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MEMOIRS OF THE

ISIR

Institute of Scientific and Industrial Research

ISIR
OSAKA UNIVERSITY

Contents

Foreword

ISIR Pursues Target-Driven Basic Research Leading to Real Innovation

Yasushi Yagi
Director of the Institute of Scientific and Industrial Research

The Institute of Scientific and Industrial Research (ISIR) was founded in 1939 as a part of Osaka University with the aim of promoting basic science for the development of industry. Since then, ISIR has conducted interdisciplinary research in the fields of materials, information, and biological sciences. We play a leading role in the nanoscience and nanotechnology research through our Nanotechnology Center, which was established in 2002 and is Japan's first such center attached to a university.

As a nationwide research collaboration system, ISIR established the Network Joint Research Center for Materials and Devices and works in conjunction with five university-attached research institutes: Research Institute for Electronic Science (Hokkaido University), Institute of Multidisciplinary Research for Advanced Materials (Tohoku University), Chemical Resources Laboratory (Tokyo Inst. Tech.), ISIR (Osaka University), and Institute. for Materials Chemistry and Engineering (Kyushu University). The Japan's first nationwide network research center provides a new framework for facilitating the inter-institute collaboration.

For industrial applications of innovative achievements, we have promoted cooperation between academia and industry through Industry-On-Campus in the newly constructed Incubation Building. To promote the globalization of basic innovative research, a research-collaboration agreement was reached between the Interuniversity Microelectronics Center (imec)— one of the world's largest nanotechnology research institutes—and ISIR in 2011.

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.

Our world-level innovative basic research efforts address problems related to the environment, energy, medicine, and security and safety on studies in the fields of materials, information, and medical sciences along with those in nanotechnology and nanoscience. ISIR pursues a target-driven basic research leading to real innovation 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 headquarters of this 5 institutes network.

In 2011,research-collaboration agreement was reached between the Interuniversity Microelectronics Center (imec)-one of the world's largest nanotechnology research institutes-and ISIR.

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 &	Quantum Functional Materials
Beam Science	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
Specially Appointed Laboratory	Innovative Nanobiodevice based on Single Molecule Analysis
Special Projects	
Laboratories of 1st Project	
Laboratories of 2nd Project	Laboratory of Microbiology and Infections Diseases
	Laboratory of Atomic Scale Materials Processing
	Laboratory of Cellulose Nanofiber Materials
Laboratories of 3rd Project	Beam Application Frontier Research Laboratory
Alliance Laboratory	Quantum Information Photonics
	(Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido

Univ.)
Department of Disease Glycomics
(Alliance Laboratory of ISIR,Osaka Univ. and RIKEN)

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-Inteligent 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

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

Nano –Macro Materials, Devices and System Research Alliance

Next Generation Electronics Research Group
New Energy Harvesting Materials and Devices Research Group
Medical Treatment Materials and Devices Research Group
Environmental Harmonized Materials and Devices Research Group

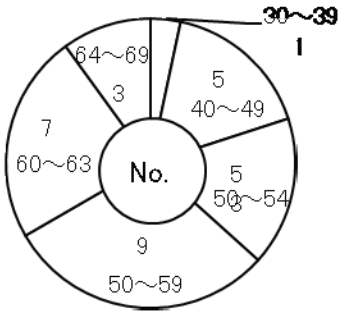
Service Facilities

Workshop
Laboratory for Radio-Isotope Experiments
Electronic Processing Laboratory
Office of Information Network
Academia Industry Relations Office

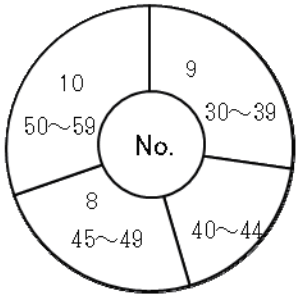
	Public Relations Office
	Library
	Open Laboratory
Technical	Machine Group
	Measurement Group
Administrative Office	Facilities Planning Office
	General Affairs Division
	Research Cooperation Division

Staffs' Age (years old) –As of 3.31.2012

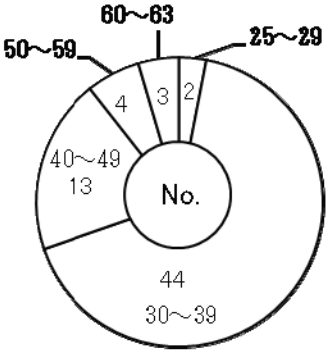
Professors



Associate Professors

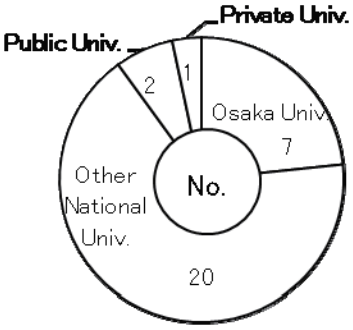


Assistant Professors

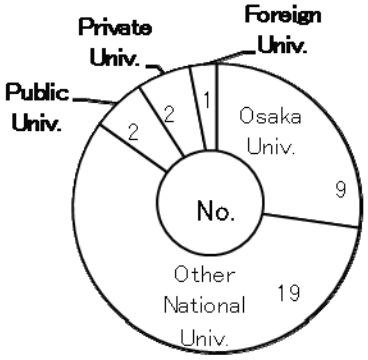


Staffs' Alma Master –As of 3.31.2012

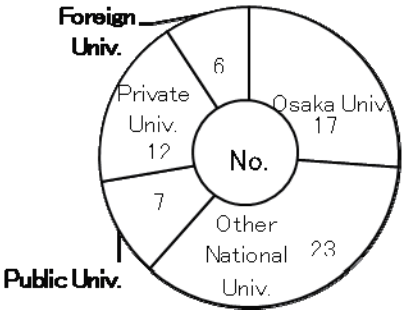
Professors



Associate Professors



Assistant Professors



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't be in the position for more than 4 years. Professor Akihito Yamaguchi has been a Director since April 1, 2008 to March 31, 2012. .

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.

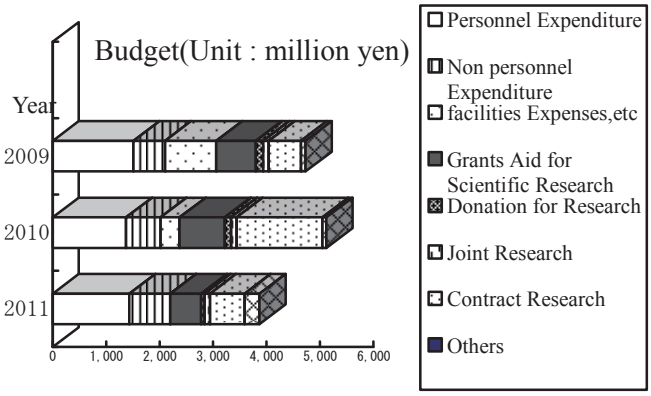
Evaluation Committee composed of outside experts in academic societies was established and the committee evaluated several items such as management, budget, facilities and research activities.

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 2011 is 576,485,000yen.



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
2011	21, 826 (14)	78, 828 (17)	10, 950 (13)	8, 500 (6)

Division / Year	Special Projects	Others	Total
2011	17, 800 (13)	400 (1)	138, 304 (64)

4) Cooperative Research

Cooperative Researches and Contract Researches in the fiscal year 2011-2012 are as follows: Cooperative Researches are carried out with 50 organizations and the budget for the fiscal year 2011-2012 is 103,496,000 yen. The number of Contract Researches is 38 and the budget for the fiscal year 2010-2011 is 648,311,000 yen.

5) International Research

Organic semiconductor, Material Science	Cambridge University	U.K	Charge Transport in Organic Semicondcutors
Department of Intelligent Media	Peking University	China	Computer vision
Department of Intelligent Media	MIT	USA	Computer vision
Department of Intelligent Media	MSRA	China	Computer vision
Department of Reasoning for Intelligence	Monash University	Australia	Density Estimation based on Mass
Department of Reasoning for Intelligence	Helsinki University	Finland	Estimating Exogenous Variables in Data with More Variables than Observations
Knowledge Systems	Laboratory for Applied Ontology (ISTC-CNR, Italy), Delft University of Technology,etc.	EU(Italy, Netherlands, Poland)	EU the Marie Curie "EuJoint" project (IRSES 247503)
Architecture for Artificial Intelligence	De La Salle University	Philippine	Empathic Computing
Department of Quantum Functional Materials	University of California, San	USA	Optical studies of topological insulators

	Diego		
Semiconductor devices	Slovak Academy of Science	Slovakia	Development of low temperature semiconductor processes and spectroscopic and electrical analyses
Semiconductor processes	Inner Mongolia Normal University	Chaina	Development of nitric acid oxidation method
Metallic Materials Process	Inha University	Korea	Joint research for Porous Intermetallic Compound with Directional Pore
Metallic Materials Process	Stanford University	USA	Investigation of Heat Transfer Performance of Lotus-type Porous Metal
Department of excited solid-state dynamics	University College London	U.K	Excited-state science of solid surfaces
Department of Accelerator Science	Synchrotron Light Research Institute	Thailand	Upgrade of the accelerator system for the synchrotron light source
viral detection	National University of Singapore	Singapore	Viral detection by hairpin primer method
Organic fine Chemicals	Max Planck Society, Chemical Genomics Centre	Germany	Modulation of 14-3-3 Protein Functions by Small Organic Molecules
Organic fine Chemicals	University of South Florida	USA	Whole cell based assay of guanidino-containing prenyltransferase inhibitors
Department of Cell Membrane Biology	Franch National Institute for Agricultural Research	France	Identification of intrinsic and environmental regulations of the Ram locus involved in the multidrug resistance of Salmonella
Laboratory of Microbiology and Infectious Diseases	Institut National de la Recherche Agronomique	France	Identification of intrinsic and environmental regulations of the Ram locus involved in the multidrug resistance of Salmonella
Laboratory of Microbiology and Infectious Diseases	Ghent University	Bergium	Uncovering the molecular basis of multidrug efflux pumps involved in resistance of Salmonella Enteritidis against Ovotransferrin and its peptide
Laboratory of Microbiology and Infectious Diseases	Hong Kong University	HongKong	Development of the Regulatory Network for the Multidrug Efflux Nano-Devices

Laboratory of Microbiology and Infectious Diseases	Institut für Lebensmittelqualität und -sicherheit Tierärztliche Hochschule Hannover	Germany	Studies on bacterial drug resistance against triclosan
Nanosicence devices	CNR	Italy	Oxide MEMS
Nanosicence devices	Indian Academy of Sciences	India	Oxide Nanospintronics
Radiation Chemistry	CNRS	France	Femtosecond pulse radiolysis study of initial process of radiation chemistry
Radiation Chemistry	Brookhaven National Laboratory	USA	Femtosecond pulse radiolysis study of electron transfer in conjugated molecules
Accelerator Physics	Tsinghua University	China	Application of RF gun to electron diffraction and microscopy
Accelerator Physics	Shanghai Institute of Applied Physics	China	Development of new RF gun
Department of Nanocharacterization for Nanostructures and Functions	Utrecht University	Netherlands,	Structural transformation of gold nanorods in gases
Department of Nanocharacterization for Nanostructures and Functions	Lawrence Berkeley National Laboratory	USA	High resolution TEM observations of Au nanoparticles supported on metal oxides catalysts
Department of Nanocharacterization for Nanostructures and Functions	FEI Company	USA	Development of a high resolution envirionmental TEM

6) Symposia, Seminars, Workshops and Lectures

2011/05/19～ 2011/05/20	IPSJ SIG-CVIM: Computer Vision and Image Media
2011/6/23	Printed Electronics Association
2011/7/17～23	Asian Computational Materials Design Workshop

2011/7/22～23	The 33th Annual Meeting of the Japanese Society for Photomedicine and Photobiology
2011/7/26	7th Academic Meeting in Research Laboratory for Quantum Beam Science
2011/9/5～9	19th Computational Materials Design Workshop
2011/9/21	Printed Electronics Association
2011/9/26	Brain-storming Workshop on Chemistry and Physics of Organic Semiconductors
2011/9/28～30	54th meeting of Japanese Society of Radiation Chemistry
2011/10/3～4	International Workshop on Quantum Nanostructures and Nanoelectronics
2011/10/7	Seminar on the roles of drug efflux pumps in bacterial multidrug resistance and virulence
2011/10/13～14	INRA-SANKEN Joint Meeting
2011/10/24	Printed Electronics Association
2011/11/10～11	7th Handai Nanoscience and Nanotechnology International Symposium
2011/11/22	67th Symposium special topic and subsequent conference for presenting results of research activities made by the members of the Institute
2011/11/27～12/2	MRS Fall Meeting Symposium
2011/12/2～3	14th Biomolecular Chemistry Meeting
2011/12/16	8th Academic Meeting in Research Laboratory for Quantum Beam Science
2012/1/11	3rd AFCV International Workshop on Recent Trends in Computer Vision
2012/1/12～13	The 15th SANKEN International Symposium 2012/ The 10th SANKEN Nanotechnology Symposium
2012/1/27	Workshop on Application of Revolutional Algorithm to Material Researches
2012/1/30～31	Workshop on Physics of Hydrogen in Materials
2012/1/31	Printed Electronics Association
2012/2/3～4	Emergence in Chemistry third Symposium
2012/2/9	9th Academic Meeting in Research Laboratory for Quantum Beam Science
2012/2/20	Workshop [A-4] of Network Joint Research Center for Advanced Materials and Devices
2012/2/23～24	ISIR Intra-University Collaboration Meeting
2012/3/5	RIEC-ISIR Joint Workshop
2012/3/6～10	20th Computational Materials Design Workshop
2012/3/10	FIRST project Public Symposium
2012/3/15	The 50th Spring Meeting, 2012 The Japan Society of Applied Physics
2012/3/21～22	International Symposium on Innovative Nanobiodevices (ISIN 2012)
2012/3/23	Theoretical Nanotechnology Special Seminar
2012/3/29	85th Annual Meeting of Japanese Society for Bacteriology

Other Lectures and Seminars

2011/4/1	Norifumi Watanabe	Tamagawa University	Postdoctral researcher	Pedestrian guidance, modeling of action decision on passing each other
2011/4/19	Naoyuki Nagasako	Toyota Central R&D LABS., INC	Researcher	Stress Calculation by FLAPW Method
2011/4/26	Takurou Fukunaga	Kyoto University	Assistant Professor	Angorithm for Network Design and Partition
2011/5/12	H. Sirringhaus	Cambridge University	Professor	Charge Transport in Organic Polymer Semiconductors
2011/5/17	Tuyoshi Nishimatu	Instuitute for Materials Research, Tohoku University	Assistant Professor	Tips to Draw a Dispersion Relation without Group Theory
2011/6/2	Masaaki Mochimaru	The National Institute of Advanced Industrial Science and Technology, Digital Human Research Center	Director	Health Promotion Technology based on Digital Human Models -Modelling and Prediction based on Body and Gait Databases-
2011/6/3	Shuji Hisaeda	CambridgeSoft	International Marketing, Manger	ChemBioOffice Seminnar
2011/6/11	Dae Won Cho	Konkuk University	Professor	S2-emission of BODIPY
2011/6/17	Shigeki Imai	Sharp corporation	guest professor	Displays and the application
2011/6/17	Hiroaki Kouno	Kouno Hiroaki Patent Firm	president	Digging potential inventor
2011/6/20	Andrew Brotman	GLOBAL FOUNDRIES	vice president	Design and manufacuturing challenges at advanced CMOS process nodes
2011/6/22	Ikutaro Hamada	Advanced Institute for Materials Research, Tohoku University	Assistant Professor	van der Waals Corrections to Density Functional Theory
2011/6/28	Hiroaki Kouno	Kouno Hiroaki Patent Firm	president	Concrete method to evaluate intelectual prroperty
2011/7/1	Sathya Sheela S	Japan Advanced	Researcher	A First Principles Quest for New

		Institute of Science and Technology		Multiferroics by Chemical Ordering
2011/7/5	Seog Kyu Kim	Yonnam University	Professor	DNA Interaction with Small Molecules Studied by CD and LCD Spectroscopies
2011/7/5	A. Fazel Famili	Institute for Information Technology, NRC and University of Ottawa	Group Leader	Knowledge Discovery from life sciences data: Choosing the right approach
2011/7/8	Shigeki Imai	Sharp corporation	president	Displays and the application
2011/7/12	A. Rahman	Universiti Sains Malaysia	Professor	Production of Carbon Nanotubes from Chemical Vapor Deposition of Methane in a Continuous Rotary Reactor System
2011/7/14	RHYU Keel-Soo	Korea Maritime University	Professor	Fault Diagnosis and Monitoring of Diesel Engine based on Sensor Data
2011/8/22	Atif Mossad Ali	King Khalid university,Abha,Saudi Arabia	researcher	Science and technology for silicon nano particles
2011/8/23	Dipankar Sen	Simon Fraser University	Professor	Electron Transfer in DNA Studied Electronchemical and Biological Detection
2011/8/25	Richard P. Cheng	National Taiwan University	Associate Professor	Effect of Highly Fluorinated Amino Acids on Protein Secondary Structure Stability
2011/8/25	Steffen Rendle	University of Konstanz	Assistant Professor	About Factorization Models and Linear/Polynomial Regression
2011/8/30	Hiroyoshi Momida	Institute of Industrial Science, The University of Tokyo	Post Doctoral Fellow	Real-time Time Dependent Density Functional Method
2011/9/5	Massimiliano Di Ventra	University of California San Diego	Professer	Memory at the nanoscale: from spintronics to DNA sequencing
2011/10/13	Thomas Wirth	Cardiff University	Professor	Advanced Concepts for Catalysis in Synthesis and Flow Chemistry

2011/11/1	Rustam I. Aminov	University of Aberdeen	Professor	Evolutionary, ecological and societal aspects of antibiotic resistance
2011/11/11	Bert Poolman	Membrane Enzymology, GBB, University of Groningen	Professor	Function and Structure of ATP-binding cassette transporters
2011/11/14	Barry P. Rosen	Florida International University, Herbert Wertheim College of Medicine	Professor	Pathways of arsenic transport, metabolism and detoxification
2011/11/15	Minoru Ikeda	Fujitsu Laboratories	Researcher	First-principles Analysis of Solid Electrolyte Li3PS4 (Li3PO4)
2011/11/16	Luc Van Den Hove	Interuniversity Microelectronics Centre	CEO & President	The Latest research trend of imec
2011/11/28	Takao Abe	Shin-Etsu Chemical Co., Ltd. Advanced Functional Materials Research Center	Chief Researcher	History of Silicon Crystal Growth and Perspective
2011/12/5	Toshiaki Murai	Gifu University	Professor	Development of New Reactions and New Compounds Based on Chalcogene-Containing Double Bonds
2011/12/13	Y. Ohno	Institute for Materials Research, Tohoku University	Associate Professor	Electronic properties of dislocations in semiconductor -ZnO & Si-
2011/12/19	Gerald Schaefer	Loughborough University	Senior Lecturer	Interactive navigation of image databases
2011/12/19	J. Yamasaki	EcoTopia Science Institute, Nagoya University	Assistant Professor	Development and application of atomic-scale imaging by aberration corrected TEM
2012/1/26	Vaidhyanathan Ramamurthy	Miami University	Professor	Recent Development of Photochemistry
2012/2/9	Daisuke Ueda	Panasonic	head of the laboratory	The enterprise forefront #1
2012/2/14	Coneria Bohne	Victoria University	Professor	Dynamics of Guest Binding to Cucurbiturils

2012/2/15	Kazuo Kyuma	Mitsubishi Electric	Vice President	The enterprise forefront #2
2012/2/28	Satoko Moriguchi	Tokyo Metroplitan University	Assistant Professor	Minimization of Discrete L/M Convex Function - Algorithm and Its Implementation -
2012/3/5	David Bartels	University of Notre Dame	Professor	Radiation chemistry in water
2012/3/12	Jens Kunstmann	Technical University Dresden Institute for Materials Science and Max Bergmann Center of Biomaterials	Researcher	Physical Properties of Bulk and Nanostructures of Elemental Boron
2012/3/16	Hidetada Hirakawa	Department of Microbiology, University of Washington	Postdoctoral Fellow	Anaerobic bio-degradation of aromatic ring compounds by Rhodopseudomonas palustris and its regulation study
2012/3/19	Vito Lippolis	The University of Cagliari, Italy	Professor	Probing Biologically and Environmentally Important Metal Ions with Fluorescent Chemosensors: Thermodynamic vs Optical Selectivity
2012/3/27	Tomoko Ohnishi	Dept. Biochemistry and Biophysics, University of Pennsylvania	Professor	Biophysical analysis of the mechanism of the respiratory chain complex 1
2012/3/30	Takashi Nukii	Sharp Corporation	executive officer	frontline research and development

7) Public Information Activity

Public information activity of ISIR in 2011 is as follows:

- Bulletin of ISIR 2011 (in both Japanese and English)
- Memoirs of the Institute of Scientific and Industrial Research, Osaka University Vol.68 2011 (in English)
- Annual Report of ISIR (in Japanese)
- SANKEN News Letters, 43-45(in Japanese)

- Report on SANKEN Techno Salon 2011 (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 2011 is 539. The details are described in the part of activity of divisions and facilities.

9) Scientific Awards

H. SASAI	The Moleculer Chirality Research Organization「MOLECULAR CHIRALITY AWARD 2011」	2011/5/20
Y. HISANO	The Japanese Biochemical Society, Kinki Branch, Best Presentation award	2011/5/21
T. WASHIO	The Japanese Society for Artificial Intelligence Incentive Award	2011/6/2
Y. MUKAIGAWA	2010 IPSJ Transactions on Computer Vision and Applications Outstanding Paper Award	2011/6/2
Y. YAGI	2010 IPSJ Transactions on Computer Vision and Applications Outstanding Paper Award	2011/6/2
K. NAGASHIMA	The 9th Annual Meeting of Society of Nano Science and Tachnology Young Best Presenter Award	2011/6/3
T. YANAGIDA	The 9th Annual Meeting of Society of Nano Science and Tachnology Young Best Presenter Award	2011/6/3
K. SUGANUMA	Best Award of 24th Fall Symposium of Reliability Engineering Association of Japan	2011/6/3
N. TANIGUCHI	The 101st Japan Academy Prize	2011/6/20
K. NAGASHIMA	ISSP2011 the 11th International Symposium on Sputtering & Plasma Processes Best Poster Award	2011/7/8
T. YANAGIDA	ISSP2011 the 11th International Symposium on Sputtering & Plasma Processes Best Poster Award	2011/7/8
I. MITSUGAMI	The 14th Meeting on Image Recognition and Understanding, Best Paper Honorable Mention	2011/7/21
Y. YAGI	The 14th Meeting on Image Recognition and Understanding, Best Paper Honorable Mention	2011/7/21
K. FUKUI	JSAI2011 Convention Award	2011/7/15

K. NISHINO	Osaka University Achievement Award (in Research)	2011/8/1
M. NOGI	Achivement award in osaka universith(research category)	2011/8/1
Y. HISANO	FASEB Summer Resaarch Conferences, Travel Award	2011/8/19
H. NAKAJIMA	MetFoam 2011 Best Paper Award	2011/9/20
T. TOIGAWA	Poster award on Fall Meeting of AESJ 2011	2011/9/20
K. KAN	Poster award on 54th meeting of Japanese Society of Radiation Chemistry	2011/9/30
T. ARAKI	Incentive award in Japan Institute of Electronics Packaging	2011/9/30
K. KOBAYASHI	JB Award	2011/10/24
K. MAEHASHI	MNC 2010 Award for Outstanding Paper	2011/10/25
Y. OHNO	MNC 2010 Award for Outstanding Paper	2011/10/25
K. INOUE	MNC 2010 Award for Outstanding Paper	2011/10/25
K. MATSUMOTO	MNC 2010 Award for Outstanding Paper	2011/10/25
K. MAEHASHI	MNC 2010 Award for Most Impressive Poster	2011/10/25
Y. OHNO	MNC 2010 Award for Most Impressive Poster	2011/10/25
K. INOUE	MNC 2010 Award for Most Impressive Poster	2011/10/25
K. MATSUMOTO	MNC 2010 Award for Most Impressive Poster	2011/10/25
S.SASAKI	MEXT grant-in-Aid for scientific research on innovative areas "topological quantum phenomena in condensed matter with broken symmetries" topological quantum phenomena best poster award in the international workshop for young researchers	2011/11/4
R. NAKAHARA	8th Symposium on Thin-film Devices, Best Paper Award	2011/11/5
K. KAWAI	ISNAC Outstanding Oral Presentation Award for Young Scientist in 2011	2011/11/10
K.FUJIWARA	7th Handai Nanoscience and Nanotechnology International Symposium Poster presentation Awards	2011/11/10
M. TSUTSUI	7th Handai Nanoscience and Nanotehnology International Symposium "Young Researcher Poster Award"	2011/11/11
S. YAMASAKI	Best Presentation Award, 64th Kansai Branch General Meeting of Japanese Society for Bacteriology	2011/11/19
A. HATTORI	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/12
T. YANAGIDA	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13

K. NAGASHIMA	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
Y. YAGI	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
I. MITSUGAMI	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
K. TANIZAWA	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
T. OKAJIMA	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
T. NAKAI	The 15th SANKEN International Symposium 2012 The 10th SANKEN Nanotechnology Symposium Best Poster Award	2012/1/13
S.TAGAWA	The Japan Society of Applied Physics Hokuriku-Shin´etsu Chapter Encourage Award	2012/1/21
M. TANE	Grobal COE program "Center of Excellence for Advanced Structural and Functional Materials Design" Best Paper Award	2012/2/14
M. TANE	Grobal COE program "Center of Excellence for Advanced Structural and Functional Materials Design" Best Paper Award	2012/2/14
J. TAKEYA	Nanotech 2012 Best Project Award	2012/2/17
Y. MUKAIGAWA	IPSJ Yamashita SIG Research Award	2012/3/7
H. YOSHIDA	The 109th CATSJ Meeting Excellent Poster Presentation Award	2012/3/29
S. YAMASAKI	Excellent Poster Award, 85th Annual Meeting of Japanese Society for Bacteriology	2012/3/29
K. KAIHATSU	"Precious Metals Research Grants" Gold Prize	2012/3/29
T. TOKUNO	Tanaka Precious Metals Group "Precious Metals Research Grants" MMS Awards	2012/3/30

2. Education

ISIR accepts graduate students (197) 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, 2012 is as follows.

Field / Course	Science	Engineering	Engineering Science	Pharmaceutical Science	Information Science and Technology	Frontier Biosciences	Total
Master Course	52	48	14	5	15	8	141
Doctor Course	17	24	5	—	6	2	56
Total	69	72	19	5	21	10	197

Number of students who had obtained Bachelor's, Master's or Doctor's Degree in 2011 is as follows.

Field / Degree	Science	Engineering	Engineering Science	Pharmaceutical Science	Information Science and Technology	Frontier Biosciences	Total
Doctor Degree	1	6	0	0	0	1	8
Master Degree	25	21	0	2	3	3	54
Bachelor	1	7	0	1	0	0	9
Total	27	34	0	3	3	4	71

3. International Exchange

1) Exchange Agreement

At Present, academic exchange agreements are concluded with the following 24 organizations.

○Faculty of Natural Science, Otto-von-Gueriche University Magdeburg (Germany)
○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)
○Centre National de la Researche scientifique : CNRS (France)
○Rwth Aachen University (Germany)

○College of Natural Science, Chungnam National University (Korea)
○Institute of Romote 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)
○University of Augsburg(Germany)
○College of Computer Studies,De La Salle University (Philippine)
○University of Augsburg(Germany)
○Department of Chemistry, Korea Advanced Institute Science and Technology (Korea)
○School of Enviromental Science and Engineering/Department of Chemical Engineering, Pohang University of Science and Technology(Korea)
○Gachon Bionano Research Institute, Kyungwon University (Korea)
○Institute of Fisheries Sciences, Pukyong National University (Korea)
○Faculty of Science, Assiut University(Egypt)
○Interuniversity Micro Electronics Center (Belgium)

2) Foreign Researchers and Students

Number of foreign researchers and students staying in ISIR as of March 31, 2012 is 83 in total. Details are, Assistant Professor(include of specially appointed staffs) (7), Specially Appointed Researcher(6), Part-time Employee (22), Graduate Students (35:Doctor Course,14, Master Course,21). Their nationalities are: China(37), Korea(13), Thailand(5),Taiwan(4),Philippine(4),India(4), Viet Nam(4), Mexico(2), Bangladesh(2), Germany(2), Russia(2), U.S.A.(1),Brazil(1), France(1), Myanmar (1)

Foreign visitors in 2010 are as follows:
U.S.A. (12), Korea (8), China(7) ,England(6),France(5),Canada(4),Italia(3), Germany (3), Australia(2),New Zealand (2),Poland(2), Taiwan(1) ,Thailand(1),Norway(1), Bangladesh(1), Pakistan(1),Belgium(1), Netherland(1), Saudi Arabia(1),Malaysia (1), Total 63.

3) International Conferences and Symposiums

Number of presentations (plenary, invited, oral and poster in various international conferences and symposia) by staff of ISIR is 525 in total.

Number of ISIR staffs who have been working as committee members of

International Conferences or Editorial Board of international academic journals are 179 in total. For more details, see the part of activity of divisions and facilities.

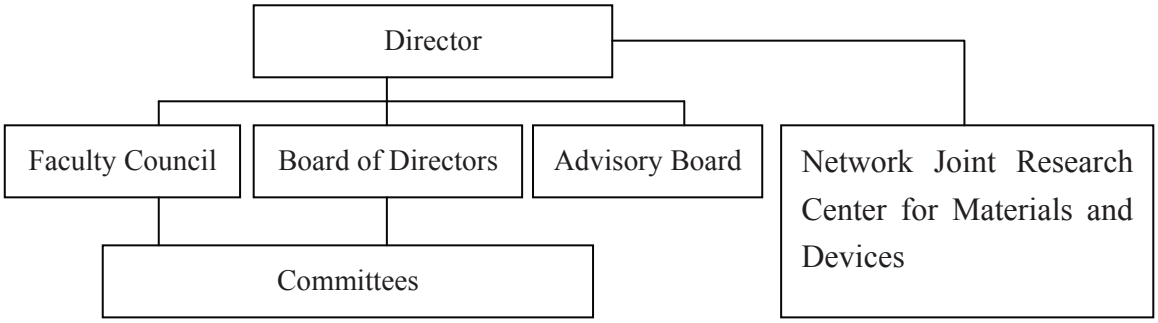
4. Concluding Remarks

(1) Organization and Management System

After the reorganization in 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.

【Management 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 headquarters of the network.

In 2011,Research Collaboration Agreement was reached between Interuniversity Microelectronics Center(imec) and ISIR.

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 Nanosocience 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 about 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 staffs 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. We 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),publications and website. 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 2006, 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 elements 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, 2012), 83 foreign researchers ,students and others 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, International Collaboration Center was started for promoting the foreign exchange. The center consists of several 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 was opened for the core of academia-industry collaboration.

In 2011, the time has come to advance to the next step for ISIR. We promoted international collaboration with imec for open innovation.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
- The world-first unified definition of biological and artifactual functions
- 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 photonic quantum circuit combining single-photon-level optical nonlinearities.

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: Kang-Min KIM, Takasi KUCHIYAMA, Kotaro HIGASHI
Fumio YUKAWA, Junichi KUKUCHI
Hiroya ICHIHARA, Mai UENAKA, Takahiro SHIMOI
Li ZHOU, Yuki NAKATANI, Ayumi BEPPU
Yousuke MITSUNO, Ken YONEOKA, Mariko KIMURA
Masaaki SANO
Undergraduate Student: Sota SANO, Akihiro YAMAGUCHI
Support Staff: Akiko WATANABE, Ikuko ISHITANI

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

Crystal Growth and Properties of Diluted Magnetic Semiconductors

Diluted magnetic semiconductors are gathering great interest as a candidate for new functional materials. In 2011, GaDyN-based double-barrier magnetic tunnel junctions (DB-MTJs) were grown by radio frequency plasma assisted molecular beam epitaxy (RF-MBE). GaDyN-based DB-MTJs with the 3-, 5-, and 8-nm-thick middle magnetic layers were grown. It was confirmed that the Dy ions were incorporated into the Ga sites by the x-ray absorption fine structure (XAFS) analysis. X-ray diffraction (XRD) profile for these three samples is shown in Figure 1. Several weak peaks were observed in the low-angle region, which were assigned from GaN tempelate. No secondary phase such as DyN can be confirmed. A clear peak was observed at the low angle side of the GaN (0002) reflection peak. This can be deduced that effective radii of Dy ions are larger than those of Ga ions, therefore lattice constant of GaDyN is larger than that of GaN. Ferromagnetic behavior was confirmed for the samples at room temperature. Figure 2 shows the saturation magnetization as a function of the middle GaDyN layer thickness. It is found that the magnetization per unit volume show a change with

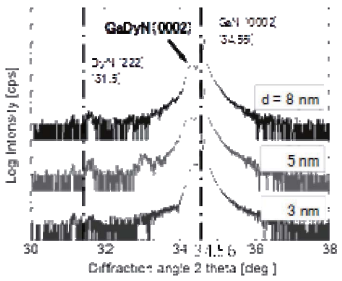


Figure 1: XRD curves for the GaDyN-based DB-MTJs with 3-, 5-, and 8-nm-thick middle magnetic layers.

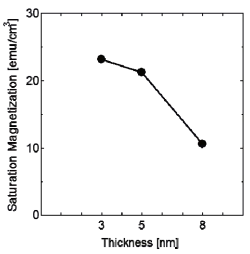


Figure 2: The saturation magnetization as a function of the middle GaDyN layer thickness.

increase the thickness of the middle GaDyN layer. This implies that the interlayer coupling exists between GaDyN layers.

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 2011, SP-STM was used to investigate current-voltage (I-V) characteristics of Fe islands epitaxially grown on GaN. It was found that tunnel magnetoresistance images of Fe islands derived from the I-V characteristics reflected the direction of their magnetization. In addition, we pointed out from spin-dependent band structures that (110)-oriented CoFe bcc layers are advantageous because of a much higher spin polarization value of about 80% than that for (110)-oriented bcc Fe layers (~30%) in Fe/GaN(0001) system. We also examined room temperature growth of Co single layers and Co/Fe multilayers on GaN(0001) and their magnetic properties. It was found that in Co/GaN(0001) system, (111)-oriented Co fcc nanodots were initially grown followed by the growth of (0001)-oriented hcp nanodots. As the dot size increased, their magnetic moment per Co atom decreased and approached the value of magnetic moment per atom for bulk hcp Co. For Co/Fe multilayers, (110)-oriented nanodots were grown. Their magnetic properties strongly depended on the structures of layer stacking.

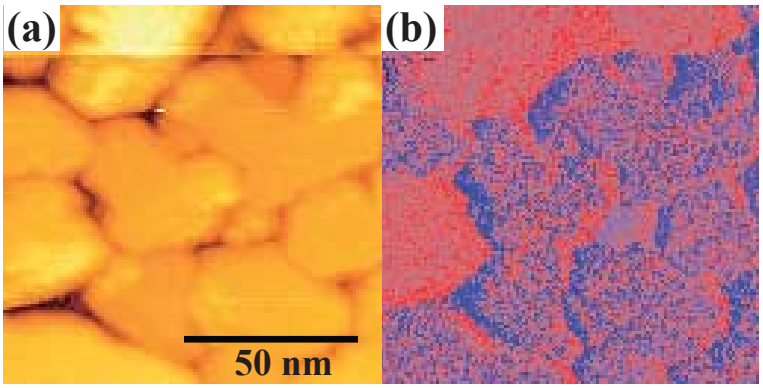


Figure 3: Topographic (a) and tunnel magnetoresistance (b) images of Fe islands

3. 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. Furthermore, this research technique also has an advantage of specific element selectivity. The atomic arrangements/coordination in the new functional materials, GaCrN and GaGdN, was characterized and it was showed that the Gd (Cr) atoms substitutionally occupy the group III sites. In 2010, GaGdN/AlGaN 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. Under the present growth conditions, we have no remarkable evidence for such situation. As a new result, a vacancy of nitrogen ion adjacent to the Gd ion was found in 2011. It depends on the growth conditions. This nitrogen vacancy may play like as NV center in diamond. The simulation of the XAFS spectra around the Gd L_{III}-edge indicates the nitrogen vacancy at the one of the three equivalent legs. The stability of the vacancy will be given by first principles calculation, which is under progress in 2012.

Department of Semiconductor Electronics

Professor:	Kazuhiko MATSUMOTO
Associate Professors:	Koichi INOUE, Kenzo MAEHASHI
Assistant Professor:	Yasuhide OHNO
Post Doctoral Fellows:	Masuhiro ABE, Takafumi KAMIMURA
Researcher:	Mari KONISHI
Graduate Students:	Yusuke YAMASHIRO, Satoshi OKUDA, Yasuyuki SOFUE, Shogo OKAMOTO, Kenta GUMI, Yusuke FUJII
Under Graduate Students:	Takashi IKUTA, Keisuke KOSHIDA
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 Projects

Horizontally Aligned Carbon Nanotubes on Quartz Substrates for Chemical and Biological Sensing

We have developed electrolyte-gated sensors based on a field-effect transistor (FET) consisting of horizontally aligned single-walled carbon nanotubes (CNTs) synthesized on single-crystal quartz substrates. (Fig. 1) Dense well-aligned CNTs serving as channels enabled high device current and large transconductance with low noise. For immunosensing, selective detection of human immunoglobulin E (IgE) by using aptamer-functionalized CNTFETs was demonstrated in the presence of nontarget

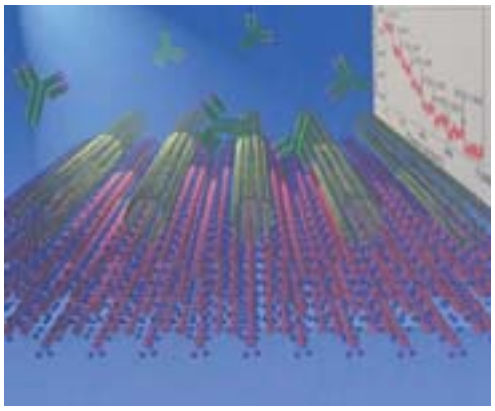


Fig. 1 Schematic illustration of electrolyte-gated CNTFET sensor.

proteins at much higher concentration. The developed sensors with aligned channels exhibited a drain current of 400-fold that of single-channel devices. Therefore, aligned-channel CNTFETs are useful for highly sensitive and practicable solution sensing.

Ionophore-Modified Graphene Field-Effect Transistors as Selective Ion Sensors

Graphene has recently been expected for ultrasensitive sensors because of its high mechanical strength and wide surface area. Potassium (K) ion sensors were demonstrated by modifying graphene field-effect transistors with valinomycin which is a selective K ionophore. The transfer curves of the transistors were shifted to the negative direction as the K ion concentration increased, The results showed that K ions in solution were effectively detected over a wide concentration range. On the other hand, the addition of Na ions did not cause any changes in the transfer characteristics. We have thus succeeded in the utility of graphene transistors as specific ion sensors with high sensitivity.

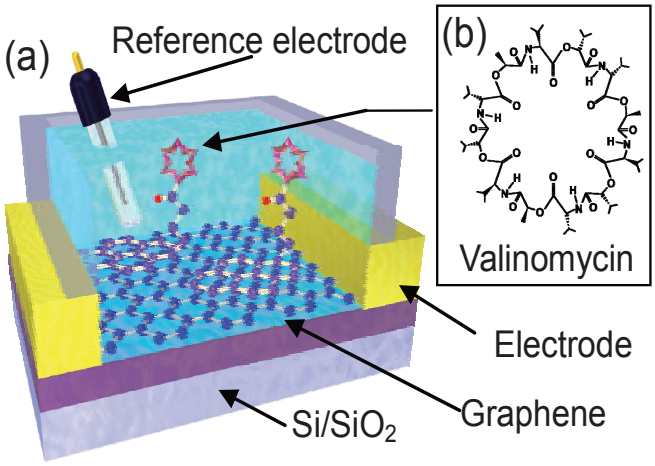


Fig. 2. (a) Schematic illustration of measurement set-up incorporating valinomycin-modified graphene field-effect transistor and (b) chemical structure of valinomycin.

Electric-Field-Induced Band Gap of Bilayer Graphene in Ionic Liquid

Ionic liquid-gated graphene field-effect-transistors (G-FETs) were fabricated to investigate the band gap generated in a bilayer graphene by external electric field. The ionic-liquid-gate structure (Fig. 3) enables us to apply the external electric field effectively to the graphene channel. As the result, an increase in the resistance of the bilayer graphene was clearly observed under the high electric field, owing to the creation of the band gap. From measurement of temperature dependence of the electrical characteristics, the valule of the band gap energy was estimated to be 235 meV at the ionic-liquid-gate voltage of -3.0 V.

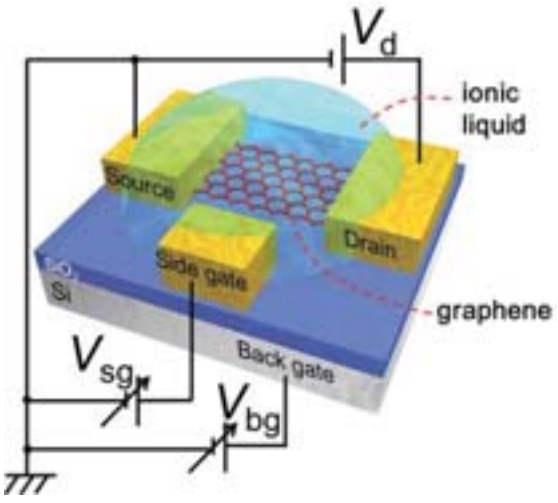


Fig. 3. Experimental setup of ionic liquid-gated graphene field-effect-transistor.

