeted Overexpression of *N*-acetylglucosaminyl-transferase-IVa Ameliorates

High-Fat Diet Induced Diabetic Phenotypes. (oral), K.Ohtsubo: 10th HGPI meeting; Satellite Meeting of the Japanese and German Study Groups for Glycobiology in 20th Joint Glycobiology Meeting, Nov.10, 2009.

[13]Pancreatic β Cell-Targeted Overexpression of *N*-acetylglucosaminyltransferase-IVa Ameliorates High-Fat Diet Induced Diabetic Phenotypes. (poster), K.Ohtsubo: The 13th Annual San Diego Glycobiology Symposium, Jan. 8-9, 2010.

[14]Alpha 1,6 fucosyltransferase heterozygous knockout (KO) mice have increased susceptibility to elastase-and cigarette smoke-induced emphysema models. (oral), CX.Gao: 10th HGPI meeting; Satellite Meeting of the Japanese and German Study Groups for Glycobiology in 20th Joint Glycobiology Meeting, Nov. 10, 2009.

[15]Simultaneous determination of nucleotide sugars with ion-pair reversed-phase HPLC and LC-ESI-MS. (poster), K.Nakajima: 20th Joint Glycobiology Meeting, Nov. 8-10, 2009.

[16]Simultaneous determination of nucleotide sugars with ion-pair reversed-phase HPLC and LC-ESI-MS. (poster), K.Nakajima, S.Kitazume, E.Miyoshi and N.Taniguchi: 20th International Symposium on Glycoconjugates, Nov. 29-Dec. 4, 2009.

[17]Comprehensive *in vivo* analyses of *N*-acetylglucosaminyltransferase (GnT)-IV. (poster), S.Takamatsu: 20th Joint Glycobiology Meeting, Nov. 8-10, 2009.

Contributions to International Conferences and Journals

N.TANIGUCHI	Journal of Biological Chemistry (Editorial Board)
N.TANIGUCHI	Cellular and Molecular Life Sciences (Editorial Board)
N.TANIGUCHI	Clinical Proteomics (Editorial Board)
N.TANIGUCHI	Glycobiology (Editorial Board)
N.TANIGUCHI	IUBMB Life (Editorial Board)
N.TANIGUCHI	IUBMB Biochemistry and Molecular Biology Education (Editorial Board)
N.TANIGUCHI	Nitric Oxide (Editorial Board)
N.TANIGUCHI	Protein Expression and Purification (Editorial Board)
N.TANIGUCHI	Biochemical and Biophysical Research Communications (Editor)
N.TANIGUCHI	Glycoconjugate Journal (Editor)
N.TANIGUCHI	International Journal of Oncology (Editor)
N.TANIGUCHI	Proteomics (Editor)
N.TANIGUCHI	Proteomics Clinical Applications (Editor)

Publications in Domestic Meetings

The 82nd Annual Meeting of the Japanese Biochemical Society	8 papers		
Grant-in-Aid for Scientific Research			
N.Taniguchi	Analysese of biological regulation for acetylglucosamine glycan cycle	¥9,750,000	
A.Matsumoto	A mechanism of aggregation in amyotrophic lateral sclerosis.	¥2,730,000	
Entrusted Research			
N.Taniguchi	Japan Society of the Promotion of Science	Human disease-related functional glycomics initiative	¥27,302,000
Contribution to Research			
N.Taniguchi	The Naito Foundation	¥4,000,000	
N.Taniguchi	The Foundation for Basic Research of Oncology	¥5,000,000	
Cooperative Research			
N.Taniguchi	Research Association for Biotechnology	¥3,675,000	
Other Research Fund			
K.Ohtsubo	SUNTORY Institute for Bioorganic Research	¥500,000	
K.Ohtsubo	Japan fundation for applied Enzymology	¥1,000,000	
K.Ohtsubo	Osaka Cancer Society	¥500,000	

Handai Multi-Functional Nanofoundry

Original Papers

- [1] Nano-fabrication and Functionalization of Crosslinked PTFE Using Focused Ion Beam, Y. Takasawa, N. Fukutake, K. Okamoto, A. Oshima, S. Tagawa, M. Washio: *J. Photopolym. Sci. Tech.*, 22 (2009) 341-346.
- [2] Adhesion Improvement of Perfluoro-sulfonic Acid Membrane by UV-irradiation for PEFC Performance, F. Shiraki, Y. Oshima, A. Oshima, M. Washio: *J. Photopolym. Sci. Tech.*, 22 (2009) 335-340.
- [3] Ion-beam Irradiation Effects on Polyimide-UV-vis and Infrared Spectroscopic Study, H. Kudo, S. Sudo, T. Oka, Y. Hama, A. Oshima, M. Washio and T. Murakami: *Radiat. Phys. Chem.*, 78 (2009) 1067-1070.
- [4] Development of a Compact X-ray Source and Super-sensitization of Photo Resists for Soft X-ray Imaging, T. Gowa, N. Fukutake, Y. Hama, K. Hizume, T. Kashino, S. Kashiwagi, R. Kuroda, A. Masuda, A. Oshima, T. Saito, K. Sakaue, K. Shinohara, T. Takahashi, T. Urakawa, K. Ushida, M. Washio: *J. Photopolym. Sci. Tech.*, 22 (2009) 273-278.

Review Papers

Nanofabrication of Fluorinated-Polymers Using Quantum Beam, A. Oshima, *Radiation & Industries, RADA*, 124 (2009), 9-14.

Patents

[1] Microfabrication of polymeric materials N. Nagasawa, A. Oshima, S. Tagawa, M. Washio, S. Okubo, M. Tamada, JP2010-053172

International Conferences

- [1] Nano and Micro Fabrication of Fluoropolymers Using Quantum Beam Technology (invited), M. Washio, N. Miyoshi, N. Fukutake, H. Nagai, T. Urakawa, T. Gowa, Y. Takasawa, T. Takahashi, T. Katoh, A. Oshima, S. Tagawa: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [2] Fabrication of PEFC Membrane based on Perfluorinated Polymer Using Quantum Beam Induced Grafting Technique (oral), A. Oshima, Y. Sato, F. Shiraki, N. Mitani, K. Fujii, Y. Oshima, H. Fujita, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [3] Surface Modification of Polymeric Materials Using Ultra Low Energy Electron Beam Irradiation (poster), A. Oshima, F. Shiraki, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [4] Study on Sensitivities of Resist Materials under UV, EB and Soft X-ray Exposure (oral), T. Gowa, T. Takahashi, T. Urakawa, N. Fukutake, K. Sakaue, A. Oshima, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [5] Heavy Ion Irradiation Effects on Depth Profiles in Poly(tetrafluoroethylene-co-ethylene) (poster), T. Gowa, T. Shiotsu, T. Urakawa, T. Oka, T. Murakami, A. Oshima, Y. Hama, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [6] Study on Direct Etching of Fluoropolymers by Heavy Ion Beam Irradiation (poster), Y. Takasawa, N. Fukutake, T. Takahashi, T. Urakawa, Y. Oshima, T. Gowa, F. Shiraki, H. Fujita, T. Oka, T. Murakami, A. Oshima, Y. Hama, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [7] Change of Surface Morphology for polytetrafluoroethylene by Reactive Ion Etching (poster), T. Takahashi, Y. Hirano, Y. Takasawa, T. Gowa, N. Fukutake, A. Oshima, S. Tagawa, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [8] The Effect of Water Uptake Gradient in Membrane Electrode Assembly on Fuel Cell Performance (poster), H. Fujita, F. Shiraki, Y. Oshima, T. Tatsumi, T. Yoshikawa, T. Sasaki, A. Oshima, M. Washio: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10, 2009.
- [9] Changes to the chemical structure of isotactic-polypropylene induced by ion-beam irradiation (poster), T. Oka, A. Oshima, R. Motohashi, N. Seto, Y. Watanabe, R. Kobayashi, K. Saito, H. Kudo, T. Murakami, M. Washio, Y. Hama: 11th Pacific Polymer Conference (PPC-11) Cairns, Australia, December 6-10,

2009.

[10]Nanoimprint Using the Mold of Crosslinked PTFE Fabricated by Focused Ion Beam (poster), T. Takahashi, N. Fukutake, Y. Takasawa, T. Gowa, T. Tatsumi, T. Sasaki, A. Oshima, S. Tagawa, M. Washio: 21st International Microprocesses and Nanotechnology Conference (MNC2009) , Hokkaido, Japan, November 16-19,2009.

[11]Development of Functionally-graded Hybrid Electrolytes for Polymer Electrolyte Fuel Cells (poster), F. Shiraki, Y. Oshima, Y. Sato, M. Naoyuki, K. Fujii, A. Oshima, M. Washio: 2009 Fuel Cell Seminar & Exposition, Palm Springs, USA, November 16-19, 2009.

Publications in Domestic Meetings

Chemical Society of Japan			3 papers
Japanese Society of Radiation Chemistry			3 papers
Japan Radioisotope Association			2 papers
The Committee of Battery Technology			2 papers
Grant-in-Aid for Scientific Research			
A. Oshima	Fabrication of high aspect multi-nanoarray electrodes using quantum beam		¥13,260,000
Entrusted Research			
T. Kawai	MEXT	Mission of Nanotechnology Network Japan	¥108,000,000

Comprehensive Analysis Center

Original Papers

[1]Development of chiral spiro ligands for metal-catalyzed asymmetric reactions, Bajracharya, G. B.; Arai, M. A.; Koranne, P. S.; Suzuki, T.; Takizawa, S.; Sasai, H.: Bull. Chem. Soc. Jpn., 82 (2009) 285-302.

[2]Ir-Catalyzed Oxidative Desymmetrization of *meso*-Diols, Suzuki, T.; Ghozati, K.; Katoh, T.; Sasai, H.: Org. Lett., 11 (2009) 4286-4288.

[3]Chiral protonated amino acid ester discrimination by acyclic chiral hosts including D-mannofuranose moieties in fast atom bombardment mass spectrometry coupled with the enantiomer labeled guest method, Shizuma, M.; Sato, H.; Takai, Y.; Ono, D.; Suzuki, T.; Nakamura, M.: *J. Mass Spectrom. Soc. Jpn.*, 57 (2009) 331-339.

International Conferences

[1]Iridium-Catalyzed Oxidative Desymmetrization of *meso*-Diols , Kazem Ghozati, Shuhei Takatani, Tadashi Kato, Hiroaki Sasai, Takeyuki Suzuki: 11th International Kyoto Conference on New Aspects of Organic Chemistry, Kyoto, Japan, November 9-13, 2009.

[2]Iridium-Catalyzed Oxidative Desymmetrization of Diols , Takeyuki Suzuki, Kazem Ghozati, Tadashi Kato, Hiroaki Sasai: molecular chirality2009, Osaka, Japan, May 12-13, 2009.

[3]Oxidative Desymmetrization of Diols by Iridium Catalyst , Takeyuki Suzuki, Kazem Ghozati, Kaoru Suzuki, Tadashi Kato, Hiroaki Sasai: 15 - Symposium on Organometallic Chemistry Directed towards Organic Synthesis, Glasgow, UK, July 26-30, 2009.

[4]Enantioselective Oxidative 6-Endo-Trig Cyclizations Catalyzed by Palladium(II)-Spiro Bis(isoxazoline) Complex , Suman C. Mohanta, Yugo Tanigaki, Mahesh L. Patil, C. V. Laxman Rao, Kazuhiro Takenaka, Shinobu Takizawa, Takeyuki Suzuki and Hiroaki Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium , Osaka, Japan, November 6-8, 2009.

[5]Iridium-Catalyzed Oxidative Desymmetrization of Diols , Takeyuki Suzuki, Ghozati Kazem, Naveen K. Mangu and Hiroaki Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium , Osaka, Japan, November 6-8, 2009.

[6]Iridium-Catalyzed Oxidative Dimerization, Tishchenko Reaction and Oxidative Desymmetrization , Takeyuki Suzuki, Ghozati Kazem, Naveen K. Mangu and Hiroaki Sasai: The 12th SANKEN International Symposium, Osaka, Japan, January 22, 2009.

[7]Development of Dinuclear Vanadium Catalysts and Acid-Base Organocatalysts for Enantioselective Reactions via Dual Activation Mechanism, Shinobu Takizawa, Matsui Katsuya, Tomomi Katayama, Naohito Inoue, Doss Rajesh, Shuichi Hirata, Kimiko Kiriyama, Takeyuki Suzuki and Hiroaki Sasai*: The 12th SANKEN International Symposium, Osaka, Japan, January 22, 2009.

Publications in Domestic Meetings

Japan Chemical Society Annual meeting	4 papers
Organic synthesis symposium	1 paper
Contribution to Research	
T.SUZUKI KRI	¥300,000

Reserch Laboratory for Quantum Beam Science

Original Papers

[1]Study On Gamma-Ray-Induced Degradation Of Polymer Electrolyte By Ph Titration And Solution Analysis, Y. Akiyama, H. Sodaye, Y. Shibahara, Y. Honda, S. Tagawa, S. Nishijima: Polymer Degradation and Stability, 95 (1) (2010) 1-5.

[2]Emission Mechanism of Doubly Ortho-linked Quinoxaline/Diphenylfluorene or cis-Stilbene/Fluorene Hybrid Compounds Based on the Transient Absorption and Emission Measurements during the Pulse Radiolysis, Y. Wei, S. Samori, S. Tojo, M. Fujitsuka, J.-S. Lin, C.-T. Chen, and T. Majima: J.Am.Chem.Soc., 131 (19) (2009) 6698-6707.

[3]Electron Transfer in Supramolecular Donor-Acceptor Dyad of Zinc Porphycene, M. Fujitsuka, H. Shimakoshi, S. Tojo, L. Cheng, D. Maeda, Y. Hisaeda, and T. Majima: J. Phys. Chem. A., 133 (14) (2009) 3330-3335.

[4]Emission from Regioisomeric Bis(phenylethynyl)benzenes during Pulse Radiolysis, S. Samori, S. Tojo, M. Fujitsuka, T. Ryhding, A. G. Fix, B. M. Armstrong, M. Haley, and T. Majima: J.Org.Chem., 74 (10) (2009) 3776-3782.

[5]Intramolecular Dimer Radical Anion of [3n]Cyclophanes: Transannular Distance Dependent Stabilization Energy, M. Fujitsuka, S. Tojo, T. Shinmyozu, and T. Majima: Chem.Commun., (2009) 1553-1555.

[6]Important factors for the radiolysis-induced emission intensity of aromatic hydrocarbons, S. Samori, S. Tojo, M. Fujitsuka, and T. Majima: J.Photochem.Photoiol.A., 205 (2) (2009) 179-185.

Review Papers

S.Nishijima, Y.Akiyama, Y.Shibahara, H.S.Sodaye, Y.Honda, S.Tagawa, The Journal of Fuel Cell Technology, Fuel Cell Development Information Center, 9[2] (2009), 78-81.

International Conferences

[1]Study on Degraded Electrolyte Membrane with Positron (oral), Y. Honda, S. Tojo, S. Tagawa, H. S. Sodaye, Y. Akiyama, S. Nishijima: Advanced Science Research Symposium 2009, 10-12 Nov. Tokai, Japan.