Department of Advanced Electron Devices

Professor: Jun TAKEYA
Associate Professor: Koichi SUDOH
Specially Appointed Associate Professor: Toshihiro OKAMOTO
Assistant Professor: Takafumi UEMURA
Specially Appointed Assistant Professor: Chikahiko MITSUI (2011.4.1-)
Research Fellow: Ken-ichi Sakai, Masakazu YAMAGISHI, Kazumoto MIWA, Yuri HIROSE, Wanyan LI
Research Assistant: Naoko NANBA, Jung Hee HONG, Yuki TANAKA
Graduate Students: Yugo OKADA, Kengo NAKAYAMA, Katsumasa NAKAHARA, Junshi SOEDA, Yuichi TAKATSUKI, Junya CHIBA, Kenjiro MIYAKE, Shin KITAOKA
Supporting Staff: Mako UENO, Hiroko KIRIYAMA

Outlines

Facing to the global environmental change and rapidly aging society in many countries, innovative technologies are anticipated to emerge in order to sustain our comfortable way of living even in such circumstances. Next-generation electronic devices, therefore, are required to diverse functions to help human life minimizing their burden to the environment in their production processes. Organic electronics are attracting much attention as a practical candidate to meet the requirement because such devices can be fabricated by printing at a low cost without processes at high temperatures. In addition, their mechanical flexibility appends further attractiveness, enabling unique devices that fit human shapes, for example. In Department of Advanced Electron Devices, we have been developing new organic transistors and organic photovoltaic cells, which are two of the fundamental devices for organic electronics.

Current Research Projects

High-Speed Flexible Organic Field-Effect Transistors with a 3D Structure

High-speed, flexible organic field-effect transistors with a 3D structure are fabricated on a plastic substrate in which vertical channels are formed to realize high response speed. With the benefit of short channel lengths, the fabricated transistors show fast dynamic switching within 250 ns, which corresponds to 4 MHz operation, even with the modest carrier mobility of 0.2 cm^2/Vs in organic semiconductors deposited on the vertical sidewalls.

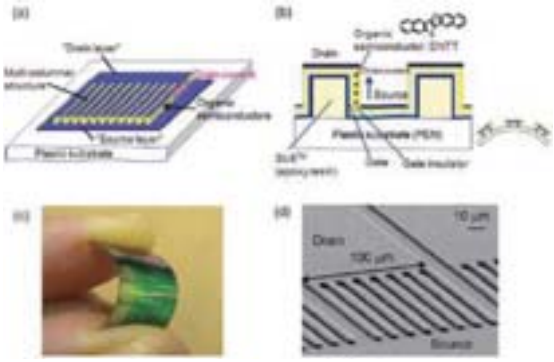


Fig.1 (a, b) Schematic illustrations of the 3D-OFET structure.
(c) Device picture and (d) SEM image of the 3D-OFET.

Air-Stable and High-Performance *n*-type OFETs

High-mobility and air-stable *n*-type organic field transistors based on solution-crystallized N,N'-1H,1H-perfluoro- butyldicyanoperylene carboxydi-imide (PDIF-CN_2) are developed. Electron mobility as high as 1.3 cm^2/Vs is achieved owing to the almost-perfect periodic crystal packing. In Addition, a complementary-inverter circuit using the solution processed OFETs is demonstrated. For the n-type transistor, the present PDIF-CN_2 device was utilized. A p-type transistor of a solution-crystallized C_8-BTBT OFET was also fabricated using a solution-crystallized method. A typical inverter response with high DC gain was observed.

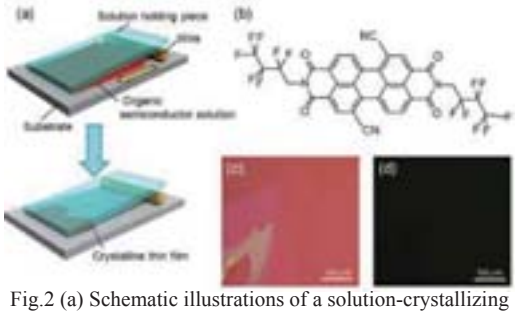


Fig.2 (a) Schematic illustrations of a solution-crystallizing method. (b) Molecular structure of PDIF-CN_2 (c, d) Optical and polarized microscope images of a PDIF-CN_2 crystalline film.

Charge Transport Properties of Organic Semiconductor under High Pressure

The method of studying the effect of hydrostatic pressure on organic semiconductors is established employing precise measurement of both four-terminal conductivity and Hall coefficient on high-mobility rubrene single-crystal transistors. It turned out that enhanced intermolecular charge transfer causes an increase in the mobility of the bandlike charge carriers by 20% GPa up to 600 MPa, which is typically one order of magnitude larger than that in inorganic semiconductors.

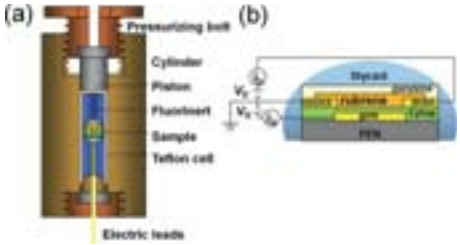


Fig.3 (a) Schematic illustrations of a high pressure cell (b) Device structure of Rubrene FETs

Solution-Processed Organic Active-Matrix Backplane for Driving LC Display

Organic field-effect transistors are regarded as an important technology for a broad range of applications such as flexible displays and other large-area imaging devices. In this study, organic active-matrix backplane for driving a LC display are demonstrated with high-mobility solution-crystallized organic transistors. The size of the display is 2.3 inch in diagonal. The number of pixels is 30 × 23 and the pixel size is 1.5 mm × 1.5 mm. The pixel transistors are made by air-stable compound of 2,9-didecyldi-naphtho [2,3-b:2',3'-f]thieno[3,2 -b]thiophene with a solution-crystallized method. Average mobility of pixel transistors is about 3 cm^2/Vs, which is the fastest switching performance among the reported organic active matrix backplanes.

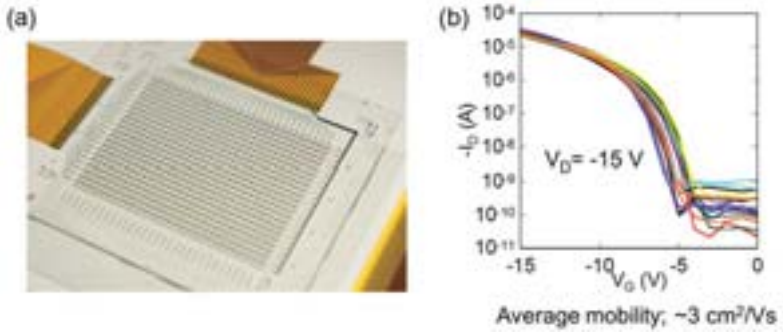


Fig.4 (a) A picture of the LC display driven by the organic active-matrix backplane. (b) Transistor characteristics of pixel transistors.

Department of Intelligent Media

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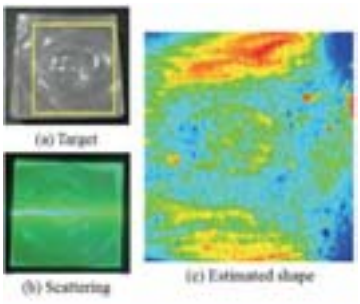
Outlines

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.

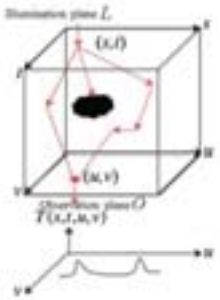
Current Research Projects

Shape estimation of translucent objects based on attenuation of single scattering



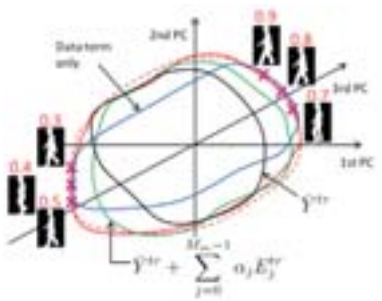
We propose a new method based on attenuation of single scattering for estimating shape of translucent objects. The light path of the single scattering and the attenuation along the light path can be easily analyzed, because the single scattering is occurred by one-bounce collision between the incident light and molecule. We can thus estimate shape by applying the light attenuation model to single scattering component which is separated from scatterings. Moreover, though there is an ambiguity between scattering properties and the estimated shape, we show that the ambiguity can be solved with multiple observations by shifting incident depth. We demonstrate that single scattering can be used as clue for shape measurement by experiments.

Estimation of Shielding Object Distribution in Scattering Media by Analyzing Light Transport



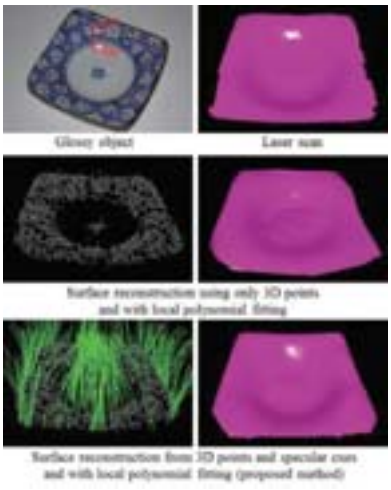
We propose a new method to estimate the distribution of shielding objects in scattering media by analyzing light transport, which is measured by an illuminator and camera. This estimation problem is regarded as an inverse problem compared to the forward rendering problem. In contrast to previous methods, which are difficult to be applied to strongly scattered media, our method achieves a much better performance. The distribution of shielding objects can be estimated by voting the likelihood of existence. The performance of our method has been evaluated by the experiment.

Periodic Image Sequence Reconstruction from Low Frame-rate Videos for Gait Recognition



We propose a temporal super resolution approach for quasi-periodic image sequence such as human gait. The proposed method effectively combines example-based and reconstruction-based temporal super resolution approaches. A periodic image sequence is expressed as a manifold parameterized by a phase and a standard manifold is learned from multiple high frame-rate sequences in the training stage. In the test stage, an initial phase for each frame of an input low frame-rate image sequence is estimated based on the standard manifold at first, and the manifold reconstruction and the phase estimation are then iterated to generate better high frame-rate images in the energy minimization framework that ensures the fitness to both the input images and the standard manifold. The proposed method is applied to low frame-rate gait recognition and experiments with real data of 100 subjects demonstrate a significant improvement by the proposed method, particularly for quite low frame-rate videos.

Surface Reconstruction from Sparse Depths and Specular Cues



We propose a novel surface reconstruction method that takes sparse 3-D points and specular measurements. The proposed method is particularly useful for reconstructing glossy surfaces where obtaining stable correspondences is difficult. To efficiently reconstruct a surface from such sparse measurements, our method represents a local surface shape by polynomial surfaces and determines the shape by finding the optimal polynomial coefficients that fit both the sparse 3-D points and specular observations. The local polynomial surfaces are finally integrated to obtain the whole surface. The effectiveness of the proposed method is demonstrated using both synthetic and real-world examples.

Department of Reasoning for Intelligence

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Supporting Staff:	Hiroko OKADA

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. Currently, we work on the following four research projects..

Current Research Projects

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 studied a Monte Carlo method to simulate state transitions of molecules in a state space having dozens or hundreds of dimensions. In addition, we started a new study on mass which represents data density, applied it to clustering, anomaly detection and classification, and showed its higher performance than conventional approaches.

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, in a transition-based parser of Natural Language Processing, a transition sequence can be represented by a graph sequence where each graph, vertex, and edge respectively correspond to a state, word, and dependency. In this year, we developed a method for mining rules for rewriting from states reaching incorrect final states to states reaching the correct final state, and developed a dependency parser that uses rewriting rules. We confirmed that developed parser outperforms the conventional methods in terms of dependency accuracies. In addition, we confirmed that the developed parser mines rewriting rules which can shed light on why incorrect dependency structures are returned by the transition-based dependency parsers.

Discovering hidden causal structures in data

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. In this year, we developed a method for learning causal orders that is robust against latent confounders. Existence of latent confounders is a major difficulty in causal discovery. We showed that the new method enables more accurate estimation of causal structures.

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) with respect to several types of problems that are important in applications. 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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Specially Appointed Assistant Professors:	Hiroko KOU, Yuki YAMAGATA
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Under Graduate Students:	Ryosuke FUKUI, Toshiyuki BABA Takeshi MASUDA, Yoshiki HIROHATA, You KOBAYASHI
Supporting Staff:	Akiko HASHIMOTO

Outlines

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 includes an investigation of 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, sharing of technical knowledge, intelligent educational/training systems, and ontology-aware authoring systems. In 2011, an EU's international collaborative research project: EuJoint with distinguished researchers in ontological engineering and philosophy has been continued. By intensive discussions, we have obtained several remarkable results about the issues described below.

Current Research Projects

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. The latest achievements include the following; 1) We developed a dynamic *is-a* hierarchy generation system based on user's viewpoint as an extended function of Hozo and have evaluated it through application to a disease ontology. 2) We have refined a comprehensive ontology of about 6000 diseases from 12 clinical divisions and proposed a new ontological definition of diseases based on a theory of causal chains. 3) We developed an ontology for comprehensive systematization of abnormal states in every clinical division. 4) We developed an ontology for interoperability of phenotype descriptions of genomics in the collaboration with experts of RIKEN. 5) As a part of the EuJoint project, we have investigated an innovative theory of roles by employing the

notion of meta-role and on a new theory of parts. 6) 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

Aiming at promotion of sharing of knowledge about functionality of artifacts among engineers, we have developed an ontology-based modeling framework. The framework has been deployed successfully in some manufacturing companies. Based on the framework, a functional knowledge externalization and sharing tool named OntoloGear was developed as a software product. We have also developed a phase-oriented model of function along the product life-cycle and an evolutional model along the evolutional history of creatures. In 2011, as a part of the EuJoint project, we have collaboratively identified the relationships among some different definitions of artifacts and jointly published the results as an international workshop paper.

Furthermore, we have generalized this framework into a goal-oriented modeling framework for procedural knowledge. In the collaborative research with a public hospital, we have described models of the nursing procedures, which are going to be deployed with tablet-style computers as described below. In addition, we have investigated the notion of services, identified their essential definition and proposed an ontological model of complex structures of the service systems.

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) investigations of the effectiveness of our authoring system and multi-agent system for ICT education design in lesson plan design and refinement with real teachers in Tokyo and Okayama, 2) integration of ontologies for individual and collaborative learning, and 3) refinement of an improved framework of meta-cognition and suggestions for improvement of representative learning support systems for meta-cognition.

4. Academic-Industrial Alliance for Ontology-based Application Design Theory

Along with the progress of the ontology engineering technologies for both fundamental and developmental theories, the importance of theories for ontology-based application design/development is increasing. To realize practical design/development theories for building applications, we have been promoting several academic-industrial alliance research projects. This year, we focused on electronic instruction manuals for emergency aid procedures with Osaka Kouseinenkin hospital, Miki city hospital in Hyogo prefecture and Kobe City college for nurses. For each project, cooperating with domain experts, we investigated problems to be solved and designed ontology-based prototype systems. We plan to carry out on-site experiments to evaluate the feasibility of our tools.

Department of Architecture for Intelligence

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Post Doctoral Fellow:	Roberto LEGASPI
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Under Graduate Students:	Yu YAMANO
Research Students:	Ira PUSPITASARI (2011.10.1 -)
	Vanus VACHIRATAMPORN (2011.10.1 -)
Exchange Students:	Anh Bao MAI (2011.10.1 -)
Supporting Staff:	Misuzu YUKI

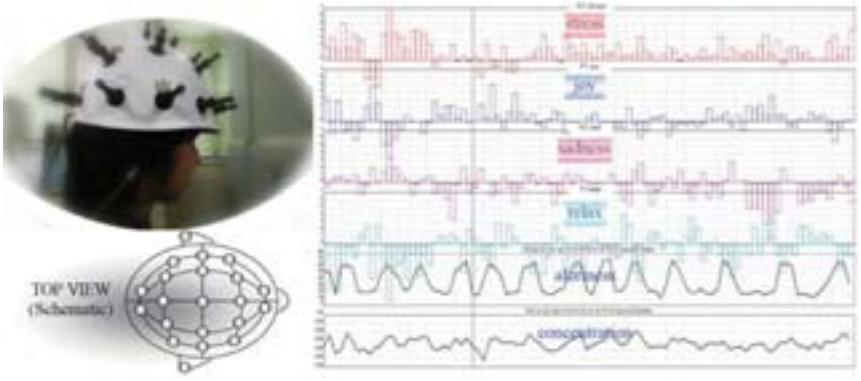
Outlines

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 Projects

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.

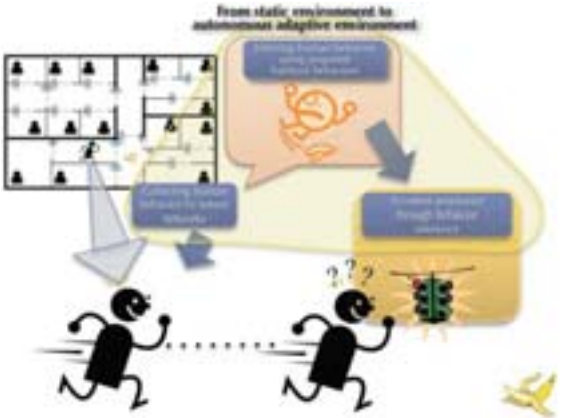
Intelligent Tutoring System

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.)

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Visiting Professor:	Aephraim M. STEINBERG (2011.4.1 - 2011.5.30)
Assistant Professor:	Ryo OKAMOTO
Assistant Professor:	Masazumi FUJIWARA
Post Doctoral Fellow:	Hideaki TAKASHIMA
Post Doctoral Fellow:	Hong-Quan ZHAO
Post Doctoral Fellow:	Masayuki OKANO
Post Doctoral Fellow:	Shanthi SUBASHCHANDRAN
Post Doctoral Fellow:	Takafumi ONO
Intl. Guest Researcher:	Tim SCHRÖDER (2011.4.18 - 2011.6.30)
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Supporting Staff:	Izumi KASAGI, Ryouko ITO

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

Ultra-low dark count superconducting single photon detector

Low dark counts and high detection efficiency are critical parameters essential for a single photon detector. As a collaboration with Nanjing University, we have developed a photon detection system using a superconducting nanowire single photon detector, exhibiting ultra-low dark counts (0.01Hz) with high detection efficiency up to 30% in the near IR region. We systematically studied

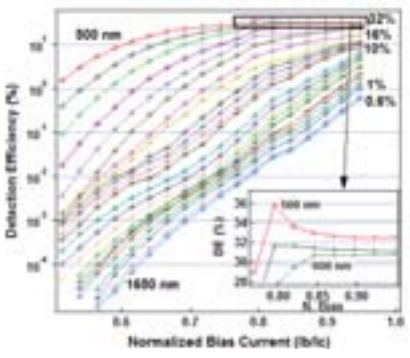

Fig. 1: Spectral dependence of the DE

the effect of reducing the nanowire width to 50 nm on the detection efficiency (DE) of a meander type SNSPD device in the spectral range from 500 nm to 1650 nm in steps of 50 nm using a white light source and a Bragg laser line tunable band pass filter (Fig. 1). A maximum detection efficiency of 32% at 500 nm, 30% at 600 nm, 16% at 800 nm, 10% at 1000 nm, and 1% at 1550 nm. Since DE at 500 nm to 600 nm was kept around 32 - 30% even with small bias current, an ultra-low dark count of 0.01 Hz was realized without appreciable decrease of DE.

Cancellation of the group velocity dispersion effect toward high-resolution quantum optical coherence tomography

Optical coherence tomography (OCT) based on Michelson interferometer has widely been utilized in biology and medicine. In contrast, quantum optical coherence tomography (QOCT), which is based on two-photon interferometer of quantum entangled photon pairs, has better axial resolution and can compensate the group velocity dispersion (GVD) effect. As a collaboration with Nagoya University, we have demonstrated the cancellation of the group velocity dispersion effect by the QOCT with broadband light sources. We compared the QOCT with 80-nm-bandwidth parametric fluorescence as entangled photon pairs and the OCT with 77-nm-bandwidth light sources to investigate how much GVD is generated in a high dispersive media. The resolution of the OCT signal was broadened over ten times larger than 4 micron-width without the dispersive media, while the broadening of the QOCT signal width was only broadened by two times compared with 2 micron-width without the media.

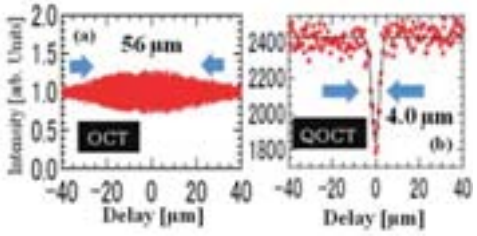

Fig. 2 : OCT (a) and QOCT (b) signals with the dispersion media in a sample path.

Highly efficient coupling of photons from nanoemitters to single mode fibers using optical nanofibers

Collection of fluorescence photons from single nanoemitters is of fundamental importance in quantum information science because they can be employed as single-photon sources that are crucial devices for realizing QKD protocols. Coupling the nanoemitter's fluorescence with single mode fiber is very important for the fiber integration and development of future quantum photonic networks.

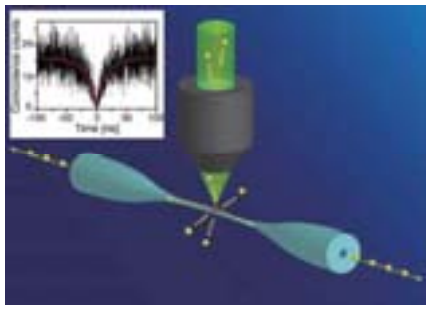
Fig. 3: a schematic picture of coupling of single nanoemitters to single mode optical fiber using 300-nm ultrathin tapered fibers

We have demonstrated highly efficient coupling of fluorescence photons from single quantum dots to single-mode fibers by using optical nanofibers. We were able to couple 7.4 % of the total emitted photons from single CdSe/ZnS nanocrystals into tapered fibers. This efficient photon collection technique is promising for single-photon sources.

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 highly functional materials, which provide basis of future developments in several important fields of information, energy, environmental and medical technologies. Emphasis is placed both on establishment of full understanding of fundamental mechanisms of the functions and on evolutional 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 quality, and use the quantum beams in a new field of beam-induced materials science.

Achievements

- Developments of topological insulators and elucidation of their basis properties
- Explorations of topological superconductors and other novel superconductors
- Development of chemical surface treatment of Si for reducing metallic contamination to 10^{-5} monolayer
- Creation of SiO_2/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 Sn whisker growth mechanism and developing high-temperature solders
- Direct observation of ultrafast structural phase transition of Si using time-resolved transmission electron diffraction
- Ultrafast dynamics of holes injected into Si valence band using two-photon photoemission spectroscopy
- Development of L-band RF photocathode
- Characterization of free-electron laser coherence
- Development of resist processes for extreme ultraviolet lithography
- Chemical reactions induced in condensed matter by quantum beam

Department of Quantum Functional Materials

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Outlines

The research of the Department of Quantum Functional Materials focuses on growth of high-quality singe 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 Projects

Basic research of Topological Insulators and Topological Superconductors

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" by a "Z_2 topological invariant". Intriguingly, the resulting metallic surface state is "helically spin-polarized" (i.e., right- and left-moving electrons carry up and down spins, respectively) and consist of "massless Dirac fermions" (i.e., the energy of quasiparticles is linearly dependent on the momentum). Those peculiar properties of the surface state open exciting new opportunities for novel spintronics devices with ultra-low energy consumptions. Even more exotic state of matter is Topological Superconductor, which is predicted to bear Majorana fermions on the surface. Majorana fermions are peculiar in that the particles are their own antiparticles, and they were originally conceived as mysterious neutrinos. Currently their realization in condensed matter is of significant interest because of their novelty as well as the potential for quantum computation.

1) *Surface-dominant transport in new Topological Insulator* $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$.

An important experimental challenge in TI research is to achieve a bulk-insulating state in real samples, so that one can unambiguously study the transport properties of the helically spin-polarized Dirac fermions on the surface. We synthesized a new topological insulator compound $Bi_{2-x}Sb_xTe_{3-y}Se_y$ (BSTS) and determined the specific composition $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$, where the surface-dominant transport has been

achieved for the first time in bulk single crystals of a topological insulator. This achievement made it possible to study the transport properties of the surface state in detail. As a result, we found an interesting phenomenon that a time-dependent change in the surface chemical potential alters the nature of the Dirac fermions from holes to electrons with time, and this evolution allows one to elucidate the dispersion relation across the Dirac point via transport measurements.

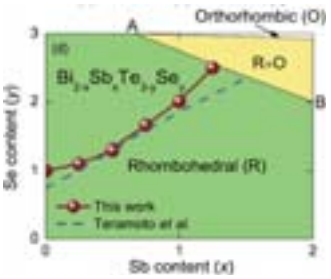

Fig.1 Composition-structure diagram of the BSTS.

2) Quantum phase transition in Tl-based Topological Insulator.

Using the spin- and angle-resolved photoemission, we studied a solid-solution $TlBi(S_{1-x}Se_x)_2$ and found that this system goes through a quantum phase transition from the topological to the non-topological phase. By tracing the evolution of the electronic states, we discovered that the massless Dirac state in $TlBiSe_2$ switches to a massive state before it disappears in the non-topological phase. The measurements of the spin texture of surface states reveal their intrinsic in-plane spin polarization unambiguously indicating the topological origin of the gapped Dirac surface states This result suggests the existence of a condensed matter version of the 'Higgs mechanism' where particles acquire a mass through spontaneous symmetry breaking.

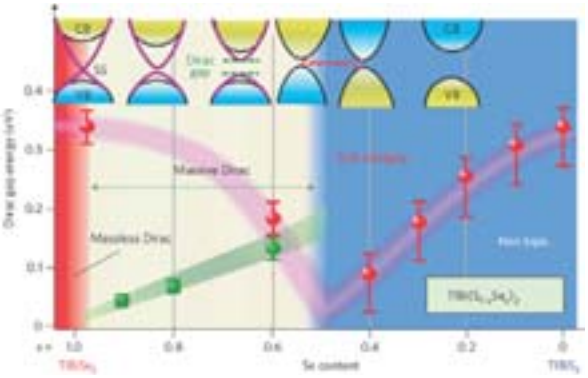

Fig.2 Electronic phase diagram showing the surface and bulk bands evolution with Se/S substitution.

3) Topological superconductivity of $Cu_xBi_2Se_3$ nailed down for the first time

Soon after the discovery of topological insulators, a new class of condensed matter phase called "topological superconductor" (TSC) was theoretically predicted and generated great interest. While its experimental confirmation is important, it has been elusive. One of the prime candidates of TSCs is the electron-doped TI $Cu_xBi_2Se_3$. In point-contact spectroscopy of $Cu_xBi_2Se_3$, we observed the pronounced zero-bias conductance peak (Fig.3c) that is a clear signature of the Andreev bound state and a hallmark of unconventional superconductivity. Theoretical considerations allow us to make unambiguous conclusion that the observed unconventional superconducting state can be only of topological nature. This makes $Cu_xBi_2Se_3$ to be a first discovered Topological Superconductor.

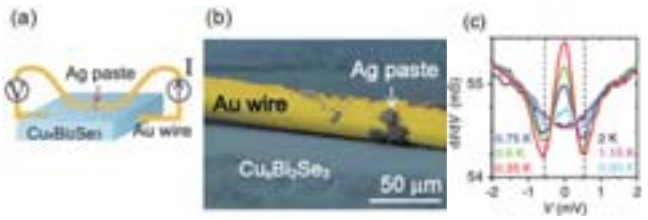

Fig.3 (a) Sketch of the soft point contact and the measurement circuit of point-contact spectroscopy. (b) Scanning-electron-microscope (SEM) picture of a sample. (c) Zero-bias conductance peak originated from the Majorana fermions on the surface of $Cu_xBi_2Se_3$, which confirms the topological nature of superconductivity.

Department of Semiconductor Materials and Processes

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Support Staff: Chika KUROSAKI

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 and materials studied in this department are: 1) Si solar cells, 2) Si nanoparticles produced from Si swarf, 3) metal-oxide-semiconductor (MOS) devices for LSI, 4) thin film transistors (TFT) for display devices.

Current Research Projects

Improvement of minority carrier lifetime and Si solar cell characteristics by nitric acid oxidation method

The minority carrier lifetime of single crystalline Si increases by the formation of an ultrathin silicon dioxide (SiO_2) layer by use of the nitric acid oxidation of Si (NAOS) method. With the NAOS method using 68 or 98 wt% HNO_3 solutions, large increases in the lifetime are observed while the enhancement of the lifetime is low for the 40 wt% HNO_3 NAOS method. In the case of the hydrogen-terminated Si surfaces formed by hydrofluoric acid (HF) treatment, the initial minority carrier lifetime is high,

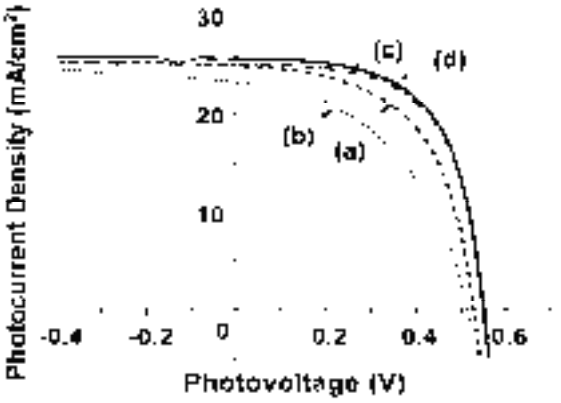

Figure 1 I-V curves under AM 1.5 100 mW/cm^2 irradiation for the p-type poly-Si-based pn-junction solar cells: (a) with no treatment; (b) with the NAOS treatment using 40 wt% HNO_3; (c) with the NAOS treatment using 68 wt% HNO_3; (d) with the NAOS treatment using 98 wt% HNO_3.

but it returns to the value before the HF treatment by keeping in air for 5 days. In the case of the NAOS method, on the other hand, the enhanced lifetime remains unchanged with time kept in air. This stability is attributed to high atomic density of the NAOS SiO_2 layer which prevents diffusion of oxidizing species. The atomic density of the NAOS SiO_2 layer increases with the HNO_3 concentration, which leads to an increase in the valence band discontinuity energy at the SiO_2/Si interface. When the NAOS method with 68 and 98 wt% HNO_3 solutions is applied to poly-crystalline Si-based pn-junction solar cells, the relative conversion efficiency is increased by 14 and 17 %, respectively, and this improvement is attributed to elimination of interface states (Figure 1).

Chemical states of copper contaminants on SiO_2 surfaces and their removal by ppm-order HCN aqueous solutions

Cu contaminants of 1×10^{13} atoms/cm^2 on SiO_2 surfaces can be removed to less than 3×10^9 atoms/cm^2 by immersion in 3ppm HCN aqueous solutions within 2 min at room temperature. The Cu removal process by HCN aqueous solutions consists of the initial fast and subsequent slow steps. X-ray absorption fine structure (XAFS) measurements with the total reflection X-ray fluorescence (TXRF) geometry (TXRF-XAFS) have been used for determination of chemical states of Cu contaminants before and after cleaning with HCN aqueous solutions. Cu contaminants are composed of Cu^+ and Cu^{2+} species, latter being present above the former. In the former species, a Cu atom is linearly bound to two oxygen atoms (Cu_2O-like species), while in the latter species, a Cu atom is bound to four equatorial oxygen atoms and two axial oxygen atoms ($Cu(OH)_2$-like species). CN ions react with outer $Cu(OH)_2$ like species with a high rate, leading to initial fast removal of Cu contaminants. When the Cu concentration decreases to 1×10^{10} atoms/cm^2, Cut species becomes a main species and its removal rate becomes much lower.

1.5-V-Operation Ultralow Power Circuit of Poly-Si TFTs Fabricated Using the NAOS Method

We have fabricated thin-film transistors (TFTs) and liquid-crystal displays (LCDs) with monolithic drivers on glass substrates and achieved ultralow power consumption by operating with a low power-supply voltage at 3 V (Figure 2). The gate insulator of the TFTs has a stack structure with an ultrathin interfacial SiO_2 layer formed by nitric acid oxidation of silicon and a 40-nm-thick SiO_2 layer formed by plasma-enhanced chemical vapor deposition. Owing to the TFTs with the thin gate insulator, the driving circuits of the LCDs can be operated at a supply voltage of 1.5 V, which is much lower than that of conventional LCDs of 10–15 V.

Figure 2 Ultralow power liquid crystal displays operated at 3 V with NAOS-SiO_2/CVD-SiO_2 stacked gate oxide.

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. So far, lotus metals have been fabricated by unidirectional solidification of the melts under pressurized gases. However, in order to use lotus metal practically, development of the fabrication technique of lotus metal without pressurized hydrogen gas is required. Therefore, lotus metal was fabricated by continuous casting technique through thermal decomposition of gas compounds in this year. In order to develop lotus metals with superior energy absorption, the formation mechanism of plateau stress region was investigated using the Hopkinson pressure bar method at 77K and 298 K.

Furthermore, we are studying the formation mechanism on nanovoids during annealing of amorphous oxides to establish the principle for fabricating novel nanoporous materials. In this year, we obtained the results that amorphous Ta_2O_5 and Nb_2O_5 with much lower density than their crystalline phases became unique nanoporous structures as a result of crystallization.

Current Research Projects

Fabrication of Lotus-type Porous Copper by Continuous Casting Technique through Thermal Decomposition Method

Lotus metal can be fabricated by utilizing pore formation of insoluble gas when the melt dissolving gas is solidified. Dissolution of hydrogen into the melt is crucial. Recently, thermal decomposition method of gas compounds was developed to supply dissolving gas source, which is superior to the conventional fabrication method using pressurized hydrogen gas. In order to use lotus metal practically, continuous casting technique is suitable mass production. In this year, lotus metal was fabricated by continuous casting technique through thermal decomposition method.

TiH_2 was added into the molten copper at constant supply rate and then the molten copper dissolving hydrogen is solidified unidirectionally.

Lotus copper possessing directional pore alighted in one direction was fabricated by continuous casting technique through thermal decomposition method. It is because sufficient hydrogen was supplied near the liquid-solid interface constantly.

Formation Mechanism of Plateau Stress Region in Dynamic Compression of Lotus Carbon Steel

Dynamic compressive deformation behavior of lotus carbon steel (S15CK) was investigated using the Hopkinson pressure bar method. Figure 1 shows the dynamic compressive stress-stain curves (a) 298 K and (b) 77 K in direction parallel and perpendicular to the pore direction. At room temperature (298 K), Plateau stress region does not appears regardless of the pore direction, because the compressive deformation proceeds with the ductile cracks which originate from the accumulation of dislocations. On the other hand, the plateau stress region appears only in the compression direction parallel to the pore direction at 77 K. It is because the brittle cracks, which can occurs without the accumulation of dislocations, domains the compressive deformation at 77 K, and preparation of brittle cracks is prevented by unidirectional pore only in the compression direction parallel to the pore direction.

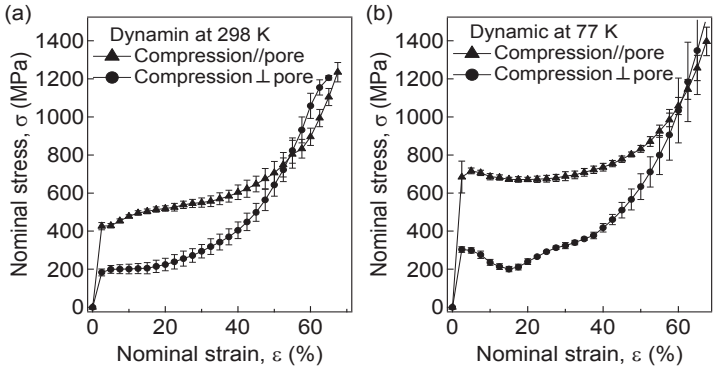

Fig. 1 Dynamic compressive stress-strain curves of lotus-type porous carbon steel at (a) 298 K and (b) 77 K in direction parallel and perpendicular to the pore direction.

Formation of Nanoporous Oxides with Oriented Pores via Annealing of Amorphous Thin Films

Formation behavior of nanovoids through the annealing of amorphous Ta_2O_5 and Nb_2O_5 was studied by transmission electron microscopy. It was found that a large amount of oriented and elongated nanopores were introduced as a result of the crystallization of amorphous Ta_2O_5 and Nb_2O_5. Figure 2 shows TEM images of (a) Ta_2O_5 and (b) Nb_2O_5 after crystallization. The TEM analyses revealed that voids were elongated in the [100] direction perpendicular to the longitudinal b axis of the orthorhombic structure. The self-assembly of a significant amount of oriented nanovoids can be contributed to the strong anisotropic crystal structure of orthorhombic Ta_2O_5 and Nb_2O_5.

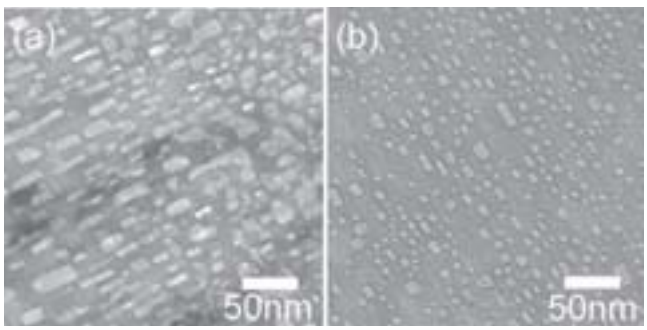

Fig. 2 TEM images of crystallized Ta_2O_5 (a) and Nb_2O_5 (b) after annealing at 1023 and 923 K for 1hr in air, respectively.

Department of Advanced Interconnection Materials

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Support Staff:	Mariko HATAMURA, Noriko KAGAMI, Kyoko HAMASAKI, Misa MATSUSHITA, Kayo SATO

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, die-attach materials, Tin whiskers and conductive adhesives, and the composite materials based on metals and intermetallic compounds.

Current Research Projects

Super stretchable conductive wirings by printing technology

Smart textiles such as wearable computers and health-care sensors on everyday clothing will be realized likely in the near future. We fabricated printable and stretchable conductive wirings comprising silver flakes and elastomers. Their high conductivity was maintained on polyurethane substrates stretched up to a strain of 600%. Illumination of a light-emitting diode was also successful with the stretched wirings.

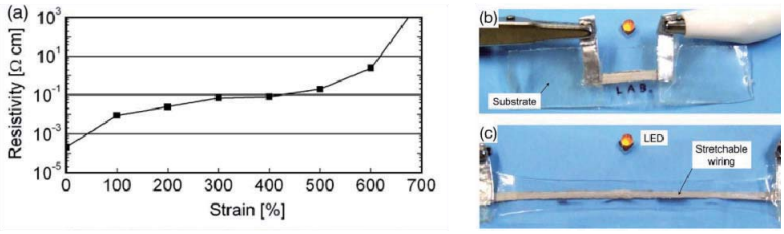

Fig. 1 Super stretchable conductive wirings by printing technology

Ink-jet printing technologies for high conductive lines

Highly conductive printed line is crucial for printed electronics. Among the numerous printing technologies, inkjet printing has a few advantages such as non-contact, mask-less printing. Therefore, this technique has received considerable attention as one of the most promising alternatives for producing electronic equipment.

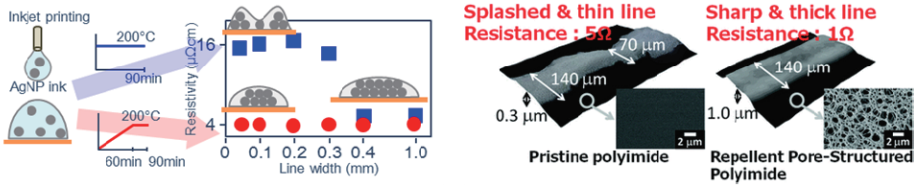

Fig. 2 Ink-jet printing technologies for high conductive lines

However, because low viscosity ink is used in the inkjet printing, the morphology of the printed lines often spreads, splashes, and takes on a wave form. In this study, to fabricate highly conductive inkjet-printed lines without spreading of ink, we modified either heating condition or substrate surface.

Enhanced ductility and oxidation resistance of Zn through the addition of minor elements for use in wide-gap semiconductor die-bonding materials

Pure Zn is one of the best die-attachment candidates for use in next-generation wide-gap semiconductor power devices operating at temperatures up to 300 °C. However, it has certain drawbacks when used at high operating temperatures: poor ductility and limited oxidation resistance. We enhanced the ductility and oxidation resistance of pure Zn.

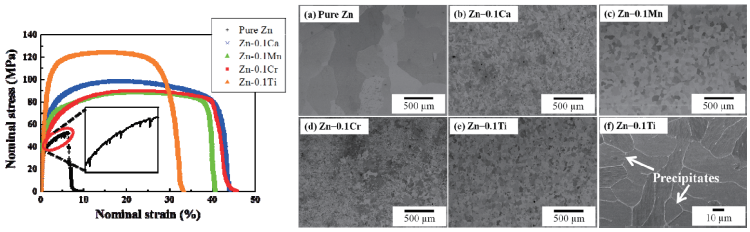

Fig. 3 Nominal stress–strain curves of Zn alloys, and their microstructures.

Development of the low energy packaging technology of the die-bonding materials for the next generation power devices

New die-bonding materials need high heat resistance for the development of the next generation power devices. The conventional die-bonding materials using nano Ag particles need a high temperature and pressure at the sintering process. We achieved the high die-bonding strength at the low temperature and pressure (0.4MPa) sintering by using the thin and flat micro Ag flakes. Moreover, the die-bonding material maintained high die-bonding strength even after 1000 thermal cycles, giving high reliability.

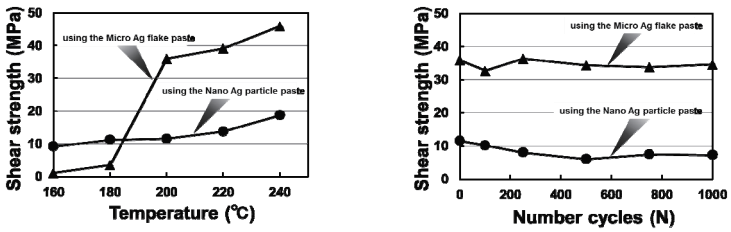

Fig. 4 Shear strength of new bonding materials as a function at the each given conditions.

Growth mechanism of Sn whiskers in a vacuum and air with thermal cycling

Thermal cycling test were carried out up to 100 cycles in both air and vacuum with 5 μm electro deposited on a 42 alloy(Ni42%-Fe57%) substrate. Cracking of tin plating surface was identified as grain boundary cracking and severe in air than that in vacuum. Tin whiskers generated mainly from multiple grains in the form of thick nodule type in air. In contrast, long and thin filament type whiskers grew in vacuum. This difference is likely to be caused by difference in oxidation behavior in both atmospheres.

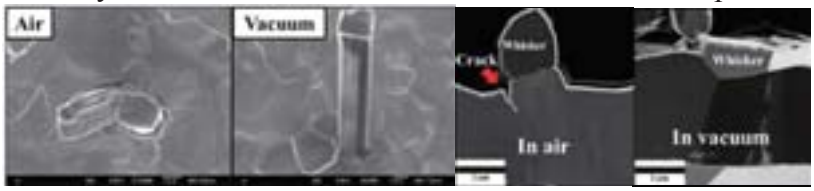

Fig. 5 The growth mechanism of Tin whiskers by inflicting thermal cycling in air and vacuum.

Department of Excited Solid-State Dynamics

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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-dimensinal 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 diffractomator with 100-fs temporal resolution.

Current Research Projects

1. Ultrafast carrier dynamics in semiconductors and on their surfaces studied by femtosecond two-photon photoemision 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 and on a two-dimensional imaging detection of photoelectrons with respect to energy and momentum has opened a new breakthrough for the studies.

By probing electrons populated in the conduction band of Si or GaAs, we have elucidated directly the ultrafast processes of intra- and inter-valley relaxation and energy relaxation of highly excited hot electrons. Furthermore, by using 6-eV probe photons, we can study the dynamics of photogenerated holes in bulk valence band, which can be probed as a time-dependent small depression of occupied-state photoemission intensities. A typical result is shown in Fig.1, where the population density of hot electrons generated by fs pulses in GaAs is imaged as a function of kinetic energy and emission angle representing parallel momenta. Depending on the time delay after generation, electron distribution changes significantly; a quasi-equilibrated distribution is established at 2.5 ps after excitationat the bottom of the conduction band (CBM). The result provides new light for understanding photoinduced effects in semiconductors.

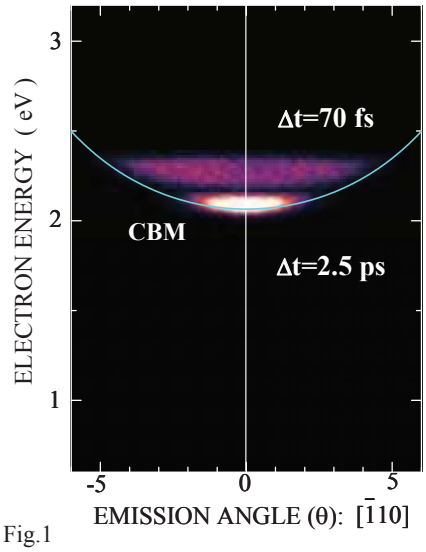

Fig.1

2. Ultrafast structural dynamics of solids by transmission electron diffraction 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.

Our diffractometer uses relativistic electron beams generated by fs-laser induced RF photocathode, and collimated beams are dispersed on the phosphor screen to display the diffraction patterns. Important point which should be emphasized is that a single-shot diffraction images can be measured clearly, thus making it possible to study irreversible processes of structural changes. In Fig.2, we show typical results measured for Si, which show the ultrafast tetragonal lattice distortion induced by laser excitation at 3.20 eV. Coherent acoustic-phonon modulation is associated with the lattice deformation. This machine has been used to study real-time observation of the ultrafast structural dynamics in photo-induced structural phase transitions in several solids, like Si, Au, Graphite, and $Ge_2Sb_2Te_5$.

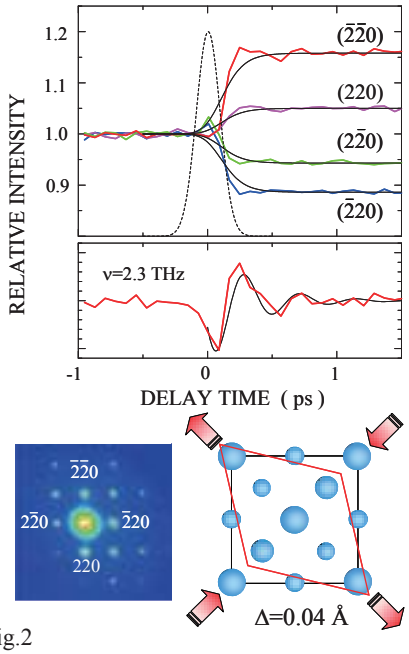

Fig.2

Department of Accelerator Science

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Associate Professor: Ryukou KATO
Assistant Professors: Keigo KAWASE
Akinori IRIZAWA (2012.1.1-)
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Visiting Professor: Shigemasa SUGA
Graduate Students: Jen SHEN, Sho HIRATA, Masaki FUJIMOTO, Fumiyoshi KAMITSUKASA, Hiroki OHSUMI

Outlines

Particle accelerators are widely used from basic science to industrial applications. In this department, we conduct research on accelerators with the object of producing quantum beams, including the high-brilliant electron beam and light. Because new kinds of quantum beams extend the world we can see with, they will 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 as well as applications to study on solid state physics or relevant fields using coherent radiation, and SASE (Self-Amplified Spontaneous Emission) in the infrared region.

Current Research Projects

Upgrade of the L-Band Electron Linac

The FEL gain depends on the charges per bunch for the electron beam. Increase of the FEL gain provides not only the increase of the peak intensity of the FEL output, but also the FEL amplification to overcome the diffraction loss which is larger in the longer wavelength, and then it makes the extension of the wavelength range of the output. At the present operation of the L-band linac system for the FEL, however, because the beam loading to the RF power applying to the acceleration structure is large, it is difficult to increase the average beam current. In order to increase the charges of the beam bunches keeping the average beam current, we have developed a grid pulser with the repetition of 27 MHz and the duration of 8 μs. Recently we have installed it into the L-band linac system, then succeeded the acceleration of the macropulse electron beam with the duration of 8 μs at 27 MHz, and confirmed the lasing with this electron beam (Fig. 1).

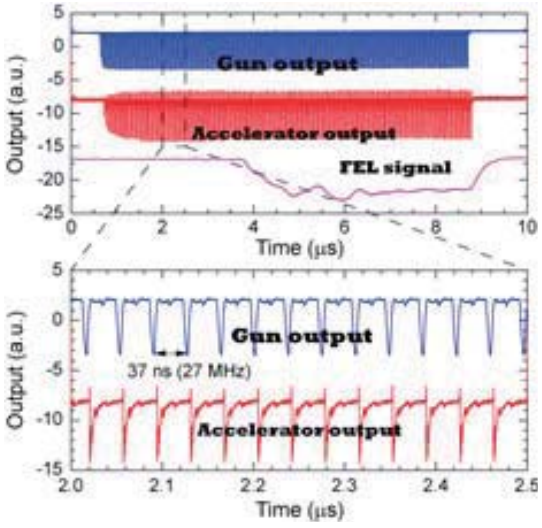


Fig. 1. The signal waveforms of the electron beam at the gun output and accelerator output, and the FEL (top), and the expansion of the waveforms of the electron beam signal (bottom).

Development of Free Electron Laser

We conduct researches and developments of the resonator type FEL in the Terahertz region. It has achieved

the high power operation that reaches the power saturation within the wavelength range from 25 to 150 μm (frequency from 12 to 2 THz). We also evaluated spectrum intensities of the FEL (Fig. 2). The FEL wavelength can be swept by changing the magnetic pole gap of the wiggler for the fixed electron energy. In the figure, the wavelength has been swept from 105 down to 55 μm by changing the gap from 30 to 41 mm in 1 mm step. At this time, the beam energy is 15 MeV. The spectrometer is a cross Czerny-Turner type with the plane grating which has grating constant of 0.2 grooves/mm, and the detector is a joule meter. The FEL is a quasi-monochromatic light, and has the typical bandwidth of 2~3% as shown in figure. Although monochromatic light source is excellent as an excitation source, it is not easy to use it as a light source for analytical measurements. To improve this feature, we developed the system that was able to measure the spectrum over the large wavelength range within the narrow bandwidth by rotating the grating synchronized with changing the wiggler gap,

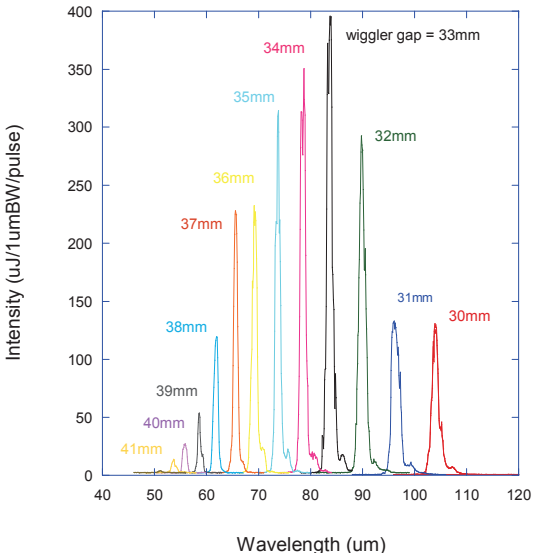


Fig. 2. The FEL spectrum intensities per 1 um bandwidth per pulse. The horizontal axis shows wavelength in μm, and the vertical shows energy in μJ.

Application of High Intensity THz Radiation

For the purpose of developing user experiments using THz-FEL beam at ISIR, we continue to upgrade the measuring equipment and to examine several test experiments. We conduct experiments in the lower energy region using technologies developed in the infrared region in order to have information not available in the past, and aim to develop experiment techniques to make best use of characteristics of FEL, including its time structure, brightness, and coherence. Currently, a problem about the pulse-to-pulse fluctuation of the FEL light intensity has been overcome by a reference-calibration method and a revision of the light-focusing configuration. This year, we moved to propose and execute irradiation and spectroscopic experiments and achieved to control the polarity of lights (linear, circular) and the continuous wavelength-tunable experiments. Meanwhile, direct THz-imaging experiments using a THz camera are in progress for several compounds.

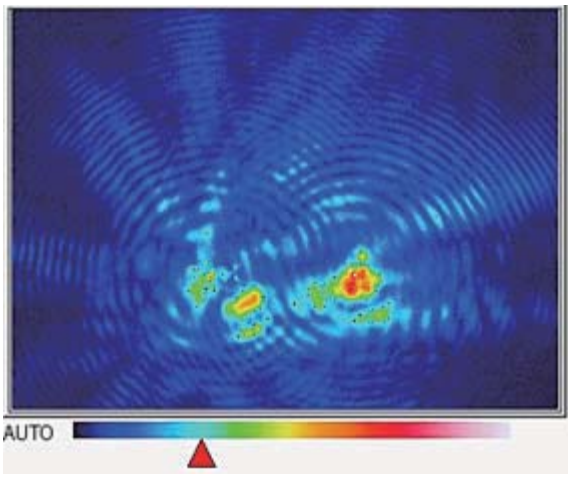


Fig.3. Interference pattern observed by THz camera which reflects the high coherency of THz-FEL beam.

Department of Beam Materials Science

Professor: Takahiro KOZAWA
Assistant Professor: Kazuo KOBAYASHI
Assistant Professor: Hiroki YAMAMOTO
Graduate Students: Mayu FUJIKAWA

Outlines

The industrial application of quantum beam will rapidly expand in the field such as high-volume production of semiconductor devices. Cancer therapy using ionizing radiation has also attracted much attention. In Department of Beam Materials Science, the radiation-induced chemical reaction and reaction field have been investigated using state-of-the-art quantum beam (electron, extreme ultraviolet radiation, laser, synchrotron radiation, X-ray, g-ray, ion beam). We have studied the chemical reaction system from the energy deposition on materials to the expression of material function. On the basis of these studies, we have designed a noble chemical reaction system.

Current Research Projects

Study on state-of-the-art EUV Lithography

The nanolithography applied to the high-volume production of semiconductor devices is an important application field of quantum beam. The efficient use of the energy deposited on materials by quantum beams is a key to the development of next generation materials for nanolithography. In chemically amplified resists, an aerial image of incident photons is converted to acid image. The acid image is converted to latent image through chemical reaction. In exposed region, polymers become soluble. The unexposed regions remain insoluble. These regions can be basically controlled. However, the intermediate region is a mixture of soluble and insoluble molecules and absolutely stochastic. So, the distribution of these molecules cannot be controlled. This inhomogeneity leads to line edge roughness (LER) formation. Therefore, the reduction of LER requires the reduction of intermediate region, namely, the enhancement of chemical gradient.

In this study, we investigated a chemically amplified resist with a fullerene matrix by analyzing the dose-pitch matrices of line width and LER. It was found that the proportionality constant between LER and the chemical gradient of the fullerene resist was smaller than those of polymer-type resists, probably owing to its molecular size. However, the chemical gradient was lower than those of typical polymer-type resists because of a low effective acid concentration and a small effective reaction radius. These results suggest that the performance of fullerene resist can be improved by increasing the quantum efficiency of acid generation and the effective reaction radius for deprotection.

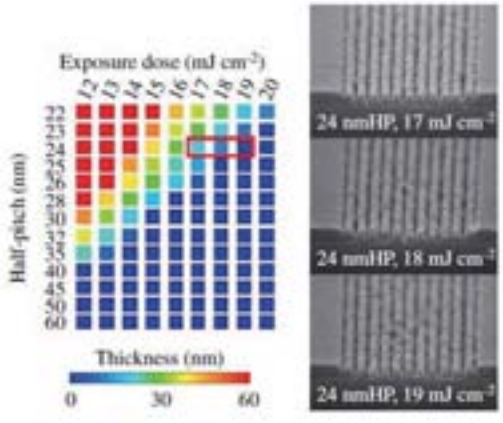


Figure 1.SEM images of L&S patterns.

Production of metal nanoparticles in THF using γ-ray

Metal and semiconductor nanoparticles attract much interest because of their specific properties

and because they are expected as next generation electronic materials for display and LED, catalyst of solar cells, fluorescent marker in medical field, color material, optical limiter and so on. Radiolysis is appropriate to form metal nanoparticles in solutions. Although water is generally used as solvent to generate metal nanoparticles in solution, it restricts the choice of the polymer. Organic solvents such as THF are preferable because many kinds of polymers are easily dissolved. Therefore, the elucidation of formation mechanism in organic solvents such as THF is essential because it can provide the information on the size control of nanoparticles in this type of solutions. In this study, we investigated the synthesis of metal nanoparticles induced by γ-ray irradiation in THF solutions, the polymer dependence of cluster stability, dose effect, and effects of isopropanol addition.

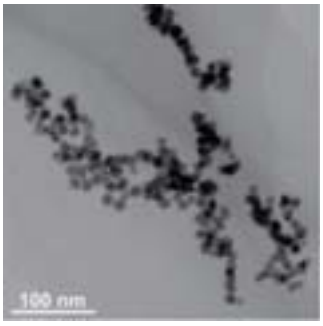


Figure 2. TEM images of Ag nanoparticles

Dynamics of Electrons in DNA

The direct effect of ionizing radiation on DNA relating to base alternation and strand breaks is mediated by one-electron deficient DNA base radicals. In order to understand the effects, it is necessary to know the reduction potentials of the one-electron deficient base. Especially, hole transfer for A-hopping proceeds via a multistep mechanism between AA dimers, suggesting that the oxidation potential and surface stacking area of the AA dimer hole carriers are important factors. In this work, we analyzed the spectral and kinetic behavior of A radical cation (A+·) in ApA, a model compound of AA dimer. From the transient spectrum of A+· in ApA exists primarily in the stacked form as a dimer. Electron transfer equilibrium between A+· in ApA with trimethoxybenzene was determined. The difference in redox potential of A+· between A and AA dimer was estimated to 10~20 mV.

Superoxide-mediated Signal Transduction of Transcription Factor in SoxR

Reactive oxygen species (ROS) produce cellular and genetic damage in aerobic organisms. Cells have thus evolved defense systems against ROS and respond to sublethal levels of oxidative stress through activation of a battery of antioxidant genes. The transcription factor SoxR is activated by reversible one-electron oxidation of the [2Fe-2S] cluster and enhances the production of various antioxidant proteins in *Escherichia coli*. To elucidate the mechanism of the activation, its interaction with O_2^- was investigated by the use of pulse radiolysis. On pulse radiolysis of a solution of SoxR under aerobic conditions, hydrated electrons (e_{aq}^-) reduced with the oxidized form of [2Fe-2S] cluster of SoxR initially. Subsequently, a reoxidation of the [2Fe-2S] cluster was observed in the time range of milliseconds. The oxidation was found to be inhibited upon the addition of superoxide dismutase (SOD) (I_{50} = 1.0 μM). This indicates that O_2^- oxidized the reduced form of SoxR directly. The second-order rate constant of this process was calculated to be $5.0 \times 10^8\ M^{-1}\ s^{-1}$. These results strongly suggest that the SoxR protein directly senses superoxide for the activation.

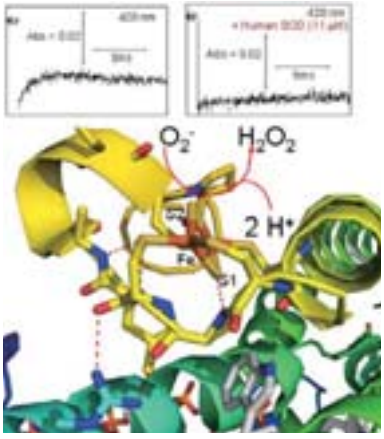


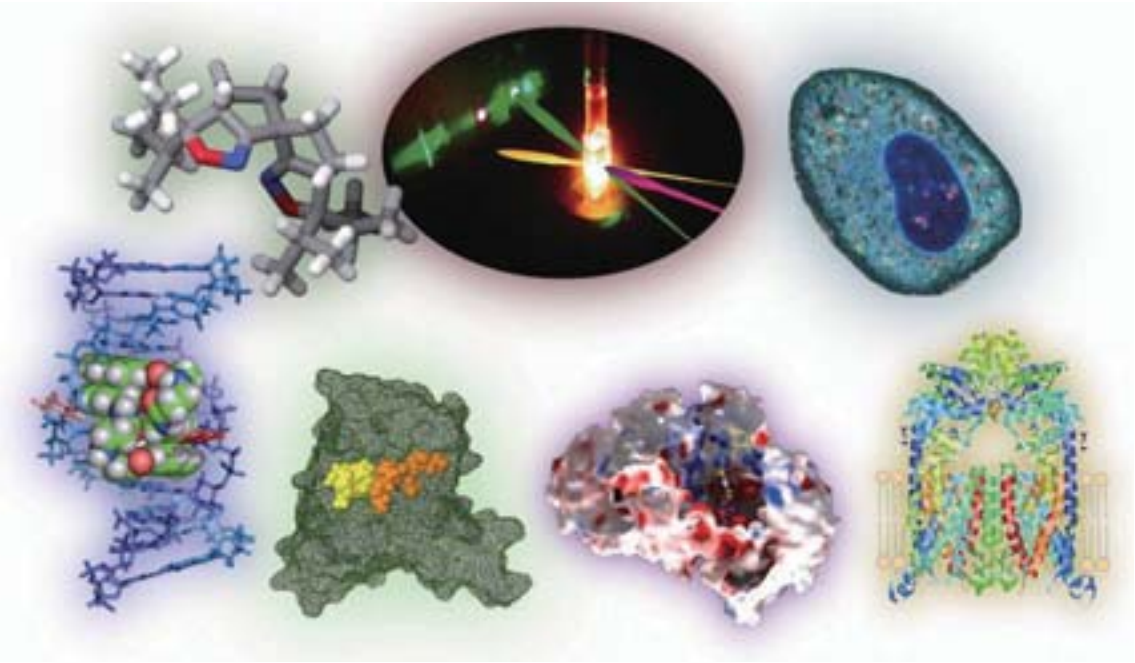
Figure 3. Reaction scheme of SoxR.

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 Department of Biomolecular Science and Engineering. These departments are engaged in research in various fields of biological science including molecular enzymology, signal transduction, membrane 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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Assistant Professor: Takashi TACHIKAWA
Specially Appointed Professor: Akira SUGIMOTO
Specially Assistant Professor: Jungkweon CHOI
Postdoctoral Fellow: Takumi KIMURA
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Graduate Students: Man Jae PARK, Sooyeon KIM, Mitsuo HAYASHI, Tomoyuki YONEZAWA, Mayuka ISHIKAWA, Tatsuya OHSAKA
Supporting Staff: Sanae TOMINAGA

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.

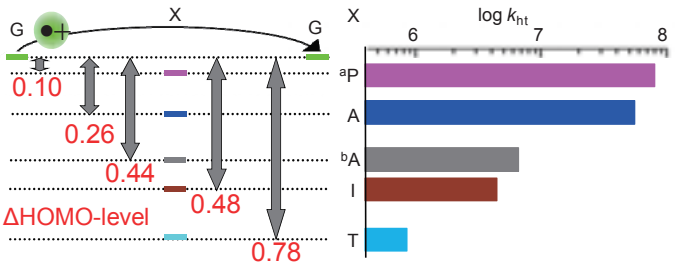
1. Formation and reactivities of reactive intermediates in photochemistry and radiation chemistry, and photochemistry of reactive intermediates
2. Multi-beam chemistry with irradiation by two-color laser-laser and electron pulse-laser flash
3. Multiple-photon chemistry of organic compounds using UV,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

Current Research Projects

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, from the viewpoint of higher excited state chemistry, we have investigated the S_2-state properties of BODIPYs. The S_2 fluorescence and internal conversion processes were clarified. The relaxation time from the Franck-Condon state was estimated for star-shaped oligofluorenes. From the theoretical calculation, it was indicated that the planarization of oligofluorenes is important in the relaxation process. Furthermore, photoinduced processes of several photofunctional molecules such as porphyrin isomers and DNA conjugated with photosensitizing electron donor have been clarified.

Hole transfer dynamics in DNA



DNA consists of two types of base-pairs, G-C and A-T, in which the highest occupied molecular orbital (HOMO) localizes on the purine bases G and A. While the hole transfer through consecutive Gs or As occurs faster than 10^9 s^{-1}, a significant drop in the hole transfer rate was observed for G-C and A-T mixed random sequences. In this study, by using various natural and artificial nucleobases having different HOMO levels, the effect of the HOMO-energy gap between bases (Δ_{HOMO}) on the hole-transfer kinetics in DNA was investigated. The results demonstrated that the hole transfer rate can be increased by decreasing the Δ_{HOMO} and can be finely tuned over three orders of magnitude by varying the Δ_{HOMO}.

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 investigated the interfacial electron transfer on individual TiO_2 crystals using single-molecule, single-particle spectroscopy with a novel redox-responsive fluorescent dye. It was found that reaction sites for the effective reduction of the probe molecules are preferentially located on the {101} facets of the crystal rather than the {001} facets with a higher surface energy. This surprising discrepancy can be explained in terms of face-specific electron-trapping probability. The statistical analysis of the catalytic reactivity and fluorescence on times also revealed that molecular adsorption/desorption kinetics are strongly associated with the surface structures of the exposed crystal facets.

Conformational dynamics of non-B DNA

Using the combination of FRET and FCS, we investigated the dynamics of the pH-induced conformational change of i-motif DNA in the bulk phases and at the single-molecule level. The partially folded species as well as the single-stranded structure coexist at neutral pH, supporting that the former may exist *in vivo*. The gradual decrease of the diffusion coefficient (D) of i-motif with increasing pH is not only due to the change in the intermolecular interaction between i-motif and solvent accompanying by the increase of pH, but also the change of the shape of DNA. It is found that the intrachain contact formation and dissociation for i-motif are 5-10 times faster than those for the open form. We found that poly(dA) at acidic pH forms a right-handed helical duplex with parallel-mannered chains whereas the coralyne-poly(dA) binding induces a stable anti-parallel duplex converting to “S-form”, while the A-motif-coralyne assembly is dissociated into single strands below a certain concentration.

Department of Synthetic Organic Chemistry

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Under Graduate Student:	Yoshihiro NAGATA
Supporting Staff:	Fumiyo WATANABE (~2011.9.15), Ayaka HONDA (2011.11.1~)

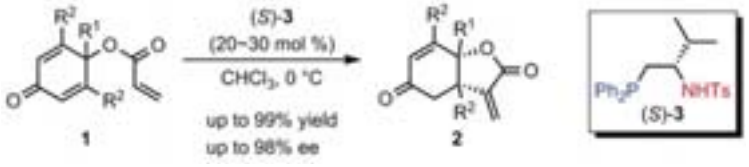
Outlines

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 Projects

Enantioselective Synthesis of α-Alkylidene-γ-Butyrolactones via an Intramolecular Rauhut–Currier Reaction Promoted by Acid–Base Organocatalyst

The Rauhut–Currier (RC) reaction is known to be a readily access to α-substituted enones via coupling of two different α,β-unsaturated carbonyl compounds, where one acts as a latent enolate. To date, attractive systems based on achiral catalysis have been developed for the RC process, although few examples of synthetically useful enantioselective RC transformations have been reported. Highly selective construction of complex frameworks via the enantio-

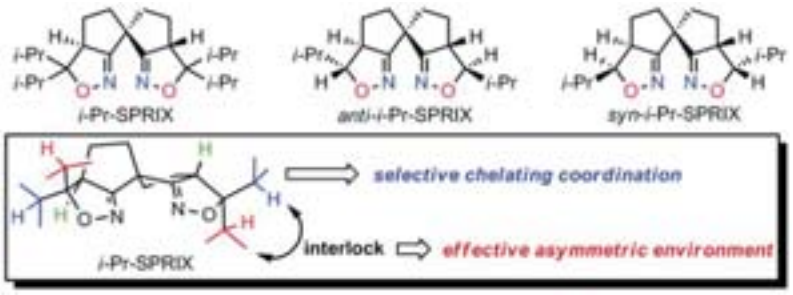


Scheme 1. Enantioselective RC Reaction Promoted by Organocatalyst (*S*)-**3**

selective RC reaction has been a challenge in asymmetric synthetic chemistry. This time we have succeeded in developing the multifunctional organocatalyzed intramolecular RC reaction of the prochiral dienones **1**. Aliphatic and aromatic substituted starting materials **1** were cyclized to give α-alkylidene-γ-butyrolactones **2** in good yields and high enantioselectivities. The lactones were determined to be *cis*-configured via NOESY experiments. In all cases, a single diastereomer was obtained.

Study on Asymmetric Environment of SPRIX

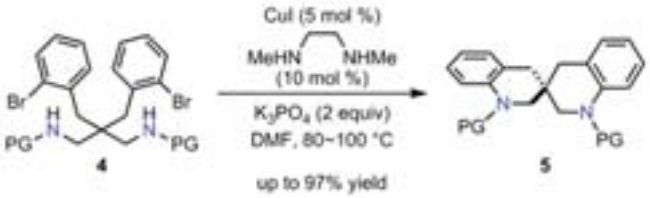
Tetraisopropyl spiro bis(isoxazoline), *i*-Pr-SPRIX, turns out to be an excellent chiral ligand in a variety of asymmetric oxidative cyclizations promoted by Pd catalyst. For a better understanding of its characteristic features, which contributes to development of more valuable SPRIX ligands, we designed and prepared novel diisopropyl spiro bis(isoxazoline)s, *anti*-*i*-Pr-SPRIX and *syn*-*i*-Pr-SPRIX, whose stereoconfiguration at the C5 center of the isoxazoline rings was regulated. It is consequently found that for *i*-Pr-SPRIX, all the *i*-Pr groups work cooperatively to create an effective asymmetric environment through an interlock mechanism.



Scheme 2. Asymmetric Environment of *i*-Pr-SPRIX

Development of New Synthetic Approach to Chiral Spiro Skeleton

We have established an enantioselective construction of spirobilactams via a Pd-catalyzed intramolecular double C–N bond forming reaction. In this work, 1,3-propanediamine derivatives were employed as a substrate in order to develop a new synthetic route of chiral spiro compounds. After screening of reaction conditions, Cu catalysts proved to promote the desired intramolecular double cyclization to furnish a chiral spirobi(tetra-hydroquinoline) scaffold efficiently.



Scheme 3. Cu-catalyzed Construction of Spiro Skeleton

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, halogen-free epoxides were easily prepared. The tungstate catalyst/ apatite powder showed high reusability; the catalytic activity did not reduce after 20 times of reuses. Scale-up of the powder reaction has been studied toward practical use.

Department of Regulatory Bioorganic Chemistry

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Specially Appointed Assis. Prof.: Takeo FUKUZUMI
Specially Appointed Researchers: Asako MURATA, Reshma RANI (2011.11~)
Graduate Students: Shiori Umemoto, Changfeng Hong, Hiroshi Atsumi, Tomonori Shibata, Xi Chen (~2011.9), Lanxian Chen, Izumi Kohyama, Takahiro Otabe, Mariko Toda, Shingo Makishi, Tetsuya Tsuda, Jin Song, Gaigai Yu Saki Matsumoto
Research Assistance: Maki Kimura, Yasue Harada, Ayako Sugai (2011.10~), Miho Kawabata (2012.2~)
Supporting Staff: Yuriko YAGUCHI

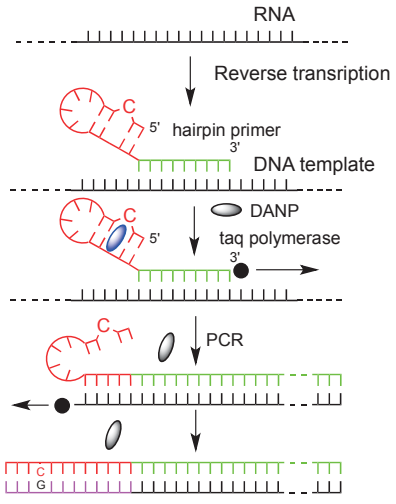
Outlines

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 Projects

Development of Technology for Gene

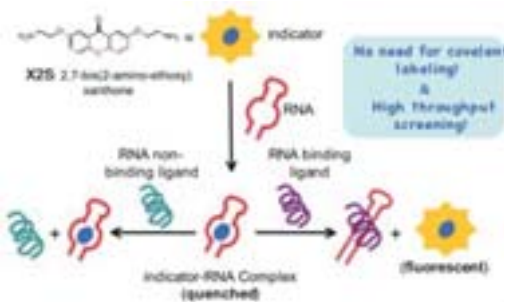
The technique for promptly detecting the genetic mutation is expected as a basis technology that supports the personalized medicine. We have reported a new SNP typing method from DNA secondary structure-inducible ligand fluorescence, from which can be also used as the real-time PCR. In this SNP typing method, the hairpin tag is dissolved by a PCR and is transformed into a duplex. As a result, the primer losses of the DANP binding sites, and the fluorescence intensity decreases (HP-PCR method). This time, we applied this HP-PCR method for making RNA detection system. It included reverse transcription and PCR part. However, RT and PCR were progressed in one tube by controlled PCR temperature because the fluorescence molecule did not inhibit transcription of RNA to DNA This is the simple method to detect RNAs without optimized a PCR conditions.



RT-HP-PCR method

Fluorescent displacement assay for the detection of RNA-ligand interactions

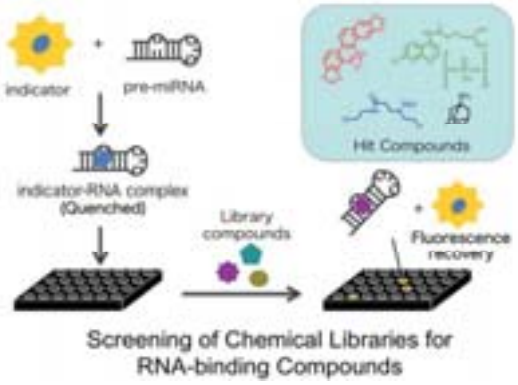
Non-cording RNA (ncRNAs) are involved in many biological processes including development, differentiation and carcinogenesis. Small-molecule modulators of ncRNAs would be important tools for the elucidation of the detailed mechanisms of ncRNA function and would be lead compounds for the development of new drugs that target ncRNAs. We have developed a fluorescent displacement assay for RNA-ligand interactions based on a novel fluorescent indicator, a 2,7-disubstituted 9*H*-xanthen-9-one derivative (X2S). X2S is non-fluorescent when bound to RNA but fluoresces when it is displaced from RNA. We performed a high-throughput screening of a large chemical library using our system to identify small molecules that bind to specific pre-miRNA stem-loop and found several candidate compounds.We investigated the compounds by in-silico docking simulation. Reporter gene assay can also used.



Fluorescent indicator displacement assay

High-throughput screening of a large chemical library for the discovery of RNA-binding compounds

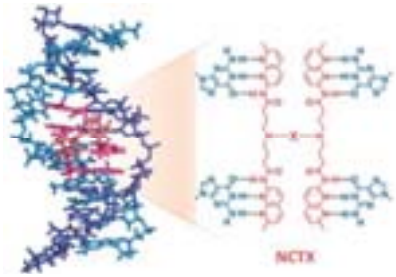
Non-coding RNA are now broadly recognized as an important drug target for the treatment of various diseases. We have developed a fluorescent displacement assay for detecting RNA-ligand interaction in vitro. Using the assay, we performed a high-throughput screening of a large chemical library (9600 compounds) to identify small molecules that bind to specific pre-miRNA and found several candidate compounds. We are also exploring a cell-based assay to evaluate the interaction between pre-miRNA and hit compounds in cells.



Screening of Chemical Libraries for RNA-binding Compounds

Naphthyridine tetramer with a preorganized structure for 1:1 binding to a CGG/CGG sequence

We synthesized a series of naphthyridine tetramers consisting of two naphthyridine carbamate dimer molecules connected with various linkers to seek a ligand that binds to a CGG/CGG sequence exclusively with a 1:1 stoichiometry. *Z*-**NCTS**, which possesses a rigid *(Z)*-stilbene linker, binds to CGG/CGG sequences with high affinity exclusively with a 1:1 binding stoichiometry. Thermodynamic parameters obtained by isothermal titration calorimetry indicated that preorganized conformation of the *(Z)*-stilbene linker in *Z*-**NCTS** enhanced the binding by minimizing the entropic cost. This study provides not only a novel 1:1 binding ligand, but also valuable feedback for subsequent molecular design of DNA and RNA binding ligands. **[Original Paper 7]**.



Department of Organic Fine Chemicals

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Assistant Professors:	Hajime NITTA, Shunro YAMAGUCHI, Kunihiro KAIHATSU
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Under Graduate Student:	Ryosuke ISHIDA
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Technical Assistants:	Hiroyo MATUMURA, Azusa OHTA
Supporting Staff:	Misuzu TANNO (2011.10.16–)

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 Projects

A fusicoccin derivative that preferentially targets hypoxic tumor cells and inhibits tumor growth in xenografts

Malignant cells in solid tumors survive under prolonged hypoxia and can be a source of resistance to current cancer therapies. Tumor hypoxia is also associated with a more malignant phenotype and poor survival in cancer patients. We have found that a fusicoccin derivative, ISIR-042, is more cytotoxic to hypoxic cells than to normoxic cells. ISIR-042 inhibited the growth of human pancreatic cancer MIAPaCa-2 cells while sparing normal endothelial cells, and significantly inhibited the growth of MIAPaCa-2 cells as xenografts without apparent adverse effects. Pancreatic cancer cells expressing CD24 and CD44 exhibited characteristics of stem cells. Treatment with gemcitabine increased this stem cell-enriched population, and this effect was significantly inhibited by ISIR-042, suggesting that ISIR-042 preferentially inhibits stem/progenitors in pancreatic cancer cell lines compared with chemotherapeutic agents. These results suggest that ISIR-042 may be a potential therapeutic agent for hypoxic tumors such as pancreatic cancer.

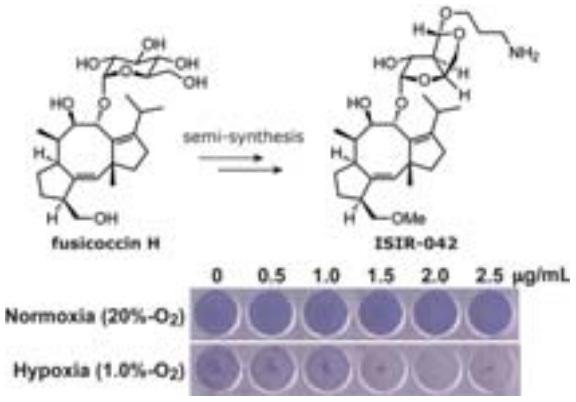


Fig. 1. Growth inhibition effects of ISIR-042 on MCF-7 (Breast cancer) cells in normoxic (upper) and hypoxic conditions: 7 days, Giemsa staining.

Fusicoccin-based probes for phospholigand-dependent fluorescent labeling of 14-3-3 protein

The 14-3-3 proteins are a family of dimeric proteins expressed in all eukaryotic cells, and play a critical role in serine/threonine kinase dependent signaling pathways through protein-protein interactions (PPIs) with phosphorylated protein ligands. Hundreds of intracellular ligand proteins possessing 14-3-3 consensus motifs have been identified, however, details regarding 14-3-3 related PPI networks remain unknown. The diterpene fusicoccin (FC) binds to a hydrophobic cavity adjacent to the phosphopeptide binding groove of 14-3-3, and forms a stable ternary complex with a phosphopeptide ligand possessing a valine residue at i+1 position. We therefore rationally designed an FC-based chemical probe, in which ISIR-042 is covalently linked to a fluorescent tag through a bioorthogonal reactive linker. In vitro evaluations demonstrated that the probes site-specifically attached a fluorescent tag onto the protein surface as a result of ternary complex formation with the 14-3-3 protein and a phosphopeptide ligand. The BODIPY- attached probe labeled human endogenous 14-3-3 in cancer cells under hyper-phosphorylation conditions, proving that 14-3-3 is a primary target of the FCs in mammalian cells. These results suggest that this cell-penetrating labeling agent may provide a useful tool to explore the mechanism of antitumor activity associated with FC-related agents as well as the details of 14-3-3 related PPI networks.

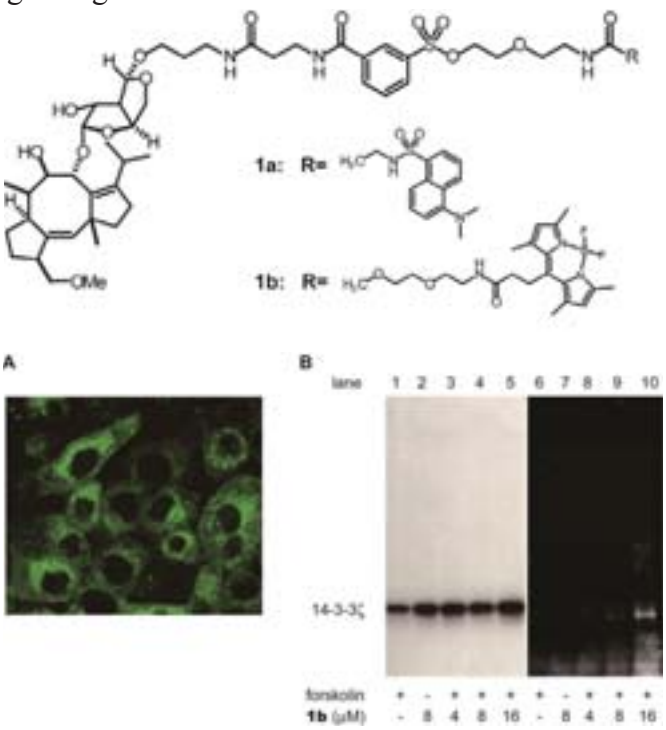


Fig. 2. FC-based probes (above), fluorescent cell imaging (below, left), labeling of endogenous 14-3-3 in cells (below, right).

Diagnosis of influenza virus strain by hairpin-type peptide nucleic acid

A highly conserved 15-base viral genome sequence among swine-origin influenza A/H1N1 viruses was identified by CONSERV software. We synthesized hairpin-type peptide nucleic acid (bisPNA), which possesses two PNA strands connected with a linker molecule, 2-aminoethoxy-2-ethoxyacetic acid, can form a stable PNA/RNA/PNA triplex with the complementary viral genome RNA via Watson-Crick and Hoogsteen base pairings. BisPNA efficiently recognized the viral RNA and inhibited reverse transcription in a sequence specific manner. Introducing azobenzene(AZO), an intercalator, into bisPNA further enhanced the genome binding affinity approximately 10-fold. We employed bisPNA-AZO conjugate and succeeded to capture swine-origin influenza A virus genome on a chromatography and visualized it detectable by naked eyes within 5 min.