Publications in Domestic Meetings

Atomic Energy Society of Japan	1 paper
Entrusted Research	
S. Nishijima NEDO	Development of Detailed Analytic Method for PEMFC Based on Positron Annihilation Spectroscopy
	¥900,000

Hard Materials Research Group

Original Papers

[1]Fabrication of Lotus-Type Porous Cobalt and Silicon through Decomposition of Moisture, H. Onishi, S. Ueno, S.K. Hyun and H. Nakajima: Metallurgical and Materials Transactions A, 40 (2) (2009) 438-443.

- [2]Fabrication of Lotus-Type Porous Al-Si Alloys Using the Continuous Casting Technique, J.S. Park, S.K. Hyun, S. Suzuki, H. Nakajima: Metallurgical and Materials Transactions A, 40 (2) (2009) 406-414.
- [3]Fabrication of Lotus-type Porous Aluminum through Thermal Decomposition Method, S.Y. Kim, J.S. Park, H. Nakajima: Metallurgical and Materials Transactions A, 40 (4) (2009) 937-942.
- [4]Compressive deformation behavior of porous g-TiAl with directional pores, T. Ide, M. Tane, H. Nakajima: Materials Science and Engineering A, 508 (1-2) (2009) 220-225.
- [5]In vivo osteocompatibility of lotus-type porous nickel-free stainless steel in rats, K. Alvarez, S.-K. Hyun, T. Nakano, Y. Umakoshi, H. Nakajima: Materials Science and Engineering C, 29 (4) (2009) 1182-1190.
- [6]Fabrication of Lotus-type Porous Aluminum Utilizing Decomposition of Moisture, M. Tane, H. Nakajima: Materials Transactions, 50 (6) (2009) 1477-1481.
- [7]An Effect of Addition of NiO Powder on Pore Formation in Porous Nickel, H. Onishi, S. Ueno, H. Nakajima: Journal of the Japan Institute of Metals, 73 (8) (2009) 618-621.
- [8]Metallic Scaffolds for Bone Regeneration, K. Alvarez, H. Nakajima: Materials, 2 (2009) 790-832.
- [9]Fabrication of Lotus-type Porous Carbon Steel via Continuous Zone Melting and Its Mechanical Properties, M. Kashihara, H. Yonetani, T. Kobi, S. K. Hyun, S. Suzuki, H. Nakajima: Materials Science and Engineering A, 524 (1-2) (2009) 112-118.
- [10]The Uncertainty in SCHF-DT Thermal Conductivity Measurements of Lotus-Type Porous Copper, H. Chiba, T. Ogushi, H. Nakajima, S. Ueno, K. Torii, T. Tomimura: Advanced Engineering Materials, 11 (10) (2009) 848-851.
- [11]Fabrication of Porous Metals with Directional Pores through Thermal Decomposition of Chromium Nitride, T.Wada, T.Ide, H. Nakajima: Metallurgical and Materials Transactions A, 40 (13) (2009) 3204-3209.
- [12]Shrinkage of Hollow Nanoparticles of Oxides of Cu and Ni at High Temperatures, R. Nakamura, H. Nakajima, H. Mori: Defect and Diffusion Forum, 289-292 (2009) 673-678.
- [13]Structure Change and Improvement of the Mechanical Properties of Lotus-type Porous Copper by ECAE Process, J. Lobos, S. Suzuki, H. Utsunomiya, H. Nakajima: Materials Science Forum, 620-622 (2009) 757-760.
- [14]Fabrication of Porous Metals with Directional Pores Through Solidification of Gas-dissolved Melt, H. Nakajima, T. Ide, S.-Y. Kim: Materials Science Forum, 620-622 (2009) 785-790.
- [15]Fabrication of Lotus-type Porous Carbon Steel by Continuous Casting Technique and Application to Machine Tools, M. Kashihara, H. Yonetani, S. Suzuki, S.Y. Kim, H. Nakajima: Proceedings of International Symposium on Cellular Metals for Structural and Functional Applications(CELLMET2008), (2009) 89-94.
- [16]Lotus-type Porous Ni-free Stainless Steel Biomaterial Produced by Continuous Zone Melting Technique, K. Alvarez, H. Nakajima: Proceedings of International Symposium on Cellular Metals for Structural and Functional Applications(CELLMET2008), (2009) 301-306.
- [17]Effects of Static Magnetic Field and Gas Atmosphere on Solidification of Silicon by Electromagnetic Levitation, S. Ueno, H. Kobatake, H. Fukuyama, S. Awaji, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012020.
- [18]Fabrication of porous aluminium with directional pores through thermal decomposition method, H. Nakajima, S. Y. Kim, J. S. Park: Journal of Physics: Conference Series, 165 (2009) 012063.
- [19]Fabrication of lotus-type porous copper through thermal decomposition of titanium hydride, T. Ide H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012064.
- [20]Fabrication of Porous Magnesium with Directional Pores through Thermal Decomposition of Magnesium Hydride, M. Tane, H. Nakajima: Journal of Physics: Conference Series, 165 (2009) 012065.

- [21]Fabrication of lotus-type porous aluminum using thermal decomposition of magnesium hydroxide, J. S. Park, H. Nakajima: *Journal of Physics: Conference Series*, 165 (2009) 012066.
- [22]Fabrication of a lotus-type porous Al-Si alloy by continuous casting with a thermal decomposition method, T.B. Kim, S. Suzuki, H. Nakajima: *Journal of Physics: Conference Series*, 165 (2009) 012067.
- [23]Fabrication of Al-Cu alloy with elongated pores by continuous casting technique, S. Suzuki, T.B. Kim, H. Nakajima: *Journal of Physics: Conference Series*, 165 (2009) 012068.
- [24]Structure change and improvement of the mechanical properties of a lotus-type porous copper by wire-brushing, J. Lobos, S. Suzuki, H. Nakajima, Y. S. Ji, H. Fujii, D. Terada, N. Tsuji: *Journal of Physics: Conference Series*, 165 (2009) 012070.
- [25]Mechanical property of lotus-type porous carbon steel fabricated by continuous casting method, Y. Kawamura, S. Suzuki, S.Y. Kim, H. Nakajima, M. Kashiwara, H. Yonetani: *Journal of Physics: Conference Series*, 165 (2009) 012071.
- [26]Effect of Additive Method and Additive Amount of Titanium Hydride on Pore Formation of Lotus-type Porous Copper Fabricated by Thermal Decomposition Method, T. Ide, H. Nakajima: *Journal of Japan Research Institute for Advanced Copper-base Materials and Technologies*, 48 (2009) 96-99.
- [27]The effect of microstructure on the pore morphology in Al-Mg-Si alloys fabricated by unidirectional solidification, T.B. Kim, S. Suzuki, H. Nakajima: *Journal of Japan Institute of Light Metals*, 59 (2009) 678-684.
- [28]-Ag-Cu Soldering Reliability Influenced by Process Atmosphere, A. Baated, J. Jiang, K. S. Kim, K. Saganuma, S. Huang, B. Jurcik, S. Nozawa, M. Ueshima: *IEEE T ELECTRON. PACK. MANU.*, 33 (1) (2010) 38-43.
- [29]Improving the Reliability of Si Die Attachment with Zn-Sn-Based High-Temperature Pb-Free Solder Using a TiN Diffusion Barrier, S. Kim, K. S. Kim, K. Saganuma, G. Izuta: *J. Electron. Mater.*, 38 (12) (2009) 2668-2675.
- [30]Interfacial Reactions of Si Die Attachment with Zn-Sn and Au-20Sn High Temperature Lead-Free Solders on Cu Substrates, S. Kim, K. S. Kim, K. Saganuma, G. Izuta: *J. Electron. Mater.*, 38 (6) (2009) 873-883.
- [31]Diamagnetism and Cooper pairing above T_c in cuprates, L. Li, Y. Wang, S. Komiya, S. Ono, Y. Ando, G. D. Gu, and N. P. Ong: *Phys. Rev. B*, 81 (5) (2010) 054510/1-9.
- [32]Zn-impurity effects on quasiparticle scattering in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ studied by angle-resolved photoemission spectroscopy, T. Yoshida, S. Komiya, XJ. Zhou, K. Tanaka, A. Fujimori, Z. Hussain, ZX. Shen, Y. Ando, H. Eisaki, and S. Uchida: *Phys. Rev. B*, 80 (24) (2009) 245113/1-7.
- [33]Josephson scanning tunneling microscopy: A local and direct probe of the superconducting order parameter, H. Kimura, RP. Barber, S. Ono, Y. Ando, and RC. Dynes: *Phys. Rev. B*, 80 (14) (2009) 144506/1-16.
- [34]Deviation from the Wiedemann-Franz law induced by nonmagnetic impurities in overdoped $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$, XF. Sun, B. Lin, X. Zhao, L. Li, S. Komiya, I. Tsukada, and Y. Ando: *Phys. Rev. B*, 80 (10) (2009) 104510/1-7.
- [35]X-Ray Absorption Spectra Reveal the Inapplicability of the Single-Band Hubbard Model to Overdoped Cuprate Superconductors, DC. Peets, DG. Hawthorn, KM. Shen, YJ. Kim, DS. Ellis, H. Zhang, S. Komiya, Y. Ando, GA. Sawatzky, RX. Liang, DA. Bonn, and WN. Hardy: *Phys. Rev. Lett.*, 103 (8) (2009) 087402/1-4.
- [36]Universal versus Material-Dependent Two-Gap Behaviors of the High-T_c Cuprate Superconductors: Angle-Resolved Photoemission Study of $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$, T. Yoshida, M. Hashimoto, S. Ideta, A. Fujimori, K. Tanaka, N. Mannella, Z. Hussain, ZX. Shen, M. Kubota, K. Ono, S. Komiya, Y. Ando, H. Eisaki, and S. Uchida: *Phys. Rev. Lett.*, 103 (3) (2009) 037004/1-4.
- [37]Far-Infrared Absorption and the Metal-to-Insulator Transition in Hole-Doped Cuprates, S. Lupi, D. Nicoletti, O. Limaj, L. Baldassarre, M. Ortolani, S. Ono, Y. Ando, and P. Calvani: *Phys. Rev. Lett.*, 102

(20) (2009) 206409/1-4.

[38]Comment on "Low-temperature phonon thermal conductivity of single-crystalline Nd_2CuO_4 : Effects of sample size and surface roughness", XF. Sun, and Y. Ando: Phys. Rev. B, 79 (17) (2009) 176501/1-3.

[39]Possibility of magnetic-field-induced reconstruction of the Fermi surface in underdoped cuprates:Constraints from infrared magneto-optics, A. D. LaForge, A. A. Schafgans, S. V. Dordevic, W. J. Padilla, K. S. Burch, Z. Q. Li, K. Segawa, S. Komiya, Y. Ando, J. M. Tranquada, and D. N. Basov: Phys. Rev. B, 81 (6) (2010) 064510/1-7.

[40]Magnetic and Transport Properties of FeAs Single Crystals, K. Segawa, and Y. Ando: J. Phys. Soc. Jpn., 78 (10) (2009) 104720/1-3.

[41]Universal critical behavior in single crystals and films of $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$, H. Xu, S. Li, SM. Anlage, CJ. Lobb, MC. Sullivan, K. Segawa, and Y. Ando: Phys. Rev. B, 80 (10) (2009) 104518/1-11.

[42]Direct mapping of the spin-filtered surface bands of a three-dimensional quantum spin Hall insulator, A. Nishide, A. A. Taskin, Y. Takeichi, T. Okuda, A. Kakizaki, T. Hirahara, K. Nakatsuji, F. Komori, Y. Ando, and I. Matsuda: Phys. Rev. B, 81 (4) (2010) 04139/1-4.

[43]Quantum oscillations in a topological insulator $\text{Bi}_{1-x}\text{Sb}_x$, A. A. Taskin, and Y. Ando: Phys. Rev. B, 80 (8) (2009) 085303/1-6.

[44]Direct mapping of the spin-filtered surface bands of a three-dimensional quantum spin Hall insulator, A. Nishide, A. A. Taskin, Y. Takeichi, T. Okuda, A. Kakizaki, T. Hirahara, K. Nakatsuji, F. Komori, Y. Ando, and I. Matsuda: Phys. Rev. B, 81 (4) (2010) 04139/1-4.

Review Papers

Anisotropic Mechanical Properties of Lotus-Type Porous Metals, H. Nakajima, M. Tane, S. K. Hyun, H. Seki, IUTAM Bookseries 12(Proceedings of the IUTAM Symposium on Mechanical Properties of Cellular Materials), Springer Science+Business Media B.V, なし (2009), 43-50.

Peculiar physical properties of copper-oxide high-temperature superconductors: clues for elucidating the superconductivity mechanism, Y.Ando, Materia Japan, Bulletin of the Japan Institute of Metals, 1 (2010), 7-12.

Books

[1]Diffusion in Materials(M. Koiwa) M. Koiwa, H. Nakajima, "Diffusion in Materials", Uchida Rokakuho Publishing Co., Ltd, 2009.

[2]Metallic Porous Materials(S. Kitagawa) H. Nakajima, "Porous materials designed by nanoscience", CMC Publishing CO.,LTD, 2010.

Patents

[1]Production Method for Porous Metals H. Nakajima, Korea 10-0887651

[2]Production Method for Porous Metals H. Nakajima, Canada 2378825

[3]Conductive adhesive as solder replacement and circuit therewith K. Suganuma, Y. Shirai, K. Suzuki, JP2010-59426

[4]Silver β -ketocarboxylate, metallic silver manufacturing material thereof, and application of silver thereof K. Suganuma, S. Yamaguchi, M. Hatamura, JP2009-221222

[5]Storage-stable inks containing β -ketocarboxylic acid silver salts, kits therefor, and forming method of wiring using them K. Suganuma, M. Hatamura, T. Matsumoto, M. Kawazome, JP2009-197133

[6]Silver containing conductive paste K. Suganuma, K.S. Kim, D.S. Kim, JP2009-170277

[7]Semiconductor devices having adhesive layers comprising laminated porous layers and joining layers and their fabrication K. Suganuma, G. Izuta, K.S. Kim, D.S. Kim, JP2009-164208

[8]Semiconductor devices and their fabrication by bonding under application of acceleration K. Suganuma, G. Izuta, K.S. Kim, D.S. Kim, JP2009-164203

[9]Fabrication of Ag nano particles K. Suganuma, J. Jiu, K.S. Kim, JP2009-155674

- [10] Laminated solder material, soldering method using the same, and solder junction K. Suganuma, G. Izuta, S. Murai, JP2009-142890
- [11] Inks containing β -ketocarboxylic acid silver salts, kits for them, and formation of wiring using them K. Suganuma, M. Hatamura, K.S. Kim, T. Matsumoto, M. Kawazome, JP2009-114232
- [12] Method for connecting terminals with high reliability, connected structure, and resin pastes therefor K. Suganuma, K. Otsuka, JP2009-99708
- [13] Nanofiber sheets and its fabrication methods. T. Nogi, K. Yano, JP2010-7010

International Conferences

- [1] Fabrication of Hollow Nano Particles of Metallic Oxides Through Oxidation Process (invited), *H. Nakajima, R. Nakamura: International Conference on PROCESSING & MANUFACTURING OF ADVANCED MATERIALS Processing, Fabrication, Properties, Applications (Thermec' 2009), Berlin, Germany, Aug.25-29, 2009.
- [2] Investigation Of The Mechanical Properties Of Lotus-Type Porous Carbon Steel Made By Continuous Zone Melting Technique (oral), *T. Kujime, H. Nakajima: International Conference on PROCESSING & MANUFACTURING OF ADVANCED MATERIALS Processing, Fabrication, Properties, Applications (Thermec' 2009), Berlin, Germany, Aug.25-29, 2009.
- [3] High Strain Rate Compression Behaviour of Porous Iron with Directional Pores (oral), *M. Tane, T. Kawashima, K. Horikawa, H. Kobayashi, H. Nakajima: European Congress on Advanced Materials and Processes (Euromat 2009), Glasgow, UK, Sep. 7-10, 2009.
- [4] Recent advances in the research on cellular metals in Asia (invited), *H. Nakajima, M. Tane, S. Suzuki, T. Ide, S. Ueno: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [5] Formation of Hollow and Porous Oxides through Oxidation of Metal Nanoparticles (invited), *H. Nakajima, R. Nakamura: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [6] Improvement of the strength of porous copper with directional pores (oral), *J. Lobos, S. Suzuki, H. Utunomiya, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [7] Fabrication of carbon steel with directional pores by continuous casting technique and their mechanical properties (poster), *S. Suzuki, Y. Kawamura, M. Kashihara, H. Yonetani, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [8] Fabrication of Al-Cu alloys with directional pores by continuous casting technique (poster), *S. Suzuki, T.B. Kim, H. Nakajima: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [9] Standardization of method for thermal conductivity test of porous metals (poster), *H. Nakajima, K. Torii, T. Ogushi, H. Chiba, F. Ono: 6th International Conference on Porous Metals and Metallic Foams (MetFoam2009), Bratislava, Slovakia, Sept. 1-4, 2009.
- [10] Elastic and Plastic Deformation Behaviors of Lotus-type Porous Metals (invited), *M. Tane, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [11] Dynamic Compression Behavior of Lotus-type Porous Iron (poster), *M. Tane, T. Kawashima, K. Horikawa, H. Kobayashi, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [12] Effect of Foaming Temperature on Pore Morphology of Al/AlN Composite Foam Fabricated by Melt Foaming Method (poster), *Y.H. Song, M. Tane, T. Ide, Y. Seimiya, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [13] Effect of Transfer Velocity on Porosity of Lotus-type Porous Aluminum Fabricated by Continuous

- Casting Technique (poster), *Y. Iio, T. Ide, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [14]Fabrication of Lotus-type Porous Iron by Thermal Decomposition Method (poster), *T. Ide, T Wada, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [15]Formation of Hollow and Porous Nanostructures of Iron Oxides via Oxidation of Iron Nanoparticles and Nanowires (poster), *R. Nakamura, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [16]Formation of Oxide Nanotubes and Bamboo-like Structures via Oxidation of Cu, Fe and Ni Nanowires (poster), *G. Matsubayashi, R. Nakamura, H. Tsuchiya, S. Fujimoto, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [17]Pore Growth Direction of Lotus-type Porous Copper Fabricated by Continuous Casting Technique (poster), *S. Suzuki, J.S. Park, K. Sugihara, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [18]Effect of Addition of NiO Powder on Pore Formation in Lotus-type Porous Carbon Steel Fabricated by Continuous Casting (poster), *M. Kashihara, H. Yonetani, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [19]Fabrication of Lotus-type Porous Al-Ti Alloys using the Continuous Casting Technique (poster), *T.B. Kim, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [20]Anisotropic Growth of Pores in Lotus-type Porous Magnesium (poster), *K. Sugihara, S. Suzuki, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [21]Consideration of Pore Diameter Distribution on Heat Transfer Capacity of Lotus-type Porous Copper Heat Sink for Air Cooling (poster), *H. Chiba, T. Ogushi, S. Ueno, H. Nakajima: The 11th the International Symposium on Eco-materials Processing and Design (ISEPD2010), Sakai, Japan, Jan. 9-12, 2010.
- [22]An Effect of Transfer Velocity on Porosity of Lotus-type Porous Aluminum Fabricated by Continuous Casting Technique (poster), *T. Ide, Y. Iio and H. Nakajima: The 13th SANKEN International Symposium 2009, Izumisano, Japan, Jan. 18-19, 2010.
- [23]Tin Whisker Growth in Vacuum Thermal Cycling (invited), K. Sukanuma, A. Baated, S. Kim, K. S. Kim, N. Nemoto, T. Nakagawa, Y. Toshiyuki: 2010 TMS Annual Meeting & Exhibition, Washington State Convention & Trade Center, Seattle, Washington, USA, Feb.14-18, 2010.
- [24]Investigation of Mechanism for Spontaneous Zinc whisker Growth from an Electroplated Zinc Coating (oral), A. Baated, K. S. Kim, K.Sukanuma: 2009 International Symposium on High Density Packaging and Microsystem Integration (HDP'09), Beijing, China, August 10-13, 2009.
- [25]JEITA Sn whiskers mitigation project-Room Temperature Whiskers, Thermal cycling Whiskers and Alloying Effects (oral), K. Sukanuma, K.S. Kim, Y. Shimada, K. Yamamoto, T. Kudoh, N. Nakamura, H. Oshima, S. Hayashi: 3rd International Symposium on Tin Whiskers, Technical University of Denmark, Denmark, June 23-24, 2009.
- [26]Joining Characteristics of Various High Temperature Lead-free Interconnection Materials (poster), K. Sukanuma, K.S. Kim, S.S. Kim, D.S. Kim, M. Kang, S.J. Kim: 59th Electronic Components & Technology Conference (ECTC 2009), San Diego, CA, USA, May 26-29, 2009.
- [27]Transport and Magnetic Studies of the Topological Insulator Bi-Sb (invited), *Y. Ando: International Workshop on Novel Topological States in Condensed Matter Physics, Hong Kong, China, June 23, 2009.
- [28]Electron-Hole Asymmetry in an Ambipolar Cuprate (invited), *Y. Ando: Emergence of

Inhomogeneous Phases in Strongly Correlated Electron Systems (Glassy '09), Paris, France, July 2, 2009.

[29] Unusual Transport and Magnetic Properties of a Topological Insulator Bi-Sb (oral), *Y. Ando, and A. A. Taskin: 6th International Symposium on High Magnetic Field Spin Science in 100T: Application of High Magnetic Field for Condensed Matter and Material Sciences, Sendai, Japan, December 7, 2009.

[30] Quantum Oscillations in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y. Ando, and A. A. Taskin: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.

[31] Anomalous magnetic-field-angle dependence of the magnetoresistance in PbS in the quantum transport regime (poster), *K. Eto, A. A. Taskin, K. Segawa, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.

[32] Study of the novel superconductivity in Cu-intercalated Bi_2Se_3 (poster), *Z. Ren, A. A. Taskin, K. Segawa, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.

[33] Anomalous Magnetotransport in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (oral), *Y. Ando, and A. A. Taskin: Workshop on Exotic Insulating State of Matter, Johns Hopkins Univ., Baltimore, USA, January 14-16, 2010.

[34] Quantum Oscillations in a Topological Insulator Bi-Sb (invited), *Y. Ando: American Physical Society March Meeting, Portland, USA, March 15, 2010.

[35] Spatial modulations of electronic states in the pseudogap phase of cuprates: ordering or interference (oral), *C. Parker, A. Pushp, A. Pasupathy, K. Gomes, S. Ono, Y. Ando, J. Wen, Z. Xu, and G. Gu : American Physical Society March Meeting, Portland, USA, March 15, 2010.

[36] Exfoliated Thin Crystals: A New Platform For Exploring Cuprate Physics (oral), *L. Sandilands, G. Chugunov, S. Ono, P. Kim, Y. Ando, and K. Burch: American Physical Society March Meeting, Portland, USA, March 17, 2010.

[37] Universal critical behavior in single crystals and films of $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ (oral), *S. M. Anlage, H. Xu, S. Li, C.J. Lobb, M.C. Sullivan, K. Segawa, and Y. Ando: American Physical Society March Meeting, Portland, USA, March 17, 2010.

[38] Transport properties of the Mott-insulating $\text{YBa}_2\text{Cu}_3\text{O}_{6.03}$ single crystals (poster), *K. Segawa, and Y. Ando: 9th International Conference on Materials and Mechanisms of Superconductivity (M2S-IX), Tokyo, Japan, September 8, 2009.

[39] Electron-hole asymmetry in the doping dependence of the Neel temperature in an Y-123 system (poster), *K. Segawa, and Y. Ando: Gordon Research Conference on Superconductivity, Hong Kong, China, June 8, 2009.

[40] Effect of Carbon Content on Synthesis of SiC/BN Nanocomposite Powders by Carbothermal Reduction - Nitridation of Borosilicate Glass (poster), *T. Kusunose, T. Sekino, Y. Ando: The Third International Conference on the Science and Technology for Advanced Ceramics (STAC-3).

[41] Oscillatory Angular Dependence of Magnetoresistance in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (poster), *A. A. Taskin, and Y. Ando: RIKEN Workshop on "Emergent Phenomena of Correlated Materials," Saitama, Japan, December 3, 2009.

[42] Oscillatory Angular Dependence of Magnetoresistance in a Topological Insulator $\text{Bi}_{1-x}\text{Sb}_x$ (poster), *A. A. Taskin, and Y. Ando: Workshop on Exotic Insulating State of Matter, Johns Hopkins Univ., Baltimore, USA, January 14-16, 2010.

Contributions to International Conferences and Journals

- | | |
|-------------|--|
| H. Nakajima | Sixth International Conference on Porous Metals and Metal Foaming Technology (MetFoam2009) (International Advisory Board Member) |
| H. Nakajima | High Temperature Materials and Progress (Editorial Board Member) |
| H. Nakajima | Diffusion and Defect Data (Editorial Board Member) |
| H. Nakajima | Materials Science Foundations (Editorial Board Member) |

H. Nakajima	International Conference on New Frontiers of Process Science and Engineering in Advanced Materials (Organizing Committee Member)		
H. Nakajima	6th International Conference on Diffusion in Solids and Liquids (Organizing Committee Member)		
H. Nakajima	International Conference on Eco-Materials Processing and Design 2010 (Organizing Committee Member)		
H. Nakajima	3rd International Symposium on Cellular Metals for Structural and Functional Applications (Program Committee)		
H. Nakajima	International Conference on Advanced Structure and Functional Materials Design (Organizing Committee Member)		
H. Nakajima	THERMEC 2009 International Conference on Advanced Materials (International Advisory Board Member)		
Y. Ando	EPL-Europhysics Letters (Co-editor)		
Publications in Domestic Meetings			
	The Japan Institute of Metals		22 papers
	The Japan Institute of Light Metals		4 papers
	The Japan Copper and Copper Alloys Research Association		2 papers
	Japan Heat Transfer Symposium		4 papers
	24th JIEP Annual Meeting		1 paper
	19th Micro-Electronic Symposium		1 paper
	Japanese Physical Society 65th Annual Meeting		3 papers
	Japanese Physical Society 2009 Autumn Meeting		7 papers
Grant-in-Aid for Scientific Research			
H. Nakajima	Fabrication of Novel Nano-hollow Sphere Metals and Metallic Nano-tube and Elucidation of Physical Properties		¥10,010,000
H. Nakajima	Development of unidirectionally porous metals using metal-gas compounds and application for electronic and medical materials		¥2,300,000
Entrusted Research			
H. Nakajima	Japan Science and Technology Agency	Development of unidirectionally lotus-type porous aluminum with high air-cooling power	¥2,000,000
H. Nakajima, S. Suzuki, M.Ishimaru	Small and Medium Enterprise Agency, Strategic Innovation of Fundamental Technologies	Combined Process of Rolling and Forging for High Silicon Containing Stainless Steels	¥2,310,000
H. Nakajima	Mori Seiki co. Ltd.	Investigation for process of manufacture of lotus carbon steel (2008-2010)	¥11,550,000
Katsuaki Suganuma	NEDO	R&D of flexible thermoelectric module for curved drainpipes of hot waste water	¥4,052,000
Contribution to Research			
H. Nakajima	The Japan Institute of Light Metals		¥250,000
H. Nakajima	FukudaHiroshiSyoten CO.,LTD		¥500,000
Cooperative Research			
H. Nakajima	Toyota Motor Corporation		¥9,372,000
Katsuaki Suganuma	C.Uyemura & Co.,Ltd		¥420,000
Other Research Fund			
H. Nakajima	Japan Society for the Promotion of Science, Joint Research Project under the Japan-Korea Basic Scientific Cooperation Program		¥800,000