Department of Structural Molecular Biology

Professor:	Katsuyuki TANIZAWA
Invited Professor:	Shun'ichi KURODA
Associate Professor:	Toshihide OKAJIMA
Assistant Professors:	Kenji TATEMATSU, Tadashi NAKAI
	Takashi MATSUZAKI
Graduate Students:	Yuki NAKAGAKI, Hidehiro IWASAKI, Hiroto ITO,
	Takafumi DEGUCHI, Kazuhiro YAMADA, Jurina YAGI
	Hiroki YAMANE, Ayano IWAI, Yasuhisa NAGASAKI
Supporting Staff:	Mayuko MURAI

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 Projects

An Unusual Subtilisin-like Serine Protease Is Essential for Biogenesis of Quinohemoprotein Amine Dehydrogenase

Quinohemoprotein amine dehydrogenase (QHNDH) is an αβγ heterotrimer present in the periplasm of several gram-negative bacteria and catalyzes the oxidative deamination of various aliphatic amines such as *n*-butylamine for assimilation as carbon and energy sources. The γ-subunit of mature QHNDH contains a protein-derived quinone cofactor, cysteine tryptophylquinone, and 3 intrapeptidyl thioether cross-links between Cys and Asp or Glu residues. In its cytoplasmic nascent form, the γ-subunit has a 28-residue N-terminal leader peptide, which is necessary for the production of active QHNDH but must be removed in the following maturation process. In this study, we investigated the role of a subtilisin-like serine protease encoded in the fifth ORF of the *n*-butylamine-utilizing operon of *Paracoccus denitrificans* (termed ORF5) in QHNDH biogenesis. *ORF5* disruption caused bacterial-cell growth inhibition in *n*-butylamine-containing medium and production of inactive QHNDH, in which the γ-subunit retained the leader peptide. Supply of plasmid-encoded *ORF5* restored the cell growth and production of active QHNDH, containing the correctly processed γ-subunit.

ORF5 expressed in *Escherichia coli*, but not its catalytic-triad mutants, cleaved synthetic peptides surrogating for the γ-subunit leader peptide, although extremely slowly. The cleaved leader peptide remained unstably bound to ORF5, most likely as an acyl-enzyme intermediate attached to the active-site Ser residue (Fig. 1). These results demonstrate that ORF5 is essential for QHNDH biogenesis, serving as a processing protease to cleave the γ-subunit leader peptide nearly in a disposable manner.

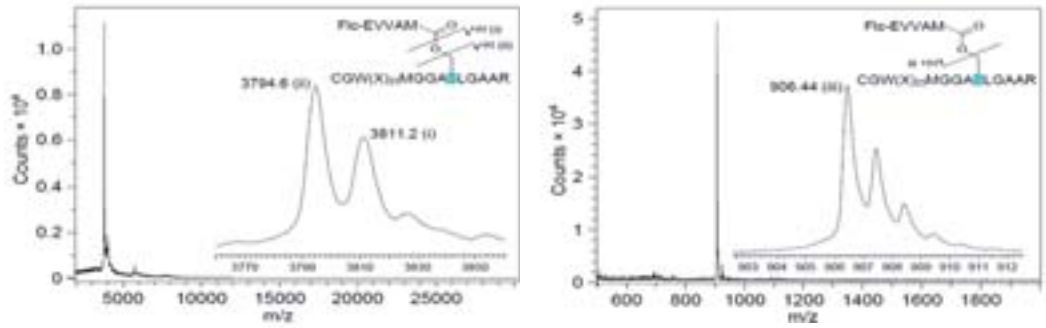


Fig. 1. MALDI-TOF mass analysis of acyl-enzyme intermediate.

Fluorophore-labeled Nanocapsules Displaying IgG Fc-Binding Domains for the Simultaneous Detection of Multiple Antigens

Simultaneous detection of multiple antigens by conventional immunological methods has been limited by the source of primary antibodies. Each antibody should be derived from a different host species (or subclass of immunoglobulin) for suppressing the cross-reactions of secondary antibodies. We developed an innovative method for simultaneous, rapid, and sensitive detection of multiple antigens using about 30-nm bio-nanocapsules (BNCs) displaying IgG Fc-binding Z domains derived from *Staphylococcus aureus* protein A (ZZ-BNC). When Cy2-labeled ZZ-BNC (Cy2-ZZ-BNC) was used instead of Cy2-labeled secondary antibody in western blot analysis, both sensitivity and signal intensity were significantly increased. The complex of Cy5-ZZ-BNC and mouse IgG2a (which shows moderate affinity to the Z domain) was not dissociated, even in the presence of 8-fold excess of free mouse IgG2a. In addition, crosslinking with bis-sulfosuccinimidyl suberate efficiently stabilized the interaction. The ZZ-BNCs labeled with various Cy dyes facilitated the simultaneous detection of multiple antigens using primary antibodies derived from the same host species, by western blotting (Fig. 2), immunocytochemistry and flow cytometry, which could expand the possibility of bio-imaging probes in various immunofluorescence techniques.

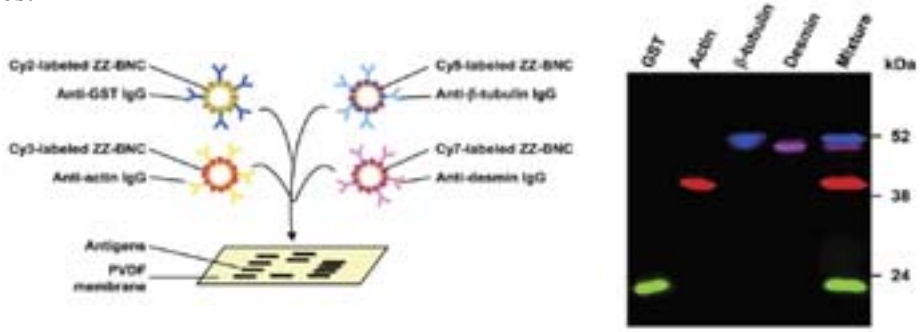


Fig. 2. Simultaneous detection of 4 proteins by western blotting.

Department of Cell Membrane Biology

Professor:	Akihito YAMAGUCHI
Visiting Professor:	Yoshimi MATSUMOTO
Associate Professor:	Tsuyoshi NISHI
Assistant Professor:	Ryosuke NAKASHIMA
Specially Appointed Assistant Professor:	Keisuke SAKURAI
Post Doctoral Fellows:	Shoko NISHI, Yu HISANO
Specially Appointed Researcher:	Kohei YAKAWA
Graduate Students:	Aiko OONO, Seiji YAMASAKI, Masaki MASHITA, Yumiko MATSUYAMA, Suguru YAMASAKI
Under Graduate Students:	Yuma OKA, Katsuhiko HAYASHI
Supporting Staff:	Aiko FUKUSHIMA, Kimie KITAGAWA, 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 2010-11, we found the new additional multisite drug binding pocket named proximal pocket and proposed the peristaltic pump mechanism from the entrance to the exit through the proximal pocket (access stage) and distal pocket (binding stage). In addition, studies on the exporters for lipophilic signal transducers in mammalian cells have also been advanced as described below.

Current Research Projects

Peristaltic pump mechanism of AcrB through two multisite-drug binding pockets.

Since we determined the world-first crystal structure of multidrug efflux transporter (***Nature*** **414**, 2002), we are leading the studies on the structural basis of multidrug recognition in the world. In 2010-11, we have succeeded to determine the new large-mass drug molecules-binding structure of AcrB and found the additional multisite drug binding pocket named proximal pocket (***Nature*** **480**, 2011).

We have reported the multisite drug binding pocket located at the phenylalanine cluster region of AcrB (***Nature*** **443**, 2006). Now, we found the other multisite drug binding pocket near the entrance and named “proximal pocket”. Proximal and distal pockets are arranged on the same substrate-translocation channel. Both pockets are separated by the

Phe-617 loop. A drug molecule first binds to the proximal pocket at the access stage, then moved to the distal pocket by the conformation change from access to binding stage. Finally, it is excludes into TolC channel from the exit at the extrusion stage. Drug migration is driven by a peristaltic motion of the efflux protein according to the conformational change. This peristaltic pump mechanism was supported by very recent work of Pos KM (***PNAS*** 2012).

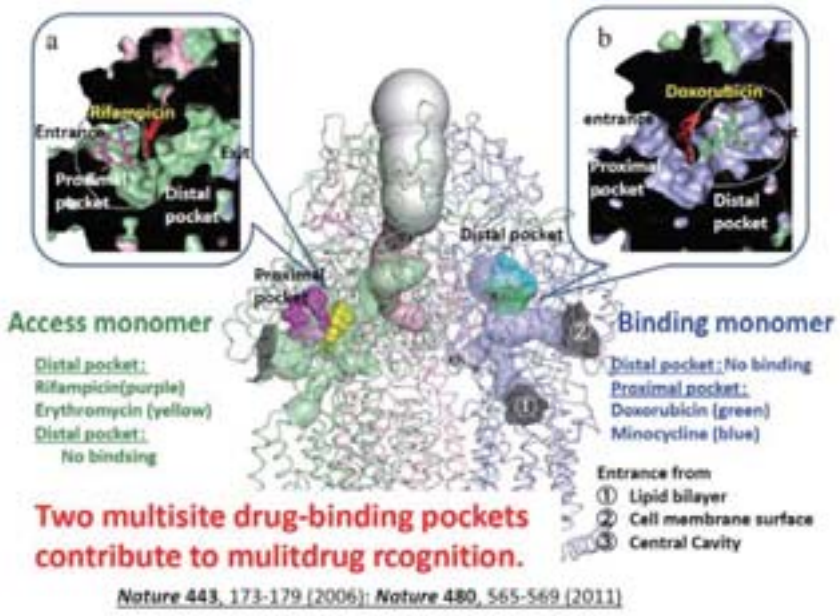


Fig. 1. Two multisite drug binding pocket in the structure of AcrB

Physiological role of the sphingosine 1-phosphate transporter, SPNS2 in mice.

Sphingosine 1-phosphate (S1P) is one of the most important lipid mediators and essential for cell migration such as lymphocyte, preosteoclast cells and endothelial cells in mammalian. We have been trying to identify the physiologically functional S1P transporter(s) that supply S1P into blood plasma in mammalians. Recently, we identified that zebrafish *Spns2* is a physiologically functional S1P transporter and essential for myocardial precursors migration to form normal heart in zebrafish. *Spns2* has orthologues in human and mouse genomes and encoded proteins of these orthologues have S1P transport activity as similar extent to zebrafish *Spns2*.

To elucidate a physiological role of SPNS2 in mammals, we analyzed Spns2-defecient mice. Although SPNS2-deficient mice were born in the expected Mendelian ratios, they displayed an eye-open at birth (EOB) phenotype. Other than the EOB phenotype, the SPNS2-deficient mice showed no abnormalities in the cardiovascular system or other organs, suggesting that there are functional differences between zebrafish and mammals in the physiological roles of SPNS2 in cardiogenesis.

Spns2 transcripts were detected in vascular endothelial cells and S1P secretion were abolished in the vascular endothelial cells prepared from SPNS2-defecient mice. Consequently, blood plasma S1P concentration of SPNS2-defecient mice was reduced to approximately 60% of wild-type. Although about a half of S1P remaining in blood plasma, the blood of SPNS2-deficient mice contained significantly fewer lymphocytes. However, lymphocytes in SPNS2-defecient mice thymus express more S1P1 and show a high migration activity at a lower S1P concentration.

These results suggested that S1P at microenvironments around the thymus endothelial cells is rather important for the lymphocytes egress from the thymus than overall S1P concentration in plasma.

Department of Biomolecular Science and Engineering

Professor: Takeharu NAGAI
Associate Professor: Yoh WADA
Specially Appointed Associate Professor: Kenta SAITO
Specially Appointed Assistant Professor: Masahiro NAKANO
Post Doctoral Fellows: PEREZ Koldenkova Vadim, TIWARI Dhermendra Kumar

Outlines

The "cooperative" functioning of a nanosystem composed of a small number of elemental molecules can be considered as a vital phenomenon in living system. However, no previous study has analyzed the elementary process of cooperation among small groups of molecules (minority molecules) in live cells. In our laboratory, we will approach how the minority molecules in live systems emerge robustness and adaptability of cellular functions by developing super-resolution molecular counting methods and techniques for physiological imaging and manipulation at molecular level.

Current Research Projects

Development of high performance of genetically-encoded Ca^{2+} indicators with blue, green and red emission

Engineered fluorescent protein (FP) chimeras that modulate their fluorescence in response to changes in calcium ion (Ca^{2+}) concentration are powerful tools for visualizing intracellular signaling activity. However, despite a decade of availability, the palette of single FP-based Ca^{2+} indicators has remained limited to a single green hue. We have expanded this palette by developing blue, improved green, and red intensiometric indicators (Fig.1), as well as an emission ratiometric indicator with an 11,000% ratio change. This series enables improved single color Ca^{2+} imaging in neurons and transgenic *Caenorhabditis elegans*; imaging of Ca^{2+} dynamics in three subcellular compartments; and, in conjunction with a CFP-YFP-based indicator, simultaneous imaging of both Ca^{2+} and ATP dynamics (Fig.2). This palette of indicators paints the way to a colorful new era of Ca^{2+} imaging [Original paper 1].

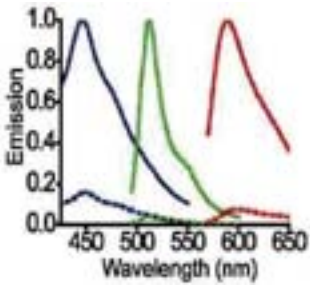


Fig.1. Emission spectrum of GECO series

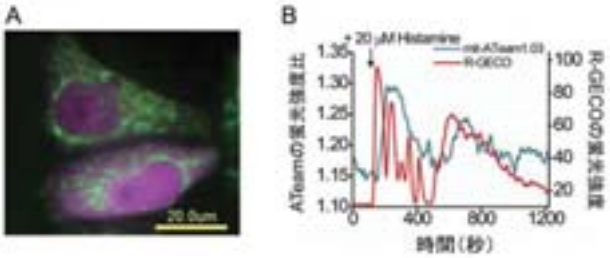


Fig.2. Dual imaging of Ca^{2+} and ATP dynamics in HeLa cells using R-GECO and mtATeam1.03

Conjugation of aslant incident light in Nipkow disk confocal microscope to increase availability of incoherent light source

Laser-scanning confocal microscopy has been employed for exploring structures at subcellular, cellular and tissue level in three dimensions. To acquire the confocal image, a coherent light source, such as laser, is generally required in conventional single-point scanning microscopy. The illuminating beam must be focused onto a small spot with diffraction-limited size, and this determines the spatial resolution of the microscopy system. In contrast, multipoint scanning confocal microscopy using a Nipkow disk enables the use of an incoherent light source. We previously demonstrated successful application of a 100-W mercury arc lamp as a light source for the Yokogawa confocal scanner unit in which a microlens array was coupled with a Nipkow disk to focus the collimated incident light onto a pinhole [Saito et al. *Cell Struct. Funct.*, 33: 133-141, 2008]. However, transmission efficiency of incident light through the pinhole array was low because off-axis light, the major component of the incident light, was blocked by the non-aperture area of the disk. To improve transmission efficiency, we propose an optical system in which off-axis light is able to be transmitted through pinholes surrounding the pinhole located on the optical axis of the collimator lens. This optical system facilitates the use of not only the on-axis but also the off-axis light such that the available incident light is considerably improved. As a result, we apply the proposed system to high-speed confocal and multicolor imaging both with a satisfactory signal-to-noise ratio (Fig. 3). By using this system, we greatly improve the availability of incident light thereby high speed confocal imaging as well as multicolor imaging with satisfied signal-to-noise ratio can be performed (Fig. 4). We also tried multi-color multi-focus time-lapse imaging (3D-imaging) [Original paper 2].

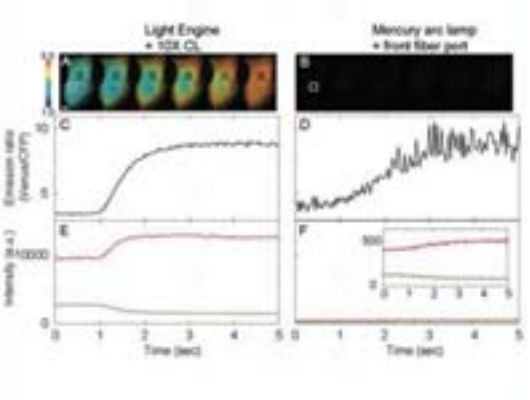


Fig. 3. High-speed (30 Hz) Ca^{2+} imaging of HeLa cell expressing YC3.60 with our new system (left) and previous system (right).

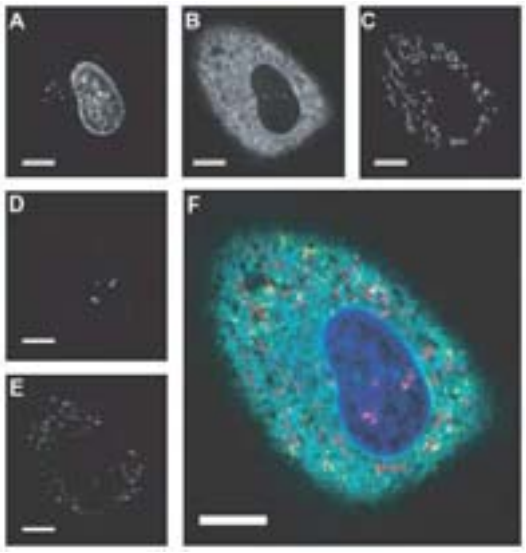


Fig. 4. Multi-color 3D-imaging of HeLa cell by using our new system.

Original paper

1. Zhao Y. et al., Science 333: 1888-1891, 2011
2. Saito K. et al., *Cell Struct. Funct.*, 36: 237–246, 2011

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.

Department of New Industry Generation System

Specially Appointed Professor: Mototsugu OGURA

Outlines

ISIR contracted with imec for “Collaboration Framework Agreement” on November 16, 2011. Signing Ceremony was held by Luc Van den hove, President&CEO of imec and Akihito Yamaguchi, director of ISIR. This agreement is composed of co-development and academic exchange, currently three theme are already on going.

Current Research Projects

Collaboration starts with imec under “Collaboration Framework Agreement”

1. imec(Interuniversity Micro Electronics Center) is currently of 62 countries, 600 companies, and top runner, world’s largest nanotechnology consortium.
2. collaboration items of nano-carbon electronics, bio-application, printed electronics and organic electronics firstly start.
3. collaboration items will be extended in sequence to medical-engineering collaboration and information-scientific fields.
4. academic exchange of PhD students, scientists as well as co-development will be aggressively done.

Osaka University has already promoted domestic industry-government-academic alliance. This time by widely expanding imec-ISIR co-development, Osaka University is becoming the Japanese representative hub of global collaboration in the fields of nano-science and nano-technology, then most advanced co-developed results will be disclosed to the world and by cultivating global world-class talents Osaka university will be able to contribute the creation of next generation industry in the world.

Department of Intellectual Property Research

Specially Appointed Professor: Hirokazu SHIMIZU
Visiting Professor: Seiichiro TAMAI
Guest Associate Professor: Takahiro MURATA

Outlines

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 Projects

Research on Methods of Searching Academia Industry Collaboration Partners by Patent Survey

We studied new methods to search possible industry partners to collaborate with the university laboratories by patent survey. We test the effectiveness of the method to find out technically specialized companies possible to cooperate by patents classification search of a group of patens that have been taken out by a particular laboratory.

Investigation of New Business Fields of Academia Industry Collaboration

We have investigated the research and development problems and university-industry collaboration projects of the following new business fields.

-New elementary technology of value-adding for natural material
-Laser lighting technology
-Grain size reduction technology of silicon rich stainless steel for tableting mold

Specially Appointed Laboratory: Kawai FIRST Project

Specially Appointed Professor: Tomoji KAWAI
Specially Appointed Assis. Professors: Takahito OHSHIRO, Masayuki FURUHASHI, Kazuki MATSUBARA, Soh RYUZAKI
Specially Appointed Technical Expert: Hiroe KOWADA
Specially Appointed Researchers: Makusu TSUTSUI, He YUHUI, Sakon RAHONG, Kazumi KONDA, Chie HOTEHAMA, Tomoyo KAWASE, Sanae MURAYAMA, Rie YAMADA
Support Staff: Yayoi KATAYAMA

Outlines

Our research group was launched in 2010 as one of the FIRST Projects: "Research and Development of Innovative Nanobiodevices Based on Single-Molecule Analysis", and directs toward developing innovative technologies and devices that enable single-molecular separation, detection, and analysis of biological substances of varied sizes such as DNA/RNA molecules, proteins, virus, and pollen allergens. Main subjects are (1) Development of Gating Nano/Micropore Device for Single-molecule Analysis, (2) Control of Translational Velocity for a DNA Passing through a Nanopore, (3) DNA Separation and Elongation in a Nanostructure-integrated Microchannel, (4) Development of Optical Gating Nanopore Device for Single-molecule Detection.

Current Research Projects

Development of Gating Nano/Micro-pore Device for Single-molecule Analysis

Gating nanopore devices realize high-speed sequencing of singe DNA molecule. This device consists of a nano-size pore and a pair of nano-gapped metal electrodes (Fig. 1a). We have developed fabrication processes of gating nanopore devices and evaluated their electric properties. As the processes were improved, size of the pore was shrunk from several dozen micrometers to 14 nm. In addition, we have succeeded in integration of a nanopore device and a nanofluidic channel on a silicon substrate (Fig. 1b). When the buffer solution containing two types of polystyrene beads (the diameters; 40 and 80 μm) flowed through the pore, dips were observed on the ionic current (Fig. 1c). The current histogram of the dips shows peaks corresponding to the sizes of beads (Fig. 1d).

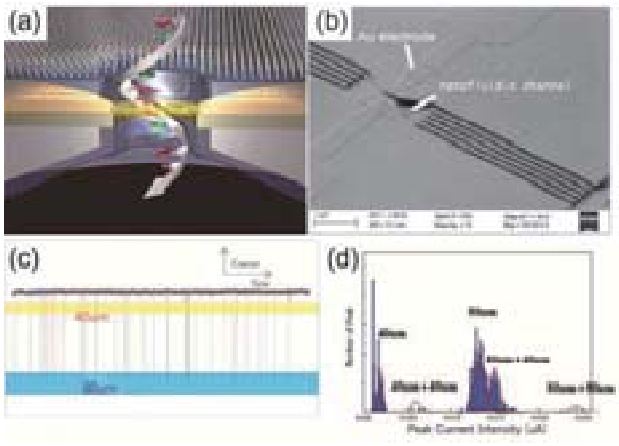


Fig.1 (a)Cross sectional picture of a gating nanopore and (b)SEM image of a developed integrated nanopore device. (c) Time trace of ionic current through a micropore device with two types of polystylene beads. (d) Current histogram of (c).

Control of Translational Velocity for a DNA Passing through a Nanopore

Control of molecular orientation and motion is indispensable for the nanopore based DNA sequencing. We have theoretically expected electric control of molecular translational velocity. Based on the result, we have prepared a gate electrode (surround gate) on a nanopore using microfabrication process (Fig. 2a), and confirmed the passage of DNAs through the nanopore. Furthermore, we have fabricated an in-plane nanopore with gate electrodes (Fig. 2b). Comparing ionic currents, translational velocity of DNAs with the gate voltage became slower than that without the voltage.

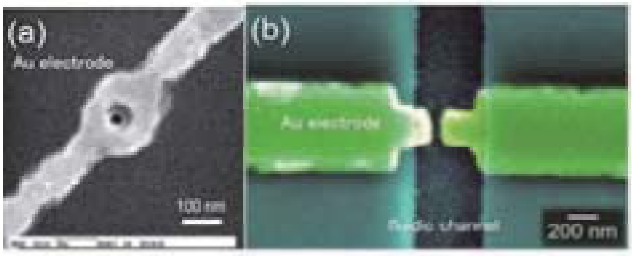


Fig.2 SEM images of (a) a surround gate and (b) an in-plain nanopore device with control electrodes. There is a nanopore at the center of the surround gate.

DNA Separation and Elongation in a Nanostructure-integrated Microchannel

Nanostructure-integrated micro-channels with a gating nanopore structure have been designed for realizeing high-speed separtion, elongation, and flow dynamics control of DNA molecules. We have fabricated SnO_2 nanowires with diameters of sub-10 nm in a fluidic channel of 25 μm width on patterned Au films (Fig. 3a). This method has succeeded in controlling the density of the nanowires. In addition, we have designed and prepared a nanofluidic channel that enables DNAs to keep extended and elongated (Fig. 3b). Furthermore, we have established the detection method for single DNA molecule in the channel using a total internal reflection fluorescence microscope. The correlation between the channel width and the translational velocity revealed that the force for elongation was applied on the DNAs along the flow direction.

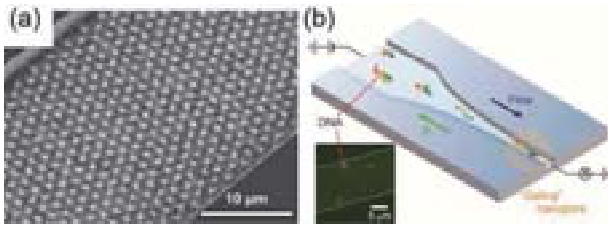


Fig.3 (a) SEM image of a microfluidic channel with SnO_2 nanowires. (b) Schematic diagram of a nanofluidic channel for elongation of DNA molecules. A photographic image of fluorescence from DNAs is also shown.

Development of Optical Gating Nanopore Device for Single-molecule Detection

In the view of an analogy to the nanogap electrodes as shown above, it is expected that using a pair of optical waveguides instead of metal electrodes allows single molecule detection by light. For this purpose, a pair of gapped channel optical waveguides composed of TiO_2 has been fabricated using microfabrication process (Fig. 4). We have revealed that the transmittance became smaller as the gap size became wider, but that the light had enough intensity at the gap to excite fluorophores.

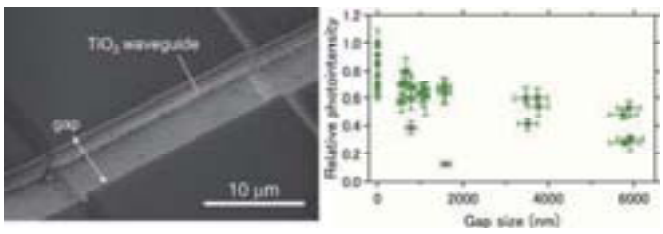


Fig.4 SEM image of a gapped TiO_2 channel waveguide and dependence of transmittances on the gap size.

Laboratory of Microbiology and Infectious Diseases

Associate Professor: Kunihiko NISHINO
Specially Appointed
Assistant Professor: Mitsuko NISHINO
Graduate Students: Aiko ONO, Seiji YAMASAKI, Suguru YAMASAKI
Under Graduate Students: Katsuhiko HAYASHI
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 Projects

AcrA dependency of the AcrD efflux pump in *Salmonella enterica* serovar Typhimurium

Multidrug efflux pumps belonging to the resistance-nodulation-cell division (RND) family play major roles in the intrinsic and elevated resistance of Gram-negative bacteria to a wide range of compounds. RND efflux pumps require two other proteins to function: a membrane fusion protein (MFP) and an outer membrane protein. A recent study demonstrated that *Salmonella enterica* serovar Typhimurium has five RND efflux systems: AcrAB, AcrD, AcrEF, MdtABC, and MdsABC. Most RND efflux system genes also code for an MFP in the same operon; however, an MFP gene is not located near *acrD*, and the MFP, with which AcrD functions, remains to be studied in detail. The aim of this study was to

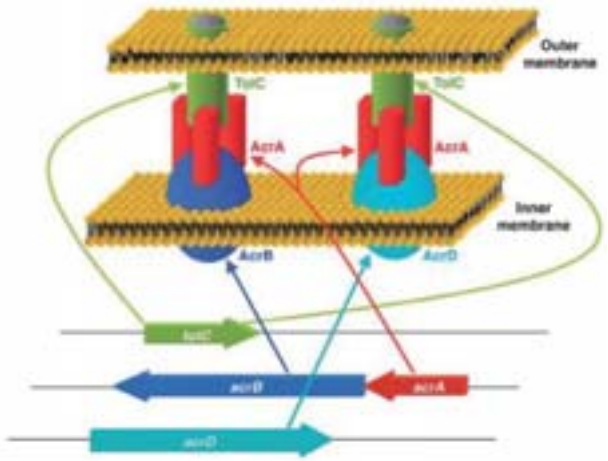


Fig. 1. Model for AcrA utilization as an MFP by the AcrAB-TolC and AcrD efflux systems in *S. enterica.* In *S. enterica*, AcrA functions with AcrB and AcrD efflux pumps, resulting in an increase in multidrug resistance.

investigate the requirement of an MFP for the AcrD efflux system in this organism. When overproduced, AcrD significantly increased the resistance of the *acrB* mutant to oxacillin, cloxacillin, nafcillin, carbenicillin, sulbenicillin, aztreonam, sodium dodecyl sulfate, and novobiocin. The increase in drug resistance caused by AcrD overproduction was completely suppressed by deleting the MFP gene, *acrA*, or the multifunctional outer membrane channel gene, *tolC*. Although the overexpression of *acrD* did not confer drug resistance to the Δ*acrAB* strain, co-overexpression of *acrD* with *acrA* increased the multidrug resistance of this mutant. Our results indicate that the AcrA MFP and TolC outer membrane protein, in addition to their roles in the AcrB efflux system, are required for the function of the AcrD efflux pump in *S. enterica* serovar Typhimurium (Fig. 1).

Physiological role of the MdtEF multidrug efflux pump during the anaerobic respiration in *E. coli*

Drug efflux represents an important protection mechanism in bacteria to withstand antibiotics and environmental toxic substances. Efflux genes constitute 6-18% of all transporters in bacterial genomes, yet the expression and functions of only a handful of them have been studied. Among the 20 efflux genes encoded in the *E. coli* K-12 genome, only the AcrAB-TolC system is constitutively expressed. The expression, activities, and physiological functions of the remaining efflux genes are poorly understood. In this study, we identified a dramatic up-regulation of an additional efflux pump, MdtEF, under the anaerobic growth condition of *E. coli* which is independent of antibiotic exposure. We found that expression of MdtEF is up-regulated more than 20 fold under anaerobic conditions by the global transcription factor ArcA, resulting in increased efflux activity and enhanced drug tolerance in *E. coli*. Cells lacking *mdtEF* display a significantly decreased survival rate under the condition of anaerobic respiration of nitrate. Deletion of the genes responsible for the biosynthesis of indole, *tnaAB*, or replacing nitrate with fumarate as the terminal electron acceptor during the anaerobic respiration, restores the decreased survival of *ΔmdtEF* cells. Moreover, cells harboring deletion of *mdtEF* are susceptible to indole nitrosative derivatives, a class of by-products formed and accumulated within *E. coli* when the bacterium respirates nitrate under anaerobic conditions. Taken together, we conclude that the multidrug efflux pump MdtEF is up-regulated during the anaerobic physiology of *E. coli* to protect the bacterium from nitrosative damage through expelling the nitrosated indole derivatives out of the cells (Fig. 2).

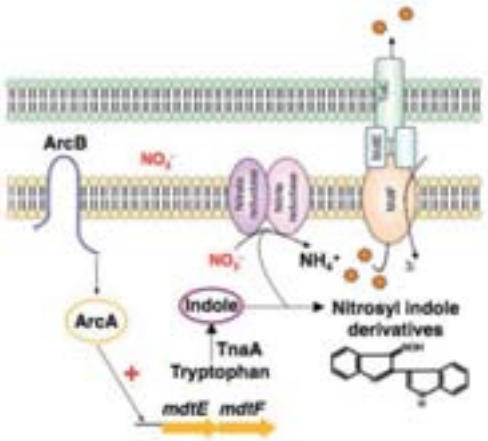


Fig. 2. A working model for the regulation and physiological roles of MdtEF during anaerobic growth of *E. coli*. During anaerobic respiration of nitrate in *E. coli*, reactive nitrogen species (RNSs) were generated and react with high levels of indole to form toxic indole nitrosative derivatives. Multidrug efflux pump *mdtEF* is up-regulated by ArcA during this process to export these compounds out of cells, thus protect cells against nitrosative damage during the anaerobic respiration of nitrate.

Laboratory of Atomic Scale Materials Processing

Associate Professor:	Takeshi YANAGIDA
Specially Appointed Assitant Professor:	Kazuki NAGASHIMA
Specially Appointed Researcher:	Mati HORPRATHUM (2011.5.16-)
Specially Appointed Researcher:	Bo XU (2011.6.1-)
Specially Appointed Researcher:	Fuwei ZHUGE (2011.7.1-)
Specially Appointed Researcher:	Yong HE (2011.7.1-)

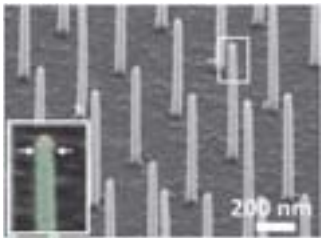
Outlines

This research group investigates the atomic scale materials processing by taking over the principle being familiar to mother nature, in which their 3D hierarchical structures are naturally formed by utilizing extremely small energy and reacting in limited environments. We are trying to explore the construction of the atomic scale materials processing based on the natural law, and to create the higher-order hierarchical nanostructures, the functional properties and the unique nanodevices. Main subjects are (1) Creation and design 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.

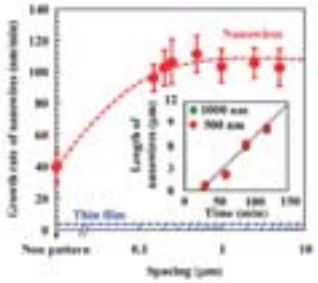
Current Research Projects

Mechanism of One-dimensional Oxide Nanostructure Growth

Understanding the one-dimensional oxide nanowire growth is crucial to control the shape and property of oxide nanowires and also to fabricate the nanowire based nanodevice applications. Here we successfully identified the transport pathway of adatoms on the oxide nanowire (MgO nanowire) growth mechanism. When decreasing the catalyst spacing, the nanowire growth rate drastically decreased under 200nm spacing due to the material competition regime. From the detailed analysis, the major transport pathway of adatoms was found to be vapor phase transport. These findings might be the key to synthesize the novel oxide nanowires beyond the conventional materials.



Oxide nanowire array grown from well-controlled Au nanodot array



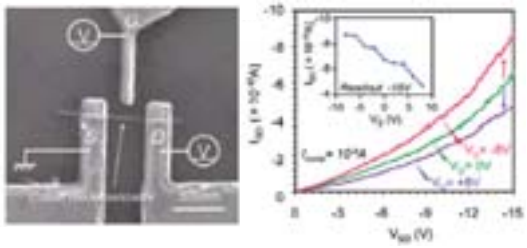
Effect of catalysts spacing on nanowire growth rate

Nature of Nonvolatile Resistive Switching using a Single Oxide Nanowire

Resistive switching in metal/oxide/metal junction, so-called ReRAM or Memristor,

has attracted much attention toward the next-generation nonvolatile memory. However, the lack of understanding as to the nanoscale switching mechanism has held back the range of device applications. The nanowire structure with the finite space allows us to capture and identify the intrinsic characteristics of resistive switching.

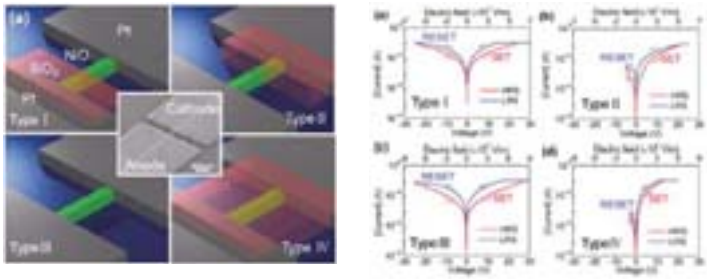
A) We demonstrate the nonvolatile resistive switching mechanism in p-type CoO using MgO/CoO nanowire (~10nm scale). We utilized a planar type FET device and a multi-electrode device to identify the carrier type and the switching position during resistive switching event, which have been difficult in typical thin film devices. As a result, we, for the first time, experimentally clarified that the hole conduction based resistive switching near the cathode side is crucial in p-type CoO, which differs from the previous electron conduction based resistive switching near the anode.



Oxide nanowire FET and I_{SD}-V_{SD} curve

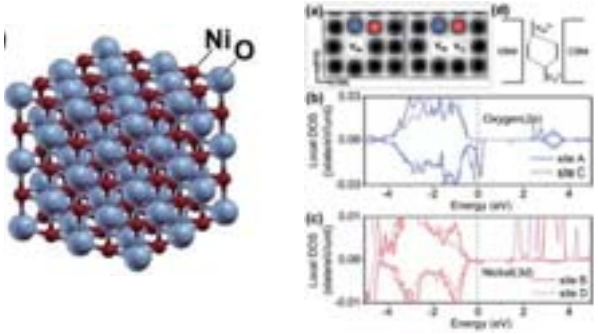
Multi-electrode device

B) Crucial switching area in p-type NiO was investigated using asymmetrically passivated NiO nanowire device patterned by electron beam lithography. Resistive switching drastically changed when the passivation layer was partially introduced at the cathode side, indicating that the cathode side is crucial for resistive switching in p-type NiO. Since this result is consistent with that from our p-type CoO nanowire device, our finding might be universal for resistive switching in p-type oxides.



Effect of asymmetrically passivated NiO nanowire device on resistive switching behaviors

C) Co-existence of oxygen vacancy and cation vacancy is modeled for resistive switching in p-type NiO oxide. Simulation based on first-principle calculation revealed that the co-existence of both vacancies is energetically stable and possibly explains the occurrence of hole conduction through the drift of oxygen ions under electric field. This physical picture is applicable to the resistive switching in diverse p-type oxides.



Effect of vacancy position on the local density of state in NiO

Laboratory of Cellulose Nanofiber Materials

Associate Professor: Masaya NOGI
Postdoctoral Fellow: Thi Thi Nge
Supporting Staff: Ming-chun Hsieh (2011.11.1-)

Outlines

Cellulose nanofibers with a width of 4-20 nm are bundles of cellulose microfibrils, which are frameworks of cell walls in all the plants. We have developed nano-fibrillation processes of bio-resources (wood, plants fibers, crabs, shrimps, etc.) and some advanced nanofiber materials with high optical transparency. Moreover, we have also improved their properties or processes to realize their applications in the electronic devices.

Current Research Projects

Reinvention of paper

We believe that future electronic devices should be fabricated on cellulosic papers using printing technology (Fig. 1 left). To make it possible, we have re-invited transparent paper using cellulose nanofibers with a width of 15 nm (Fig. 1 right).

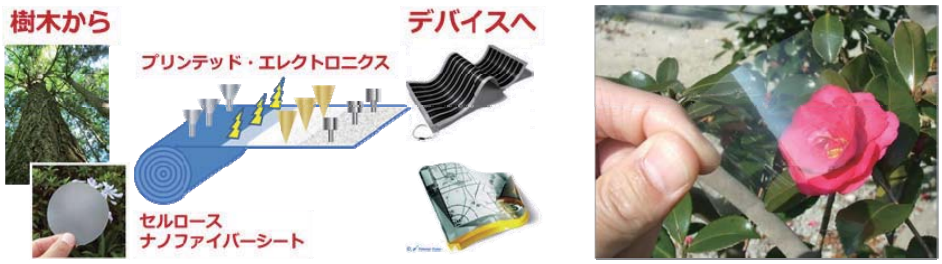


Fig. 1 Our research target of “printed devices from trees” (left) and optically transparent nanofiber paper (right)

Printed electronics for cellulose nanofiber sheets

We have developed some printed electronic technologies for cellulose nanofiber sheets. In cooperation with Department of Advanced Interconnection Materials in ISIR, we have succeeded in the development of printing technologies of antenna and foldable conductive lines (Fig. 2).

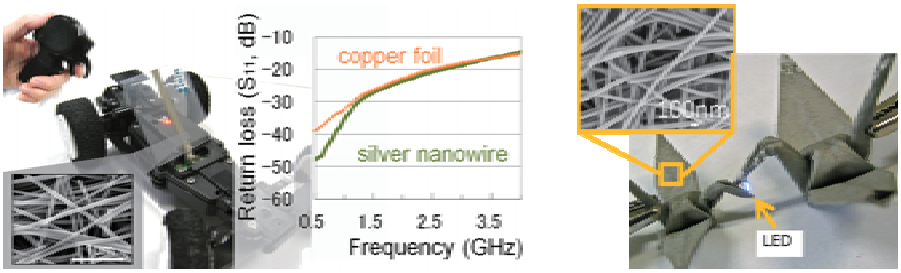


Fig. 2 Developments of printed electronics for cellulose nanofiber sheets
(left) printed antenna, (right) printed foldable conductive lines

Department of Beam Application Frontier

Specially Appointed Professor:	Seiichi TAGAWA
Specially Appointed Professor:	Masayuki ENDO
Specially Appointed Researcher:	Dinh CONG
Specially Appointed Researcher:	Dang TUAN
Assigned Researcher:	Satoshi ENOMOTO
Supporting Staff:	Kaoru KOJIMA

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 process of energy imparted to resist

The extent of radiacal cation dynamics of poly(styrene-*co*-methylmethacrylate) was studied by pulse radiolysis and acid determinate quantity. It was clarified that the radical cation of methylmethacrylate was preferentially decomposed proir to the hole transfer to the styrene unit with smaller styrene mol ratio (50% and below). It is thought that this is because the hole is non-localized in styrene unit. However, acid yield decreased with the increase of styrene mol ratio more than 70% (Fig. 1). Thus, it was clarified that the hole transfer from methylmethacrylate to three styrene units. It was also clarified that the effect of hole transfer is significant in the area of large styrene unit mol ratio.

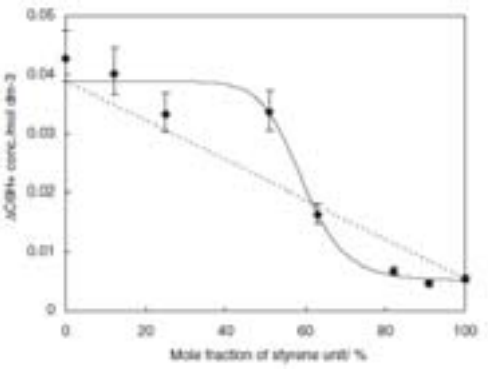


Fig.1. The ralationship between styrene unit mil ration and acid determinate quantity.

2. Theoretical study on reactivity of polymers and photoacid generators and the acceleration of their realization

The sensitivity of resist for EUV depends on the ionization of the polymer and the electron affinity of photoacid generator. We so far theoretically calculated electron affinity of photoacid generator and found electron withdrawing substituent enhances the electron affinity of photoacid generators. Here, we have theoretically studied the ionization of polymers using quantum chemical calculation. During the ionization, the radical cations of polymer are produced. As the radical cations are unstable, the energy barrier between before and after ionization of polymer was calculated after the optimization of the molecular structures. Smaller energy barrier means more products of

secondary electrons, which lead to the increase of resist sensitivity. Figure 2 shows the energy barrier of poly(4-hydroxy-2,3,5,6-tetra substituted styrene). It is found that the electron providing group such as amino and methoxy group makes the energy barrier decrease and the electron withdrawing group of fluorine atom makes the energy barrier increase as compared with poly(4-hydroxy styrene). These findings together with the results of photoacid generators will become the design concept for the sensitivity improved EUV resist.

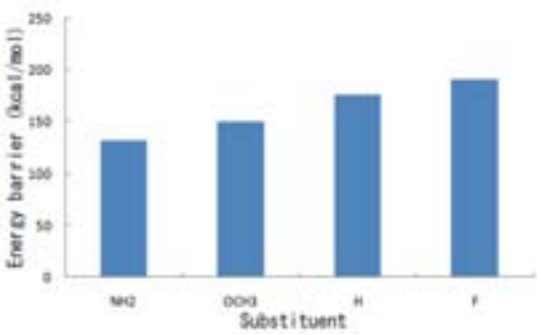


Fig.2. The ralationship between substituent and energy barrier.

3. Clarification of deblocking process and develoment process of resist

We investigated the difference of dissolution behaviors between polymer boung photoacid generator, which is attached to polymer with covalent bonding, and polymer blend photoacid generator using Quarts Crystal Microbalance (QCM). Though it was observed that both resists have swelling during development, the swelling of the resist using polymer boung photoacid generator was less than it of the resist using polymer blend photoacid generator. It was also observed resist sensitivity increased with increase of the concentration of polymer bound photoacid generator. This results from that the recombination of geminate ions were supressed by the increase of reaction of secondary electrons with photoacid generator. Thus polymer bound photoacid generator is hopeful as the advanced resist materials in view of introducing the high concetration photoacid generator.

4. Clarification of the method to increase generated acid

We studied the sensitivity and resolution of the resist using polymer boung photoacid generator, which can be uniformly incorporated with high concentration. Its evaluation, compared with the resist using polymer blend photoacid generator, was performed using EUV exposure tool. Figure 3 shows SEM photograph of the resist pattern and AFM photograph of the resist film before development. The resist contains 10mol% polymer boung photoacid generator. High sensitivity and high resolution was achieved owing to the high concentaration of the photoacid generator. Surface roughness was also smooth. Thus, we clarified polymer boung photoacid generator is promising for nanolithography material.

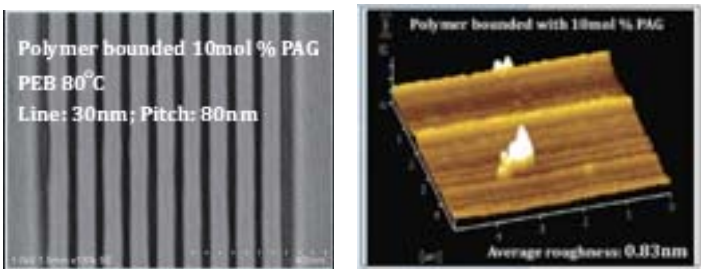


Fig.3. SEM photograph of the resist pattern (left) and AFM photograph of the resist film before development (right). The resist uses polymer boung photoacid generator

Department of Chemical Biology, Glycomics Team, Systems Glycobiology Research Group (RIKEN-ISIR, Osaka University Alliance Lab)

Guest Professor:	Naoyuki TANIGUCHI
Guest Associate Professor:	Kazuaki OHTSUBO
Visiting Academic Staff:	C.-X. GAO, Hiroaki KOREKANE
	Shinji TAKAMATSU
Technical Assistant:	Masahiro SANO
Supporting Staff:	Izumi SUGASE

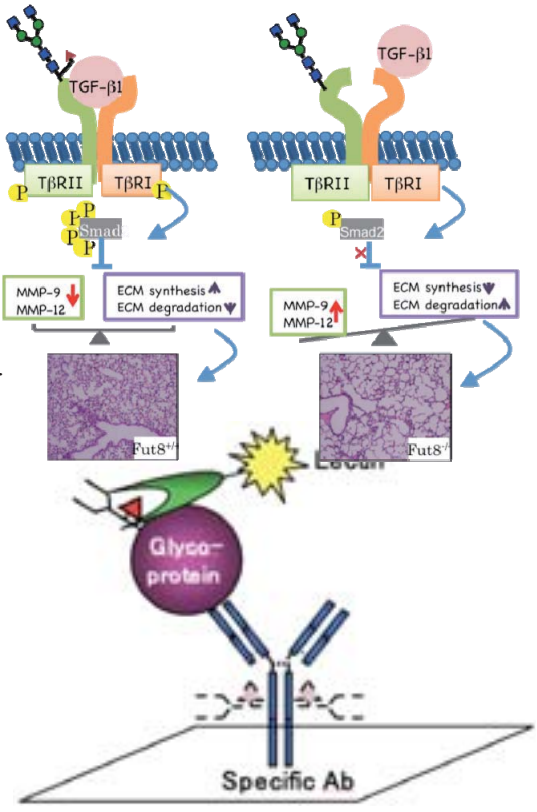
Outlines

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 Projects

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.

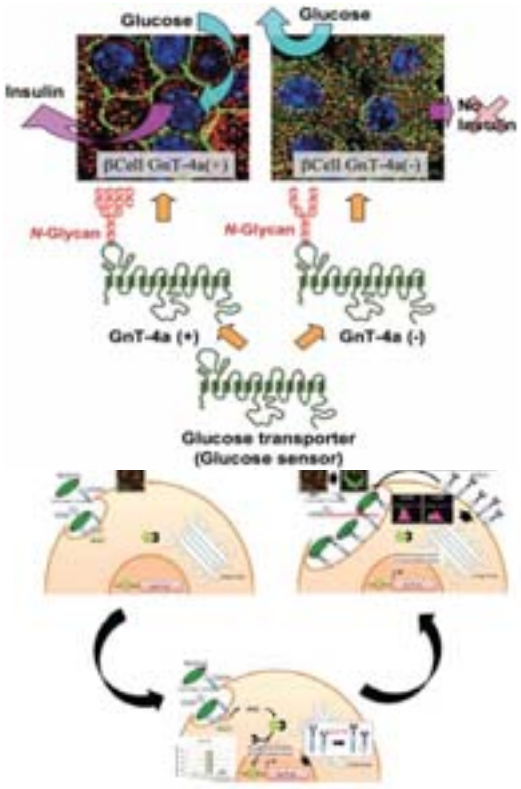


Development of the highly-sensitive and -specific tumor diagnostic marker

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.

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.

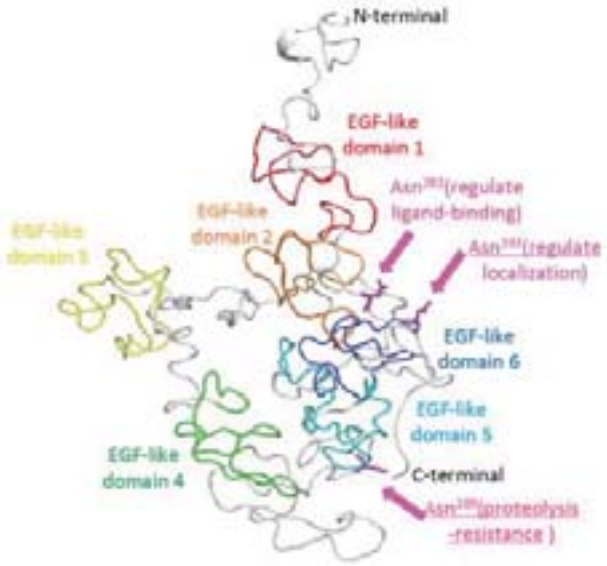


Physiological control of scavenger receptor glycosylation in the process of phagocytosis

We have elucidated GnT-III expression is controlled by production of reactive oxygen species that is coincident with N-glycosylation of scavenger receptors and the facilitation of phagocytosis. These results illuminate the biological significance of GnT-III in the positive feedback mechanism in phagocytosis.

Functional relevance of N-glycans of SREC-I in pathogenesis of atherosclerosis

SREC-I is an endocytic receptor for chemically modified LDL such as acetylated and oxidized LDLs and has been implicated in pathogenesis of atherosclerosis. Structure-function relationship analyses revealed that N-glycans of Asn289, Asn382 and Asn393 have distinct functions in regulating proteolytic resistance, ligand-binding affinity, and subcellular localization, all of which could be involved in the development of atherogenesis.



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 leaded 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 Professors: Teruo KANKI, Azusa HATTORI, Kohei FUJIWARA
Post Doctoral Fellow: Koichi OKADA
Graduate Students: Hidefumi TAKAMI, Atsushi ONO, Takuya SAKAMOTO, Kenichi KAWATANI, Takayoshi KUSHIZAKI, Yasushi FUJIWARA
Under Graduate Students: Takashi ICHIMURA, Hiroki UEDA
Technical Supporting Stuff: Rie YAMAKAGE (2011.9.1-2012.3.31)
Supporting Staff: Tomoko OKUMOTO

Outlines

This research group focuses on functional oxide materials showing huge response against external fields, and establishes nano-fabrication techniques 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

Construction of 3-D nano-fabrication process for functional metal oxides

We have proposed and established new method involving the fabrication of extremely small size nano structures beyond top down lithographic technique and handling of well controlled size/shape/positioning beyond bottom-up self-assembled growth. In this method, the target materials are deposited onto side wall of the well-defined patterned template prepared by top-down nano lithography. This technique has an advantage for fabrication of small nano structures defined by film thickness. The metal oxide nanostructures with tunable size of 10 nm to 100 nm, position and shape can be successfully fabricated. Fig. 1 shows room temperature ferromagnetic semiconductor $(Fe,Mn)_3O_4$ nanodot and opto-semiconductor ZnO nanobox and nanowire structures fabricated by this method. We confirmed high functionalities of the nanostructures; even a single ZnO nanobox exhibits excellent wide gap luminescent semiconductor characteristics. Based on this nanofabrication technique, the large arrays of programmable structures for building reconfigurable architectures would be achieved for versatile applications.

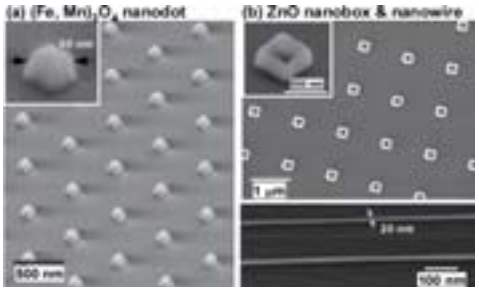


Fig. 1 (a) $(Fe_{3-x}Mn_x)O_4$ nanodot (diameter: 60nm), and (b)ZnO nanobox(width:70 nm, height: 250 nm) and nanowire (width: 20nm) structures fabricated by our established original combination technique.

Ferromagnetic Fe-oxide one-dimensional structures for spintronic applications

One-dimensional nanostructures such as nanowires hold promise as building blocks for future electronic devices. In particular, ferromagnetic nanowires are highly important to incorporate spin degrees of freedom into conventional charge-based devices. $Fe_{3-x}Mn_xO_4$ (FMO) is appealing for this purpose due to its high Curie temperature, spin polarization, and tunable electric and magnetic properties. In this study, we have fabricated FMO nanowire structures [Fig. 2(a)] using our 3D nanotemplate-PLD lateral growth technique, and investigated their fundamental transport properties with the aim of developing spintronic devices based on them. To definitely evaluate the quality of the fabricated nanowires, we measured magnetoresistance (MR) for a single FMO nanowire [Fig. 2(b)]. It is known that, in magnetite and FMO thin films, MR does not saturate even at high fields due to the presence of antiphase boundaries across which ferromagnetic domains are coupled antiferromagnetically. Figure. 2(c) shows temperature dependent MR properties ($MR = [R(H)-R(0)]/R(0)$) of a single 120-nm-width $Fe_{2.5}Mn_{0.5}O_4$ nanowire and a $Fe_{2.5}Mn_{0.5}O_4$ thin film directly grown on an $Al_2O_3(0001)$ substrate. The $Fe_{2.5}Mn_{0.5}O_4$ nanowire has essentially identical behavior to that of the film, evidencing that the ferromagnetic character of FMO is well maintained even in nanowire form. Based on this result, we are attempting to fabricate new spintronic devices.

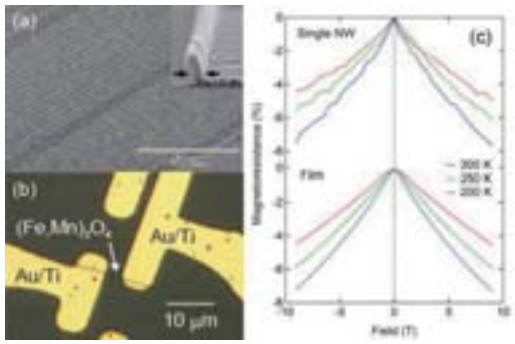


Fig. 2 (a) SEM image of FMO nanowire arrays fabricated by the 3D nanotemplate-PLD lateral growth technique. (b) Optical microscope image of a single FMO nanowire. (c) Magnetoresistance properties. Data of a thin film grown on $Al_2O_3(0001)$ substrate is also included for comparison.

Observation and evaluation of spatially separated metal-insulator states in VO_2

Vanadium dioxide (VO_2) shows orders-of-magnitude changes in resistance around 340 K, showing a metallic state at high temperature and an insulating state at low temperature. In terms of nano-spatial characteristic in VO_2, their mixed electronic phases are present in nature. These domains work on an important element in their physical properties. In this year, we evaluated a transient electronic phase structure called M_2 existing in the mixed phases and could identify the insulator structure in detail. Moreover we discovered existence of micro-sized domains in VO_2 thin films on $TiO_2(001)$ substrate (see Fig.3) and succeeded in observation of abrupt resistive changes caused by changes of one domain. (Fig. 4). These results will lead to ultra power saving devices with huge electronic response.

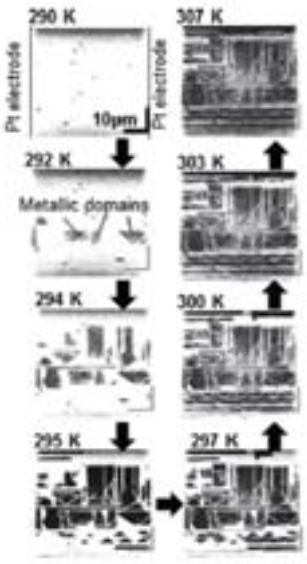


Fig.3 Optical microscope images at temperatures from 290 to 307K for a heating process in a VO_2 thin film on $TiO_2(001)$ substrate

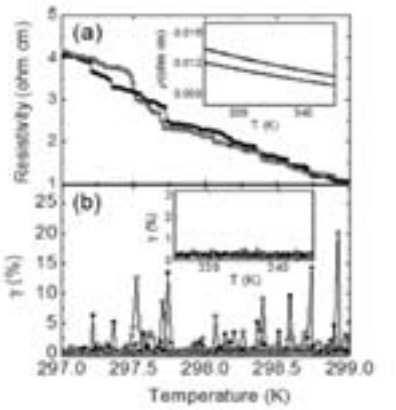


Fig. 4 Temperature dependence of resistance in a VO_2 on $TiO_2(001)$ thin film

Department of Advanced Nanofabrication

Professor:	Yoichi YOSHIDA
Associate Professors:	Jinfeng YANG
	Takahiro KOZAWA (-2011.5.31)
Assistant Professor:	Takafumi KONDOH
Specially Appointed Assistant Professor:	Koichi KAN
Guest Professor:	Atsushi OGATA, Hitoshi KOBAYASHI
Graduate Student:	Tomohiro TOIGAWA
Research Student:	Liang LI
Supporting Staff:	Mie KOBAYASHI (-2011.12.31)
	Anna CHIYO

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 reveal the reaction mechanism in nano-space, a femtosecond/attosecond pulse radiolysis and femtosecond time-resolved electron microscopy are being developed using an advanced photocathode electron gun.

Current Research Projects

Study of the equivalent velocity spectroscopy method (EVS) for pulse radiolysis

Toward the attosecond pulse radiolysis, a new technique called the equivalent velocity spectroscopy (EVS) method has developed. In the case of the electron beam pulse radiolysis, the degradation of the time resolution due to the difference in the speed of analysis-light and high energy electron beam in a sample becomes a critical problem. To reduce this degradation, very thin sample as 200 μm was used in the current pulse radiolysis system, however it is not a fundamental solution. The EVS method which has been introduced widely in domestic and overseas is an idea to solve this problem fundamentally. However, there was great difficulty to realize simultaneous pursuit of compression and rotation of the electron beam pulse for the EVS. In a conventional method, the electron beam pulse could be rotated without pulse compression, the time resolution of the EVS pulse radiolysis had remained in the 4.3 ps. By the longitudinal and transverse modulation of electron beam, both of the pulse rotation of 18-45 degree and the pulse compression of up to 600 fs was achieved. Furthermore this method improved time resolution up to 1.2 ps. Big problem in the EVS method which is the one of elementary techniques of the femtosecond pulse radiolysis was solved and the principle of the EVS was successfully verified.

Development of double-decker pulse radiolysis

Double-decker pulse radiolysis (DDPR), which utilized double-decker electron beams, was investigated for a new pulse radiolysis with a high time resolution. The double-decker electron beams were generated by injecting two UV lights to a photocathode radio-frequency (RF) gun. In the pulse radiolysis, one electron beam was

used for a pump beam; the other, a conversion to a probe light. Finally, the first DDPR was demonstrated successfully, resulting in an observation of solvated electrons in water with a 10-90% rise time of 8.6 ps. DDPR also indicated a feasibility of a spectrum measurement. In the future, the time resolution in DDPR will be improved by the optimizations of the double-decker electron beams and pulse radiolysis system. Besides improving the time resolution, another application to a pulse radiolysis in THz-range would be expected.

Femtosecond Pulse Radiolysis Study of Solvated Electron in Polar Liquids

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 polar liquids are stabilized by solvating polar molecules and then solvated electrons are produced. 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 and alcohol were observed. The experimental data indicated that the solvated electron is formed in water and ethanol with a time constant of 550 fs and 3 ps, respectively. Additionally, expanding the measurement wavelength region allows us to understand the formation mechanism of solvated electron.

Study of the geminate ion recombination in n-dodecane by using the Near Infrared femtosecond pulse radiolysis

By expanding the measurable region to the near infrared, the time-dependent behavior of electron was measured in n-dodecane which is one of non-polar solvent. The time-dependent behavior of electron was compared with that of radical cation, and it was analyzed by the simulation based on the diffusion theory on the geminate ion recombination. The time-dependent behavior of electron is coincided with that of radical cation in several hundred ps region. It was reconfirmed that radical cation and electron is the geminate ion pair as in conventional story. However, it was found that the time-dependent behavior of electron is different from that of radical cation within 50 ps. The difference in time dependent behaviors of electron and radical cation within 50 ps is due to the formation of radical cation from excited radical cation, as reported in last year. Mismatch of the time-dependent behaviors of electron and radical cation in early stage is one of evidence of the excited radical cation.

Development of femtosecond time-resolved electron microscopy

MeV electron microscopy with a time-resolved function is a powerful and dreamy tool to reveal the ultrafast hidden dynamics of intricate molecular and atomic processes in materials. A time-resolved MeV electron microscopy based on a femtosecond rf electron gun is being developed in ISIR, Osaka University. In 2011, to achieve the high spatial resolution, an objective magnetic lens (OL) with the maximum magnetic field of 2.2 T has been developed. Both the spherical aberration and chromatic aberration effects were reduced by optimizing the shape and the distribution of magnetic field in OL. Finally, an image measurement system has been constructed using a high-efficiency Cs(Tl) fiber-optic plate.

Department of Nanocharacterization for Nanostructures and Functions

Professor: Seiji TAKEDA
Associate Professor: Manabu ISHIMARU
Assistant Professor: Hideto YOSHIDA
Graduate Students: Hiroki OMOTE, Hitoshi YAMAMURA, Yusuke ISOZAKI, Shuki NAKAMURA
Supporting Staff: Shigeko TOMII

Outlines

Our group is aiming to characterize nanomaterials and nanodevices at the atomic scale when they actually exhibit their functions. We have developed high-resolution environmental transmission electron microscopy (ETEM) that allows us to observe solid-gas reactions in situ at atomic scale. Using the ETEM, we have studied the morphology and surface structure of gold and platinum nanoparticles supported on oxides under reaction conditions in order to elucidate the catalytic mechanism of supported nanoparticulate catalysts.

Current Research Projects

Morphology change of supported Au nanoparticles during CO oxidation

As is well known, chemically inactive solid gold shows remarkable catalytic activity for CO oxidation even below room temperature. Unlike platinum and palladium, gold must be supported on crystalline metal oxides such as TiO_2 and CeO_2 in the form of nanoparticles. The mechanism of catalysis by gold nanoparticles (GNPs) has recently aroused much attention. Nevertheless, the operand structure of the GNP catalysts has remained unclear.

In real GNP catalysts, the structures of GNPs and the interface between the GNPs and the supports are not identical at atomic scale. Hence, we examined a large number of GNPs supported on CeO_2 using ETEM, and found that the majority of the GNPs behaved systematically, depending on the partial pressures of CO and O_2 in CO/air at room temperature, as shown in Fig. 1. These

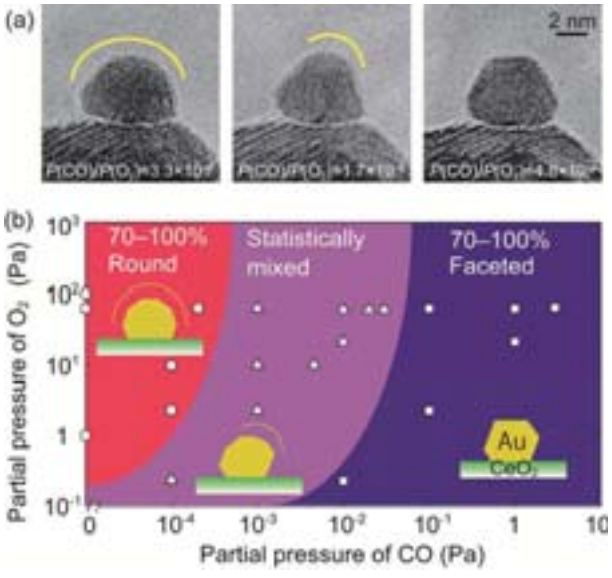


Fig.1 (a) Typical ETEM images and (b) the morphology diagram of GNPs supported on CeO_2 as a function of the partial pressures of CO and O_2 in CO/air.

systematic and quantitative microstructural data for an operating nanoparticle catalyst were obtained for the first time to our knowledge. Adsorbed CO molecules stabilize the major {111} and {100} facets of GNPs, and dissociation of O_2 molecules may occur at the perimeter interface of GNPs and CeO_2 with the aid of electron irradiation, causing rounded morphology of the GNPs.

Atomic-scale imaging of surface reconstruction of gold nanoparticles induced by adsorbed CO molecules at reaction conditions

Direct visualization of individual atoms and molecules provides us with insights into heterogeneous catalysis in real space and time. Applying aberration-corrected ETEM, we have found that CO gas makes the {100} facets of a gold nanoparticle reconstructed during CO oxidation at room temperature. Figure 2 shows that structural reconstruction is induced onto the {100} facets under the catalytic reaction. As shown in the enlarged images in Fig. 2, the {100} facets remain unreconstructed in vacuum. Under a specific reaction environment, the Au atomic columns on the topmost and second topmost {100} layers shift to peculiar positions. In the reconstructed surface the Au atoms on the topmost surface layer form an undulating hexagonal lattice, while those on the second topmost surface layer form a normal square lattice with slight distortion.

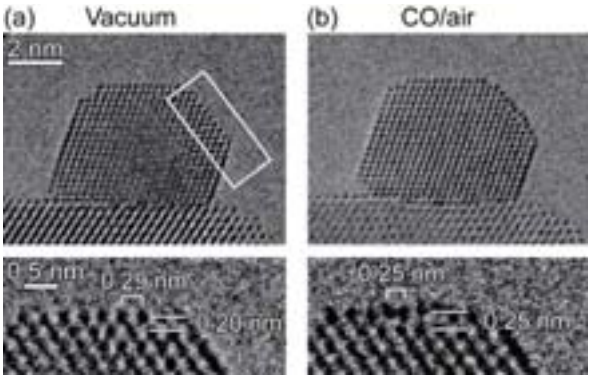


Fig. 2 Aberration-corrected ETEM images of a GNP supported on CeO_2 in (a) a vacuum and (b) a reaction environment (CO/air). The enlarged images of rectangular regions in vacuum and in CO/air are shown at the bottom. Au{100}-hex reconstructed surface appeared under catalytic conditions.

Under the specific reaction environment, an unusual contrast appeared on the reconstructed facet of a GNP (Fig. 3(b), (c)). An image simulation was performed in combination with ab initio electronic calculations with regard to CO adsorption on the Au{100}-hex reconstructed surface. A simulated image (Fig. 2(d)) based on an energetically favorable model for CO adsorption that is superimposed on the simulated image fit well with the observed image. Hence, we have now obtained a convincing atomistic view about the adsorption of CO molecules onto the supported GNP catalysts.

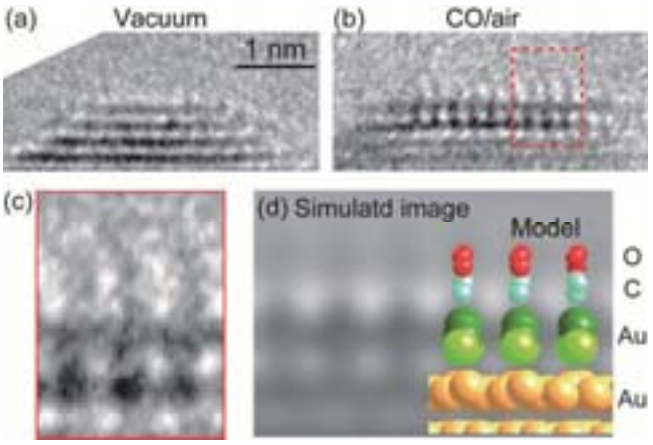


Fig. 3 Adsorbed CO molecules on a Au{100}-hex reconstructed surface under catalytic conditions. Aberration-corrected ETEM images in (a) a vacuum and (b) a reaction environment. (c) The enlarged image in the rectangular region in (b). (d) A simulated image based on an energetically favorable model. The model is superimposed on the simulated image.

Department of Theoretical Nanotechnology

Professor:	Tamio OGUCHI
Associate Professor:	Koun SHIRAI
Assistant Professor:	Kunihiko YAMAUCHI
Guest Professors:	Akira YANASE, Hiromitsu MOTOKAWA
Visiting Professor:	Ole Martin LØVVIK (2012.2.29-2012.3.29)
Post Doctoral Fellows:	Hongbin HUANG (-2012.3.31), Mitsuru KODERA (-2012.3.31)
Graduate Students:	Naoki UEMURA, Yuji TANAKA, Takayoshi FUJIMURA, Shouhei KOMORI, Takuya UEDA
Research Student:	Jagadeesh SURIYAPRAKASH (2010.10.1-2011.9.27)
Undergraduate Student:	Masataka DEGUCHI
Supporting Staff:	Minako KAKIUCHI

Outlines

We currently study the electronic structure of various kinds of solid and surface systems on the basis of first-principles calculation for the prediction of materials properties. Clarifying the underlying electronic mechanisms, we endeavor to design new materials with desired properties. The development of related theory and first-principles calculation methods is also carried out.

Current Research Projects

Development of first-principles calculation methods

The all-electron full-potential linearized augmented plane wave (FLAPW) method is well known as one of the most precise first-principles electronic structure calculation methods. We have developed some numerical schemes and codes based on the all-electron FLAPW method. Recently, we have proposed a stress-tensor formula, which is quite efficient for structural optimization and elastic-constant calculation. In FY2011, the formula was further generalized within the generalized gradient approximation and its numerical accuracy was examined by calculating pressure and elastic constants for several transition metals and their compounds.

Rashba effect of Bi films

Rashba effect is the spin splitting phenomenon seen in a 2-dimensional free electron system under an electric field and expected to be a new mechanism to realize and control spin without magnetic field in the field of spintronics. Recently, Rashba effect has been observed for some surface systems by angle-resolved photoemission experiments and its electronic mechanism has been successfully explained by means of group theory. We have performed first-principles calculations for Bi film systems with several kinds of thickness and compared their electronic structure including Rashba-split surface states, quantum well states, and energy gaps, with angle-resolved photoemission spectroscopy experiments done

by a Tohoku-University group [paper 2].

Electronic structure and magnetism of A-site ordered transition-metal perovskites

The transition-metal oxides reveal several novel electronic properties originating from the localized and itinerant nature of the *d* orbitals of transition-metal ions. In particular, the crystal field and hybridization with oxygen 2*p* orbitals may change owing to the local structure around the transition-metal sites, leading to a variation in the properties. We focus on some transition-metal oxides with the A-site ordered perovskite-type structure $AA'_3B_4O_{12}$ and investigate their electronic structure and magnetism by using first-principles calculation. It is known experimentally that, as temperature is decreased, $CaCu_3Fe_4O_{12}$ shows a charge disproportionation transition of $Fe^{4+} \rightarrow Fe^{3+}$ and Fe^{5+} at T=210K. Recently x-ray absorption spectroscopy (XAS) and x-ray magnetic circular dichroism (XMCD) measurements have been carried out to confirm a ferrimagnetic ordering of Fe and Cu spins. We have found a stable ferrimagnetic solution, where the spin magnetic moment of Cu is opposite to that of Fe. We have also computed the XAS and XMCD spectra at the Fe-L, Cu-L, and O-K edges, which reproduce well the experimental XAS and XMCD spectra. The experimental and theoretical O-K edge spectra clearly indicate the existence of O-2*p* holes and strong hybridization between O-2*p* and Fe-3d orbitals, which may be a clue to understand the electronic states involved in the charge disproportionation transition.

Materials design utilizing atom dynamics

DFT calculations treat the ground states of materials at T=0. Of course, all experiments are performed at finite T. Integrated study of the ground-state properties and atom dynamics is one of the main research subjects in our group. In this year, progresses have been achieved in the following issues.

Crystals of boron are candidates for high T_c superconducting materials. Before, the phase diagram of boron was not known, so that experimentalists had difficulty for synthesizing materials. We predicted for the first time the phase diagram of boron several years ago. In this time, the correctness of the predicted phase diagram has been proven experimentally [paper 7]. Not only this, also the mechanism of the insulator-metal transition has been clarified. For achieving the superconductivity of boron at normal pressure, heavy doping is needed, but this was very difficult experimentally. Our calculation shows why this is difficult. Moreover, a method to overcome this difficulty has been proposed. The idea is use of high pressure for doping of soft matter into hard materials [paper 9].

Multiferroics and magnetoelectrics

Multiferroics are the systems that show both magnetism and ferroelectricity. It has been reported that the asymmetric *p-d* hybridization under spin-orbit coupling (SOC) is responsible for the magnetically-controllable electric polarization, i.e. magnetoelectric (ME) effect, observed in $Ba_2CoGe_2O_7$. After looking for novel material which shows such ME effect, we found a relevant ME mechanism in magnetite Fe_3O_4, where the polar charge-ordering pattern (with *Cc* space group) induces large ferroelectric polarization, while SOC gives rise to small ME effect, modifying the net polarization. [paper 5]

Department of Soft Nanomaterials

Professor:	Yoshio ASO
Associate Professor:	Yutaka IE
Assistant Professors:	Makoto KARAKAWA, Masashi NITANI
Research Fellow:	Masaru ENDOU (2011.4-2011.10)
Graduate Students:	Jianming HUANG, Masashi UETA, Aya KOJIMA, Seihou JINNAI, Kazunari TANAKA
Supporting Staffs:	Keiko YAMASAKI , Misayo UMEDA Takeo MAKINO

Outlines

The main subject in the Department of Soft Nanomaterials is the development of novel molecular-based materials with promising electronic and photoelectronic 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, and (2) functionalized molecular wires and metal-electrode-anchoring units applicable to molecular electronic devices.

Current Research Projects

Organic electronics materials

We have developed organic materials for n-type field-effect transistors (FETs). It has been known that the introduction of electron-withdrawing groups into pi-conjugated systems increases their n-type character. We have designed carbonyl-bridged bithiazole and synthesized their based conjugated oligomers. On the basis of these findings, we have developed electronegative pi-conjugated compounds based on darbonyl-bridged bithiazole and alkyl-substituted dioxocyclopentene-annelated thiophene as a candidate material for solution-processable n-type OFET transistors. [Original Paper 1] (Fig. 1). Their cyclic voltammetry measurements indicate fairly low LUMO levels, and

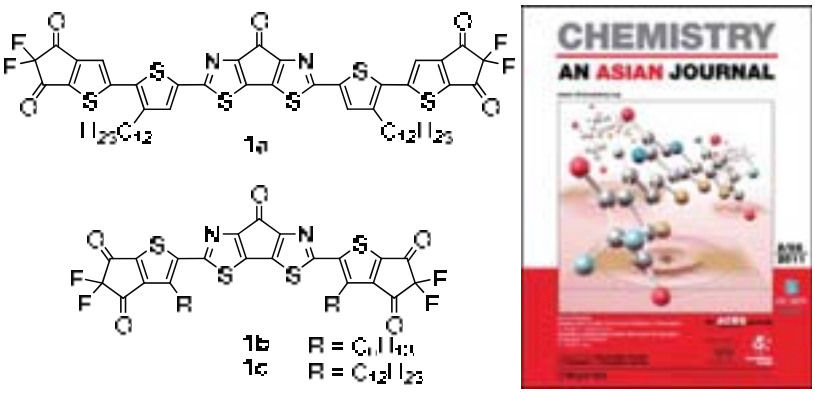


Fig. 1. Electronegative oligomers based on carbonyl-bridged bithiazole.

their FET devices showed high n-type FET performance and air-stable operation as our expectations.

New buckminster fullerene derivatives were synthesized to refine a relationship between substituent structures and miscibility concerning for making an ideal *p-n* junction for organic photovoltaic cells. We started to synthesize three kind of $PC_{61}BM$ analogous and evaluated an effect of the substituent at fulleropyrrolidine derivatives. Photovoltaic parameters drastically changed with types of substituents at the *N*-1 position of the pyrrolidine ring. The cells of fullerene derivatives with a phenyl group at the *N*-1 position (Fig. 2) show over 10 times higher photovoltaic performances up to 2.41 % than that of cells using fullerene derivative with an alkyl group at the position. We thus investigate about relationships between novel fulleropyrrolidine derivatives and device configurations. Photovoltaic cells based on fullerene derivatives with alkyl groups at the *N*-1 position were then significantly improved from 0.02 to ca. 2.0 % with device structure changed. We have found the mechanism to improve the photovoltaic performances using novel fulleropyrrolidine derivatives. Our results suggest the concepts to design and to synthesis of promising acceptor materials for the OPV cells.

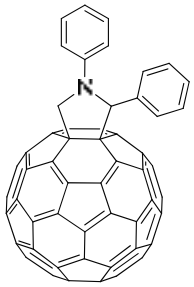


Fig. 2 novel fulleropyrrolidine derivative

Molecular electronics materials

In the field of molecular electronics, it is highly important to develop new molecular wires. In this context, we have designed and synthesized completely encapsulated oligothiophenes ***n*T** and **HS-*n*T-SH** to investigate single-molecule conductance [Original Paper 5] (Fig.3). The complete encapsulation of the conjugated backbone and the high co-planarity of the thiophene rings were unambiguously revealed by X-ray crystallographic analysis. UV-vis absorption spectra also indicated that effective conjugation is maintained in these oligomers. Despite the presence of the encapsulating unit, these molecules are electrochemically active in cyclic voltammetry measurements. UV-vis-NIR measurements of oxidized species revealed the absence of intermolecular interactions between the conjugated backbones. The conductance of a single-molecule junction was measured by modified scanning tunneling microscope techniques, and the decay constant was successfully determined to be 1.9 nm^{-1}.

Fig 3. Chemical structures of encapsulated oligothiophene molecular wire.

Department of Bionanotechnology

Professor: Masateru TANIGUCHI
Assistant Professors: Hiroyuki TANAKA, Makusu TSUTSUI
Supporting Staff: Noriko FUJIBAYASHI

Outlines

This research group aims to develop a new biosensing platform based on biomimetic nano-architecture for future medical diagnosis. Our strategy is based on electrical detection of single molecules or particles using a pair of sensor electrodes with a nanometer separation. We have developed nano-fabrication processes to form several-nanometer-sized electrode gap in nano-fluidic channels, the structure of which mimics ionic channels in biological systems. This solid-state device can be used as a useful tool to characterize the electrode-molecule link chemistry, local heating, chemical reactions, and translocation dynamics of single-molecules passing through the nano-channel. We have also been working on single-molecule observations and manipulations of DNA and other biologically important molecules using a scanning electron tunneling microscopy. To bring the single-molecule science in industries, we are creating new single molecule technologies for future development of Single-Molecule Total Analysis System (SM-TAS). Current research topics include: Development of electrode-embedded nanochannel single-molecule detectors; Scanning probe microscopy observations of single-biomolecules; Electrical DNA sequencing using solid-state nanopores; Development of single-molecule energy harvesting devices.

Current Research Projects

Transverse electric field dragging of DNA in a nanochannel

Single-nucleotide identification via transverse electron transport is a promising physical approach for high-speed and low-cost genome sequencing. Combining this capability, sensing-electrode-embedded solid-state nanopore is considered as a promising detector structure offering prospects for $1000 genome. Despite the huge potential, fabrication of a molecular-scale nanoelectrode-nanopore has been a formidable task that requires atomic-level alignment of a few nanometer sized pore and an electrode gap. Here, we developed a self-alignment technique to reproducibly form a nucleotide-sized nanopore-nanoelectrode solid-state device compatible with silicon integrated circuit technology (Fig. 1). We demonstrate single-molecule counting of nucleotide-sized metal-encapsulated fullerenes in a liquid by tunnelling current using the electrode- integra-

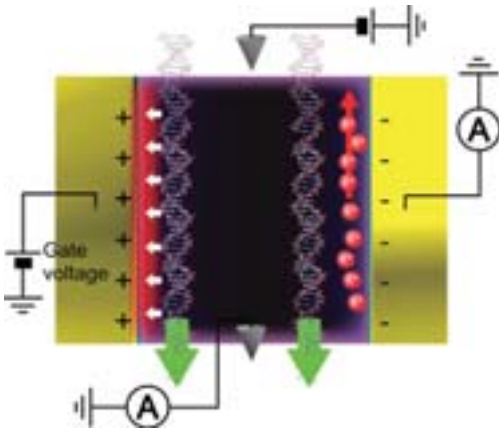


Fig.1 Schematic illustration depicting transverse electric field dragging of DNA molecules flowing through the nanochannel.

ted nanopore sensor. We also performed electrical identification of nucleobases in a DNA oligomer. Unlike the conventional cross-plane configuration of nanopore detectors, the in-plane device geometry is amenable to integration of additional functionalities such as gate control of DNA translocation speed and single-molecule tracking by fluorescence imaging, thereby suggesting the potential use of this synthetic electrode-in-nanopore architecture as a unique platform for the electrical DNA sequencing.

Unsymmetrical heating by hot electron in a current-carrying quasi-ballistic nanocontact

Understanding and control of heat dissipation in nanoscale structures is one of the key issues in development of nanoelectronics. Unlike diffusive electron transport in macroscopic systems, electrons are allowed to transmit through atomic/molecular conductors without being scattered by phonons or defects. Energy dissipation in this quasi-ballistic regime is of practical importance from viewpoint of evaluating the atomic/molecular device energy efficiency and current carrying capacity. Here, we address this intriguing issue by exploiting a novel nanostructured temperature sensing system that enables us to directly assess electrical heating in a quasi-ballistic gold single-atom junction. We found asymmetric electrical heating effects in the essentially symmetric single-atom contact. We simultaneously identified the voltage polarity independent onset of local ionic heating at ∓0.01 V by conducting the inelastic noise spectroscopy. As a result, we revealed significant heat dissipation by hot electrons transmitting ballistically through the single-atom junction that creates a hot spot at the current downstream. This new technique can be used as a platform for studying heat dissipation and transport in atomic/molecular systems.

Molecular rotation in self-assembled multi-decker porphyrin complexes

Alkyl chain-substituted multi-decker porphyrin (a cerium double-decker porphyrin (CeDDP) and a lanthanum triple-decker porphyrin (LaTDP)) complexes were arranged in a monolayer array on Au(111) substrate. By using a pulse injection deposition method, both multi-decker complexes were deposited on the surface intact to form a well-defined two dimensional array. Low-temperature scanning tunneling microscopy (STM) allowed to measure the topographic heights of the multi-decker porphyrin complexes, and to visualize their internal structures clearly. The STM images suggest that the top porphyrin ligand in CeDDP rarely rotates under nondestructive imaging condition, while the top porphyrin ligand in LaTDP exhibits flip-flop rotation even under the nondestructive imaging condition at sub-pA tunneling currents (Fig. 2). These results provide the future applications of molecular- scale mechanical machines and single molecule storage memory.