Soft Materials Research Group

Original Papers

- [1] Sequence-independent and rapid long-range charge transfer through DNA, K. Kawai, H. Kodera, Y. Osakada, and T. Majima: *Nature Chem.*, 1 (2) (2009) 156-159.
- [2] "Signal-On" Detection of DNA Charge Transfer at the Single Molecule Level, T. Takada, Y. Takeda, M. Fujitsuka, and T. Majima: *J. Am. Chem. Soc. (Commun.)*, 131 (19) (2009) 6656-6657.
- [3] Emission Mechanism of Doubly *Ortho*-linked Quinoxaline/Diphenylfluorene or *cis*-Stilbene/Fluorene Hybrid Compounds Based on the Transient Absorption and Emission Measurements during the Pulse Radiolysis, Y. Wei, S. Samori, S. Tojo, M. Fujitsuka, J.-S. Lin, C.-T. Chen, and T. Majima: *J. Am. Chem. Soc.*, 131 (19) (2009) 6698-6707.
- [4] Photochemical Reactivity of Gold Cluster; Dependence of Size and Spin Multiplicity, M. Sakamoto, T. Tachikawa, M. Fujitsuka, and T. Majima: *Langmuir*, 25 (24) (2009) 13888-13893.
- [5] Emission from Regioisomeric Bis(phenylethynyl)benzenes during Pulse Radiolysis, S. Samori, S. Tojo, M. Fujitsuka, T. Ryhding, A. G. Fix, B. M. Armstrong, M. Haley, and T. Majima: *J. Org. Chem.*, 74 (10) (2009) 3776-3782.
- [6] Fullerol-Titania Charge Transfer Mediated Photocatalysis Working under Visible Light, Y. Park, N. J. Singh, K. S. Kim, T. Tachikawa, T. Majima, and W. Choi: *Chem. Eur. J.*, 15 (41) (2009) 10843-10850.
- [7] Comparing electroluminescence efficiency and photoluminescence quantum yield of fluorene-based π -conjugated copolymers with narrow band-gap comonomers, J. Han, J. An, C. Im, N. S. Cho, H. K. Shim, and T. Majima: *J. Photochem. Photobiol. A*, 205 (2-3) (2009) 98-103.
- [8] Important factors for the radiolysis-induced emission intensity of aromatic hydrocarbons, S. Samori, S. Tojo, M. Fujitsuka, and T. Majima: *J. Photochem. Photobiol. A*, 205 (2-3) (2009) 179-185.
- [9] Carbon-doped TiO₂ Photocatalyst Synthesized without Using an External Carbon Precursor and the Visible Light Activity, Y. Park, H. Park, W. Kim, T. Tachikawa, T. Majima, and W. Choi: *Appl. Catal. B*, 91 (1-2) (2009) 355-361.
- [10] Long-Range Charge Transfer through DNA by Replacing Adenine with Diaminopurine, K. Kawai, H. Kodera, and T. Majima: *J. Am. Chem. Soc.*, 132 (2) (2010) 627-630.
- [11] Evaluating Host-Guest Interactions in a Metal-Organic Framework Using a Polarity-Sensitive Probe, J. R. Choi, T. Tachikawa, M. Fujitsuka, and T. Majima: *J. Phys. Chem. Lett.*, 1 (7) (2010) 1101-1106.
- [12] Electron Transfer in the Supramolecular Donor-Acceptor Dyad of Zinc Hemiporphycene, M. Fujitsuka, H. Shimakoshi, S. Tojo, L. Cheng, D. Maeda, Y. Hisaeda, and T. Majima: *J. Phys. Chem. A*, 114 (12) (2010) 4156-4162.
- [13] Solvent-Polarity Dependence of Electron Transfer Kinetics in a CdSe/ZnS Quantum Dot-Pyromellitimide Conjugate, S.-C. Cui, T. Tachikawa, M. Fujitsuka, and T. Majima: *J. Phys. Chem. C*, 114 (2) (2010) 1217-1225.
- [14] Synthesis of a Novel Sn(IV) Porphycene-Ferrocene Triad Linked by Axial Coordination and Solvent Polarity Effect in Photoinduced Charge Separation Process, D. Maeda, H. Shimakoshi, M. Abe, M. Fujitsuka, T. Majima, and Y. Hisaeda: *Inorg. Chem.*, 49 (6) (2010) 2872-2880.
- [15] Probing Photocatalytic Active Sites on a Single Titanosilicate Zeolite with Redox-Responsive Fluorescent Dye, T. Tachikawa, S. Yamashita, and T. Majima: *Angew. Chem. Int. Ed.*, 49 (2) (2010) 432-435.
- [16] Photochemical Fabrication of Silver Nanostructure at Solid-liquid Interface Using the Recyclable Photosensitized Reduction Process, M. Sakamoto, S. S. Kim, K. Furusho, and T. Majima: *Phys. Chem. Chem. Phys.*, 12 (2) (2010) 365-372.
- [17] One-pot Preparation of Chiral Dinuclear Vanadium(V) Complex, S. Takizawa, D. Rajesh, T. Katayama, H. Sasai: *Synlett*, (10) (2009) 1667-1669.
- [18] Ir-Catalyzed Oxidative Desymmetrization of meso-Diols, T. Suzuki, K. Ghozati, T. Katoh, H. Sasai: *Org. Lett.*, 11 (19) (2009) 4286-4288.

- [19] Enantioselective Intramolecular Oxidative Aminocarbonylation of Alkenylureas Catalyzed by Palladium-Spiro Bis(isoxazoline) Complexes, . Tsujihara, T. Shinohara, K. Takenaka, S. Takizawa, K. Onitsuka, M. Hatanaka, H. Sasai: *J. Org. Chem.*, 74 (24) (2009) 9274-9279.
- [20] Asymmetric Synthesis of Chiral Spiro Bis(isoxazoline) and Spiro (Isoxazole-Isoxazoline) Ligands, K. Takenaka, T. Nagano, S. Takizawa, H. Sasai: *Tetrahedron: Asymmetry*, 21 (4) (2010) 379-381.
- [21] Enantioselective 6-Endo-Trig Wacker-Type Cyclization of 2-Geranylphenols: Application to Facile Synthesis of (–)-Cordiachromene, K. Takenaka, Y. Tanigaki, M. L. Patil, C. V. L. Rao, S. Takizawa, T. Suzuki, H. Sasai: *Tetrahedron: Asymmetry*, 21 (7) (2010) 767--770.
- [22] Acid-Base Organocatalysts for the Aza-Morita-Baylis-Hillman Reaction of Nitroalkenes, S. Takizawa, A. Horii, H. Sasai: *Tetrahedron: Asymmetry*, 21 (8) (2010) 891-894.
- [23] Enantioselective Wacker-Type Cyclization of 2-Alkenyl-1,3-Diketones Promoted by Pd-SPRIX Catalyst, K. Takenaka, S. C. Mohanta, M. L. Patil, C. V. L. Rao, S. Takizawa, T. Suzuki, H. Sasai: *Org. Lett.*, 12 (15) (2010) 3840-3483.
- [24] Formal Total Synthesis of Ottelione Using Iridium-Catalyzed Oxidative Desymmetrization, T. Suzuki, K. Ghozati, D.-Y. Zhou, T. Katoh, H. Sasai: *Tetrahedron*, 66 (38) (2010) 7562-7568.

Review Papers

- Development of Reaction Mechanistic Studies Based on Radiation Chemistry, M. Fujitsuka, T. Majima, *Radiation Chemistry, Japanese Society of Radiation Chemistry*, 87 (2009), 14-22.
- Photochemistry of New Supramolecules with Imides, M. Fujitsuka, A. Sugimoto, T. Majima, *Journal of Synthetic Organic Chemistry, The Society of Synthetic Organic Chemistry, Japan*, 67[4] (2009), 328-336.
- Foerster Theory, M. Fujitsuka, T. Majima, *Journal of Synthetic Organic Chemistry, The Society of Synthetic Organic Chemistry, Japan*, 67[4] (2009), 400.
- Marcus Theory, M. Fujitsuka, T. Majima, *Journal of Synthetic Organic Chemistry, The Society of Synthetic Organic Chemistry, Japan*, 67[4] (2009), 400.
- Preparation of Gold Nanoparticles from Photochemical Reaction: 3D Fabrication Using Two-color Two-laser Irradiation, M. Sakamoto, T. Majima, *Chemistry, Kagaku-Dojin*, 64[5] (2009), 23-28.
- Photochemistry Using Two-color Two-laser Irradiation: Application to 3D Fabrication, M. Sakamoto, T. Majima, *Journal of Japan Laser Processing Society, Japan Laser Processing Society*, 16[2] (2009), 147-151.
- Single-Molecule Fluorescence Imaging of TiO₂ Photocatalytic Reactions, T. Tachikawa and T. Majima, *Langmuir (Feature Article), American Chemical Society*, 25[14] (2009), 7791-7802.

Books

- [1] Kinetics of Long-Range Oxidative Electron Transfer through DNA (Marc M. Greenberg) K. Kawai and T. Majima, "Radicals in Nucleic Acids, Volume 2 in the Wiley Series of Reactive Intermediates in Chemistry and Biology", John Wiley & Sons, Inc., 2009.
- [2] (K. Maruoka) H. Sasai, S. Takizawa, Kagaku-dojin Publishing Company, INC, 2009.
- [3] C-C (K. Maruoka, K. Nozaki, Y. Ishi, J. Ootera, K. Tomioka) H. Sasai, S. Takizawa, K. Takenaka, 2010.

Patents

- [1] Detection Method of SNP T. Majima, K. Kawai, JP2010-9822

International Conferences

- [1] Photochemical formation of Gold Clusters and Nanoparticles in Polymer Matrix (invited), T. Majima: 5th Hnadai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, September 1-3, 2009.
- [2] Photochemical Reactions of Gold Clusters (invited), T. Majima: Langmuir Symposium, Tsukuba, Japan, September 14, 2009.
- [3] Beam-induced molecular chemistry (invited), T. Majima: International Meeting on Interdisciplinary

Chemistry 2009, Gunma, Japan, September 18-19, 2009.

[4]Kinetic Studies of Long-Range Hole Transfer through DNA (oral), *K. Kawai, and T. Majima: 6th International Symposium on Nucleic Acids Chemistry, Takayama, Japan, September 27-October 1, 2009.

[5]Interfacial Electron Transfer Dynamics of Solar Materials Studied by Single-Particle Fluorescence Measurement (invited), T. Majima: 1st WCU International Workshop on Dye-sensitized and Organic Solar Cells, Jochiwon, Korea, October 13, 2009.

[6]TiO₂ Photocatalysts for Green Technology (invited), T. Majima: Korean Chemical Society Meeting, Deajeon, Korea, October 29-30, 2009.

[7]Interfacial Electron Transfer Dynamics in a Single CdTe Quantum Dot-Pyromellitimide Conjugate (invited), T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[8]Electron Transfer in Supramolecular Donor-Acceptor Dyad of Zinc Porphycene (invited), *M. Fujitsuka, H. Shimakoshi, S. Tojo, D. Maeda, Y. Hisaeda, and T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[9]DNA Electronics (poster), T. Majima: 2009 KOREA-JAPAN Symposium on Frontier Photoscience, Jochiwon, Korea, October 13-November 2, 2009.

[10]Photochemistry of Gold Clusters (invited), T. Majima: 1st International Forum on Photoenergy Future (IFPF), Choenan, Korea, December 11-13, 2009.

[11]DNA Electronics (oral), T. Majima: 2009 Asian Symposium on Organic Materials for Electronics and Photonics (ASOMP 2009) and The 7th International OLED and PLED Materials Workshop, Taipei, Taiwan, December 13-15, 2009.

[12]Electron Transfer in Supramolecular Donor-Acceptor Dyad of Porphyrin Isomers towards Efficient Photo-Energy Conversion Systems (poster), M. Fujitsuka and *T. Majima: 13th SANKEN International Symposium, Osaka, Japan, January 19-20, 2010.

[13]Enantioselective PdII/PdIV Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: 15th IUPAC International Symposium on Organometallic Chemistry Directed toward Organic Synthesis (OMCOS 15).

[14]Oxidative Desymmetrization of Diols by Iridium Catalyst (poster), *T. Suzuki, K. Ghozati, K. Suzuki, T. Kato, H. Sasai: 15th IUPAC International Symposium on Organometallic Chemistry Directed toward Organic Synthesis (OMCOS 15).

[15]Enantioselective Oxidative Coupling Reaction of 2-Naphthol Derivatives Using Dinuclear Vanadium Complexes (poster), *R. Doss, S. Takizawa, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS).

[16]Iridium-Catalyzed Oxidative Desymmetrization of meso-Diols (poster), *K. Ghozati, S. Takatani, T. Kato, T. Suzuki, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS).

[17]Enantioselective Oxidative 6-Endo-Trig Cyclizations Catalyzed by Palladium(II)-Spiro Bis(isoxazoline) Complex (poster), *S. C. Mohanta, Y. Tanigaki, M. L. Patil, C. V. L. Rao, K. Takenaka, S. Takizawa, T. Suzuki, H. Sasai: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium (5th SPJ-OCS).

[18]Enantioselective PdII/PdIV Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11).

[19]Enantioselective Oxidative Coupling of 2-Naphthols Using Dinuclear Vanadium(V) Catalysts (poster), *R. Doss, S. Takizawa, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11).

[20]Iridium-Catalyzed Oxidative Desymmetrization of meso-Diols (poster), *K. Ghozati, S. Takatani, T.

Kato, H. Sasai, T. Suzuki: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11).

[21]Enantioselective Oxidative 6-Endo-Trig Cyclizations Catalyzed by Palladium(II)-Spiro Bis(isoxazoline) Complex (poster), *S. C. Mohanta, Y. Tanigaki, M. L. Patil, C. V. L. Rao, K. Takenaka, S. Takizawa, T. Suzuki, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11).

[22]Development of Enantioselective Organocatalyzed Domino Reactions (poster), *S. Takizawa, N. Inoue, K. Kiriyama, S. Hirata, S. Murakami, T. Nguyen, T. Suzuki, H. Sasai: The 11th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-11).

[23]Oxidative Desymmetrization of Diols by Iridium Catalyst (poster), *T. Suzuki, K. Ghazati, K. Katoh, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium.

[24]Enantioselective PdII/PdIV Catalysis Using Spiro Bis(isoxazoline) Ligand (poster), *K. Takenaka, T. Tsujihara, K. Onitsuka, M. Hatanaka, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium.

[25]Novel Enantioselective Domino Reactions Promoted by Acid-Base Organocatalysts (poster), *S. Takizawa, N. Inoue, S. Hirata, H. Sasai: The 13th SANKEN International Symposium 2009 / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium.

[26]Exploring a New Paradigm in Immobilization of Asymmetric Catalysts (invited), *H. Sasai, S. Takizawa, D Rajesh: 239th ACS National Meeting & Exposition.

[27]Exploring a New Paradigm in Immobilization of Multicomponent Asymmetric Catalyst (oral), *H. Sasai, S. Takizawa, M. L. Patil, K. Marubayashi: The 14th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis.

Contributions to International Conferences and Journals

T. MAJIMA	2009 Korea-Japan Symposium on Frontier Photoscience (Organizing Chair)
T. MAJIMA	FIRST WORKSHOP OF COLLEGE OF SCIENCE AND TECHNOLOGY, KOREA UNIVERSITY AND SANKEN, OSAKA UNIVERSITY (Organizing Chair)
T. MAJIMA	Second WORKSHOP OF COLLEGE OF SCIENCE AND TECHNOLOGY, KOREA UNIVERSITY AND SANKEN, OSAKA UNIVERSITY (Organizing Committee)
T. MAJIMA	2010 WORKSHOP OF COLLEGE OF SCIENCE, National Taiwan University and SANKEN, OSAKA UNIVERSITY (Organizing Committee)
T. MAJIMA	Langmuir (Senior Editor)
T. MAJIMA	ACS Applied Materials and Interfaces (Editorial Board)
H. SASAI	2010 The 7th International Symposium on the Chemistry and Biological Chemistry of Vanadium (Organizing Committee)
H. SASAI	The 11th International Kyoto Conference on New Aspects of Organic Chemistry (Organizing Committee)

Publications in Domestic Meetings

The 31th Japan Photobiology and Photomedicine Meeting	1 paper
The Photobiology Association of Japan Meeting	1 paper
The 23rd symposium on Biofunctional Chemistry Photochemistry Meeting 2009	1 paper
5 papers	
The 52th Radiation Chemistry Meeting	1 paper
Catalyst Meeting	1 paper
The 90th Japan Chemical Society Meeting	8 papers
Annual Meeting of The Chemical Society of Japan	6 papers
Symposium on Molecular Chirality	3 papers
Symposium on Organometallic Chemistry	2 papers

Symposium on Organic Reaction			2 papers
Summer Symposium of The Japanese Society for Process Chemistry			1 paper
Symposium on Organocatalysis			1 paper
Symposium on Organic Synthesis			1 paper
Medicinal Chemistry Symposium			1 paper
Grant-in-Aid for Scientific Research			
T. Majima	Nanoscience of Photofunctionalized DNA		¥7,800,000
M. Sakamoto	Research for three dimensional processing using the two-color two-laser beams		¥910,000
Entrusted Research			
H. Sasai	Japan Science and Technology Agency (JST)	Development of Novel Enantioselective Catalysis via Pd(II)/Pd(IV) Cycle	¥2,000,000