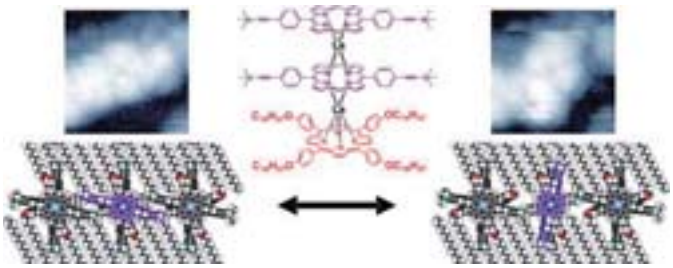


Fig. 2 Schematic illustration and STM images of the triple decker porphyrin.

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 focused on recently discovered compound $Bi_{2-x}Sb_xTe_{3-y}Se_y$ which has the lowest residual bulk conductivity among known topological insulators.

Current Research Projects

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 naturally exists on the surface of a *topological insulator* (TI), 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 (spin-momentum locked surface state). 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 practical utilization of the spin transport properties remains challenging. It is therefore important to develop suitable device designs for electrically detecting the surface spin currents, based on the deep understanding of topological insulator materials. Known TIs such as Bi_2Se_3 and Bi_2Te_3 have a relatively large bulk conductivity which prevents reliable detection of the surface transport. Recently we found a new topological insulator $Bi_{2-x}Sb_xTe_{3-y}Se_y$, in which the surface-dominant transport has been achieved for the first time in bulk single crystals of TIs. Using this material, we pursue an idea of detecting the spin currents on the surface of TI by fabricating diode-like devices (Fig. 1A) on small exfoliated pieces of $Bi_{2-x}Sb_xTe_{3-y}Se_y$, where spin-polarized electrons from ferromagnetic contacts will be filtered by the surface state depending on match or mismatch to the spin polarization of electrons at the surface of the sample.

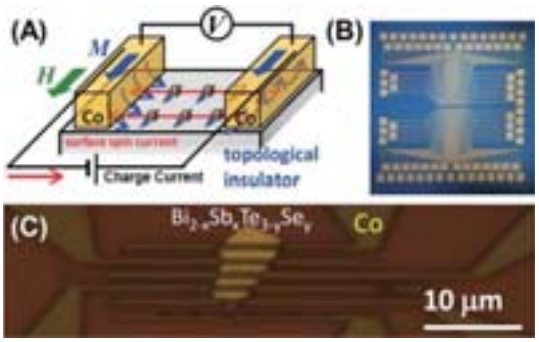


Fig. 1 (A) Schematics of a spin diode device with ferromagnetic contacts, Co, on the surface of a topological insulator. (B) Cr/Au electrodes made with photo lithography. (C) Cobalt contacts on an exfoliated piece of Bi_2-xSbxTe$_{3-x}$Se$_x$ fabricated with *e*-beam lithography.

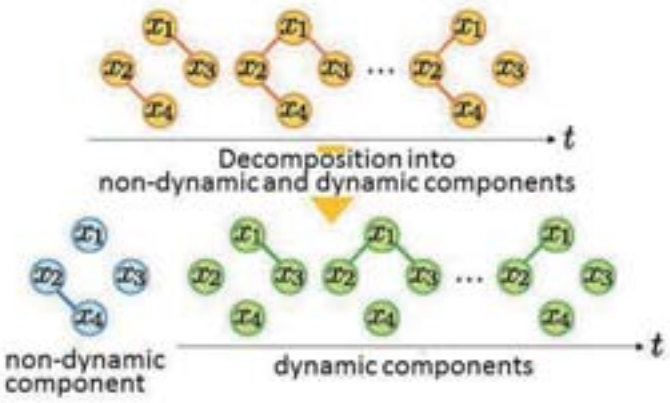
Department of Nano-Intelligent Systems

Professor: Takashi WASHIO

Outlines

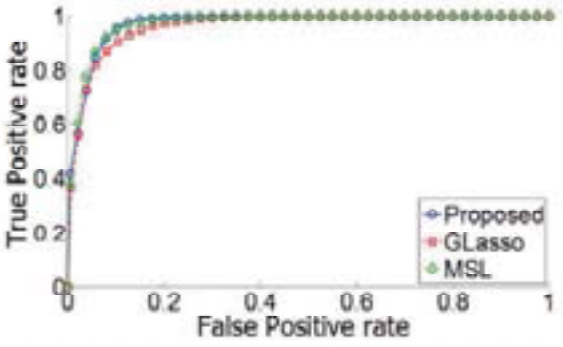
Massive data are being accumulated in nano-technology study along the development of experiment and measurement techniques. However, the fast extraction of meaningful knowledge from the massive data is difficult due to the limitation of human analyst's ability. To address this issue, we develop methods 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 novel mathematical criterion and a new algorithm implementing the criterion to derive further accurate estimation from a sample distribution and likelihood provided by the large scale non-stationary experimental results and the positive semi-definiteness.

Current Research Projects



Relations between states on state density matrices.

	Best AUC
Proposed	0.97
GLasso	0.96
MSL	0.97



Comparisons of estimation accuracy between our new method and conventional methods.

Department of Nanodevices for Medical Applications

Professor: Kazuhiko NAKATANI

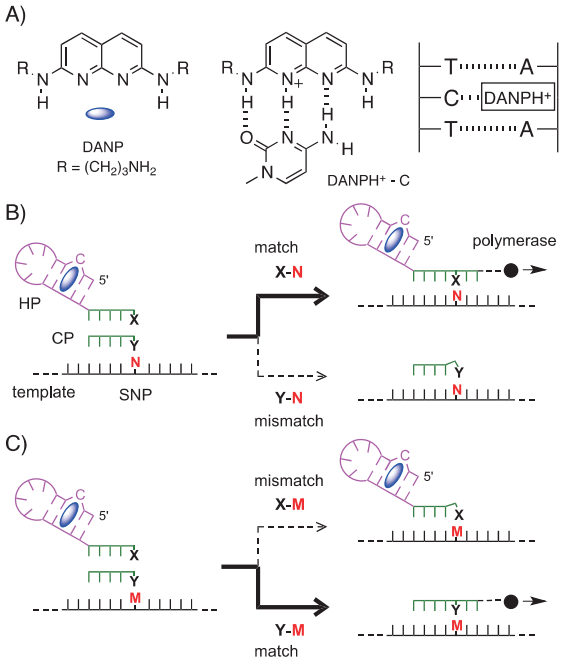
Outlines

We are developing novel method and devices for rapid, simple, and cost-effective detection of genetic mutations on the basis of a proposal of new concept.

Current Research Projects

Development of Technology for Single Nucleotide Polymorphisms (SNP)

The technique for promptly detecting the genetic mutation is expected as a basic technology that supports the personalized medicine. We have reported a new SNP typing method based on DNA secondary structure-inducible ligand fluorescence. In this SNP typing method, the hairpin tag is unfolded by a PCR and is transformed into a duplex. As a result, the primer losses of the DANP binding sites, and the fluorescence intensity decreases. This time, we have focused on the method to improve the allele specificity of the PCR using hairpin primers with competitor primers, and the SNP alleles are discriminated by fluorescence. The allele-specific hairpin primer PCR (AS-HP-PCR) method is the simple method to increase the allele specificity without optimized a PCR conditions. The allele specificity is dramatically increased by this method.



This research is collaborative research with assistant professor Dr. Fumie Takei in department of regulatory bioorganic chemistry.

Department of Nanosystem Design

Guest Professor: Hideaki TAKAYANAGI (2011.7.1-2011.9.30)

Outlines

Low-temperature electronic state in organic field-effect transistors

Achievements

The guest professor has been leading the academic area of quantum devices which controls electronic coherence at very low temperature, especially minimizing the structure sizes of clean semiconductors and superconductors. Recently his activity focuses on LED-controlled superconducting qubits for quantum computing. We have shared these fundamentally new concepts in the opportunities of various seminars and informal discussions. Since organic semiconductors are found to realize the band transport at low temperatures recently by the group in ISIR, the research project started aiming at future possibility of controlling the coherence in electrons in organic semiconductors. Their advantage includes small spin-orbit coupling and geometrical advantage of the bottom-up processes to realize self-assembled devices with enhanced controllability. As the result, we have found a new molecular design that enables Aharonov-Bohm interference within the single molecule, so that incident magnetic field sensitively gates the current the device actively for logic circuitry.

In addition, a presentation titled “Optic and electronic coherence for next-generation novel quantum devices” was given on May 27 2011 as an introductory seminar that actually stimulated young researchers and graduate students with their growing interest in the field.

Department of Nanosystem Design

Guest Associate Professor: Masamichi SAKAI (2011.7.1-9.30)

Outlines

So far, we have fabricated Yttrium dihydrides (YH2), aiming at producing quasi-zero Hall coefficient materials, which is considered to generate the transverse mass flow accompanied with no electrical charge under the presence magnetic field applied perpendicular to longitudinal current. The mechanism of the charge-less flow is based on the simultaneous presence of electrons and holes each having the approximately same densities and mobilities. In addition to the quasi-zero Hall coefficient characteristic, considerable spin polarization of mobile carriers is indispensable for generation of pure spin current. Our approach employs the Pauli paramagnetism for carrier spin polarization. Since an increase in density of state at the Fermi level in the conduction band would increase the Pauli paramaginetism-induced spin polarization, incorporation of gadolinium (Gd) into YH_2 is considered to be useful for generation of spin current using the quasi-zero Hall coefficient characteristic.

Achievements

The alloys of gadolinium and yttrium ,Gd_xY_{1-x}, were prepared by electron-beam deposition, and were subsequently hydrogenated so that $Gd_xY_{1-x}H_2$ (x=0.18～0.79) were obtained. It was observed that the lattice constant of $Gd_xY_{1-x}H_2$ increases almost linearly with increasing *x* value, indicating Vegard's law. The Hall effect in $Gd_xY_{1-x}H_2$ (x=0.49) clearly shows anomalous Hall effect, which is very similar to the magnetization curve observed in this alloy, indicating the presence spin-polarized carriers under an external magnetic field. The anomalous Hall coefficient is derived to be $Rs=5\times10^{-9}$ m^3/C at 300 K and $Rs=1.2\times10^{-8}$ m^3/C at 77 K. The ordinal Hall coefficient in $Gd_xY_{1-x}H_2$ (x=0.49) is also determined to be $R_H=7.9\times10^{-12}$ m^3/C at 300 K and $R_H=-1.5\times10^{-11}$ m^3/C at 77 K, manifesting the quasi-zero Hall coefficient characteristic as observed in YH_2. It follows from these results that $Gd_xY_{1-x}H_2$ (x=0.49) could be a preferable material for generation of pure spin current under the presence of an external magnetic field.

Department of Nanosystem Design

Guest Professor: Fumitoshi KAKIUCHI (2011.11.16-2012.3.31)

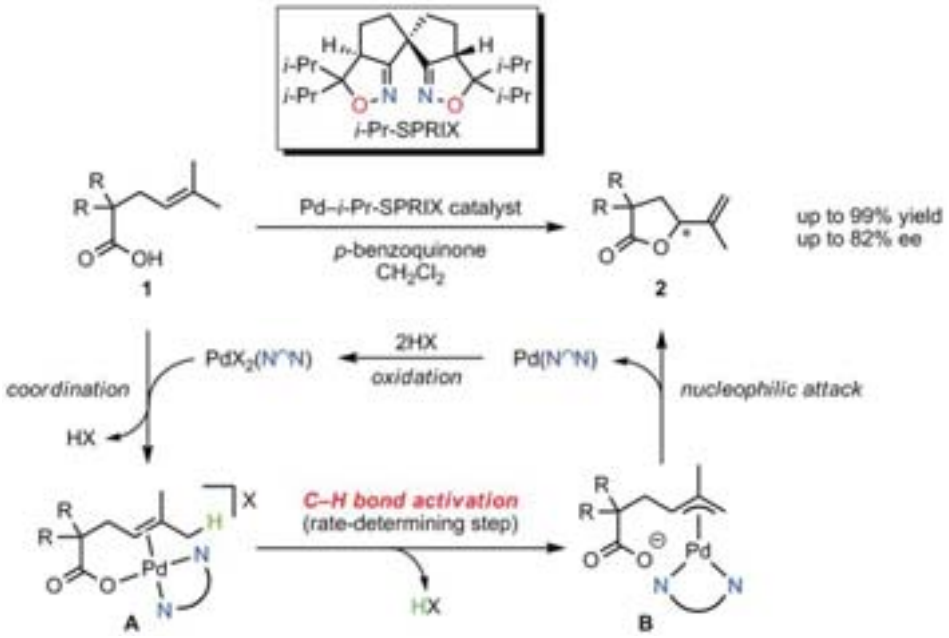
Outlines

Asymmetric catalysis has been generally recognized as the most environmentally benign methodology for the preparation of optically active compounds. Recently, direct C–H bond functionalizations assisted by a transition metal catalyst have received considerable attention from a standpoint of eco-friendliness as well as scientific interest. In this study, we tried to develop enantioselective catalysis via a C–H bond activation, which was expected to be an ideal catalytic asymmetric synthesis.

Achievements

Development of enantioselective synthesis of *γ*-lactones by cyclization of 4-alkenoic acids via an oxidative allylic C–H activation

Enantioenriched *γ*-lactones are known to be a useful compound in various fields. Their synthetic methods reported so far require a multistep process and/or provide a significant amount of byproducts. We have successfully developed a green protocol for the preparation of *γ*-lactones **2**, which is based on an enantioselective cyclization of 4-alkenoic acids **1** promoted by a Pd catalyst. The SPRIX ligand developed in Prof. Sasai's group was pivotal in acquiring optically active products **2**. The detailed mechanistic studies revealed that this new reaction proceeded via a key *π*-allyl Pd intermediate **B** generated by the activation of an allylic C–H bond (Scheme 1).



Scheme 1. Enantioselective Synthesis of *γ*-Lactone **2** via Direct C–H Esterification Promoted by Pd–SPRIX Catalyst

Department of Nanosystem Design

Guest Associate Professor: Hiroaki NISHIKAWA (2011.12.1-2012.3.31)

Outlines

Fabrication of functional metal oxide nanostructures and their application for the energy saving devices

Achievements

Development of nanodevices based on functional oxide materials has been conducted with the emphasis on the exploration of their potential application in nanoelectronics. The enhancement of device specifications for the energy harvester utilized the piezoelectric effects of traditional metal oxides, for example, $BaTiO_3$, has been attempted by the downscaling of device structures. The nanofabrication techniques of $BaTiO_3$ nanowire structure, which is a basic structure for the energy harvester, have been developed and established.

Department of Nanodevice Characterization

Professor: Hidekazu Tanaka
Guest Professor: Saket Asthana (2011.5.10-2011.7.29)
Specially Appointed Resarcher: Koichi Okada

Outlines

To obtain room temperature ferromagnetic semiconductor $(Fe,Zn)_3O_4$ and colossal magnetoresistance manganite nanodot channels embedded in a $BiFeO_3$ (BFO, ferroelectric) matrix, using nanoimprint lithography and self-assembled growth toward oxide nano-spintronics devices, which can control ferromagnetism by electric field with high efficiency at room temperature. Major achievements in this collaborated research include the followings:

Achievements

Ferromagneitc semiconductor $(Fe,Zn)_3O_4$ nanodot with a diameter of 500 nm are successfully fabricated by nanoimprint lithography, subsequent pulsed laser deposition and posit-annealing. Well shaped and position-defied $(Fe,Zn)_3O_4$ nanodots were confirmed by scanning electron microscopy, as shown in Fig. 1. Nanostructure formation based on nanoimprint lithography and room temperature deposition has been highly developed for functional oxide in this collaborated research. The guest has understood the fabrication techniques for nano-patterning during his stay and broadened his scope of reseach.

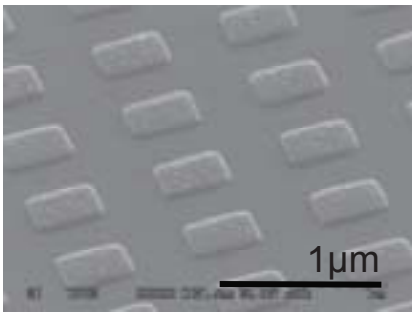


Fig. 1 Scanning electron microscopy image of $(Fe,Zn)_3O_4$ nanodot pattern.

The electric response of manganite ($Nd_{0.5}Sr_{0.5}Mn_{1-x}Cr_xO_3$) with charge order state was investigated. Resistance switching behavior was observed with reproducivility. Electrical switching has been successfully used as a probe to study the frustrated (phase separated) manganites, results will be published soon.

Department of Nanodevice Characterization

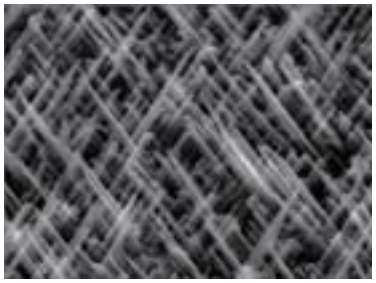
Guest Professor: Xiaomin Li(2011.8.1 ～2011.9.30)

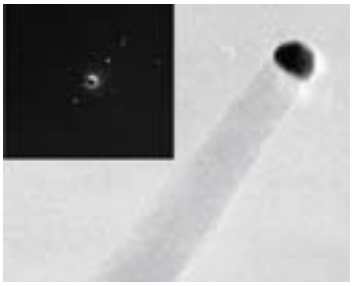
Outlines

An inorganic nanowire structure of having low order former nature attracts attention very much in recent years not only from basic science interest but from a viewpoint of nano device application. Since these nanowire structures are composed of itself, creating the device group in the size domain which exceeded the micro fabrication limit far is expected. In this research, composition and creation of new functional oxide nanowire were tried.

Achievements

In order to form a one-dimensional nanowire structure, moreover, it is necessary to introduce anisotropy into crystal growth intentionally and to specify the size strictly. Gas, a liquid, and solid (VLS) reaction method are the techniques of realizing one-dimensional single crystal nanowire through a metal catalyst, and attracts attention very much in recent years. By this technique, while there is a big advantage that the diameter of nanowire is controllable by number nanoscale by specifying the size of a catalyst strictly, it becomes possible by controlling that spatial location to form a desired material in arbitrary positions. Thus, although the VLS method was a very interesting technique, the point that the material group which can be used by an interaction with a catalyst will be limited was a big problem. Then, it tried to form into one-dimensional single crystal nanowire TiO_2 which is a classic case of a functional oxide material here using the VLS method. From the design manual based on a formation mechanism, this problem was tackled by the new technique of having controlled the flux of a metal kind, and the flux of the oxygen kind independently. As a result, it found out TiO_2 single-crystal nanowire being formed and getting in a very narrow window. As a major factor which succeeded in nanowire structure, having controlled the cation anion amount of supply in the narrow range precisely is mentioned. Moreover, it has become clear that existence of the low metal kind of steam pressure is a major factor which bars nanowire structure from comparison with the calculation result using a molecular dynamics method. Thus, with the conventional technology, producing succeeded in the invention of difficult TiO_2 single-crystal nanowire. It becomes possible to develop to a new nano device by this TiO_2 single-crystal nanowire.





Department of Nanodevice Characterization

Guest Professor: A. K. M. Akther Hossain (2011.10.3-2011.12.27)

Outlines

Research for exotic oxide spintronics devices with three dimensional nano-structures

Achievements

This research focuses on functional oxide materials showing huge response against external fields such as temperature, light, electric and magnetic fields, and aims to establish techniques for controlling dimensionality and position in nano-scale space concerning optimal oxide materials. Within this period, electronic and magnetic properties in various Fe-based magnetic oxides were investigated to find whether their magnetic oxides have proper properties for nano-spintronic devices, and some knowledge for transport properties with applying magnetic fields could be obtained.

Department of Nanodevice Characterization

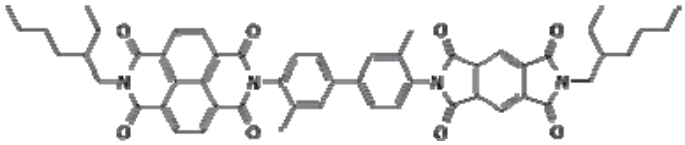
Guest Professor: Sung Sik KIM (2011.12.28-2012.2.28)

Outlines

Molecular switch, which controls distribution of localized charge upon outer stimuli such as photoexcitation, is an important device in various supramolecular systems. The present research project aimed at the ultrafast switching using femtosecond laser excitation as stimuli to the molecular system. In the present study, molecular design and synthesis of a novel dyad molecule for molecular switch with optimized functionalities have been carried out. The target molecules were successfully obtained.

Achievements

We have already reported that the molecular switches can be synthesized using imide compounds as components due to their high electron accepting abilities. Since radical anion of naphthaldiimides (NDI) exhibits a strong absorption band in the visible region, NDI seems to be suitable molecule for the investigation of the excited radical anion using femtosecond laser flash photolysis. On the other hand, pyromellitic imide (PI) possesses a strong absorption band upon reduction, in spite of the electron acceptor ability lower than NDI. Thus, we designed molecular switch, in which NDI and PI are connected by an adequate linker. For the optimization of the switching ability, the linker plays an important role. Thus, in the present study, we designed dyad molecules using several kinds of linkers. Finally, we successfully synthesized dyad molecules, which possess dimethylphenyl or demethylbiphenyl linker between NDI and PI. These molecules will be useful for the investigation of molecular switches.



Department of Nanodevice Characterization

Visiting Professor: Ole Martin LØVVIK (2012.2.29-2012.3.29)

Outlines

Thermoelectric materials have recently attracted much attention because of possible renewal energy applications. Pb-Te and Bi-Te systems have been widely used so far because of large thermoelectric figure of merit. Design and development of new materials with ubiquitous elements are now attempted owing to the critical-element arguments. We investigate the electronic structure of known thermoelectric materials and extract microscopic factors governing thermoelectric power on the basis of first-principles electronic structure calculations. Some possible applications of first-principles method in the materials-science field are also discussed.

Achievements

Electronic structure and thermoelectric properties of thermoelectric materials

According to the Boltzmann theory of transport in material, electric conductivity and thermoelectric power due to electrons are determined by the electronic states near the Fermi energy. It has been found in the previous works that Seebeck coefficient is governed by the energy derivative of the density of states at the Fermi energy. In the present study, we propose a possible mechanism to realize high Seebeck coefficients, in which the Fermi energy is shifted, for example, by introducing a gate structure in the thermoelectric device.

Applications of first-principles methods to materials science

It is well known that first-principles methods can be applied to a variety of materials systems and physical phenomena because of their general-purpose and non-empirical nature. We discuss some possible applications of the methods to solid-state and thin-film hydrogen-storage materials, solid oxide fuel cells, solar cells, etc.

Department of Nanotechnology for Industrial Applications

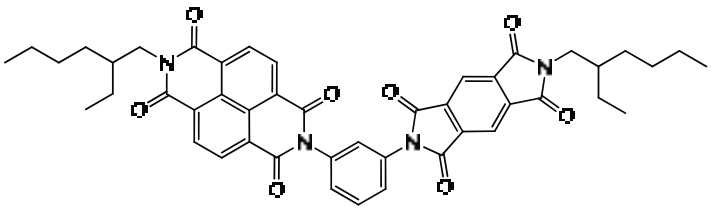
Guest Professor: Sung Sik KIM (2011.6.22-2011.8.22)

Outlines

Site-selective reaction is quite useful for the formation of nano materials. Multi-beam methods provides highly reactive intermediate only at the cross section of these beams, thus this method will be useful fabrication method in the field of the nanotechnology. In the present study, we have synthesized a novel molecule which can generate a highly reactive intermediate upon multi-beam excitation.

Achievements

The present research project aimed at the formation of highly reactive intermediate by means of multi-beam technique. For this purpose, the multichromophore arrays, in which several kinds of chromophores are connected by an adequate linker, were designed. The linker is essential for the realization of highly efficient reaction because the lifetimes of the reactive intermediates are expected to be very short. In the present study, imide compounds were selected as the chromophores, because imides exhibit the strong absorption band in the visible region upon reduction, which is useful to laser excitation. In addition phenyl was selected as a linker. Initially, *p*-diaminobenzene was used as a starting molecule for this purpose, but the reaction was failed due to strong electron accepting ability of imides. The target molecule was obtained by using *m*-diaminobenzene as a linker. This molecule will be useful for the study of highly reactive intermediate during multi-beam excitation.



Department of Nanotechnology for Industrial Applications

Guest Associate Professor: Hao Du (2011.10.1-2011.12.30)

Outlines

The aim of work is exchange the idea for second treatment on lotus-type porous metal, and discuss the potential effect of second treatment on properties, especially mechanical properties for lotus-type porous metal. The first research topic is if and how a metallic or ceramic coating can be deposited into pores of lotus-type porous metal successfully. The second research topic is the effect of the metallic or ceramic coating on the surface of pore wall on properties of lotus-type porous metal or the corresponding alloy.

Achievements

With cooperation with his colleagues in china, Dr. Hao Du achieved a deposition of Ni coating on inner surface of pores by electroplating for lotus-type porous copper with pore size of 0.6mm and pore length of 6mm, as shown in Fig.1. The thickness, thickness distribution along the pore length, and adhesion of the coating were characterized. It was indicated that the coating thickness distributes uniformly along the pore depth and about 3-5μm on the inner surface of the pores, which was much thinner than that on surface of the deposited samples. It was proved that the coating had a good adhesion to the pore walls even when the coated lotus-type porous copper was compressed to 80%.

The compressive properties of lotus-type porous copper deposited with a nickel coating on inner surface of pores were investigated. It was found that 0.2% yield stress increases from 23.0 to 30.2 MPa(Fig.2), while absorbed energy per volume from 68.5 to 96.0MJ/m^3 after depositing the nickel coating inside pores of lotus-type porous copper. The improvement on compressive properties by Ni coating was connected with the internal stress between coating and pore wall(copper substrate), the obstacle to slip line during deformation of pore wall, and energy release by coating crack. Furthermore, heat treatment on coated samples at 873 and 1023 K also caused a significant compressive property improvement compared with the original lotus-type porous copper(Fig.2), although there was a degradation than that without heat treatment, which was traced to internal stress release and defect refinement occurred in the substrate copper.

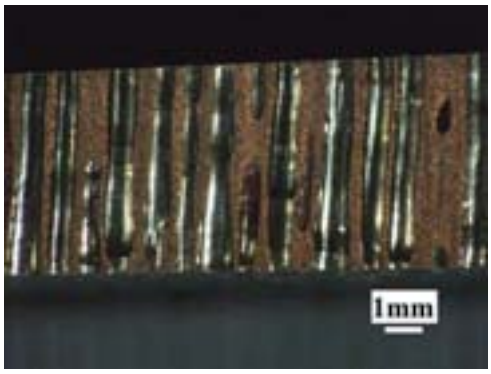


Fig.1. Optical micrograph of coated porous copper.

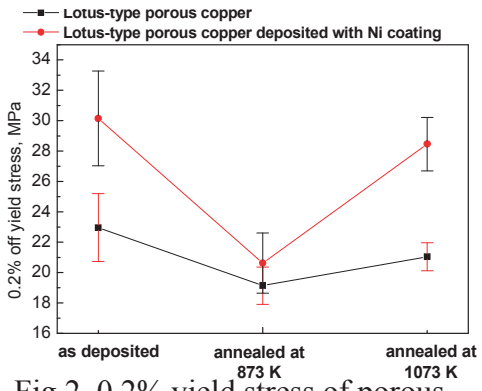


Fig.2. 0.2% yield stress of porous copper.

Department of Nanotechnology for Industrial Applications

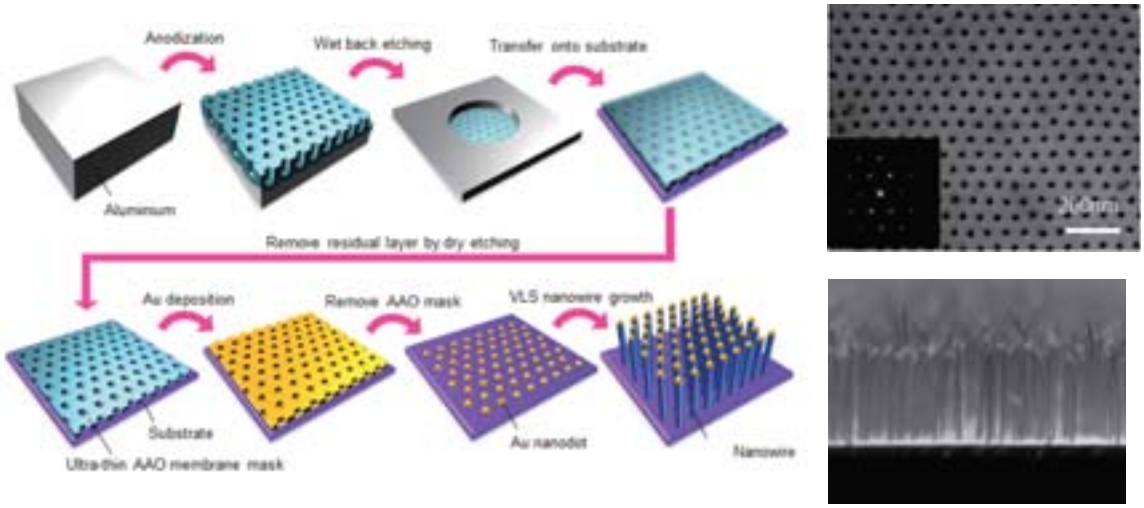
Visiting Professor: Xiaodong Fang（2012.1.20～2012.2.20）

Outlines

An inorganic nanowire structure formed in a self-set target is expected to the nanotechnology industrial application which exceeds a micro fabrication limit. However, it has been a subject of the bottleneck to control statistics distribution of its structure, physical properties, and function, when developing these to industrial application. Then, the technique of controlling the statistics distribution by this research theoretically was proposed, and the actual proof was tried.

Achievments

Vapor, liquid, and solid (VLS) reaction method are the techniques of realizing one-dimensional single crystal nanowire through a metal catalyst, and attracts attention very much in recent years. By this technique, while there is a big advantage that the diameter of nanowire is controllable by number nanoscale by specifying the size of a catalyst strictly, it becomes possible by controlling that spatial location to form a desired material in arbitrary positions. Thus, although the VLS method is a very interesting technique, the problem that the size distribution of the metal catalyst will be reflected to distribution of the diameter of nanowire formed directly is held. Then, the new technique using the anodization alumina membrane which can develop the metal catalyst size to the technique of moreover having single dispersibility in large area here was proposed. By this technique, use of the metal catalyst of single distribution in large area is attained according to the metal catalyst formation process through the ultra-thin membrane film controlled by 200 nm or less. The image was shown in the lower figure.
It became possible to control conventionally the statistics distribution which was a problem dramatically by using this technique.



Department of Nanotechnology for Industrial Applications

Guest Professor: Seog Kyu KIM (2012.2.21-2012.6.29)

Outlines

Charge transfer in DNA, so called B-DNA, has received great attention from many researchers over the past few decades from the biomedical and nanotechnological viewpoints. In contrast to B-DNA, the charge transfer in non-B DNA, which form unique structures rather than double helix of B-DNA, have not been studied. Here, I will study the charge transfer in G-quadruplex using the time-resolved spectroscopic technique.

Achievements

On the way to investigate electron transfer through G-quadruplex, we found an interesting electron transfer behavior for the F-5′-GG-NI-T-3′ oligonucleotide, where F denotes an electron donor, a riboflavin derivative, NI is 5-nitroindole (electron acceptor) and 5'-GG-NI-T-3′ is a part of the G-quadruplex forming sequence. The fluorescence lifetime and quantum yield of F decreased upon binding to 5′-GG-NI-T-3′, suggesting the charge separation between F and G-quadruplex.

Activities of Facilities

Open Laboratory

Professor:	Hiroaki SASAI
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 2011, the following 12 researchers used Open Laboratory.

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. Hirotaro MORI	Research Center for Ultra-High Voltage Electron Microscopy
Prof. Tomoji KAWAI	Institute of Scientific and Industrial Research
Prof. Hikaru 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
Prof. Seiji TAKEDA	Institute of Scientific and Industrial Research
Prof. Junichi TAKEYA	Institute of Scientific and Industrial Research

Nanofabrication Shop

Director: Hidekazu TANAKA
Technical Staffs: Shouichi SAKAKIHARA, Kimiaki TANIHATA

Outlines

Nanofabrication Shop was established in order to promote nanotechnology-related research by use of equipments and special skills for nanotechnology researchers and students belonging to ISIR. In addition, this shop fabricates nano-devices for the ISIR researchers and develops devices for researchers who want to apply those devices for their own experiments.

Activities

On demand fabrication requests

At the beginning of 2011, we established new fabrication condition in the second building of ISIR, and have utilized facilities belonging to Advanced Nanotechnology Instrument Laboratory. We have received requests from 10 laboratories in ISIR. Total number of their requests reached 62. Fig. 1 shows the transit of requests since 2005. It seems to reach to saturation number basically, but, since a major client left, requests number decreased by 38%.

Fig.1 The transit of requests since 2005.

In addition to conventional fabrication, we carried out isotropic dry etching of silicon layer by use of newly-introduced SF_6 gas. Utilizing selective etching by SF_6, only silicon layer under silicon oxide layer was etched, and then silicon oxide raft structures were obtained (Fig. 2).

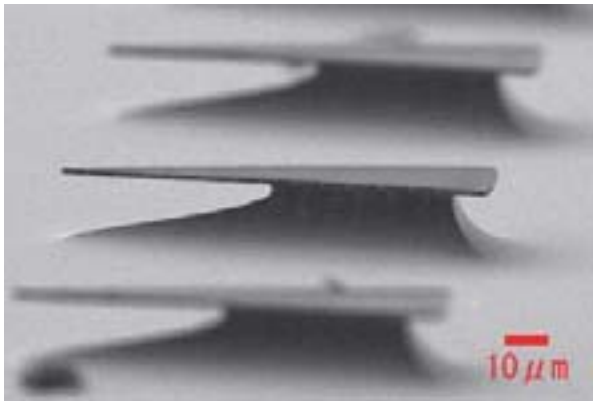


Fig.2 Silicon oxide raft structures.

Participation in “nanotech 2012”

We demonstrated a thin silicon film and a hologram, showed a panel introducing our activity in the booth of Nanotechnology Center in the international nanotechnology exhibition and conference “nanotech 2012” which was held on 15th to 17th of February in 2012.

Advanced Nanotechnology Instrument Laboratory

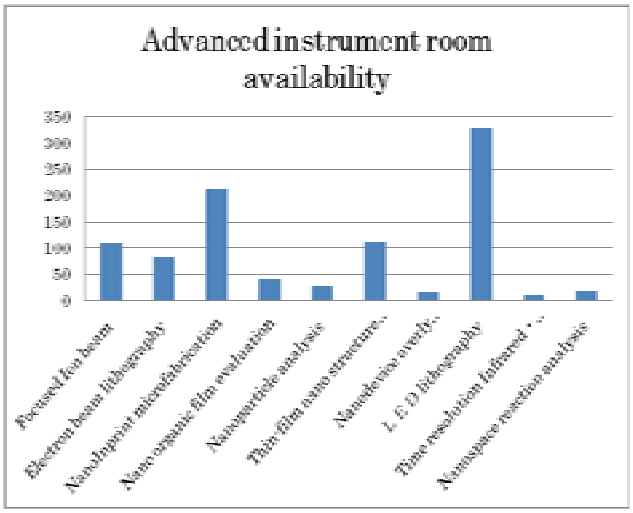
Director, Professor: Hidekazu TANAKA
Graduate Technical Staff: Michiko SAKUMA

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 Projects

The total usage count of each instrument in this year is summarized in the right panel. The number of experiments has increased from 633(FY 2010) to 961.
In particular, Focused Ion beam , Nanoimprint, and LED lithography are frequently used for nanofabrication. There has also been an increase of experiments using surface and structural analysis apparatus.



Department of Handai Multi-Functional Nanofoundry

Specially Appointed Professor:	Tomoji KAWAI
Specially Appointed Professor:	Seiichi TAGAWA, Hirotarou MORI
Professor:	Hedekazu TANAKA, Hidehiro YASUDA
Specially Appointed researcher:	Akihiro OSHIMA
	Akira KITAJIMA, Cong Que DINH (-2012.1.31)
Supporting staff	Miki KASHIWAKURA
	Kouji HIGUCHI
	Keiko ENMI

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 125 research themes in 2011.

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 Scientific 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.

Projects

Bring-up Handai Multi-Functional Nanofoundry

The 125 research themes have been supported in this project in 2011. 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 nano scale materials is acceptable in the Nanofoundry.

Fusion between Top-down and Bottom-up Nanotechnologies

For top-down and bottom-up nanotechnologies, lots of useful equipment such as EB lithography system, FIB-CVD 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
Specially AppointedAssistant Professor: Mitsuko NISHINO
Technical Staff: Takeshi ISHIBASHI, Takanori TANAKA, Tsuyoshi MATSUZAKI
Technical assistant Staff: Yoshio TAKAI, Hitoshi HANEOKA
Support Staff: Etsuko TANI

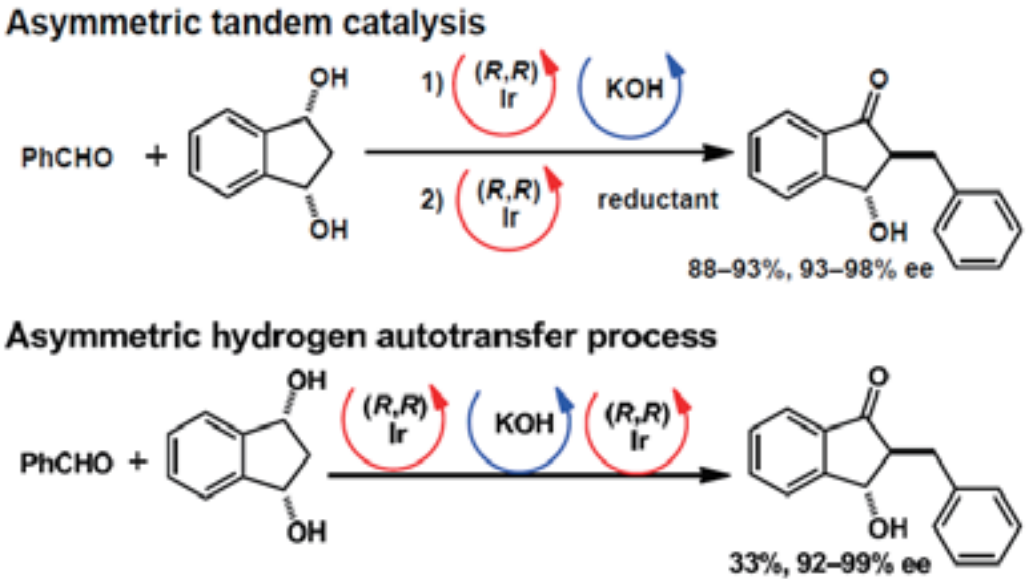
Outlines

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 Projects

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 tandem asymmetric reaction based on desymmetrization of *meso* diols. Furthermore, we found the asymmetric hydrogen autotransfer process proceeds in high selectivities.



Research Laboratory for Quantum Beam Science

Professor, Director: Goro ISOYAMA
Associate Professors: Yoshihide HONDA
Assistant Professors: Sachiko TOJO
Technical Staff: Kazuya FURUKAWA
Supporting Staff: Tamotsu YAMAMOTO, Akira TOKUCHI, Kumiko KUBO (2011.4.1-2012.3)
(Concurrent members)
Professors: Tetsuro MAJIMA, Yoichi YOSHIDA, Takahiro KOZAWA
Specially Appointed Professor: Seiichi TAGAWA, Masataka ENDO
Associate Professors: Ryuko KATO, Mamoru FUJITSUKA, Kiyohiko KAWAI, Jinfeng YANG
Assistant Professors: Kazuo KOBAYASHI, Keigo KAWASE, Takafumi KONDO, Takashi TACHIKAWA, Nobuyasu NARUSE, Akinori IRIZAWA Hiroki YAMAMOTO
Specially Appointed Assistant Professors: Koichi KAN, Kazuyuki ENOMOTO(-2011.9)

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)

According to the electric power saving campaign, an air-conditioning system in Linac building was stopped for more than 6 hours in daytime from summer to autumn. L-band electron linac was operated for 208 days, about 2,725 hours, with several operation modes. (Fig.1) Through the year, several troubles took place in the heat exchange section and the pump relating to the cooling system of the linac, insulators in the klystron tank and the modulator and a personal computer used in the controlling system, but these were all repaired or replaced. As a leakage of cooling water at the acceleration tube was increased due to replacement of the pump mentioned above, budgetary requests have been made for

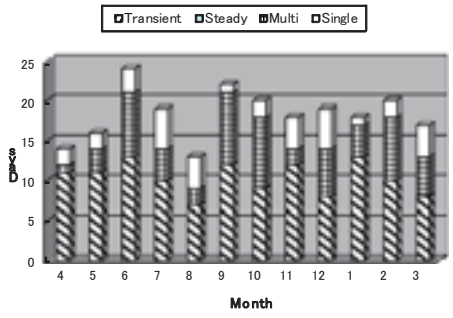


Fig.1 Progress of the operating days of L-band linac

Osaka University and ISIR to replace the acceleration tube. Concerning 150 MeV S-band electron linac, a new shielding against radiation was designed and equipped at the energy analyzer section to protect the laser used in RF-gun attached linac. However much radiation was not observed from there but from acceleration tubes. To suppress such dose, a new design and equipment of shielding for acceleration tubes were started. RF-gun attached S-band linac was operated for 104 days, about 1526 hours, for the use of research subjects. In this year, a high power charging power source was repaired. A grid pulser in the modulator and the regulator in cooling unit for klystron were replaced because of damage.

Cobalt-60 facility

Cobalt-60 facility was used in 172 days, 2901 hours, for 18 subjects, which were proposed not only by ISIR staffs but also by the member of other faculties, as shown in Fig.2. The new Cobalt-60 source was settled in this research and the area monitors were maintained.

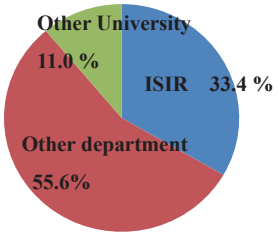


Fig.2 Percentage of Cobalt-60 user's affiliation.

Management (Joint use & Radiation safety management)

Accepted subjects relating to the joint-use facilities were 50 in total. Specially programmed academic meetings were held three times and the annual briefing session was held on March 8 in 2012. More than 350 guests visited our laboratory. About radiation safety management, the educational and training courses were opened to the new users in May. 189 researchers including students were registered as the occupationally exposed person. Special inspection by ourselves was made twice a year for radiation facilities in ISIR according to an ordinance. A new cobalt-60 γ-ray source was introduced on April 7.

Analysis of degradation process in polymer electrolyte membrane

The damage on the Nafion®117, Aquarian H87-10 and sulfonated poly(arylene ether sulfone keton) (SPESK) due to the selected radicals such as $OH^{\bullet}$, $H^{\bullet}$, $O_2^{\bullet-}$ produced by γ-irradiation were investigated mainly by positron annihilation spectroscopy (PAS) and solution analysis. The results showed that the damage was differently observed between the samples exposed to oxidative and reductive radicals, which was especially remarkable for perfluorinated sulfonic acid membranes. The change in proton conductivity showed that the reductive radicals affected membrane more seriously, and this was able to be regarded to the destruction of cluster structure by PAS. The decrease of proton conductivity and destruction of cluster including hydrophilic group was observed for SPESK exposed to both kinds of radicals, which was different from the results of perfluorinated sulfonic acid membranes.

Study of radical reactions in polymer electrolyte membrane with pulse radiolysis

The process of degradation of polymer electrolyte membrane has been studied on radiation quantum beam chemistry induced using pulse radiolysis technique. Nafion samples were prepared with substrate(S) loaded inside Nafion. The one-electron oxidation and $OH^{\bullet}$ addition of S were clearly observed in Nafion. The formation of $OH^{\bullet}$ adduct of S was decreased by decreasing the water content in Nafion. This suggests that $OH^{\bullet}$ is formed inside of the water-SO_3^- ionic clusters, mostly.

Center for Collaborative Research Education and Training

Director:	Professor Yoshio ASO
Head of Educational Affaires Board:	Professor Tamio OGUCHI
Board Members:	Professor Junichi TAKEYA
	Associate Professor Ryuko KATO
	Associate Professor Tsuyoshi NISHI
Head of International Affaires Board:	Professor Katsumi TANIMURA
Board Members:	Professor Kazuhiko NAKATANI
	Associate Professor Jinfeng YANG
	Assistant Professor Ikuhisa MITSUGAMI

Outlines

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

Outline

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, five 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.

PU-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

KU-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

POSTECH-PMR lab.

School of Environmental Science and Engineering/Department of Chemical Engineering (SES/DCE), Pohang University of Science and Technology (POSTECH), Korea, and the Institute of Scientific and Industrial Research (ISIR), Osaka University,

Japan, based on the agreement on academic exchange between SES/DCE and ISIR, established a collaborative laboratory on each side on photoresponsible materials research between both institutions.

1. TiO_2 photocatalysts
2. Visible-light responsible photocatalysts
3. Artificial photosynthesis by photocatalysts

UCL-ESS lab.

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

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

DLSU-ICT lab.

College of Computer Studies (CCS), De La Salle University-Manila (DLSU), and ISIR have established a cooperative research laboratory on information and communication technology (ICT) between both institutions. Its studies focus on empathic computing.

1. Several aspects of empathy in computing
2. User modeling based on physiological and other sensors
3. Adaptive user interfaces and machine learning

Nano-Macro Materials, Devices and System Research Alliance

Outline

The aim of "Nano-Macro Materials, Devices and System Research Alliance" is to endeavor strategic development of "Materials, Devices, and System" as a cooperative research project with Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Research Institute for Electronic Science, Hokkaido University, Chemical Resources Laboratory, Tokyo Institute of Technology, and Institute for Materials Chemistry and Engineering, Kyushu University in fiscal year 2010. This Alliance consists of four research groups; (1) Next generation electronics research group, (2) New energy harvesting materials and devices research group, (3) Medical treatment materials and devices research group, and (4) Environmental harmonized materials and devices research group. The collaborative research alliance through interuniversity research institutes aims to develop innovative materials and devices by linking nanoscopic and macroscopic worlds, toward the realization of safety and secure society.

The Nano-Macro Materials, Devices and System Research Alliance was being run under the Steering Committee of 5 member Institutes. The Committee members of FY2011 from ISIR were Prof. H. Asahi (Chair), Prof. A. Yamaguchi, and Prof. H. Tanaka. Our members of this Alliance were as follows.

(1) Next generation electronics research group
Prof. K. Matsumoto (Group Leader), Prof. H. Asahi, Prof. H. Tanaka, Prof. J. Takeya, Prof. T. Washio, Prof. Y. Ando, Prof. Y. Aso, Prof. T. Oguchi

(2) New energy harvesting materials and devices research group
Prof. H. Kobayashi (Group Leader), Prof. M. Numao, Prof. K. Tanimura, Prof. K. Suganuma, Prof. S. Takeda, Assoc. Prof. Y. Honda, Assoc. Prof. T. Suzuki

(3) Medical treatment materials and devices research group
Prof. K. Nakatani (Group Leader), Prof. Y. Yagi, Prof. R. Mizoguchi, Prof. N. Kato, Prof. K. Tanizawa, Prof. A. Yamaguchi, Prof. M. Taniguchi, Prof. T. Nagai

(4) Environmental harmonized materials and devices research group
Prof. Y. Yoshida (Group Leader), Prof. H. Nakajima, Prof. T. Majima, Prof. H. Sasai, Prof. G. Isoyama, Prof. T. Kozawa

Next Generation Electronics Research Group

Professors: Kazuhiko MATSUMOTO (Group Leader),
Hajime ASAHI, Yoshio ASO, Hidekazu TANAKA, Yoichi ANDO, Jun TAKEYA, Tamio OGUCHI, Takashi WASHIO

Outline

New functional nano-electronics mainly based on the semiconductor materials are targeted and their material characteristics, physical evaluation, device performance, etc. are analysed 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 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 antigen/antibody reaction using graphene FET was successfully developed. (Matsumoto).

On the basis of our strategy of designing and synthesizing novel π-conjugated molecular materials, we have focused our research on the development and evaluation of functionalized molecular wires and anchoring units applicable to molecular electronic devices. (Aso)

Functional oxides show unusually giant physical properties including ferromagnetism, giant metal–insulator transition, superconductivity, and others. To control their functionalities by external field, nano-structuring is quite effective toward construction of power saving devices and sensor devices. We have construct nano-heterostructured correlated oxides to effectively control their electron correlation. (Tanaka)

To develop innovative device principles to utilize novel quantum functionalities, we are studying topological insulators and topological superconductors using high-quality single crystals and top-notch measurements of basic physical properties. This year, we have succeeded in achieving the surface-dominated transport for the first time in a bulk topological-insulator crystal. (Ando)

A new technology is developed to fabricate high-performance transistor arrays of crystalline organic semiconductors. Typically one order of magnitude higher mobility is achieved so that the result offers fundamental breakthrough for low-cost and fast operating active-matrix panels. We actually demonstrate that liquid-crystal displays are driven by the matrices successfully. (Takeya)

First-principles studies to clarify the electronic mechanism for various materials properties are performed. Magnetic crystalline anisotropy of transition-metal multilayers and magneto-electric effects of multiferroics are investigated. (Oguchi)

A new estimation method to more accurately separate quantum states into invariant and variant components under condition changes in quantum experiments is developed. (Washio)

Current Research Projects

Fabrication of Diluted Magnetic Semiconductor Nano-Structures

In the GaGdN nano-rod structures the enhancement of magnetization perpendicular to the sample plane was realized by the structural magnetic anisotropy. InGaGdN/GaN multi-quantum disc structures were successfully fabricated. GaDyN/GaN tunnel magneto-resistance device structures were also fabricated.

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 phenomenon, CNT was surrounded by two dielectric layers of Si_3N_4/SiO_2 for the memory structure. In 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. By reducing the gate length down to 10nm, and all rounded structure was formed. In this device, one by one memory effect was observed even at room temperature. Using the smaller size of the device, single charge memory effect could be detected even at room temperature.

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 ~2nm, the FET showed 34times higher transconductance than measured from the backgate electrode. By modulating the surface of the graphene by the fragment antibody, antigen/antibody reaction was successfully detected electrically for the first time.

Molecular Electronic Materials

We have designed and synthesized a pyridine-based tripodal anchor unit to construct a single-molecule junction with a gold electrode. X-ray photoelectron spectroscopy measurements indicated a π-type physical adsorption of the anchor unit to the gold surface. The conductance of a single-molecule junction that consists of the tripodal anchor and a molecular wire was measured by modified STM techniques. By theoretical analyses of the transport mechanism, the participation of the π orbital of the anchor moieties and n-channel electric transport were predicted. We have also developed a series of oligothiophenes having homogeneously substituted encapsulating units that maintain the efficient conjugation of the π systems. Owing to the absence of intermolecular interactions between π-conjugated backbones, the electrical conductance of the single molecule determines the real decay constant of the oligothiophenes.

Construction of Transition Metal Oxide Nano Structured Devices

We discovered micro-scale phase separation in VO_2 thin films on TiO_2(001)

substrates and the abrupt resistive changes against temperature. Furthermore, we have constructed two-terminal multistate memory elements based on VO_2/TiO_2 thin film microcantilevers. Volatile and non-volatile multiple resistance states are programmed by current pulses at temperatures within the hysteretic region of the metal-insulator transition of VO_2. The memory mechanism is based on current-induced creation of metallic clusters by self-heating of micrometric suspended regions and resistive reading via percolation.

Basic Research of Topological Insulators and Superconductors

We discovered a highly bulk-insulating topological insulator compound $Bi_{2-x}Sb_xTe_{3-x}Se_x$, and by optimizing this material, we have succeeded in achieving the surface-dominated transport for the first time in a bulk topological-insulator crystal. Also, we discovered that the $Cu_xBi_2Se_3$ superconductor, which is an electron-doped topological insulator, is the first concrete example of a time-reversal-invariant topological superconductor that hosts Majorana fermions on the surface.

Active Matrix-panel using Solution-crystallized High-mobility Organic Transistors

High-performance active matrix panels are developed using transistor arrays of crystalline organic semiconductors fabricated through a novel solution-crystallization method. Their one order of magnitude higher mobility opens the way towards high-end flexible and printed electronics industry, so that the achievement is highly evaluated in the industrial community, being awarded as the Nanotech best project in 2012.

First-principles Studies on Materials Properties

We have investigated the spin-orbit driven magnetic crystalline anisotropy of transition-metal multilayers such as FePt and CoPt on the basis of first-principles calculations. The origin of the shape anisotropy is also studied. We have elucidated the microscopic mechanism for the ferroelectric polarization originating from spin-orbit coupling in multiferroic $Ba_2CoGe_2O_7$.

An Estimation Method of Quantum States for Quantum Experiments

Devices for quantum information processing have potential power enabling revolutional information processing. Quantum states satisfy a mathematical property named positive semidefinite. This study aims to develop an estimation method to separate quantum states into invariant and variant components under condition changes in quantum experiments. We obtained its world's first theoretical framework. 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.

New Energy Material・Devices Research Group

Professors: Hikaru KOBAYASHI (Group Leader), Katsuaki SUGANUMA, Katsumi TANIMURA, Seiji TAKEDA, Masayuki NUMAO, Tateyuki SUZUKI, Yoshihide HONDA

Outline

Silver nanowire transparent electrodes were fabricated by mechanical press at room temperature. In addition, the surface roughness of the pressed electrodes was decreased because the junctions between silver nanowires were mechanically compressed. (Suganuma).

We study the dynamics of photogenerated carriers on semiconductor surfaces and interfaces by means of time-resolved two-photon photoemission spectroscopy with fs temporal resolution. We aim to reveal dynamical aspects of hot-carrier relaxation in the processes of light-to-energy conversion of semiconductor devices. (Tanimura)

In order to elucidate the catalytic mechanism of Au nanoparticles supported on CeO_2, we have studied the morphology and surface structure of Au nanoparticles under reaction conditions using environmental transmission electron microscopy. (Takeda)

Towards constructing a fundamental technology for clarification of physical degradation and/or monitoring system of fuel cells, we develop the intelligent damage evaluation methodology based on data mining technique. (Numao)

The energy saving and environmentally benign process using transition metal catalysis is one of the most fundamental technologies. We have studied the novel tandem asymmetric reactions based on the oxidative desymmetrization. (Suzuki)

Radical-induced reactions in polymer electrolyte membrane for fuel cell, has been studied with the aids of several techniques such as gamma-ray, electron beam, laser and positron along with pulse radiolysis system. (Honda)

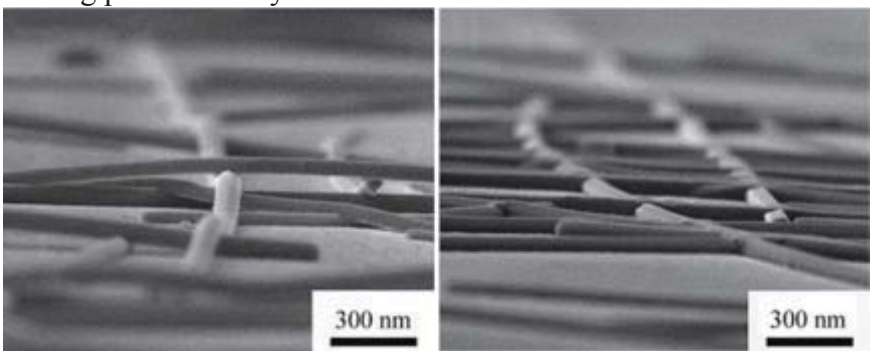
A method to effectively produce Si nanoparticles has been developed by use of the photochemical etching method. The characteristics of the *pn*-junction solar cells with the fabricated Si nanoparticles were improved by the nitric acid oxidation method. (Kobayashi)

Current Research Projects

Non heating fabrication of transparent conductive electrodes for solar cell

Silver nanowire electrodes have attracted attention as flexible transparent electrodes. However, when electrical devices are fabricated on silver nanowire electrodes, there is a issue that electrical leakage occur due to coarse surface roughness (left picture). In this study, silver nanowire electrodes were fabricated by mechanical press at room temperature. The pressed electrodes have low surface roughness (right picture). This

finding paves the way for fabrication of electrical devices on silver nanowire electrodes.



Ultrafast Carrier Dynamics on Semiconductor Surfaces Studied by Time-Resolved Two-photon Photoemission Spectroscopy

The dynamics of photoinjected hot electrons in Si and GaAs bulk conduction band has been studied using 6-eV probe pulse of 90 fs temporal width. The photogenerated electrons with a high excess energy are transferred (captured) to surface defect levels with significantly high rates before forming quasi-equilibrated distribution within a few ps after excitation. The surface recombination processes are induced in later temporal domains till 100 ps.

Morphology and surface structure of supported Au nanoparticle catalysts under reaction conditions

Operand environmental transmission electron microscopy observations show that the morphology of Au nanoparticles supported on CeO_2 depends on the partial pressures of CO and O_2. Adsorption of CO molecules stabilizes the gold nanoparticles with faceted shape. On the other hand, Au nanoparticles become rounded in O_2. In addition, we have found that adsorbed CO molecules caused the {100} facets of gold nanoparticles to reconstruct during CO oxidation.

Inference of mechanical effects among structural members on fuel cells

In order to infer mechanical effects of structural members on Solid Oxide Fuel Cell (SOFC), we validated the proposed algorithm that extracts frequently occurring damage patterns from a sequence of Acoustic Emission events of damage observation. We revealed mechanical effect among structural members of SOFC, such as initial small cracks and contraction of the glass seal significantly affect to the total fracture process. Also, we have started to apply our method to Li-ion battery.

Asymmetric tandem reactions using iridium-catalysis

Development of catalytic reaction using clean oxidant is one of the most important themes in modern organic synthesis. Ir-catalyzed oxidative desymmetrization of *meso* diols is the efficient methods for the synthesis of chiral building blocks. This time we

have developed the catalytic tandem asymmetric reaction based on desymmetrization of *meso* diols. Furthermore, we found the asymmetric hydrogen autotransfer process proceeds in high selectivities.

Study of radical reactions in polymer electrolyte membrane(PEM) with pulse radiolysis

Degradation process of PEM has been studied with electron pulse radiolysis technique. The samples were prepared by loading substrate(S) into Nafion. Decreasing water content in Nafion reduced generation of $OH^{\bullet}$ adduct of S, whereas the amount of products due to one-electron oxidation was not changed, suggesting that $OH^{\bullet}$ was mostly generated from the water-SO_3^- ionic clusters.

Solar cells using Si nanoparticles

Si nanoparticles were fabricated from Si swarf by use of the photochemical method. The fabricated Si nanoparticles possessed a strong photoluminescence peak around 400 nm, indicating that the band-gap was broaden due to the quantum size effect. The p-type Si nanoparticle/n-type crystalline Si structure showed a good rectifying behavior and the photo-response of this structure was improved by the nitric acid oxidation of Si (NAOS) method due to improvement of the contacts between nanoparticles.

Medical Treatment Materials, Devices, and System Research Group

Professors: Kazuhiko NAKATANI (Group Leader),
Yasuhi YAGI, Riichiro MIZOGUCHI, Nobuo KATO,
Katsuyuki TANIZAWA, Akihito YAMAGUCHI,
Masateru TANIGUCHI, Takeharu NAGAI

Outline

This research group focused attention on development of gene/drug delivery system, modulation of protein functions by organic small molecules, an imaging device with polyhedral mirror, gene detection method and system, bioactive substances transporter, single-molecule electrical analysis system, high-sensitive Ca^{2+} sensor, and a tool for describing human activity.

The bionanocapsule that can deliver drugs and genes to a specific organ or tissue has been developed and applied to gene/drug delivery systems. (Tanizawa)

An organic molecule that stabilizes a binary complex of 14-3-3 protein and its mode 3 client peptide has been synthesized from a natural diterpene glucoside. (Kato)

A shape estimation method by analyzing brightness of single scatterings has been developed. (Yagi)

A tool for describing human activity was developed. On the basis of positive reactions of its informal evaluation, we made an experimental plan for its evaluation of the tool by applying it to description of the guideline for emergency patients at Miki City Hospital. (Mizoguchi)

Analysis of the sphingosine 1-phosphate (S1P) transporter, SPNS2, knockout mice revealed that the secretion of S1P from vesicular endothelial cells is essential for T-lymphocyte egress into blood. Crystal structure of the inhibitor-bound multidrug transporter reveals the inhibitor-specific binding pit. (Yamaguchi)

By optimizing the length and sequence of competitor primers, we have achieved the exceptionally high allele specificity with hairpin primer PCR method. (Nakatani)

We find that transverse electric field of 10 mV/nm in an electrode-embedded silicon dioxide nanochannel slows down the biopolymer translocation velocity by about three orders of magnitude. (Taniguchi)

By construction of circularly permutated fluorescent proteins with Ca^{2+} sensor domain and development of high-efficient screening system, we made blue, green and red Ca^{2+} sensors with tremendous big dynamic range. (Nagai)

Current Research Projects

Development of a New Method of Pinpoint Gene and Drug Delivery Systems Using Bionanocapsule Derived from Hepatitis B Virus Surface Antigen L Protein (Tanizawa)

Bio-nanocapsule (BNC) is a virus-like empty nanoparticle made of phospholipids and envelope proteins derived from hepatitis B virus. Since it does not contain viral genome, BNC is nontoxic to cells *in vitro* and safe *in vivo* especially to humans when used as vaccines. BNC is now being developed as a novel drug delivery vector capable of specific delivery of genes, proteins, and pharmaceutical drugs to human hepatocytes with high efficacy. BNC potentially alters its target specificity when the PreS1 region is replaced with an appropriate bio-recognition molecule such as homing peptides, cytokines, and antibodies specific to cell surface proteins. Next-generation BNC has also been developed in this year by displaying antibody-binding modules derived from protein G and L on the BNC surface, which can bind various immunoglobulins from a number of animal species.

Client selective modulation of 14-3-3 protein functions by fusicoccin derivatives (Kato)

14-3-3 proteins play a crucial role in regulation of Ser/Thr kinase-dependent signalling pathways through protein-protein interactions. We have rationally designed and synthesized a fusicoccin derivative (FC-THF) that stabilizes a binary complex of 14-3-3 protein and its mode 3 client protein selectively. FC-THF stabilized 14-3-3/TASK-3 interaction and increases potassium currents in *Xenopus laevis* oocytes.

Shape from Single Scattering for Translucent Objects (Yagi)

A shape estimation method by analysing brightness of single scatterings has been developed. The single scattering is a one-bounce collision of light to a particle in the medium, hence the optical path and the attenuation can be analysed. Based on this analysis, we confirmed that the surface shape of translucent objects such as plastic can be roughly estimated.

Development of a tool for describing human task-performing behaviors (Mizoguchi)

We developed a tool called CHARM-Pad for describing human behaviors on tablet computers. Its major features include computer-interpretable semantics, explicit representation of the purposes of actions and easy comparison among action-execution ways with explicit reasons of the way selection. It is now under on-site evaluation in the Osaka Kouseinenkin Hospital for ICU tasks.

Analysis of Sphingoshine 1-Phosphate Transporter (SPNS2)-Knockout Mice and the Determination of the Inhibitor-binding Structure of Multidrug Transporter (Yamaguchi)

Analysis of the SPNS2-KO mice revealed that SPNS2 is a S1P efflux transporter in vesicular endothelial cells. The lack of the S1P from vesicular endothelial cells results

in the disappearance of T-cells in blood, indicating that secretion of S1P by SPNS2 is essential for the T-lymph egress into blood. Crystal structure of the inhibitor-bound multidrug efflux transporter revealed the specific inhibitor binding pit branched from the drug translocation route. By using the site-directed mutagenesis, we proved that the amino acid side chain at the edge of the entrance of the pit determines the inhibitor specificity.

Development of Improved Hairpin Primer PCR Method (Nakatani)

We have reported a new PCR technology using hairpin primer containing cytosine bulge named hairpin primer PCR as convenient and simple method for SNP typing. The current hairpin primer PCR detects the decrease of fluorescent intensity as the PCR proceeds. In order to increase the sensitivity of hairpin primer PCR method, fluorescent indicator DANP was attempted to covalently immobilize to the hairpin primer at the vicinity of the C-bulge. We found the site of covalent attachment of DANP showing the increase of fluorescent intensity. This method is applied for the detection of virus infection.

Method to Control the Translocation Speed of Single DNA (Taniguchi)

Transverse electric field effects on DNA translocation kinetics in a 50 nm fluidic channel was investigated by simultaneous measurements of the trans-channel and transverse current using an electrode-embedded nanochannel sensor. Transverse field of 10 mV/nm slows DNA translocation speed in the channel by three orders of magnitude. Field-retarded translocation significantly improves the single-molecule topographic reading capability and enables identification of local conformation of an individual unlabeled DNA strand.

Development of high-sensitive Ca^{2+} sensor with blue, green and red color variants (Nagai)

We developed novel Ca^{2+} sensor, GECO series, by introducing Ca^{2+} sensor domain composed of CaM and M13 into circularly permutated fluorescent protein. To seek high-Ca^{2+} sensitive sensor effectively, we invented high-effective screening system by expressing the proteins in periplasmic region of *E. Coli* so that the constructed sensors in *E. Coli* show the high sensitively for external Ca^{2+}. Finally, we yieled high dynamic range (2,600%) green Ca^{2+} sensor, G-GECO. Furthermore, we succeeded to develop color variants of GECO such as B-GECO, R-GECO and GEM-GECO which enables one wavelength excitation and two wavelength emissions (i.e., ratiometric) measurement.

Environmental Harmonized Materials and Devices Research Group

Professors: Yoichi Yoshida (Group Leader),
Hideo NAKAJIMA, Tetsuro MAJIMA, Goro ISOYAMA,
Hiroaki SASAI、Takahiro KOZAWA

Study of Environmental harmonized chemical reaction process by using quantum beam technology (YOSHIDA)

Redox reactions by active species induced by quantum beam without using harmful oxidants or reductants are environmental friendly chemical reaction process. In order to study the reaction process of active species which are very fast, the femtosecond pulse radiolysis system was developed in ISIR. By the way, room temperature ionic liquids which have common characters of non-flammable and ultra-low vapor pressure are safety and low environmental emission as environmental conscious reaction solvent. In this year, it was studied that the solvated electron was generated by the electron beam in ionic liquids, and the electron transferred to the aromatic compound (reduction). Electron beam induced redox reaction using ionic liquid is a new environment-friendly reaction processes.

Collaboration research projects: For the collaboration study, started the consideration with the chemistry of molecular assembly group in IMECE for the study of intra-molecular electron transfer. And for the environment-friendly reaction process in ionic liquids, started the consideration with the micro process control group and the nano scale evaluation group in IMECE .

Fabrication, Properties and Applications of Macro and Nano Porous Metals (NAKAJIMA)

Mechanical properties of lotus-type porous metals with directional pores were investigated, which revealed that lotus carbon steels exhibits superior impact energy absorption originating from the unidirectional pores. Furthermore, the fabrication process of nonporous oxide was investigated, which clarified that oriented anisotropic nano pores in amorphous oxides can be evolved through the structural relaxation in the amorphous thin films at high temperature. It was also revealed that inhomogeneous density distribution in the amorphous film gives rise to the formation of nano pores.

Collaboration research projects: Lotus Fe-12mass% alloys were fabricated by the continuous zone melting technique under hydrogen pressure of 2.5 MPa, using the high-purity (99.997%) raw materials prepared in Issiki group (Institute of Multidisciplinary Research for Advanced Materials, Tohoku University). It was found that large pores are formed in the high-purity Fe-Cr alloy, because the number of nucleation sites for the pore formation is small.

Beam-induced Chemistry of Nanomaterials (MAJIMA)

"Beam-induced Chemistry of Nanomaterials" based on photo- and radiation-induced chemistry of nanomaterials such as supramolecules, oligomers, polymers, DNA,

proteins, metal oxides, semiconductors, and metals has been investigated from both basic and beam-functional points of view. We carried out the research projects such as charge transfer in DNA, TiO_2 photocatalyst, energy and charge transfer in supramolecules, and dynamics of proteins and DNA.

Collaboration research projects: We carried out the collaboration with the research group of Prof. Shinmyozu in Kyushu University where cyclophane compounds are synthesized. The γ -radiolysis in the rigid matrix at 77 K and pulse radiolysis at room temperature were studied to discuss the intramolecular charge delocalization. We also carried out the collaboration with the research group of Prof. Maruyama in Kyushu University. We successfully measured the charge-recombination dynamics in DNA at the single-molecule level from fluorescence correlation spectroscopy of fluorescent dye-modified DNA.

Upgrade of a high intensity THz radiation source and its applications to research on environment-conscious materials (ISOYAMA)

As a part of study to upgrade the high intensity THz radiation source based on free electron laser (FEL), we measured the FEL gain, which has a significant influence on FEL operation, using the method developed last year to measure the FEL energy in the macropulse as a function of the number of amplifications. The maximum gain is derived to be 58 % at a 105 μm wavelength and its dependency on the optical cavity length is in good agreement with predictions of the super-mode theory. Wavelength spectra of FEL are measured with development of the FEL power at two cavity lengths and contour maps in time and wavelength ordinates are derived, showing quite different features. We conducted experiment to generate circularly-polarized light from the linearly-polarized FEL light in order to apply it to studies on the magnetic materials with spin polarization and optical isomers with chirality.

Collaboration research projects: In order to find research groups for collaboration, we continue introducing our research activities at plenary meetings of the alliance and section meetings, and continue our deliberations on possibility of collaboration studies in the next year by studying research activities of other groups.

Development of Environmentally Benign Catalytic Process for the Enantioselective Synthesis of α-Acyloxycarbonyl Compounds (SASAI)

α-Acyloxycarbonyl group is widely seen in nature and is known as a useful substructure for pharmaceutical products and synthetic intermediates. For its construction, a stoichiometric or an excess amount of a highly toxic oxidant such as manganese or lead compounds is generally necessary. We have successfully developed an environmentally benign synthetic approach to the α-acyloxycarbonyl functionality, where Pd–SPRIX complex and O_2 are serve as an effective catalyst and a green oxidant, respectively.

Collaboration research projects: We have performed the collaboration with the research group of Prof. Nagatsugi at Institute of Multidisciplinary Research for Advanced Materials in Tohoku University about the biological activity of novel chiral spiro compounds we prepared.

Study of Primary Processes of Radiation Chemistry in Condensed Matter

(KOZAWA)

The enhancement of reaction efficiency induced in materials used for high volume production is important for saving energy and resources. For the enhancement of reaction efficiency, the catalytic chain reaction induced in resist materials used for extreme ultraviolet lithography was investigated. Also, the reaction mechanisms of environmentally-responsive biomolecules were investigated using radiation-chemical method for the development of environmentally-responsive sensors.

Collaboration research projects: The response mechanism of oxygen biosensor to oxygen concentration in the environment was investigated in collaboration with Bioreaction Design group in IMRAM.

Workshop

Director Professor: Katsumi TANIMURA
Technical Staff:
Machine Shop: Michiaki KAKUICHI, Masayoshi OHNISHI, Yuki MATSUSHITA
Glassworks: Hiroaki MATSUKAWA, Noriyuki OGAWA

Outlines

A machine shop and a glass factory were set up at the same time when the Institute of Scientific and Industrial Research was founded. The machine 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.

Number of jobs
Machine Shop: 265 jobs (190 jobs in the previous year).
Glassworks: 148 jobs (144 jobs).

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 ^{3}H, ^{14}C, ^{32}P, ^{33}P or ^{35}S. The main equipments are liquid scintillation counters and a bioimaging analyzer (FLA3000). 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.

In this year, three projects were applied for use of this laboratory. 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 work-shop 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 2011, the equipment and systems were used about 50 times from 4 laboratories and facilities.

Library

Professor: Tetsuro MAJIMA
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, 2012)

	Number of books	Journals	Newspapers
Japanese	6,848	179titles	4 titles
Foreign	20,887	557titles	1 title

Office of Information Network

Professor,Director:	Hidekazu TANAKA
Professor:	Hiroaki SASAI
Assistant Professor:	Koichi MORIYAMA
Assistant Professor:	Ryusuke NAKAMURA
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 15.

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

And we have offered poster printing services for ISIR researchers. Total number of poster printing was 367.

And we updated ISIR WEB pages. Total number of pages was 271.

And we issued ISIR CARD (access control card).

And we managed business servers (ex. Web, Mail, DNS, ..).

Network Planning and Design
ODINS Wireless LAN

Academia Industry Relations Office

Director Professor:	Katsuaki SUGANUMA
Professors:	Kazuhiko MATSUMOTO, Hikaru KOBAYASHI
	Kazuhiko NAKATANI, Seiji TAKEDA
Specially Appointed Professor:	Hirokazu SHIMIZU
Research Fellow:	Seiichiro TAMAI

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 industry community of the ISIR's research activities efficiently through the interaction with the industry community such as SANKEN Techno Salon and various Lecture 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.

Activities

Introduction of ISIR's research activities to industrial sector

1) SANKEN Techno Salon: Quarterly seminar and get-together: May 13, Aug.5, Nov.7 (80th anniversary event), 2011 and Jan.27, 2012
2) Introduction of new technologies through WEB site
3) Publication of a booklet for introduction of ISIR's research activities
4) Publicity of technologies at International Frontier Industrial Exhibition 2011 (Sep.21-22, 2011), Business Encourage Fair (Nov.13-14, 2011) and 11th International Nanotechnology Exhibition (Feb.15-17, 2012).

Supporting Technology Transfer

1) One study group for the new industry generation
2) Five new collaborative research projects using Company Research Park
3) One collaborative project adopted by the supporting industries program of Ministry of Economy, Trade and Industry (METI)

Interactive ISIR's Laboratory Tour

Company group laboratory tours (Sep.1, Oct.20, 2011 and Feb.6, 2012)

Public Relations Office

Director, Professor: Yoshio ASO
Supporting Staff: Noriko MATSUMOTO, Naoko KAGITA (-2011.11)

Outlines

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 Nanoscience and 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 , 2012）

Director : Kazunari IWAKAWA

Facilities Planning Office

Staffs: Tomomi HIGASHIO
Ayako YOSHIOKA
Aya NISHIDA

General Affairs Division

Staffs: Mitsuyoshi SHIRAHAMA
Masahito KAWAZOE
Akira KAMATANI
Manabu MAEDA

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

Research Cooperation Division

Staffs: Hiromi NISHIKAWA
Shigeo KASHIWAKURA
Kouichi YAMAMOTO
Hiroshi OKADA
Misa TOKUMOTO
Yuichi TANAKA
Takayuki KOBAYASHI
Yukiyo KANDA
Makoto OTSUKA
Mina TANIZAWA
Masako MORITA

Supporting Staffs: Yukako MORI
Mari TOKUMARU
Kumiko TERADA
Mayuko TSUDA
Shigeo NAGAOKA
Kazune OTANI

List of Achievements

Department of Photonic and Electronic Materials

Original Papers

[1]Effect of growth conditions on magnetic and structural properties in Gd-doped GaN layers grown by plasma-assisted molecular beam epitaxy, Shigehiko Hasegawa, Sachio Komori, Kotaro Higashi, Daijiro Abe, Yi-Kai Zhou, and Hajime Asahi: Phys. Stat. Sol. C, 9 (3) (2012) 741-744.

[2]Structural, magnetic and optical studies of ultrathin GaGdN/AlGaN multiquantum well structure, Mohamed Almokhtar, Shuichi Emura, Yi Kai Zhou, Shigehiko Hasegawa, and Hajime Asahi: Phys. Stat. Sol. C, 9 (3) (2012) 737-740.

[3]Large magneto-optical effect in low-temperature-grown GaCrN and GaCrN:Si, Y. K. Zhou, P. H. Fan, S. Emura, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 9 (3) (2012) 719-722.

[4]Growth of InN quantum dots by droplet epitaxy and their characterization, D. Krishnamurthy, S. Hasegawa, S. N. M. Tawil, S. Emura, and H. Asahi: Phys. Stat. Sol. C, 9 (3) (2012) 666-669.

[5]Generation of Spin Current in Bipolar Conductors, Masamichi Sakai, Takahito Sakuraba, Zentaro Honda, Shigehiko Hasegawa, Akira Kitajima, Koji Higuchi, Akihiro Oshima, and Osamu Nakamura: Jpn. J. Appl. Phys., 50 (10) (2011) 103002.

[6]Negative Magnetoresistance Generated by Combination of Spin-Orbit Interaction and Applied Magnetic Field, Masamichi Sakai, Daisuke Kodama, Takahito Sakuraba, Zentaro Honda, Shigehiko Hasegawa, Akira Kitajima, Akihiro Oshima, Koji Higuchi, and Osamu Nakamura: Jpn. J. Appl. Phys., 51 (2) (2012) 23001.

[7]Composition Analysis of High-Stable Transparent Conductive Zinc Oxide by X-ray Photoelectron Spectroscopy and Secondary-Ion Mass Spectroscopy, T. Kuchiyama, S. Hasegawa, K. Yamamoto, Y. Teraoka and H. Asahi: Jpn. J. Appl. Phys., 50 (12) (2011) 121101.

[8]Surface morphology and crystalline structure of high-stable polycrystalline transparent conductive zinc oxide films, Takashi Kuchiyama, Kenji Yamamoto, Shigehiko Hasegawa, Hajime Asahi: Appl. Surf. Sci., 258 (4) (2011) 1488-1490.

[9]Atomic force microscopic investigations on the InN quantum dots grown by droplet molecular beam epitaxy", D. Krishnamurthy, S. Hasegawa, and H. Asahi, Proceedings of Asia-Pacific Wor, D. Krishnamurthy, S. Hasegawa, and H. Asahi: Proceedings of Asia-Pacific Workshop on Materials Characterization, (2011) 124-130.

[10]Growth and characterization of GaN-based dilute magnetic semiconductors, S. Hasegawa and H. Asahi: Proceedings of Asia-Pacific Workshop on Materials Characterization, (2011) 6-10.

[11]Photoluminescence from exciton-polarons in GaGdN/AlGaN multiquantum wells, M. Almokhtar, S. Emura, Y. K. Zhou, S. Hasegawa, and H. Asahi: J. Phys.: Condens. Matter., 23 (7) (2011) 325802.

[12]GaGdN/AlGaN multiple quantum disks grown by RF-plasma-assisted molecular-beam epitaxy, H. Tambo, S. Hasegawa, M. Uenaka, Y.K. Zhou, S. Emura, and H. Asahi: Phys. Stat. Sol. A, 208 (7) (2011) 1576-1578.

[13]Large magneto-optical effect in low-temperature-grown GaDyN, Y.K. Zhou, S. Emura, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 8 (7) (2011) 2173-2175.

[14]Growth of Gd-doped InGaN/GaN multiple quantum wells and their characterization, S. Hasegawa, R. Kakimi, S.N.M. Tawil, D. Krishnamurthy, Y.K. Zhou, and H. Asahi: Phys. Stat. Sol. C, 8 (7) (2011) 2047-2049.

[15]Structural characterization of MBE grown InGaGdN/GaN and InGaN/GaGdN superlattice structures, D. Krishnamurthy, S.N.M. Tawil, M. Ishimaru, S. Emura, Y.K. Zhou, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 8 (7) (2011) 2245-2247.

[16]Growth and characterization of transition-metal and rare-earth doped III-nitride semiconductors for spintronics, H. Asahi, S. Hasegawa, Y.K. Zhou, and S. Emura: MRS Proceedings, 1290 (2011) i06-01.

[17]Annealing-induced structural changes in TlInGaAsN heterostructures studied by X-ray photoelectron spectroscopy, K.M. Kim, W.B. Kim, D. Krishnamurthy, M. Ishimaru, H. Kobayashi, S. Hasegawa, and H. Asahi: Proceedings of the 23rd International Conference on Indium Phosphide and Related Materials, (2011) 110-113.

[18]Carrier-mediated ferromagnetism in InGaGdN grown by plasma-assisted molecular beam epitaxy, S.N.M. Tawil, Y.K. Zhou, D. Krishnamurthy, S. Emura, S. Hasegawa, and H. Asahi: Proceedings of the 23rd International Conference on Indium Phosphide and Related Materials, (2011) 252-255.

[19]Defect structure of MBE-grown GaCrN diluted magnetic semiconductor films, A. Yabuuchi, M. Maekawa, A. Kawasuso, S. Hasegawa, Y.K. Zhou, and H. Asahi: Journal of Physics: Conference Series, 262 (2011) 012066.

[20]Studies on the InGaGdN/GaN magnetic semiconductor heterostructures grown by plasma-assisted molecular-beam epitaxy, S.N.M. Tawil, D. Krishnamurthy, R. Kakimi, S. Emura, S. Hasegawa, and H. Asahi: J. Cryst. Growth, 323 (1) (2011) 351-354.

[21]Low-temperature molecular beam epitaxy growth and properties of GaGdN nanorods, H. Tambo, S. Hasegawa, H. Kameoka, Y.K. Zhou, S. Emura, and H. Asahi: J. Cryst. Growth, 323 (1) (2011) 323-325.

[22]Influence of Si-doping on the characteristics of InGaGdN/GaN MQWs grown by MBE, S.N.M. Tawil, D. Krishnamurthy, R. Kakimi, M. Ishimaru, S. Emura, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 8 (2) (2011) 491-493.

[23]Co-ordination alignments at the vicinity of the dopant Cr ions in AlN, S. Emura, S. Kimura, K. Tokuda, H. Tambo, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 8 (2) (2011) 473-475.

[24]Structural and Magnetic Properties of Diluted Magnetic Semiconductor GaGdN Nanorods, H. Tambo, S. Hasegawa, K. Higashi, R. Kakimi, S.N.M. Tawil, Y.K. Zhou, S. Emura, and H. Asahi: Phys. Stat. Sol. C, 8 (2) (2011) 494-496.

[25]Investigations on the properties of intermittently Gd-doped InGaN structures grown by molecular-beam epitaxy, D. Krishnamurthy, S.N.M. Tawil, R. Kakimi, M. Ishimaru, S. Emura, S. Hasegawa, and H. Asahi: Phys. Stat. Sol. C, 8 (2) (2011) 497-499.

[26]Appearance of a correlation between the Hall coefficient and electrical resistivity upon dihydrogenation of yttrium, M. Sakai, D. Kodama, S. Ito, M. Ito, O. Nakamura, S. Hasegawa, A. Kitajima, and A. Oshima: J. of Appl. Phys., 108 (8) (2010) 083719.

[27]Structural, Magnetic and Optical Studies of Ultrathin GaGdN/AlGaN Multiquantum Well Structure, Mohamed Almokhtar, Shuichi Emura, Yi Kai Zhou, Shigehiko Hasegawa, and Hajime Asahi: Phys. Stat. Sol. C, 9 (2012) 737 - 740.

[28]Interfacial Stress and Thermal Expansion Effects for PL Spectra in AlGaN/GaN MQW, Shuichi Emura, Hironobu Tani, Hannes Raebiger, Yi-Kai Zhou, Shigehiko Hasegawa and Hajime Asahi: AIP Conf. Proc., 1399 (2011) 387-388.