Medical Sciences Research Group

Original Papers

- [1]Electron tomography reveals the endoplasmic reticulum as a membrane source for autophagosome formation, M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: *Autophagy*, 6 (1) (2010) 301-303.
- [2]A subdomain of the endoplasmic reticulum forms a cradle for autophagosome formation, M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: *Nature Cell Biology*, 11 (12) (2009) 1433-1437.
- [3]H-NS modulates multidrug resistance of *Salmonella enterica* serovar Typhimurium by repressing multidrug efflux genes *acrEF*, K. Nishino, M. Hayashi-Nishino, Akihito Yamaguchi: *Antimicrob. Agents Chemother.*, 53 (8) (2009) 3541-3543.
- [4]Characterization of the ATP-dependent sphingosine-1-phosphate transporter in rat erythrocytes, N. Kobayashi, N. Kobayashi, A. Yamaguchi, T. Nishi: *J. Biol. Chem.*, 284 (32) (2009) 21192-21200.
- [5]Role of the AraC/XylS family regulator YdeO in multidrug resistance of *Escherichia coli*, K. Nishino, Y. Senda, M. Hayashi-Nishino, A. Yamaguchi: *J. Antibiot.*, 62 (5) (2009) 251-257.
- [6]Regulation and physiological function of multidrug efflux pumps in *Escherichia coli* and *Salmonella*, K. Nishino, E. Nikaido, A. Yamaguchi: *Biochim. Biophys. Acta-Proteins and Proteomics*, 1794 (5) (2009) 834-43.
- [7]Pulse radiolysis study of ion-species effects on the solvated electron in alkylammonium ionic liquids, T. Kondoh, A. Asano, J. Yang, K. Norizawa, K. Takahashi, M. Taguchi, R. Nagaishi, R. Katoh, Y. Yoshida: *Radiat. Phys. Chem.*, 78 (2009) 1157-1160.
- [8]Breaking time-resolution limits in pulse radiolysis, J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida, S. Tagawa: *Radiat. Phys. Chem.*, 78 (2009) 1164-1168.
- [9]100-femtosecond MeV electron source for ultrafast electron diffraction, J. Yang, K. Kan, N. Naruse, Y. Yoshida, K. Tanimura, J. Urakawa: *Radiat. Phys. Chem.*, 78 (2009) 1106-1111.
- [10]Pulse radiolysis study of trapped electron in MgSO₄·7H₂O single crystal, K. Norizawa, T. Kondoh, J. Yang, A. Ogata, Y. Yoshida: *Radiat. Phys. Chem.*, 78 (2009) 1153-1156.

Review Papers

- The Sphingolipid Transporter Spns2 Functions in Migration of Zebrafish Myocardial Precursors, A. Kawahara, T. Nishi, A. Yamaguchi, N. Mochizuki, *CELL TECHNOLOGY*, Gakken Medical Shujunsha Co., Ltd., 28[4] (2009), 390-391.
- Regulation of the AcrAB multidrug efflux pump in *Salmonella enterica* serovar Typhimurium, E. Nikaido, I. Shirotsuka, A. Yamaguchi, K. Nishino, *Recent Advances in Clinical Pharmacology*, Japan Research Foundation for Clinical Pharmacology, 30[29] (2009), 77-84.
- Optical Modulation of Electron Beam by the Digital Micro Mirror Device for the Radiation Therapy

based on the Photocathode RF Gun, T. Kondoh, J. Yang, K. Kan, Y. Yoshida, Radiation Chemistry, Japanese Society of Radiation Chemistry, 88 (2009), 28-32.

Books

[1]Chemotherapeutics - The forefront of antibiotic(A. Yamaguchi) A. Yamaguchi, "Chemotherapeutics - The forefront of antibiotic", KYOTO HIROKAWA, 2010.

International Conferences

[1]Regulation of multidrug efflux pumps in *Escherichia coli* (poster), *Yamasaki, S., M. Nishino-Hayashi, A. Yamaguchi, and K. Nishino.: The 10th Japan-Korea International Symposium on Microbiology, Yokohama, Japan (2010/3/26).

[2]Mechanism of the sphingosine 1-phosphate export from the cells (poster), *T. Nishi, Y. Hisano, N. Kobayashi, S. Kawasaki-Nishi, A. Yamaguchi: International Symposium of Joint Research Network on Advanced Materials and Devices, "Chou" (25-26, March, 2010, Hokkaido, Japan).

[3]Crystal structure of the substrate binding form of multidrug exporter AcrB (poster), *R. Nakashima, K. Sakurai, A. Yamaguchi: International Symposium of Joint Research Network on Advanced Materials and Devices, "Chou" (25-26, March, 2010, Hokkaido, Japan).

[4]Effects of NlpE overproduction on the induction of xenobiotic transporters involved in multidrug resistance in *Escherichia coli* (poster), *S. Yamasaki, M. Nishino-Hayashi, A. Yamaguchi, K. Nishino: The 13th SANKEN International Symposium (18 Jan. 2010, Osaka).

[5]Identification of the transporter that export sphingosine 1-phosphate from the cells (invited), *A. Yamaguchi: 11th International Conference - Cancun, Mexico (25-28 Oct. 2009).

[6]Autophagy and the Endoplasmic Reticulum (invited), *M. Hayashi-Nishino, N. Fujita, T. Noda, A. Yamaguchi, T. Yoshimori, A. Yamamoto: 5th International Symposium on Autophagy Meeting (Otsu Prince Hotel, 24-28 Sep. 2009).

[7]Membrane-damaging activity of Phe-Arg- β -Naphthylamide in *Escherichia coli* (poster), *Y. Matsumoto, K. Hayama, R. Iino, K. Nishino, H. Noji, A. Yamaguchi: 49th ICAAC, Interscience Conference on Antimicrobial Agents and Chemotherapy (12-15 Sep. 2009 SanFrancisco).

[8]Roles of xenobiotic transporters in bacterial drug resistance and virulence (poster), *K. Nishino, A. Yamaguchi: The Awaji International Forum on Infection and Immunity (8-11 Sep. 2009, Hyogo).

[9]Characterization of the ATP dependent sphingosine-1-phosphate (S1P) transporter in rat erythrocytes (poster), *N. Kobayashi, N. Kobayashi, T. Nishi, A. Yamaguchi: The 5th Takeda Science Foundation Symposium on PharmaSciences "Bioactive Lipid Molecules and Transporters" (Tokyo) May, 2009.

[10]Optical Modulation of Electron Beam by the Digital Micro Mirror Device for the Radiation Therapy based on the Photocathode RF Gun (poster), *T. Kondoh, H. Kashima, J. Yang, K. Kan, K. Norizawa, A. Ogata, Y. Yoshida, T. Tagawa: 13th SANKEN International Symposium 7th Nanotechnology Center International Symposium 2nd MSTeC International Symposium.

[11]Optical Absorption Spectrum of Hydrated Electron in MgSO₄ Aqueous Solution (poster), *K. Norizawa, T. Kondoh, J. Yang, Y. Yoshida: 13th SANKEN International Symposium 7th Nanotechnology Center International Symposium 2nd MSTeC International Symposium.

[12]Femtosecond reaction analysis based on a femtosecond electron beam and a femtosecond laser light (poster), *J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida: 13th SANKEN International Symposium 7th Nanotechnology Center International Symposium 2nd MSTeC International Symposium.

[13]From Solvated Electron to Hydrated Electron in Ionic Liquids by Controlling Water Content (oral), *T. Kondoh, J. Yang, K. Norizawa, Y. Yoshida, R. Nagaishi, M. Taguchi, K. Takahashi, R. Katoh: Radiation Chemistry in the 21st Century.

[14]Femtosecond pulse radiolysis study: Observations of solvation process in water and of geminate ion recombination in alkane in femtosecond time scale (oral), *J. Yang, T. Kondoh, K. Norizawa, Y. Yoshida: Radiation Chemistry in the 21st Century.

[15]Effect of Coexist-Water on Solvated Electron in Ionic Liquids for Formation of Nano Particle (poster),

*T. Kondoh, J. Yang, K. Norizawa, Y. Yoshida, R. Nagaishi, M. Taguchi, K. Takahashi, R. Katoh: 5th Handai Nanoscience and Nanotechnology International Symposium.

[16]Femtosecond Time-Resolved Stroboscope for Study of Nanofabrication Process (poster), *J. Yang, T. Kondoh, K. Kan, K. Norizawa, Y. Yoshida: 5th Handai Nanoscience and Nanotechnology International Symposium.

[17]Femtosecond pulse radiolysis and femtosecond electron diffraction (poster), *J. Yang, K. Kan, T. Kondoh, N. Naruse, Y. Yoshida, K. Tanimura, J. Urakawa: International Workshop on Ultrashort Electron & Photon Beams: Techniques & Applications.

[18]Collective Energy Loss of Attosecond Electron Bunches (poster), *A. Ogata, T. Kondoh, K. Norizawa, J. Yang, Y. Yoshida, S. Kashiwagi: International Workshop on Ultrashort Electron & Photon Beams: Techniques & Applications.

Contributions to International Conferences and Journals

A. YAMAGUCHI Journal of Bacteriology (Editorial Board Member)

Publications in Domestic Meetings

The 130th Annual Meeting of the Pharmaceutical Society of Japan 2 papers

The 83rd Annual Meeting of Japanese Society for Bacteriology 2 papers

The 44th Annual Meeting of the Pseudomonas Aeruginosa Infection Society 1 paper

The 35th Annual Meeting of Japan Bioenergetics Group 2 papers

31st Symposium on Biomembrane-Drug Interaction 6 papers

The 57th Annual Meeting of the Japanese Society of Chemotherapy, Western Japan 1 paper

Division

The 19th Annual Meeting of Japanese Association of Cardiovascular Pharmacology 1 paper

The 47th Annual Meeting of the Biophysical Society of Japan 2 papers

The 82nd Annual Meeting of the Japanese Biochemical Society 6 papers

11th Annual Meeting for the Society of Evolutionary Studies, Japan 1 paper

The 52nd Annual Meeting of the Japanese Society for Neurochemistry 1 paper

The 57th Annual Meeting of the Japanese Society of Chemotherapy 2 papers

The 61st Annual Meeting of the Japan Society for Cell Biology 1 paper

The 4th Annual Meeting of the Japan Transporter Research Association 3 papers

The 9th Annual Meeting of the Protein Society of Japan 1 paper

The 89th Annual Meeting of the Chemical Society of Japan 1 paper

The Workshop of High LET Radiation 2 papers

The 6th Annual Meeting of Particle Accelerator Society of Japan 3 papers

The 2009 Fall Meeting of AESJ 3 papers

The 52th Annual Meeting of the Japanese Society of Japan 6 papers

The 4th Takasaki Quantum Application Symposium 1 paper

The 7th Workshop of High-brightness RF gun 4 papers

The 2010 Spring Meeting of AESJ 3 papers

Academic Degrees

Master Degree for Roles of bacterial xenobiotic transporters in immune evasion

Pharmaceutical

Sciences

T. Ueda

Master Degree for Study on mechanism of multidrug resistance in *Salmonella enterica* serovar

Pharmaceutical Typhimurium

Sciences

I. Shirosaka

Master Degree for Evolutionary Studies on bacterial drug exporters

Pharmaceutical

Sciences

M. Tanaka

Master Degree for Pharmaceutical Sciences	Functional analysis of human spinster-like protein 3; a homologue of sphingosine 1-phosphate transporter, spns2		
M. Murata			
Doctor Degree for Pharmaceutical Sciences	Search for sphingosine 1-phosphate(S1P) efflux transporters and identification of a novel S1P transporter, Spns2		
Y. Hisano			
Grant-in-Aid for Scientific Research			
A. Yamaguchi	Structures, functions, regulations and physiological roles of xenobiotic exporters		¥21,580,000
M. Nishino	Mechanisms of bacterial infection and host defence		¥1,391,000
Y. Yoshida	Research on next-generation attosecond/femtosecond pulse radiolysis		¥58,890,000
Entrusted Research			
A. Yamaguchi	National Institute of Biomedical Innovation	Development of novel inhibitors that counteract infectious diseases by drug resistant bacteria	¥84,000,000
A. Yamaguchi	The Naito Foundation Subsidy for Promotion of Specific Research Projects	Identification and investigation of the sphingosine-1-phosphate efflux transporters	¥1,500,000
Contribution to Research			
M. Nishino	The Sumitomo Foundation		¥1,500,000

Human Interface Research Group

Original Papers

- [1]Performance of Kernel SOM considering Adjacency for Damage Evaluation, Ken-ichi Fukui, Shogo Akasaki, Kazuhisa Sato, Junichiro Mizusaki, Koichi Moriyama, Satoshi Kurihara, and Masayuki Numao: Transactions on Mathematical Modeling and its Applications, 3 (1) (2010) 36-48.
- [2]Visualization of Damage Progress on Solid Oxide Fuel Cell, Ken-ichi Fukui, Shogo Akasaki, Kazuhisa Sato, Junichiro Mizusaki, Koichi Moriyama, Satoshi Kurihara, and Masayuki Numao: Transactions of the Japan Society of Mechanical Engineers, 76 (762) (2010) 223-232.
- [3]Direct fabrication of integrated 3D Au nanobox arrays by sidewall deposition with controllable heights and thicknesses, N.-G. Cha, B. K. Lee, T. Kanki, H. Y. Lee, T. Kawai, H. Tanaka: Nanotechnology, 20 (2009) 395301.
- [4]The water falls but the waterfall does not fall: New perspectives on objects, processes and events, Antony Galton and Riichiro Mizoguchi: Journal of Applied Ontology, 4 (2) (2009) 71-107.
- [5]A Functional Ontology of Artifacts, Riichiro Mizoguchi and Yoshinobu Kitamura: The Monist - An Int'l Quarterly J. of General Philosophical Inquiry, 92 (3) (2009) 387-402.

International Conferences

- [1]Growth Analysis of Neighbor Network for Evaluation of Damage Progress (oral), *Ken-ichi Fukui, Kazuhisa Sato, Junichiro Mizusaki, Kazumi Saito, Masahiro Kimura, and Masayuki Numao: Proc. the 13th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD-09), (Lecture Notes in Artificial Intelligence 5476). Bangkok, Thailand. pp. 933-940. April 2009.
- [2]Evaluation Method for Mechanical Performance of Solid Oxide Fuel Cell under Simulated Operating Conditions (oral), *Kazuhisa Sato, Ken-ichi Fukui, Masayuki Numao, Toshiyuki Hashida, and Junichiro Mizusaki: ASME 7th International Conference on Fuel Cell Science, Engineering and Technology, California, USA. June 8-10 2009.
- [3]Visual Data Mining for Supporting Damage Evaluation of Fuel Cells (poster), *Ken-ichi Fukui, Shogo Akasaki, Kazuhisa Sato, Junichiro Mizusaki, and Masayuki Numao: The 13th SANKEN International

Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Jan. 2010.

[4]OntoGear: A Platform for Externalization of Functional Knowledge and its Interoperability (poster), *S. Takafuji, Y. Kitamura, and R. Mizoguchi: Asian Semantic Web Conference 2009, Shanghai, China, Dec. 6-9, 2009.

[5]Some Ontological Distinctions of Function based on the Role Concept (oral), *Yoshinobu Kitamura, Riichiro Mizoguchi: ASME 2009 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2009), San Diego, CA, USA, Aug. 30 - Sep. 2, 2009.

[6]Control of Metal-Insulator Transition at Room Temperature on W doped VO₂ Thin Films (poster), *H. Takami, T. Kanki, N.G. Cha, H. Tanaka: The Korean Physical Society Fall Meeting, 2009.

[7]Control of Metal-Insulator Transition Temperature in W-doped VO₂ Thin Films and Investigation of Their Electronic Properties (poster), *H. Takami, T. Kanki, S. Ueda, N.G. Cha, H. Tanaka: The 13th SANKEN International Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Jan. 2010.

[8]Direct Fabrication of an 80-nm Integrated Fe_{2.5}Mn_{0.5}O₄ (FMO) Nanocrystal Arrays in Large Area Using a Hollow Nanopillar Metal Mask for High Temperature (poster), *N.G. Cha, T. Kanki, H. Tanaka: 2009 MRS Fall Meeting.

[9]Fabrication of the Epitaxially grown Fe_{2.5}Mn_{0.5}O₄ (FMO) Nanocrystal Arrays in Large Area Using a Hollow Mo Nanopillar Metal Mask (poster), *N.G. Cha, T. Kanki, H. Tanaka: The 13th SANKEN International Symposium / The 8th SANKEN Nanotechnology Symposium / The 3rd SANKEN MSTEC Symposium / The 2nd SANKEN Alliance Symposium, Osaka, Jan. 2010.

[10]Construction of 3D transition metal oxide nano superstructures and their physical properties toward device application (invited), *H. Tanaka, N.G. Cha, S. Yamanaka, T. Kanki, T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes (ISSP 2009), Kanazawa, Japan, July 8-10, 2009.

Publications in Domestic Meetings

SIG-MPS, Information Processing Society of Japan (IPJS)		2 papers	
SIG-AI, the Institute of Electronics, Information and Communication Engineers (IEICE)		1 paper	
the SOFC Society of Japan		1 paper	
Annual Meeting of Self-Organizing Maps in Japan		1 paper	
Annual Conference of The Japanese Society for Artificial Intelligence (JSAI)		1 paper	
Design and Systems Division Symposium, Japan Society of Mechanical Engineers		1 paper	
2009 JSAP Fall Meeting		2 papers	
2010 JSAP Spring Meeting		2 papers	
The 6th Technological exchange workshop, Sputtering and Plasma Process		1 paper	
Sub-Division The Vacuum Society of Japan			
Grant-in-Aid for Scientific Research			
K. Fukui	A Study on Mechanical Property Evaluation of a Solid-type Electric Battery Based on Multidisciplinary Data Mining	¥780,000	
R. Mizoguchi	Building a Theory-aware and Standard-compliant Knowledge Server	¥13,780,000	
Entrusted Research			
N.G. Cha	Japan Science and Technology Agency	Development of Nano-structured solar cell using oxide nano-imprint lithography	¥2,000,000
Cooperative Research			
R. Mizoguchi	Justsystem Corporation		¥20,000,000
Other Research Fund			
K. Fukui	Kansai Research Foundation for technology promotion		¥900,000

Post-Silicon Materials and Devices Research Alliance

Original Papers

- [1]Photovoltaic Performance and Charge Carrier Mobility of Dendritic Oligothiophene Bearing Perylene Bis(dicarboximide) Groups, Y. Ie, T. Uto, A. Saeki, S. Seki, S. Tagawa, Y. Aso: *Synth. Met.*, 159 (9-11) (2009) 797-801.
- [2]STM Fluorescence of Porphyrin Enhanced by a Strong Plasmonic Field and Its Nanoscale Confinement in an STM Cavity, H. W. Liu, R. Nishitani, T. Z. Han, Y. Ie, Y. Aso, H. Iwasaki: *Phys. Rev. B*, 79 (12) (2009) 125415-1-6.
- [3]Electronegative Oligothiophenes Having Difluorodioxocyclopentene-annelated Thiophenes as Solution-processable n-Type OFET Materials, Y. Ie, M. Okabe, Y. Umemoto, H. Tada, Y. Aso: *Chem. Lett.*, 38 (5) (2009) 460-461.
- [4]Completely Encapsulated Oligothiophenes up to 12-mer, Y. Ie, A. Han, T. Otsubo, Y. Aso: *Chem. Commun.*, (21) (2009) 3020-3023.
- [5]Synthesis of Tripodal Anchor Units Bearing Selenium Functional Groups and Their Adsorption Behaviour on Gold, Y. Ie, T. Hirose, A. Yao, T. Yamada, N. Takagi, M. Kawai, Y. Aso: *Phys. Chem. Chem. Phys.*, 11 (25) (2009) 4949-4951.
- [6]Synthesis, Properties, and FET Performance of Rectangular Oligothiophene, Y. Ie, T. Hirose, Y. Aso: *J. Mater. Chem.*, 19 (43) (2009) 8169-8175.
- [7]Comprehensive Evaluation of Electron Mobility for Trifluoroacetyl-Terminated Electronegative Conjugated Oligomer, Y. Ie, M. Nitani, T. Uemura, Y. Tominari, J. Takeya, Y. Honsho, A. Saeki, S. Seki, Y. Aso: *J. Phys. Chem. C*, 113 (39) (2009) 17189-17193.
- [8]Air-Stable n-Type Organic Field-Effect Transistors Based on Carbonyl-Bridged Bithiazole Derivatives, Y. Ie, M. Nitani, M. Karakawa, H. Tada, Y. Aso: *Adv. Funct. Mater.*, 20 (6) (2010) 907-913.
- [9]Identifying Molecular Signatures in Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi, K. Shoji, K. Yokota and T. Kawai: *Nanoscale*, 1 (2009) 164-170.
- [10]Molecular vibrations in metal-single-molecule-metal junctions, K. Yokota, M. Taniguchi and T. Kawai: *Chemical Physics Letters*, 487 (4-6) (2009) 268-271.
- [11]Single-Molecule Junctions with Strong Molecule-Electrode Coupling, M. Taniguchi, M. Tsutsui, K. Shoji, H. Fujiwara and T. Kawai: *Journal of the American Chemical Society*, 131 (40) (2009) 14146-14147.
- [12]Inelastic Electron Tunneling Spectroscopy of Single-Molecule Junctions Using Mechanically Controllable Break Junction, M. Taniguchi, M. Tsutsui, K. Yokota and T. Kawai: *Nanotechnology*, 20 (43) (2009) 434008-434015.
- [13]Fabrication of the Gating Nanopore, M. Taniguchi, M. Tsutsui, K. Yokota and T. Kawai: *Applied Physics Letters*, 95 (2009) 123701(1-3).
- [14]Quantitative Evaluation of Metal-Molecule Contact Stability at the Single-Molecule Level, M. Tsutsui, M. Taniguchi and T. Kawai: *Journal of the American Chemical Society*, 131 (30) (2009) 10552-10556.
- [15]Atomistic Mechanics and Formation Mechanism of Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi and T. Kawai: *Nano Letters*, 9 (6) (2009) 2433-2439.
- [16]Transverse Field Effects on DNA-Sized Particle Dynamics, M. Tsutsui, M. Taniguchi and T. Kawai: *Nano Letters*, 9 (4) (2009) 1659-1662.
- [17]Roles of Lattice Cooling on Local Heating in Metal-Molecule-Metal Junctions, M. Tsutsui, M. Taniguchi, K. Yokota, and T. Kawai: *Appl. Phys. Lett.*, 96 (2010) 103110-103112.
- [18]Identifying Single Nucleotides by Tunnelling Current, M. Tsutsui, M. Taniguchi, K. Yokota, and T. Kawai: *Nature Nanotechnology*, 5 (2010) 286-290.

- [19]Metal–molecule interfaces formed by noble metal–chalcogen bonds for nanoscale molecular devices, K. Yokota, M. Taniguchi, and T. Kawai: *J. Phys. Chem. C.*, 114 (2010) 4044-4050.
- [20]Insulated Molecular Wire with Highly Conductive pi-Conjugated Polymer Core, J. Terao, Y. Tanaka, S. Tsuda, N. Kambe, M. Taniguchi, T. Kawai, A. Saeki and S. Seki: *Journal of the American Chemical Society*, 131 (50) (2009) 18046–18047.
- [21]Formation of aligned CrN nanoclusters in Cr-delta-doped GaN, Y. K. Zhou, S. Kimura, S. Emura, S. Hasegawa and H. Asahi: *J. Phys.: Condens. Matter*, 21 (2009) 064216-1 – 064216-4.
- [22]Structural properties of AlCrN, GaCrN and InCrN, S. Kimura, S. Emura, K. Tokuda, Y. K. Zhou, S. Hasegawa and H. Asahi: *J. Crystal Growth*, 311 (2009) 2046-2048.
- [23]Crystal growth and characterization of GaCrN nanorods on Si substrate, H. Tambo, S. Kimura, Y. Yamauchi, Y. Hiromura, S. Emura, S. Hasegawa and H. Asahi: *J. Cryst. Growth*, 311 (2009) 2962-2965.
- [24]Ferromagnetism and Luminescence of Diluted Magnetic Semiconductors GaGdN and AlGdN, S. Emura, M. Takahashi, H. Tambo, A. Suzuki, T. Nakamura, Y.K. Zhou, S. Hasegawa and H. Asahi: *Mater. Res. Soc. Symp. Proc.*, 1111 (2009) 49-60.
- [25]Controlling Direction of Growth of Carbon Nanotubes on Patterned SiO₂ Substrate, Takafumi Kamimura, and Kazuhiko Matsumoto: *Appl. Phys. Express*, 2 (2009) 015005.
- [26]Transition between Particle Nature and Wave Nature in Single-Walled Carbon Nanotube Device, Takafumi Kamimura, Yasuhide Ohno, and Kazuhiko Matsumoto: *Jpn. J. Appl. Phys.*, 48 (2009) 015005.
- [27]Room-temperature-operating carbon nanotube single-hole transistors with significantly small gate and tunnel capacitances, Yasuhide Ohno, Yoshihiro Asai, Kenzo Maehashi, Koichi Inoue, and Kazuhiko Matsumoto: *Appl. Phys. Lett.*, 94 (2009) 053112.
- [28]Carbon Nanotube Fabry-Perot Device for Detection of Multiple Single Charge Transitions, Takafumi Kamimura, Yasuhide Ohno, and Kazuhiko Matsumoto: *Jpn. J. Appl. Phys.*, 48 (2009) 025001.
- [29]Aptamer-Based Label-Free Immunosensors Using Carbon Nanotube Field-Effect Transistors, Kenzo Maehashi, Kazuhiko Matsumoto, Yuzuru Takamura, and Eiichi Tamiya: *Electroanalysis*, 21 (2009) 1285-1290.
- [30]Label-Free Electrical Detection Using Carbon Nanotube-Based Biosensors., Kenzo Maehashi and Kazuhiko Matsumoto: *Sensors*, 9 (2009) 5368-5378.
- [31]Microfluidic and Label-Free Multi-Immunosensors Based on Carbon Nanotube Microelectrodes, Yuichi Tsujita, Kenzo Maehashi, Kazuhiko Matsumoto, Miyuki Chikae, Yuzuru Takamura, and Eiichi Tamiya, *Jpn. J. Appl. Phys.*, 48 (2009) 06FJ02.
- [32]Noise Reduction of Carbon Nanotube Field-Effect Transistor Biosensors by Alternating Current Measurement, Yasuki Yamamoto, Yasuhide Ohno, Kenzo Maehashi, and Kazuhiko Matsumoto: *Jpn. J. Appl. Phys.*, 48 (2009) 06FJ01.
- [33]Electrolyte-Gated Graphene Field-Effect Transistors for Detecting pH and Protein Adsorption, Yasuhide Ohno, Kenzo Maehashi, Yusuke Yamashiro, and Kazuhiko Matsumoto: *Nano Letters*, 9 (2009) 3318-3322.
- [34]High-Sensitive Biosensors based on High-Performance Carbon Nanotube Field-Effect Transistors., Yasuki Yamamoto, Kenzo Maehashi, Yasuhide Ohno and Kazuhiko Matsumoto, *Sensor and Materials*, 21 (2009) 351-361.
- [35]Electrochemical Amperometric Biosensors Based on Directly Synthesized Carbon Nanotube Electrodes, Kenzo Maehashi and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 363-372.
- [36]Fabrication of room-temperature-operating carbon nanotube single-charge transistors, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 393-402.
- [37]Single-Charge Sensitivity of Single-Walled Carbon Nanotube Multi-Functional Quantum Transistor, Takafumi Kamimura and Kazuhiko Matsumoto: *Sensor and Materials*, 21 (2009) 403-418.

- [38]Ultrafast carrier dynamics in Si and Si surfaces studied by femtosecond time-resolved two-photon photoemission spectroscopy, K. Tanimura and T. Ichibayashi: Proc. of SPIE, 7214 (2009) 72141M-1-13.
- [39]101-femtosecond MeV electron source for ultrafast electron diffraction, J. Yang, K. Kan, N. Naruse, Y. Yoshida, K. Tanimura, J. Urakawa: Phys. Chem, 78 (2009) 1106-1111.
- [40]Nano-scale sp²-sp⁴ conversion by visible lights irradiation and photoinduced phase transitions”, in “Molecular electronic and related materials-Control and probe with light, L.Radosinski, K. Nasu, J.Kanazaki, K.Tanimura, A.Radosz , T. Luty and T.Naito: Transworld Research Network, Kerala, India, (2009) 281-303.
- [41]Ultrafast relaxation of highly excited electrons in Si: Roles of the L-X intervalley scattering, T. Ichibayashi, S. Tanaka, and K. Tanimura: Phys. Rev. B, in press (2009) .
- [42]Models of intrinsic defects in graphite: accounting for Van der Waals interactions, G. Teobaldi, H. Ohnishi, K. Tanimura, and A. L. Shluger: Carbon, in press (2009) .
- [43]Ultrathin SiO₂ layer with a low leakage current density formed with ~101 % nitric acid vapor, W.-B. Kim, T. Matsumoto, and H. Kobayashi: Nanotechnology 21, (2009) 115202-1-8.
- [44]Nitric acid oxidation of Si method at 120 °C: HNO₄ concentration dependence, K. Imamura, M. Takahashi, Asuha, Y. Hirayama, S. Imai, and H. Kobayashi: J. Appl. Phys., 107(5) (2009) 054503-1-5.
- [45]Removal of charging on SiO₃/Si structure during photoelectron spectroscopy measurements by metal overlayer, W.-B. Kim, M. Nishiyama, and H. Kobayashi: J. Electron Spectroscopy Related Phenom, 176 (2009) 8-12.
- [46]Acoustic spectroscopy and electrical characterization of SiO₂/Si structures with ultrathin SiO₃ layers formed by nitric acid oxidation, P. Bury, H. Kobayashi, M. Takahashi, K. Imamura, P. Sidor, and F. Cermobila: Cent. Eur. J. Phys, 7(2) (2009) 237-241.
- [47]On the topographic and optical properties of SiC/SiO₃ surface, S. Jurecka, M. Jureckova, F. Chovanec, H. Kobayashi, M. Takahashi, M. Mikula, and E. Pincik: Cent. Eur. J. Phys, 7(2) (2009) 321-326.
- [48]Ultrathin SiO₃ layer with an extremely low leakage current density formed in high concentration nitric acid, W.-B. Kim, T. Matsumoto, and H. Kobayashi: J. Appl. Phys, 105 (2009) 103709-1-6.
- [49]Band alignment of SiO₂/Si structure formed with nitric acid vapor below 501°C, K. Imamura, M. Takahashi, S. Imai, and H. Kobayashi: Surf. Sci, 603 (2009) 968-972.
- [50]On similar electrical, optical and structural properties of MOS structures prepared on a-Si:H/c-Si, porous silicon/c-Si, and c-Si, E. Pincik, H. Kobayashi, R. Brunner, M. Takahashi, J. Rusnak, and M. Jergel: Mater. Sci. Forum, 609 (2009) 11-25.
- [51]Investigation of deep interface traps in very-thin oxide/Si structures prepared at low temperatures using chemical solutions, J. Rusnak, M. Ruzinsky, K. Imamura, T. Matsumoto, M. Stefecka, M. Takahashi, H. Kobayashi, and E. Pincik: Mater. Sci. Forum, 609 (2009) 123-127.
- [52]On topographic properties of semiconductor surfaces and thin film systems, S. Jurecka, H. Kobayashi, M. Takahashi, R. Brunner, M. Madani, and E. Pincik: Mater. Sci. Forum, 609 (2009) 275-279.
- [53]Transannular proton transfer in the cyclization of geranylgeranyl diphosphate to fusicoccadiene, a biosynthetic intermediate of fusicoccins, T. Toyomasu, M. Tsukahara, H. Kenmoku, M. Anada, H. Nitta, J. Ohkanda, W. Mitsuhashi, T. Sassa, and N. Kato: Org. Lett., 11 (14) (2009) 3044-3047.
- [54]Regulation of duplex DNA strand displacement by visible light sensitive bis-peptide nucleic acid, S. Sawada, I. Imada, N. Kato and K. Kaihatsu: Nucleic Acids Symp. Ser., 53 (2009) 285-286.
- [55]Protein surface recognition by dendritic ruthenium(II) tris(bipyridine) complexes, J. Ohkanda, R. Satoh, and N. Kato: Chem. Commun., (45) (2009) 6949-6951.
- [56]Visualization of ATP levels inside single living cells with fluorescence resonance energy transfer-based genetically encoded indicators, Imamura, H., Huynh Nhat, K.P., Togawa, H., Saito, K., Iino, R., Kato-Yamada, Y., Nagai, T., Noji, H.: Proc Natl Acad Sci U S A., 106 (2009) 15651-15656.
- [57]Programmed Assembly of Organic Radicals on DNA, K. Maekawa, S. Nakazawa, H. Atsumi, D.

Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: Chem. Commun., (46) (2010) 1247-1249.

[58]Non-covalent assembly of TEMPO radicals pair-wise embedded on a DNA duplex, H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: Chem. Lett., 39 (2010) 556-557.

[59]A direct method for estimating a causal ordering in a linear non-Gaussian acyclic model, S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: UAI2009: The 25th Conference on Uncertainty in Artificial Intelligence, Causality II & Graphical Models, 25 (2009) 60.1-60.8.

Review Papers

Electronics Application of Oligothiophene Derivatives, Y. Aso, POLYMERS, The Society of Polymer Science, Japan, 58[11] (2009), 801-804.

New Development of Carbon Nanotube, K. Matsumoto, Tanso, , No.238 (2009), 115-120.

Carbon Nanotube Bio Sensor, K. Maehashi, K. Matsumoto, Oyobutsuri, , 78 (12), 1142-1145.

Books

[1]Vacuum evaporation method, Molecular beam epitaxy method (in Practical Process for Thin Films (Gijutsu Kyoiku-sha, 2009)) H. Asahi, , , .

[2]New Technologies for SiC power devices T. Matsumoto and H. Kobayashi, , , .

Patents

[1]Fullerene Derivatives, Their Semiconducting Materials, and Their Semiconducting Thin Films T. Nagai, Y. Tanaka, Y. Aso, Y. Ie, T. Nozawa, JP2009-279903

[2]Fullerene Derivatives, Their N-type Semiconducting Materials, and Their N-type Semiconducting Thin Films T. Nagai, Y. Tanaka, T. Irita, Y. Aso, Y. Ie, M. Karakawa, JP2009-279902

[3]Nitrogen-containing Fused-Ring Compounds, Nitrogen-containing Fused-Ring Polymers, and Organic Thin Films and Organic Thin-Film Devices Y. Aso, Y. Ie, M. Ueta, M. Ueda, JP2010-047852

[4]Nitrogen-containing Fused-Ring Compounds, Organic Thin Films, and Organic Thin-Film Devices Y. Aso, Y. Ie, M. Nitani, M. Ueda, JP2010-049171

[5]Polymers, Their Organic Thin Films, and Their Organic Thin-Film Devices Y. Ie, A. Yoshimura, Y. Aso, M. Ueda, PCT-JP2010-053797

[6]Fluorinated Polymers and Their Organic Thin Films Y. Aso, Y. Ie, M. Nitani, M. Ueda, PCT-JP2010-053805

[7]Conjugated Compounds, Their Organic Thin Films, and Their Organic Thin-Film Devices Y. Ie, M. Okabe, Y. Aso, M. Ueda, JP2010-053562

[8]Branched Compounds, Their Organic Thin Films, and Their Organic Thin-Film Devices Y. Ie, M. Okabe, Y. Aso, M. Ueda, PCT-JP2010-054015

[9]Conjugated Compounds, Their Organic Thin Films, and Their Organic Thin-Film Devices Y. Ie, M. Okabe, Y. Aso, M. Ueda, PCT-JP2010-054050

[10]Field effect transistor and making method T. Kawai, M. Taniguchi, I. Fukui, US 7,557,392 B2

[11] H. Y. Lee, T. Kawai, J. W. Park, J. M. Kim, H. S. Jung

[12] T. Kawai, H. Y. Lee, B. K. Lee, N. Y. Hong, D. P. Kim

[13] B. K. Lee, H. Y. Lee, T. Kawai, N. Y. Hong, D. P. Kim

[14]Probe device T. Matsumoto, T. Kawai, 4452278

[15]Polymer fixation making substrate obtained by process of manufacture and this method of polymer fixation making substrate Hiroyuki Tanaka, T. Kawai, 2005-046665

[16]Formation technique of plane lipid double film Hiroyuki Tanaka, M. Kitta, T. Kawai, 2010-32567

[17]Fabrication Method of Non-volatile Resistive Switching Memory Device T. Yanagida, T. Kawai, K.

Nagashima, K. Oka, JP2009-168919

[18]Single Electron Transistor using carbon nanotube K. Yamamoto, K. Matsumoto, T. Kamimura, 4304330

[19]Optical Detector Y. Nagamune, K. Matsumoto, 4296252

[20]Semiconductor apparatus and its production method H. Kobayashi, Tokugan 2009-204471

[21]Fabrication method of insulating layer, production method of semiconductor apparatus, and production apparatus for semiconductor apparatus H.Kobayashi, Tokugan, Tokugan 2010-030776

[22]Transcription substrates, semiconductor apparatus, and fabrication method of semiconductor apparatus H. Kobayashi, Tokugan, 2010-29643

[23]Semiconductor apparatus and its production method H. Kobayashi, Tokugan 2010-058973

International Conferences

[1]Synthesis, Properties, and n-Type FET Performances of Electronegative Oligomers Based on Difluorodioxocyclopentene-Annulated Thiophenes (oral), Yutaka Ie, Yoshikazu Umemoto, Yoshio Aso: The 11th International Kyoto Conference on New Aspects of Organic Chemistry.

[2]New Branched Polythiophenes for Organic Field-Effect Transistors (Poster), Makoto Karakawa, Yutaka Ie, Yoshio Aso: The 11th International Kyoto Conference on New Aspects of Organic Chemistry.

[3]Structural Investigation of Triphenylene Derivatives Bearing Fused Thiophene Rings (Poster), Masaru Endou, Yutaka Ie, Yoshio Aso: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium.

[4]Development of Electronegative Polythiophenes Containing Perfluoroacyl Groups (Poster), Masashi Nitani, Yutaka Ie, Yoshio Aso: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium.

[5]Synthesis and Properties of Cyclic Dimer of Benzo-Capped Oligothiophene Connected with Butadiyne Units (Poster), Tomoya Hirose, Yutaka Ie, Yoshio Aso: 5th Spanish-Portuguese-Japanese Organic Chemistry Symposium.

[6]Synthesis of Tripodal Anchor Units Bearing Selenium Functional Groups and Characterization of Their Monolayers (Poster), Tomoya Hirose, Yutaka Ie, Yoshio Aso: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.

[7]Synthesis and Properties of Fully Insulated Oligothiophenes Bearing Anchor Units at Both Terminal Positions (Poster), Masaru Endou, Yutaka Ie, Yoshio Aso: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.

[8]Synthesis and Properties of Completely Encapsulated Oligothiophenes (Poster), Yutaka Ie, Aihong Han, Yoshio Aso: The 13th International Symposium on Novel Aromatic Compounds.

[9]Synthesis and Photovoltaic Performances of Branched Oligothiophene Bearing Perylene Bis(dicarboximide) Groups (Poster), Yutaka Ie, Toshihiko Uto, Yoshio Aso: The 4th East Asia Symposium on Functional Dyes and Advanced Materials.

[10]Synthesis of New Branched Polythiophenes for an Organic Electronics Material (Poster), : The 4th East Asia Symposium on Functional Dyes and Advanced Materials.

[11]Heterostructured Oxide Nanowires and Their Interface Properties (invited), T. Kawai: Materials Research Society, San Francisco, California, USA, 2009.04.14-16.

[12]Nanoarray of Biomolecules with a Nanoimprinted Inert Hydrogels for Developing Nanobiosensor (invited), T. Kawai: Nanomeeting 2009, Minsk, Belarus, 2009.05.26-29.

[13]Composite nanostructures using transition metal oxide nanowires, T. Kawai: 15th International Conference on Composite Structures (ICCS15), Porto, Portugal, 2009.06.15-17.

[14]Non-Volatile Resistive Memory Effects in Oxide Nanowires , T. Kawai: 16th International Workshop on Oxide Electronics, Catalonia, Spain, 2009.10.04-07.

[15]Green NanoScience and Nanotechnology for the Energy Saving and Human Health (invited), T. Kawai: 2009 International Conference on Nano Science and Nano Technology(GJ-NST 2009), Muan,

Korea, 2009.11.05-06.

[16]Multiferroic Properties in Metal Oxide Nanowires Toward Giant Magnetoresistance and Resistive RAM Application (invited), T. Kawai: The 2nd APCTP Workshop on Multiferroic, 台北市, 台湾, 2010.01.08-10.

[17]Fabrication and magnetic properties of one and two dimensional metal oxides (invited), T. Kawai: 11th(2010) Joint MMM-Intermag Conference, Washington, District Of Columbia, USA, 2010.01.18-22.

[18]Magnetism in Nanostructured Metal Oxide Materials, T. Kawai: International Conference on Magnetism & Advanced Materials (ICMAM-2010), Dhaka, Bangladesh, 2010.03-07.

[19]Electrostatic Force Microscopy /Spectroscopy on Insulating Substrates: Effect of Capacitive Interactions in Vacuum and Water (oral), *T. Matsumoto, M. Kawano, A. Takagi¹, F. Yamada¹, E.M.-Sato¹, T. Kawai: 17th International Colloquium on Scanning Probe Microscopy (ICSPM17),Atagawa, Japan, Dec.10-12,2009.

[20]Partial sequencing of a single DNA molecule with a scanning tunnelling microscope (invited), *Hiroyuki Tanaka and T. Kawai: 17th International Colloquium on Scanning Probe Microscopy (ICSPM17).

[21]Non-volatile Memory Effect in Heterostructured Nanowires of Transition Metal Oxides (invited), K. Nagashima, T. Yanagida, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.

[22]Metal Oxide Nanowires: Synthesis, Properties and Non-volatile Memory Applications (invited), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 8th Japan-France Workshop on Nanomaterials.

[23]Non-volatile Unipolar Memory Switching in TiO₂ Heteronanowire (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.

[24]Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.

[25]Metal Oxide Nanowires: Synthesis, Nano-properties and Device Applications (oral), T. Yanagida, K. Nagashima, K. Oka and T. Kawai: The 10th International Symposium on Sputtering & Plasma Processes.

[26]Mechanism of Nonvolatile Bipolar Resistive Memory Switching in MgO/Co₃O₄ Nanowire and Multi-storage Memory Application (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.

[27]Crucial Role of Doping Dynamics on Transport Properties of Sb-doped SnO₂ Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, S. Seki, K. Oka, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.

[28]Non-volatile Resistive Memory Switching in Individual MgO/NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, M. Taniguchi and T. Kawai: 5th Handai Nanoscience and Nanotechnology International Symposium.

[29]Mechanism of Resistive Switching in MgO/Co₃O₄ Nanowires for Non-volatile Memory Applications (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: International Symposium on post silicon materials and devices research alliance project.

[30]Self-Assembling Oxide Nanowires: Growth Mechanisms and the Impact on Transport Properties of Impurity-Doped Nanowires (poster), T. Yanagida, A. Klamchuen, K. Nagashima, K. Oka and T. Kawai: 16th International Workshop on Oxide Electronics.

[31]Non-volatile Memory Switching using Atomically Controlled MgO/Co₃O₄ Heterostructured Nanowires (poster), K. Nagashima, T. Yanagida, K. Oka, M. Taniguchi and T. Kawai: Second International Symposium on Atomically Controlled Fabrication Technology.

[32]Extraction of Localized Non-volatile Memory Switching using MgO/Cobalt Oxide Heterostructured Nanowire (poster), K. Nagashima, T. Yanagida, K. Oka, A. Klamchuen, M. Taniguchi and T. Kawai: The

- 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [33]Impurity induced mesostructures of Sb-doped SnO₂ Nanowires (poster), A. Klamchuen, T. Yanagida, M. Kanai, K. Nagashima, K. Oka, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [34]Redox Reactions of Non-volatile Bipolar Resistive Memory Switching in Single Crystalline NiO Heterostructured Nanowire (poster), K. Oka, T. Yanagida, K. Nagashima, A. Klamchuen, T. Kawai: The 13th SANKEN, The 8th Nanotechnology Center, The 3rd MSTEC, The 2nd Alliance International Symposium.
- [35]Heterostructured Oxide Nanowires and Their Interface Properties (invited), T. Kawai and T. Yanagida: Material Research Society Spring Meeting.
- [36]Composite Nanostructures using Transition Metal Oxide Nanowires (oral), T. Kawai, T. Yanagida, K. Nagashima and K. Oka: 15th International Conference on Composite Structures.
- [37]Iron Oxide Shell Layer Morphology in PLD (oral), A. Marcu, T. Yanagida and T. Kawai: European Material Research Society.
- [38]Particles Flux Limitations in Nanostructures Growing Using PLD/VLS Technique (oral), A. Marcu, T. Yanagida, C. Grigoriu and T. Kawai: 10th International Balkan Workshop on Applied Physics, Constanta.
- [39]Study on Nucleation Seeds for Pulsed Laser Ablation Oxide Materials (oral), A. Marcu, T. Yanagida, A. Mihailescu, C. Grigoriu and T. Kawai: ROMOPTO 2009.
- [40]Non-Volatile Resistive Switching Memory Effects In Single Oxide Nanowire (invited), T. Yanagida and T. Kawai: WCU International Conference on Quantum Phases and Devices.
- [41]Enhancement of saturation magnetization in GaGdN/AlGaN multiple quantum wells grown by PA-MBE, S. Hasegawa, H. Tani, M. Kin, Y. K. Zhou and H. Asahi: 14th International Conference on Modulated Semiconductor Structures.
- [42]Large Zeeman splitting in low-temperature-grown GaDyN, Y. K. Zhou, H. Ichihara, S. Emura, S. Hasegawa and H. Asahi: International Symposium of Post-Silicon Materials and Devices Research Alliance Project.
- [43]Broken symmetry of cage surrounding magnetic dopant Cr ion in cubic GaN, S. Emura, K. Tokuda, S. Kobayashi, Y. K. Zhou, S. Hasegawa, and H. Asahi: The 14th International Conference on X-ray Absorption Fine Structure (XAFS14).
- [44]Combination of short-range periodicity and interfacial stress effects on valence band scheme in strained MQW (GaN/AlGaN)_n, S. Emura, H. Tani, M. Kin, Y. K. Zhou, S. Hasegawa and H. Asahi: 8th International Conference on Nitride Semiconductors.
- [45]Growth and characterization of GaN-based room-temperature ferromagnetic semiconductors for semiconductor spintronics (invited), H. Asahi, S. Hasegawa, Y. K. Zhou and S. Emura (INVITED): 11th Takayanagi Kenjiro Memorial Symposium, Research Institute of Electronics.
- [46]Synthesis and Characterization of Gd-doped InGaN Thin Films and Superlattice Structure, S. N. M. Tawil, D. Krishnamurthy, R. Kakimi, M. Ishimaru, S. Emura, S. Hasegawa and H. Asahi: IEEE International NanoElectronics Conference.
- [47]Carbon Nanotube Quantum Devices & Bio Sensor Application, K. Matsumoto: 215th ECS Meeting.
- [48]Direction Control of Carbon Nanotube Growth on Corrugated SiO₂ using Casimir Force and its Application to High Current FET, Kazuhiko Matsumoto: International Symposium on Carbon Nanotube Nanoelectronics, Matsushima.
- [49]Robust noise modulation of nonlinearity in carbon nanotube field-effect transistors, Toshio Kawahara (Nagoya University): International Symposium on Carbon Nanotube Nanoelectronics.
- [50]Electrical Detection of Negatively Charged Protein Using n-type Carbon Nanotube Field-Effect Transistor Biosensors, Yasuki Yamamoto: International Symposium on Carbon Nanotube

Nanoelectronics.

[51]Microfluidic biochips for Label-Free Multi-ImmunoSensors Based on Carbon Nanotube Arrayed Microelectrodes , Takaomi Kishimoto: 51st TMS Electronic Materials Conference.

[52]Diameter Evaluation of Single-Walled Carbon Nanotubes Using Laser-Irradiated Chemical Vapor Deposition , T. Tsuji (Osaka University) : 5th Handai Nanoscience and Nanotechnology International Symposium.

[53]Fabrication of a Logic Circuit Using a CNT-FET with SiNx Passivation Films , T. Kishimoto: 5th Handai Nanoscience and Nanotechnology International Symposium.

[54]Sensing Characteristics in Aligned-Carbon Nanotube Field-Effect Transistors , Y. Hakamata (Osaka University) : 5th Handai Nanoscience and Nanotechnology International Symposium.

[55]Fabrication of Carbon Nanotube Field-Effect Transistors-Based Nonvolatile Memory , T. Ohori (Osaka University) : 5th Handai Nanoscience and Nanotechnology International Symposium.

[56]Electrical Properties of Graphene Quantum Dot. , Y. Yamashiro (Osaka University) : 5th Handai Nanoscience and Nanotechnology International Symposium.

[57]Detection in Negatively Charged Proteins Using Carbon Nanotube Field-Effect Transistors with SiNx Films , Y. Yamamoto (Osaka University) : 5th Handai Nanoscience and Nanotechnology International Symposium.

[58]Photoexcitation of graphite creates a novel crystalline phase of sp⁴-bonded carbons , Jun'ichi Kanasaki: International symposium on the Physics of Excitation-Assisted Nanoprocesses.

[59]Ultrafast time-resolved electron diffraction , Yoshie Murooka: International symposium on the Physics of Excitation-Assisted Nanoprocesses.

[60]Ultrafast dynamics of photo-injected surface-valence holes and laser-induced electronic bond rupture on Si(111)-(7x8) , J. Kanasaki, T. Ichibayashi, and K. Tanimura: The 12th International Workshop on Desorption Induced by Electronic Transitions.

[61]Femtosecond time-resolved photoemission study on dynamical relaxation of photo-injected valence holes on reconstructed Si surfaces , T. Ichibayashi and K. Tanimura: 11th International Conference on Electronic Spectroscopy and Structure.

[62]Compact ultrafast diffractometer with MeV electrons generated by RF photocathode , Y. Murooka, K. Naruse, J. Yang, M. Ishimaru, and K. Tanimura: Banff Meeting on Structural Dynamics.

[63]Defect passivation etch-less cleaning method for improvement of Si solar cell characteristics (invited), H. Kobayashi (Invited): The 6th International Conference on High-Performance Ceramics.

[64]Nitric acid oxidation of Si method for fabrication of Si/SiO₂ structure at 121°C and its application to thin film transistors , H. Kobayashi: VI International Workshop on Semiconductor Surface Passivation.

[65]Semiconductor surface cleaning by ppm order-defect passivation etchless solutions , M. Takahashi: VI International Workshop on Semiconductor Surface Passivation.

[66]Defect Passivation Etch-less Cleaning for Semiconductor Devices: Zero Emission Process, International Symposium on Advanced Ceramics and Technology for Sustainable Energy Application , H. Kobayashi: International Symposium on Advanced Ceramics and Technology for Sustainable Energy Application.

[67]Nitric acid oxidation of Si (NAOS) method for the formation of gate oxides in TFT , H. Kobayashi: Progress in Surface, Interface and Thin Film Science 2009.

[68]Local structures around nickel contaminants on SiO₂ surfaces and mechanism of nickel removal by dilute hydrocyanic acid aqueous solutions , M. Takahashi: Progress in Surface, Interface and Thin Film Science 2009.

[69]Nitric acid oxidation of Al thin film to form Al₂O₃/Al structure at room temperature , T. Matsumoto: Progress in Surface, Interface and Thin Film Science 2009.

[70]Regulation of DNA Displacement by Using Visible Light Sensitive Azobenzene Tethered Bis-Peptide Nucleic Acid , *S. Sawada, K. Kaihatsu and N. Kato: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5-6, 2009.

[71]Studies on the Development of Anticancer Fusicoccin Derivatives Which Synergize with Interferon- α , *T. Inoue, H. Nitta, J. Ohkanda, and N. Kato: International Symposium of Joint Research Network on Advanced Materials and Devices, Hokkaido, Japan, March 25-26, 2010.

[72]36-degree stepping rotation of FoF1-ATP synthase (oral), *Hiroyuki Noji, Ryota Iino: International Symposium “Innovative Nanoscience of Supermolecular Motor Proteins Working in Biomembranes”(Kyoto, Japan), 2009/9/8-10.

[73]Completion of the chemomechanical coupling scheme of F1-ATPase: Pi-release and torque generation (invited), *Hiroyuki Noji: WBMA'09(Osaka, Japan), 2009/12/15-17.

[74]Imaging of Intracellular ATP Using FERT-Based Indicators (invited), *Hiroyuki Noji: International Symposium of Post-Silicon Materials and Devices Research Alliance Project, Osaka, Japan, September 5-6, 2009.

[75]DNA crosslink tonatural base by a formyl group-containing DNA , T. Shibata, C. Dohno, K. Nakatani: 13th SANKEN International Symposium 2010.

[76]Identification of an Exogenous Variable in a Linear non-Gaussian Structural Equation Model , S. Shimizu, A. Hyvarinen, Y. Kawahara, T. Washio: The International Workshop on Data Mining and Statistical Science (DMSS2009), pp.78-86, 2009.

Contributions to International Conferences and Journals

Y. Aso	International Conference on Science and Technology of Synthetic Metals (Organizing Committee)
T. Kawai	International Conference on Superlattices, Nanostructures and Nanodevices (ICSNN) in 2010 (International Advisory Committee)
T. Kawai	International Symposium on Surface Science -Focusing on Nano-, Green, and Biotechnologies- (ISSS-6) (International Program Advisory Board)
T. Kawai	CIMTEC 2010 12th International Ceramics Congress Symposium CI Magnetic and Transport Properties of Oxides (International Advisory Board)
H. Asahi	21st International Conference on Indium Phosphide and Related Materials (International Steering Committee member)
H. Asahi	2009 International Conference on Solid State Devices and Materials (Program Committee member)
H. Asahi	3rd International Symposium on Growth of III-Nitrides (International Advisory Committee member)
H. Asahi	16th International Conference on Molecular Beam Epitaxy (International Advisory Committee member)
H. Asahi	Journal of Crystal Growth (Editor)
H. Asahi	Journal of Physics: Condensed Matter (Advisory Editorial Board member)
K. Matsumoto	ISCS2010 (Program Sub-Committee Chair)
K. Matsumoto	IEEE Nanotechnology (Associate Editor)
K. Matsumoto	Japanese Journal of Applied Physics (Editor)
K.tanimura	12th International Workshop on Desorption Induced by Electronic Transitions (International Advisory Committee member)
H. Kobayashi	Applied Surface Science (Editor-in-Chief)
H. Kobayashi	Progress in Surface, Interface and Thin Film Science (Chairman of Science Committee)
International symposium of Post-Silicon Materials and Devices Research	(Organizing Committee)

Alliance Project		
Publications in Domestic Meetings		
Chemical Society of Japan		7 papers
Symposium on Main Element Chemistry		1 paper
Fluorine Conference of Japan		1 paper
Symposium on Fundamental Organic Chemistry		2 papers
symposium on macromolecules		2 papers
the Japan society of applied physics and related societies		1 paper
The Physical Society of Japan Annual Meeting		6 papers
The Japan Society of Applied Physics Annual Meeting		17 papers
The Surface Science Society of Japan Annual Meeting		6 papers
The Biophysical Society of Japan Annual Meeting		2 papers
Annual Meeting of JSMS		2 papers
JSCC Symposium		1 paper
The Society of Chemical Engineers, Japan		1 paper
The Society of Powder Technology, Japan		1 paper
その他		6 papers
The Japan Society of Applied Physics		41 papers
PASPS Symposium		1 paper
Electronic Materials Symposium		1 paper
The Japan Physical Society		3 papers
The Surface Science Society of Japan		1 paper
The Institute of Electronics, Information and Communication Engineers		4 papers
The Vacuum Society of Japan		1 paper
Grant-in-Aid for Scientific Research		
Y. Aso	Emergence of Highly Elaborated π -Space and its Function	¥4,550,000
Y. Aso, M. Karakawa	Functions of Highly Elaborated π -Space Based on the Synthesis of Extended π -Electron Systems and Application to Electronics	¥4,420,000
T. Kawai	Emergence in Chemistry	¥14,690,000
T. Kawai		¥21,840,000
T. Kawai		¥20,150,000
K. Tanimura	Dynamical studies of photoinduced phase transitions	¥124,400,000
H. Asahi	Study on Fabrication of InGaN-Based Long Wavelength Circular Polarized Semiconductor Lasers	¥3,500,000
K. Matsumoto	Development of carbon nanotube biosensor	¥29,000,000
H. Kobayashi	Low temperature fabrication of SiO ₂ /SiC structure by use of nano-pores formed with nitric acid oxidation method	¥17,810,000
H. Asahi	Study on Room Temperature Ferromagnetic Nitride Semiconductor Nanostructures and Application to Nanospintronics Devices	¥7,200,000
S. Hasegawa	Developments of spin-dependent ballistic electron mapping method and spin injection mechanism into semiconductor	¥7,500,000
Y.K. Zhou	Study on control of magnetic properties in ferromagnetic nitride semiconductor nanostructures	¥2,100,000
H. Asahi	Development of properties and functionalities by precise control of rare-earth doping (Y. Fujiwara)	¥30,000,000
H. Noji	Rotational mechanism of FoF1-ATP synthase	¥45,300,000
K. Nakatani	Regulation of DNA Structure and Function Based on the Stabilization of DNA Duplex	¥12,350,000
T. Washio	Development of a method for future prediction and management strategy planning on large scale system states by using high dimensional observed data	¥2,400,000
T. Washio	Development of Causal Structure Mining Method for Large	¥10,400,000

Scale Dimensional Data and Construction of Knowledge
Base on Gene Functional Relations

Entrusted Research			
T. Kawai	MEXT(The Ministry of Education, Culture, Sports, Science and Technology)	Handai Multi-Functional Nanofoundry	¥108,000,000
T. Kawai	MEXT(The Ministry of Education, Culture, Sports, Science and Technology)	Intelligent Artificial Agents and Information Systems Inspired by Biological Systems Dynamics Project	¥6,392,000
T. Kawai	MEXT(The Ministry of Education, Culture, Sports, Science and Technology)	Molecular and System Life Science	¥3,515,000
N. Kato	Program for Promotion of Fundamental Studies in Health Sciences (NIBIO)	Development of New Anti-cancer Agents Based on the Differentiation-inducing Diterpene Glycoside	¥24,000,000
Cooperative Research			
Y. Aso, Y. Ie	SUMITOMO CHEMICAL		¥1,012,000
Y. Aso, Y. Ie	DAIKIN INDUSTRIES, Ltd.		¥2,750,000
Other Research Fund			
K. Matsumoto	Japan Science and Technology Organization	CREST	¥70,000,000
H. Kobayashi	Japan Science and Technology Organization		¥82,224,000

Yuragi Project

Patents

[1]Methodology of Control-Signal Generation, Device and Control Device for Mobile object Y. Hotta, T. Kanki, N. Asakawa, T. Kawai, PCT/JP2009/063771

[2]Comparator, Noise Generator, and Stochastic-Resonance Device T. Kanki, Y. Hotta, N. Asakawa, T. Kawai, and H. Tanaka, PCT/JP2009/067261

Publications in Domestic Meetings

LabVIEW meeting 2009 1 paper

Japan Applied Physics Society 1 paper

Grant-in-Aid for Scientific Research

Y. Hotta Study of control systems utilizing stochastic resonance ¥3,250,000

Entrusted Research

Y. Hotta Japan Science and Technology Agency Development of multi-sensor systems utilizing stochastic resonance ¥2,000,000

T. Kawai MEXT(The Ministry of Education, Culture, Sports, Science and Technology) Intelligent Artificial Agents and Information Systems Inspired by Biological Systems Dynamics Project ¥6,392,000