[29]Temperature Dependence of Photoluminescence Peak Energy in Ga(In)Nas, Shuichi Emura, Hiroki Nakamoto, Fumitaro Ishikawa, Masahiko Kondow and Hajime Asahi: AIP Conf. Proc., 1399 (2011) 41-42.

International Conferences

[1]Growth and characterization of GaN-based dilute magnetic semicondcutors and their nanostructures (invited), S. Hasegawa, Y.K. Zhou, S. Emura, and H. Asahi: 2011 Villa Conference on Interactions Among Nanostructures, (2011 VCIAN), Red Rock Casino, Resort and Spa, Las Vegas, Nevada, USA, April 21-25, 2011.

[2]Annealing-induced structural changes in TlInGaAsN heterostructures studied by X-ray photoelectron spectroscopy (poster), K.M. Kim, W.B. Kim, D. Krishnamurthy, M. Ishimaru, H. Kobayashi, S. Hasegawa, and H. Asahi: 23rd International Conference on Indium Phosphide and Related Materials (23rd IPRM), Berlin, Germany, May 22-26, 2011.

[3]Carrier-mediated ferromagnetism in InGaGdN grown by plasma-assisted molecular beam epitaxy (oral), S.N.M. Tawil, Y.K. Zhou, D. Krishnamurthy, S. Emura, S. Hasegawa, and H. Asahi: 23rd International Conference on Indium Phosphide and Related Materials (23rd IPRM), Berlin, Germany, May 22-26, 2011.

[4]Large Zeeman splitting in GaGdN/AlGaN magnetic semiconductor double quantum well superlattices (poster), Y.K. Zhou, M. Almokhtar, H. Kubo, N. Mori, S. Emura, S. Hasegawa, and H. Asahi: 5th Asia-Pacific Workshop on Widegap Semiconductors (APWS-2011), Toba, Mie, May 22-26, 2011.

[5]Molecular beam epitaxy and characterization of InGaN thin films doped with gadolinium (oral), S.N.M. Tawil, D. Krishnamurthy, S. Emura, S. Hasegawa, and H. Asahi: 12th International Conference on Quality in Research, Bali, Indonesia, July 4-7, 2011.

[6]Effect of growth conditions on magnetic and structural properties in Gd-doped GaN layers grown by plasma-assisted molecular beam epitaxy (oral), S. Hasegawa, S. Komori, K. Higashi, D. Abe, Y.K. Zhou, and H. Asahi: 9th International Conference on Nitride Semiconductors (9th ICNS), Glasgow, UK, July 10-15, 2011.

[7]Temperature dependence of the photoluminescence in InxGa1-xN (poster), S. Emura, S.N.M. Tawil, S. Hasegawa, and H. Asahi: 9th International Conference on Nitride Semiconductors (9th ICNS), Glasgow, UK, July 10-15, 2011.

[8]Large magneto-optical effect in low-temperature-grown GaCrN and GaCrN:Si (poster), Y.K. Zhou, S. Emura, S. Hasegawa, and H. Asahi: 9th International Conference on Nitride Semiconductors (9th ICNS), Glasgow, UK, July 10-15, 2011.

[9]Growth of InN quantum dots by droplet epitaxy and their characterization (poster), D. Krishnamurthy, S. Hasegawa, S.N.M. Tawil, S. Emura, and H. Asahi: 9th International Conference on Nitride Semiconductors (9th ICNS), Glasgow, UK, July 10-15, 2011.

[10]New photoluminescence from GaGdN/Al0.12Ga0.88N multi-quantum well (poster), M. Almokhtar, S. Emura, Y.K. Zhou, S. Hasegawa, and H. Asahi: 9th International Conference on Nitride Semiconductors (9th ICNS), Glasgow, UK, July 10-15, 2011.

[11]Rare-earth doped III-nitride semiconductors for semiconductor spintronics (invited), H. Asahi, S. Hasegawa, Y.K. Zhou, and S. Emura: European Materials Research Society Fall 2011 Meeting, Warsaw, Poland, September 19-23, 2011.

[12]Growth and characterization of GaN-based dilute magnetic semiconductors (invited), S. Hasegawa and H. Asahi: Asia-Pacific Workshop on Materials Characterization (APWMC), Chennai, India, September 22-24, 2011.

[13]Atomic force microscopic investigations on the InN quantum dots grown by droplet molecular beam epitaxy (oral), D. Krishnamurthy, S. Hasegawa, and H. Asahi: Asia-Pacific Workshop on Materials Characterization (APWMC), Chennai, India, September 22-24, 2011.

[14]Characterization of GaGdN/AlGaN/GaGdN Triple-layer Structures with High Gd Concentration for Tunneling Magnetoresistance Devices (poster), K. Higashi, D. Abe, Y. Mitsuno, S. Komori, S. Sano, S. Hasegawa, and H. Asahi: 2011 International Conference on Solid State Devices and Materials (2011 SSDM), Nagoya, Japan, September 27-30, 2011.

[15]Formation of nitrogen vacancy adjoining to Gd ion doped in GaN (poster), D. Abe, K. Higashi, S. Emura, Y. K. Zhou, S. Hasegawa, and H. Asahi: 2011 International Conference on Solid State Devices and Materials (2011 SSDM), Nagoya, Japan, September 27-30, 2011.

[16]Growth and characterization of Gd-doped GaN nanorods on Si(111) substrate (poster), Mai Uenaka, Mariko Kimura, Shigehiko Hasegawa, and Hajime Asahi: The 6th International Symposium on Surface Science (ISSS-6), December 11-15, Tokyo, 2011.

[17]Effects of the morphology of Fe thin films grown on GaN(0001) on their magnetic properties (poster), H. Ichihara, S. Hasegawa, A. Beppu, M. Yoneoka, H. Yamaguchi and H. Asahi: The 6th International Symposium on Surface Science (ISSS-6), December 11-15, Tokyo, 2011.

[18]Growth of Co thin films on GaN(0001) and their magnetic properties (poster), A. Beppu, S. Hasegawa, H. Ichihara, M. Yoneoka, H. Yamaguchi and H. Asahi: The 6th International Symposium on Surface Science (ISSS-6), December 11-15, Tokyo, 2011.

[19]Growth and characterization of GaDyN/AlGaN multi-quantum well structures (poster), Y. Nakatani, Y. K. Zhou, M. Sano, S. Emura, S. Hasegawa, H. Asahi: The 6th International Symposium on Surface Science (ISSS-6), December 11-15, Tokyo, 2011.

[20]Characterization of Thin Yttrium Film Surfaces with Annealing (poster), Akira Kitajima, Koji Higuchi, Cong Que Dinh, Akihiro Oshima, Shigehiko Hasegawa, Masamichi Sakai: 7th Handai Nanoscience and Nanotechnology International Symposium, November 10-11, 2011, Osaka.

[21]Large magneto-optical effect in low-temperature-grown GaCrN and GaCrN:Si (poster), Y. K. Zhou, S. Emura, S. Hasegawa and H. Asahi: 7th Handai Nanoscience and Nanotechnology International Symposium, November 10-11, 2011, Osaka.

[22]Structural and magnetic characterization of GaGdN thin films grown on GaN(0001) templates (poster), Y. Mitsuno, K. Higashi, S. Sano, S. Hasegawa and H. Asahi: 7th Handai Nanoscience and Nanotechnology International Symposium, November 10-11, 2011, Osaka.

[23]Magnetic Properties of Iron Nitride Thin Films Grown on GaN(0001) Surfaces (poster), M. Yoneoka, S. Hasegawa, H. Ichihara, A. Beppu, H. Yamaguchi, H. Asahi: The 15th SANKEN International Symposium 2012, The 10th SANKEN Nanotechnology Symposium, January 12th-13th, Osaka, 2012.

Contributions to International Conferences and Journals

H. ASAHI	17h International Conference on Molecular Beam Epitaxy (International Advisory Committee member)
H. ASAHI	23rd International Conference on Indium Phosphide and Related Materials (International Steering Committee member)

H. ASAHI	24rd International Conference on Indium Phosphide and Related Materials (International Steering Committee member)
H. ASAHI	19th International Colloquim on Scanning Probe Microscopy (Advisory Board member)
H. ASAHI	4th International Symposium on Growth of Nitrides (International Advisory Committee member)
H. HASEGAWA	17th International Conference on Molecular Beam Epitaxy (General Affairs Chair)
S. EMURA	18th International Conference on Molecular Beam Epitaxy (Steering Committee member)
Y.K. ZHOU	19th International Conference on Molecular Beam Epitaxy (Steering Committee member)

Publications in Domestic Meetings

The Japan Society of Applied Physics	24 papers
The Physical Society of Japan	1 paper
The Surface Science Society of Japan	1 paper
Electronic Materials Symposium	2 papers
Japan Radioisotope Association	1 paper

Academic Degrees

Doctor Degree for Engineering T. Kuchiyama	Study on the Improvement of the Stability of Transparent Conductive Zinc Oxide Thin Films
Master Degree for Engineering H. Ichihara	Study on surface structure and their magnetic property of ferromagnetic thin film grown on GaN(0001)
Master Degree for Engineering Y. Nakatani	Growth and characterization of GaDyN single layer and GaDyN/AlGaN multiple quantum well structure
Master Degree for Engineering L. Zhou	Study on growth and evaluation of InGaGdN/GaN heterostructure
Master Degree for Science T. Shimoi	Study on selective growth of InP on localized area of Si substrate
Master Degree for Science M. Uenaka	Study on growth and evaluation of diluted magnetic semiconductor GaGdN nanorods
Master Degree for Science Y. Mitsuno	Study on dependence of growth conditions of diluted magntic semiconductor GaGdN with different thin film structure
Master Degree for Science A. Beppu	Formation and evaluation of ferromagnet/GaN(0001) structure towards spintronics device application
Master Degree for Science S. Nonoguchi	Study on growth of InGaPN and temperature stability of their light emission
Master Degree for Science F. Yukawa	Study on Gd, Si added InGaN and their addition effect
Bachelor Degree for Engineering S. Sano	Study on growth condition dependence of magnetic and electric property for diluted magnetic semiconductor GaGdN
Bachelor Degree for Engineering H. Yamaguchi	Study on formation and magnetic property of Co/Fe multiple layers grown on GaN(0001)

Grant-in-Aid for Scientific Research

H. Asahi	Development of properties and functionalities by precise control of rare-earth doping (Y. Fujiwara)	¥20,000,000
H. Asahi	Study on Room Temperature Ferromagnetic Nitride Semiconductor Nanostructures and Application to Nanospintronics Devices	¥210,000
S.Hasegawa	Developments of spin-dependent ballistic electron emission microscopy and its application to spin injection into semiconductors	¥2,470,000
Y.K. Zhou	Study on control of magnetic properties in ferromagnetic nitride semiconductor nanostructures	¥910,000
Y.K. Zhou	Study on new spintronics materials and their device applications using spinodal decomposition	¥5,850,000

Cooperative Research

H. Asahi	Nissin Electric	¥900,000

Department of Semiconductor Electronics

Original Papers

[1]External-Noise-Induced Small-Signal Detection with Solution-Gated Carbon Nanotube Transistor, Yasufumi Hakamata, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: Appl. Phys. Express, 4 (2011) 045102.

[2]Layer-by-Layer growth of graphene layers on graphene substrates by chemical vapor deposition, Ryota Negishi, Hiroki Hirano, Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto, Yoshihiro Kobayashi: Thin Solid Films, 519 (2011) 6447-6452.

[3]Graphene field-effect transistors for label-free chemical and biological sensors, Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto: SPIE Proceedings of Micro- and Nanotechnology Sensors, Systems, and Applications III, 8031 (2011) 803121.

[4]Quantized characteristics in carbon nanotube-based single-hole memory with a floating nanodot gate, Takahiro Ohori, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Yutaka Hayashi, Kazuhiko Matsumoto: Appl. Phys. Lett., 98 (2011) 223101.

[5]Robust Noise Characteristics in Carbon Nanotube Transistors Based on Stochastic Resonance and Their Summing Networks, Yasufumi Hakamata, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: Jpn. J. Appl. Phys., 50 (2011) 06GE03.

[6]Thickness Control of Graphene Overlayer via Layer-by-Layer Growth on Graphene Templates by Chemical Vapor Deposition, Ryota Negishi, Hiroki Hirano, Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto, Yoshihiro Kobayashi: Jpn. J. Appl. Phys., 50 (2011) 06GE04.

[7]Highly Sensitive Electrical Detection of Sodium Ions Based on Graphene Field-Effect Transistors, Yasuyuki Sofue, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: Jpn. J. Appl. Phys., 50 (2011) 06GE07.

[8]Label-Free Aptamer-Based Immunoglobulin Sensors Using Graphene Field-Effect Transistors, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: Jpn. J. Appl. Phys., 50 (2011) 070120.

[9]Gate voltage control of stochastic resonance in carbon nanotube field effect transistors, Toshio Kawahara, Satarou Yamaguchi, Kenzo Maehashi, Yasuhide Ohno, Kazuhiko Matsumoto, Shin Mizutani: Proceedings of 21st International Conference on Noise and Fluctuations, (2011) 364-367.

[10]Fabrication of new single-walled carbon nanotubes microelectrode for electrochemical sensors application, Nguyen Xuan Viet, Yoshiaki Ukita, Miyuki Chikae, Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto, Pham Hung Viet, Yuzuru Takamura: Talanta, 91 (2012) 88-94.

[11]Schottky barrier control gate-type carbon nanotube field-effect transistor biosensors, Masuhiro Abe, Yasuhide Ohno, Kazuhiko Matsumoto: J. Appl. Phys., 111 (2012) 034506.

[12]Complementary voltage inverters with large noise margin based on carbon nanotube field-effect transistors with SiNx top-gate insulators, Kenzo Maehashi, Takaomi Kishimoto, Yasuhide Ohno, Koichi Inoue, Kazuhiko Matsumoto: J. Vac. Soc. Technol. B, 30 (2012) 03D108.

International Conferences
[1]Graphene field-effect transistors for label-free chemical and biological sensors (invited), Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto: 2011 SPIE Defense Security+Sensing.

[2]Control of Kondo Temperature/Coulomb Blockade/Fabry-Perot Interference by Modulation of Tunneling Barrier Thickness in Carbon Nanotube FET (oral), Kazuhiko Matsumoto, Takafumi Kamimura: The 38th International Symposium on Compound Semiconductors.

[3]1/10 low bias operation and individual charge detection of carbon nanotube quantum nano memory (oral), Kazuhiko Matsumoto: 35th Workshop on Compound Semiconductor Devices and Integrated Circuits.

[4]Gate Voltage Control of Stochastic Resonance in Carbon Nanotube Field　Effect Transistors (oral), Toshio Kawahara, Satarou Yamaguchi, Kenzo Maehashi, Yasuhide Ohno, Kazuhiko Matsumoto, Shin Mizutani: 21st International Conference on Noise and Fluctuations.

[5]Influence of Trapped Single Charges in Single Walled Carbon Nanotube Transistor with SiNx/Al2O3 Double Wrapped Layers (oral), Takafumi Kamimura, Kazuhiko Matsumoto: 52nd TMS Electronic Materials Conference.

[6]Low Bias Operation & Indivisual Charge Detection of Carbon Nanotube Quantum Nano Memory (oral), Kazuhiko Matsumoto, Takahiro Ohori, Kenzo Maehashi, Yasuhide Ohno, Koichi Inoue, Takafumi Kamimura: NT11 International Conference on the Science and Application of Nanotubes.

[7]Sensing Property of Horizontally Aligned Carbon Nanotube Field-Effect Transistor on Quartz Substrate (oral), Satoshi Okuda, Shogo Okamoto, Yasuhide Ohno, Kenzo Maehashi, Kazuhiko Matsumoto: 2011 International Conference on Solid State Devices and Materials.

[8]Room Temperature Single Charge Memory by Carbon Nanotube Transistor With SiNx /Al2O3 Wrapped Double Gate Insulator Layers (oral), Takafumi Kamimura, Yutaka Hayashi, Kazuhiko Mastumoto: 2011 International Conference on Solid State Devices and Materials.

[9]Electric-field-induced band gap of bilayer graphene in ionic liquid (oral), Yusuke Yamashiro, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 2011 International Conference on Solid State Devices and Materials.

[10]Valinomycin-Modified Graphene Field-Effect Transistors for Potassium Ion Sensors (oral), Yasuyuki Sofue, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 2011 International Conference on Solid State Devices and Materials.

[11]Room Temperature Operation of Single-Charge Memory with Single Walled Carbon Nanotube Transistor (oral), T. Kamimura, Y. Hayashi, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics.

[12]Floating-Gate Memory Based on Carbon Nanotube Field-Effect Transistors with High-k Dielectrics (poster), Y. Fujii, T. Ohori, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics.

[13]Specific Protein Detection Based on Carbon Nanotube Field-Effect Transistors with Multi Channels (poster), S. Okuda, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics.

[14]Graphene Growth from Amorphous-Carbon using Metal Catalyst (poster), K. Gumi, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics.

[15]Ionic-liquid-gated bilayer graphene FETs for generating band gap (poster), Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics.

[16]Investigation of the mobilities for field effect transistor with a graphene channel prepared by chemical vapor deposition (poster), R. Negish1, Y. Ohno, K. Maehashi, K. Matsumoto, Y. Kobayashi: International Workshop on Quantum Nanostructures and Nanoelectronics,3-4 Oct,2011, Tokyo,Japan.

[17]Fabrication of field effect transistor arrays using alcohol reduced graphene oxide channel for sensing applications (poster), K. Kuramoto, R. Negishi, Y. Ohno, K. Maehashi, K. Matsumoto, Y. Kobayashi: International Workshop on Quantum Nanostructures and Nanoelectronics,3-4 Oct,2011, Tokyo,Japan.

[18]Highly Sensitive and Selective Potassium Ion Sensors based on Graphene Field-Effect Transistors (poster), Y. Sofue, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics,3-4 Oct,2011, Tokyo,Japan.

[19]Antigen-Binding Fragments-Modified Graphene-FET for Immunosensors (poster), S. Okamoto, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: International Workshop on Quantum Nanostructures and Nanoelectronics,3-4 Oct,2011, Tokyo,Japan.

[20]Chemical and Biological Sensors Using Graphene Field-Effect Transistors (poster), Yasuhide Ohno, Yasuyuki Sofue, Shogo Okamoto, Kenzo Maehashi, Kazuhiko Matsumoto: TeraNano PIRE Kick-Off Meeting 2011,October 7 - 8, 2011,USA.

[21]Label-Free Immunosensors Using Horizontally Aligned Carbon Nanotubes (poster), Satoshi Okuda, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Mastumoto: TeraNano PIRE Kick-Off Meeting 2011,October 7 - 8, 2011,USA.

[22]Characteristics of the Field Effect Transistor using Graphene Layers grown on Graphene Template by Chemical Vapor Deposition (oral), R. Negishi, Y. Ohno, K. Maehashi, K. Matsumoto, Y. Kobayashi: 24th International Microprocesses and Nanotechnology Conference,October 30 - November 2, 2011.,Kobe,Japan.

[23]Immunosensors based on Graphene Field-effect Transistors using Antigen-binding Fragments (oral), S. Okamoto, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 24th International Microprocesses and Nanotechnology Conference,October 30 - November 2, 2011.,Kobe,Japan.

[24]Carbon Nanotube-based Floating Gate Memory with High-k Dielectrics (oral), Y. Fujii, T. Ohori, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 24th International Microprocesses and Nanotechnology Conference,October 30 - November 2, 2011.,Kobe,Japan.

[25]Direct Synthesis of Graphene on SiO2 Substrates Using Transfer-Free Processes (poster), K. Gumi, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: 24th International Microprocesses and Nanotechnology Conference,October 30 - November 2, 2011.,Kobe,Japan.

[26]Horizontally Aligned Carbon Nanotubes on Quartz Substrate for Electrolyte-Gated Chemical and Biological Sensing (oral), S. Okuda, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: AVS 58th International Symposium and Exhibition,28 Oct-2 Nov,2011,Florida.

[27]Aptamer Modified Graphene Bio Sensor (oral), K. Maehashi, Y. Ohno, K. Matsumoto: AVS 58th International Symposium and Exhibition,28 Oct-2 Nov,2011,Florida.

[28]Potassium-Ion Sensors Based on Valinomycin-Modified Graphene Field-Effect Transistors (oral), Y. Sofue, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: AVS 58th International Symposium and Exhibition,28 Oct-2 Nov,2011,Florida.

[29]Band-Gap Generation by Using Ionic-Liquid Gate in Bylayer Graphene (oral), Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: AVS 58th International Symposium and Exhibition,28 Oct-2 Nov,2011,Florida.

[30]Selective Bio-Sensing Using Modified Nano Carbon FET (invited), K. Matsumoto, Y. Ohno, K. Maehashi, K. Inoue: 15th International Conference on Thin Films, 8 - 11 November 2011,Kyoto, Japan.

[31]Transfer-Free Graphene Growth by Annealing Amorphous Carbon (poster), Kenta Gumi, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[32]Carbon Nanotube NVM with High-k Gate Dielectic Stack (poster), Yusuke Fujii, Takahiro Ohori, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[33]Bilayer Graphene FET with Ionic-Liquid Electrolyte (poster), Yusuke Yamashiro, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[34]Ion Concentration Dependence of Transfer Characteristics of Ionophore-modified Graphene Field-Effect Transistors (poster), Yasuyuki Sofue, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[35]Electrolyte-Gated Multichannel Carbon Nanotube Field-Effect Transistors for Biological Sensing (poster), Satoshi Okuda, Shogo Okamoto, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[36]HSP Detection using Fab-Modified Graphene-FET (poster), Shogo Okamoto, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[37]Nano Carbon Devices and Applications (invited), Kazuhiko Matsumoto, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue: International Syposium on Terahertz Nanoscience and Workshop of International Terahertz Research Network,Osaka, Japan, Nov. 24-29, 2011.

[38]Wrapped Gate Single Charge Memory by Carbon Nanotube FET with SiNx/Al2O3 Double Gate Insulator Layers (oral), Kazuhiko Matsumoto, Takafumi Kamimura: International Symposium on

Advanced Nanodevices and Nanotechnology.

[39]Charge Sensing using Graphene & Carbon Nanotube Devices (oral), K. Matsumoto, K. Maehashi, Y. Ohno, T. Kamimura, M. Abe, K. Inoue: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[40]Carbon Nanotube Non-Volatile Memory with High-k Gate Dielectic Stack for Low-Power Operation (poster), Y. Fujii, K. Koshida, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[41]Electrical Field Dependence of Bilayer Graphene in Ionic-liquid (poster), Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[42]Dense, Horizontally Aligned Carbon Nanotubes for Highly Sensitive Chemical Sensor (poster), S. Okuda, K. Koshida, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[43]Technological Fabrication and Electrical Characterization of Graphene-Based Ion-Selective Field-Effect Transistors (poster), Y. Sofue, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[44]Direct Graphene Synthesis on SiO2 Substrates Using Transfer-Free Processes (poster), K. Gumi, K. Inoue, Y. Ohno, K. Maehashi, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[45]Detection of Antigen-Antibody Reaction Based on Antigen-Binding Fragment-Modified Graphene-FET (poster), S. Okamoto, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

Books

[1]Characteristics of graphene and application to biodevices(Eiichi Tamiya) Kenzo Maehashi, “Advanced Interdisciplinary Biodevices Based on Nanotechnology”, CMC Publishing Co.,Ltd., (1-7) 2011.

Patents

[1]Single electron transistors Y. Majima, T. Teranishi, Y. Azuma, G. Hackenberger, K. Matsumoto, K. Maehashi, Y. Ohno, JP2012-42588

[2]Single electron transistors Y. Majima, T. Teranishi, Y. Azuma, G. Hackenberger, K. Matsumoto, K. Maehashi, Y. Ohno, PCT/JP2012/55002

Contributions to International Conferences and Journals

Kazuhiko Matsumoto	International Workshop on Quantum Nanostructures and Nanoelectronics (Organaizing Committtee)
Kenzo Maehashi	International Workshop on Quantum Nanostructures and Nanoelectronics (Organaizing Committtee)
Kenzo Maehashi	Japanese Journal of Applied Physics (Editor)

Publications in Domestic Meetings

The Japan Society of Applied Physics Meeting	21 papers
The Chemical Society of Japan Meetingt	1 paper

Academic Degrees

Bachelor Degree of Engineering	Electric property of graphene field-effect transistor with ionic liquid gate

Takashi Ikuta Bachelor Degree of Engineering	Sensing Characteristics Based on Carbon Nanotube FET with Suspended Channels
Keisuke Koshida Master Degree for Science	Horizontally Aligned Carbon Nanotubes for Biological Sensing
Satoshi Okuda Master Degree for Science	Selective ion sensors based on ionophore-modified graphene field-effect transistors
Yasuyuki Sofue	

Grant-in-Aid for Scientific Research

K. Matsumoto	Carbon Nanotube-Biosensor	¥7,200,000
Y. Ohno	Development of Biosensing Technology with Graphene Transistors	¥1,170,000

Entrusted Research

K. Matsumoto	JST CREST	Development of Quantum Nano Devices by Controlling Quantum Nano Interface	¥41,600,000

Department of Advanced Electron Devices

Original Papers

[1]High-speed flexible organic field-effect transistors with a 3D Structure, M. Uno, K. Nakayama, J. Soeda, Y. Hirose, K. Miwa, T. Uemura, A. Nakao, K. Takimiya, and J. Takeya: Adv. Mater., 23 (2011) 3047–3051.

[2]Hall effect measurements probing the degree of charge carrier delocalization in solution-processed, crystalline molecular semiconductors, J.-F. Chang, T. Sakanoue, Y. Oliviera, T. Uemura, M.-B. D.-Madec, S. G. Yeates, J. Cornila, J. Takeya, A. Troisi, H. Sirringhaus: Phys. Rev. Lett., 107 (2011) 066601.

[3]Solution-crystallized organic field-effect transistors with charge-acceptor layers: high-mobility and low-threshold-voltage operation in air, J. Soeda, Y. Hirose, M. Yamagishi, A. Nakao, T. Uemura, K. Nakayama, M. Uno, Y.Nakazawa, K. Takimiya, and J. Takeya: Adv. Mater., 23 (2011) 3309-3314.

[4]High electron mobility in air for N,N'-1H,1H-perfluorobutyldicyanoperylene carboxydi-imide solution-crystallized thin-film transistors on hydrophobic surfaces, J. Soeda, T. Uemura, Y. Mizuno, A. Nakao, Y. Nakazawa, A. Facchetti, and J. Takeya: Adv. Mater., 23 (2011) 3681–3685.

[5]Organic single-crystal transistors: development of solution processes and charge transport mechanisms, T. Uemura, J. Takeya: Proceedings of SPIE, 8117 (2011) 81170J-1~7.

[6]Charge transport and Hall effect in rubrene single-crystal transistors under high pressure, Y. Okada, K. Sakai, T. Uemura, Y. Nakazawa, and J. Takeya: Phys. Rev. B, 84 (2011) 245308.

[7]Temperature dependence of the Hall effect in pentacene field-effect transistors: Possibility of charge decoherence induced by molecular fluctuations, T. Uemura, M. Yamagishi, J. Soeda, Y. Takatsuki, Y. Okada, Y. Nakazawa, and J. Takeya: Phys. Rev. B, 85 (2012) 035313.

International Conferences

[1]Hall effect and charge transport in organic thin-film transistors (oral), T. Uemura, M. Yamagishi, Y. Takatsuki, Y. Okada, Y. Nakazawa, and J. Takeya: 2011 MRS Fall Meeting, November 28 - December 2, 2011Hynes Convention Center, Boston, MA.

[2]Short-channel and high-mobility p- and n-type organic single-crystal transistors with air-gap structures (oral), M. Uno, T. Uemura, K. Miwa, A. Facchetti, and J. Takeya: 2011 MRS Fall Meeting, November 28 - December 2, 2011Hynes Convention Center, Boston, MA.

[3]P- and N-type solution-crystallized organic transistors and high-performance printable inverters (oral), J. Soeda, T. Uemura, Y. Mizuno, A. Nakao, Y. Hirose, M. Yamagishi, M. Uno, K. Nakayama, Y. Nakazawa, K. Takimiya, A. Facchetti and J. Takeya: 2011 MRS Fall Meeting, November 28 - December 2, 2011Hynes Convention Center, Boston, MA.

[4]Patternable solution-crystallized organic transistors with high charge carrier mobility (oral), T. Uemura, K. Nakayama, Y. Hirose, J. Soeda, M. Uno, Y. Nakazawa and J. Takeya: Fourth international symposium on atomically controlled fabrication technology, October 31 - November 2 , 2011, Osaka University Nakanoshima Center, Osaka, Japan.

[5]Organic single-crystal transistors based on tetracene-related materials (poster), K. Nakahara, T. Okamoto, and J. Takeya: Fourth international symposium on atomically controlled fabrication technology, October 31 - November 2 , 2011, Osaka University Nakanoshima Center, Osaka, Japan.

[6]High-power and air-stable three-dimensional polymer FETs (poster), K. Nakayama, T. Uemura, M. Uno, and J. Takeya: Fourth international symposium on atomically controlled fabrication technology, October 31 - November 2 , 2011, Osaka University Nakanoshima Center, Osaka, Japan.

[7]Organic single-crystal transistors based on tetracene-related materials (poster), K. Nakahara, T. Okamoto, and J. Takeya: 7th Handai Nanoscience and Nanotechnology international symposiu, November 10-11, 2011, Icho-kaikan, Osaka University, Japan.

[8]High-power and air-stable three-dimensional polymer FETs (poster), K. Nakayama, T. Uemura, M. Uno, and J. Takeya: 7th Handai Nanoscience and Nanotechnology international symposiu, November 10-11, 2011, Icho-kaikan, Osaka University, Japan.

[9]Organic single-crystal transistors: development of solution processes and charge transport mechanisms (invited), T. Uemura, J. Takeya: SPIE,USA.

[10]Organic active-matrix TFTs with air-stable organic semiconductors (oral), T. Uemura, M. Uno, k. Nakayama, N. Shomoto, M. Ito, K. Takimiya, J. Takeya: The 18th International Display Workshops (IDW'11),December 7(Wed) – 9(Fri), 2011,Nagoyo.

[11]Solution-crystalized organic single crystal transistors (invited), J. Takeya: ICMAT, June 28, 2011, Convention Center, Singapore.

[12]Organic Semiconductor Crystals 101: Charge transport in high-performance organic transistors (invited), J. Takeya: Tutorial, MRS Fall Meeting, November 27, 2011, Boston Convention Center, MA, USA.

[13]Pressure effect in organic single-crystal transistors (oral), J. Takeya: APS March Meeting,March 21–25, 2011,Dallas, Texas.

Books

[1]Hall effect in high-mobility organic field-effect transistors J. Takeya, “Hall effect in high-mobility organic field-effect transistors”, AGNE, 46 (11) 2011.

[2]High-mobility transistors with organic semiconductors J. Takeya, “High-mobility transistors with organic semiconductors”, The Society of Polymer Science,Japan, 61 (2) 2012.

Patents

[1]Organic transistors and its fabrication processes J. Takeya, M. Uno, JP2011-171136

[2]Compounds for self-assembled monolayer and organic semiconductor devices J. Takeya, T. Okamoto, JP2011-177539

Publications in Domestic Meetings

Annual meeting of Japan Society for Molecular Science,2011	2 papers
The 72nd JSAP Autumn Meeting 2012	5 papers
The Physical Society of Japan Autumn Meeting 2011	3 papers

Grant-in-Aid for Scientific Research

J.Takeya	Development of device functionality and physical properties on the surface of organic single crystals	¥12,870,000
K.Sudoh	Fabrication of 3 dimensional microscopic structures by surface diffusion on Si substrates	¥1,560,000
T. Uemura	Development of high-mobility organic transistors and carrier transport mechanisms on the effects of molecular fluctuations	¥16,640,000
C.Mitsui	Novel πconjugated organic semiconductors and its device application	¥1,690,000
K.Sakai	Analysis of the local electronic structures on the edge of the graphene	¥700,000

Entrusted Research

J.Takeya	Japan Science and Technology Agency	Development of flexible displays with novel high-mobility polymer semiconductors	¥20,239,000
J.Takeya	New Energy and Industrial Technology Development Organization	Development of active matrix displays with novel high-mobility organic transistors	¥299,000
J.Takeya	Japan Science and Technology Agency	Comprehensive interpretation of carrier transport mechanisms on organic single crystal and polymer semiconductors	¥4,000,000
J.Takeya	Japan Science and Technology Agency	Development of high speed logic devices for display drivers with high-mobility solution-processed organic transistors	¥3,800,000

Contribution to Research

J.Takeya	Tanaka Holdings Co., Ltd.	¥500,000
J.Takeya	Koei Chemical Co.,Ltd.	¥500,000
K.Sudoh	Fuji Electric Co., Ltd.	¥490,000

Cooperative Research

J.Takeya	The Semiconductor Technology Academic Research Center	¥5,200,000
J.Takeya	TOPPAN FORMS	¥5,630,000
J.Takeya	DENSO	¥2,492,000
J.Takeya	JNC Corporation	¥2,000,000
J.Takeya	Sumitomo Chemical Company, Limited	¥1,012,000
J.Takeya	Electroplating Engineers of Japan, Limited	¥1,000,000

Department of Intelligent Media

Original Papers

[1]The Optimal Camera Arrangement by a Performance Model for Gait Recognition, N. Akae, Y. Makihara, Y. Yagi: IEICE Trans. on Information and Systems, J95-D (3) (2012) .

[2]A Proposal for Modeling Reflectance Properties in Scattering, Y. Baba, Y. Mukaigawa, Y. Yagi: IEICE Trans. on Information and Systems, J95-D (2) (2012) 287-296.

[3]Cluster-Pairwase Discriminant Analysis, Y. Makihara, Y. Yagi: IEICE Trans. on Information and Systems, J94-D (8) (2011) 1216-1226.

[4]Gait Recognition Using Period-Based Phase Synchronization for Low Frame-Rate Videos, A. Mori, Y. Makihara, Y. Yagi: IEICE Trans. on Information and Systems, J94-D (8) (2011) 1290-1299.

[5]ROC Curve Optimization Based on Quality Measure-Based Adaptive Acceptance Threshold Control, Y. Makihara, M. A. Hossain, Y. Yagi: IEICE Trans. on Information and Systems, J94-D (8) (2011) 1227-1239.

[6]Foreground, Shadow and Background Segmentation Based on Homography-Correspondence Pair, H. Iwama, Y. Makihara, Y. Yagi: IEICE Trans. on Information and Systems, J94-D (8) (2011) 1300-1313.

[7]Periodic Temporal Super Resolution based on Phase Registration and Manifold Reconstruction, Y. Makihara, A. Mori, Y. Yagi: IPSJ Trans. on Computer Vision and Applications, 3 (2011) 134-147.

[8]Ringing Detector for Deblurring based on Frequency Analysis of PSF, C. Inoshita, Y. Mukaigawa, Y. Yagi: IPSJ Trans. on Computer Vision and Applications, 3 (2011) 236-247.

[9]Hemispherical Confocal Imaging, S.Tagawa, Y.Mukaigawa, J.Kim, R.Raskar, Y.Matsushita, Y.Yag: IPSJ Trans. on Computer Vision and Applications, 3 (2011) 222-235.

[10]Analysis of Scattering Light Transport in Translucent Media, Y.Mukaigawa, R.Raskar, Y.Yag: IPSJ Trans. on Computer Vision and Applications, 3 (2011) 122-133.

[11]Background Image Generation by Analyzing Long-Term Images for Outdoor Fixed Camera, Y. Kawanishi, I. Mitsugami, M. Minoh: IEICE Trans. on Information and Systems, J94-D (8) (2011) 1359-1367.

[12]Entire Shape Acquisition Technique Using Multiple Projectors and Cameras with Parallel Pattern Projection, R. Furukawa, R. Sagawa, H. Kawasaki, K. Sakashita, Y. Yagi, N. Asada: IPSJ Trans. on Computer Vision and Applications, 4 (2012) 40-52.

[13]Linear Solution for Oneshot Active 3D Reconstruction Using Multiple Projectors, R. Furukawa, H. Kawasaki, R. Sagawa, K. Sakashita, Y. Ohta, R. Zushi, Y. Yagi, N. Asada: Transactions of Information Processing Society of Japan, 52 (5) (2011) 1923-1938.

International Conferences

[1]Performance Evaluation of Gait Recognition using the Largest Inertial Sensor-based Gait Database, N.T. Trung, Y. Makihara, H. Nagahara, R. Sagawa, Y. Mukaigawa, Y. Yagi: Proc. of the 5th IAPR International Conference on Biometrics (ICB 2012), (2012) .

[2]Action Recognition Using Dynamics Features, A. Mansur, Y. Makihara, Y. Yagi: Proc. of 2011 IEEE International Conference on Robotics and Automation, (2011) 4020-4025.

[3]The Online Gait Measurement for Characteristic Gait Animation Synthesis, Y. Makihara, M. Okumura, Y. Yagi, S. Morishima: Proc. of Human Computer Interaction International 2011, 6773 (2011) 325-334.

[4]Primary Analysis of Human's Gait and Gaze Direction Using Multiple Motion Sensors, I. Mitsugami, Y. Nagase, Y. Yagi: Proc. of 1st Asian Conference on Pattern Recognition (ACPR2011), (2011) .

[5]Gait Recognition using Periodic Temporal Super Resolution for Low Frame-rate Videos, N. Akae, Y. Makihara, Y. Yagi: Proc. of the International Joint Conference on Biometrics (IJCB2011), (178) (2011)

1-7.

[6]Score-level Fusion based on the Direct Estimation of the Bayes Error Gradient Distribution, Y. Makihara, M.A. Hossain, D. Muramatsu, Y. Yagi: Proc. of the International Joint Conference on Biometrics (IJCB2011), (197) (2011) 1-8.

[7]Gait-based Age Estimation using a Whole-generation Gait Database, Y. Makihara, M. Okumura, H. Iwama, Y. Yagi: Proc. of the International Joint Conference on Biometrics (IJCB2011), (195) (2011) 1-6.

[8]Image-Enhanced Capsule Endoscopy Preserving the Original Color Tones, H. Vu, T. Echigo, K. Yagi, H. Okazaki, Y. Fujiwara, Y. Yagi: Proc. of MICCAI 2011 Workshop: Computational and Clinical Applications in Abdominal Imaging, 7029 (2011) 35-43.

[9]Measuring and Modeling of Multi-layered Subsurface Scattering for Human Skin, T. Mashita, Y. Mukaigawa, Y. Yagi: Proc. of Human Computer Interaction International 2011, (2011) .

[10]Providing Immersive Virtual Experience with First-person Perspective Omnidirectional Movies and Three Dimensional Sound Field, K. Kondo, Y. Mukaigawa, Y. Ikeda, S. Enomoto, S. Ise, S. Nakamura, Y. Yagi: Proc. of Human Computer Interaction International 2011, (2011) .

[11]Phase Registration in a Gallery Improving Gait Authentication, N.T. Trung, Y. Makihara, H. Nagahara, R. Sagawa, Y. Mukaigawa, and Y. Yagi: Proc. of the International Joint Conference on Biometrics (IJCB2011), (2011) 1-7.

[12]A System for Capturing Textured 3D Shapes based on One-shot Grid Pattern with Multi-band Camera and Infrared Projector, K. Sakashita, R. Sagawa, R. Furukawa, H. Kawasaki, Y. Yagi: Proc. 2011 International Conference on 3D Imaging, Modeling, Processing, Visualization and Transmission (3DIMPVT), (2011) 49-56.

Review Papers

My Recommendations on Research and Development Tools --- (46) Bundler: Structure from Motion for Unordered Image Collections, I. Mitsugami, The Journal of the Institute of Image Information and Television Engineering, The Institute of Image Information and Television Engineering, 53 (2011), 479-482.

Gait-based Age Estimation using Gaussian Processes, M. Okumura, Y. Makihara, Y. Yagi, Image Laboratory, Japan Industrial Publishing, 22 (2011), 15-20.

Books

[1]Measurement and Modeling of Reflection and Scattering(Y. Yagi, H. Saito) Y. Mukaigawa, “Computer Vision and Image Media 4”, Advanced Communication Media, 4 (121-150) 2011.

Contributions to International Conferences and Journals

Y. Yagi	14th International Workshop on Combinatorial Image Analysis (IWCIA2011) (Programm Committee)
Y. Yagi	International Journal of Automation and Computing (Editorial Board)
Y. Yagi	The Open Artificial Intelligence Journal (Editorial Board)
Y. Yagi	2011 IEEE International Conference on Robotics and Automation (ICRA2011) (Editorial Board)
Y. Yagi	The 24th IEEE Conference on Computer Vision and Pattern Recognition (CVPR2011) (Review Committee)
Y. Yagi	The 24th IEEE Conference on Computer Vision and Pattern Recognition (CVPR2011) (Program Committee)
Y. Yagi	Panamedia 2011 Workshop (Stearing Chair)

Y. Yagi	IEEE MMTC (Stearing Committee)
Y. Yagi	IPSJ Trans. Computer Vision and Application (Assoc. Editor-in-Chief)
Y. Yagi	Asian Federation of Computer vision societies (Financial Chair)
Y. Yagi	Asian Conference on Pattern recognition 2011 (Program co-chair)
Y. Yagi	IEEE Communication Society Multimedia Communications Technical Committee (Voting Member)
Y. Yagi	The 13rd International Conference on Computer Vision (ICCV2011) (Programm Committee)
Y. Yagi	Asian Conference on Pattern recognition 2013 (General Chair)
Y. Yagi	3rd AFCV International Workshop on Recent Trends in Computer Vision (Organizer)
Y. Mukaigawa	The 24th IEEE Conference on Computer Vision and Pattern Recognition (CVPR2011) (Programm Committee)
Y. Mukaigawa	The 17th Scandinavian Conference on Image Analysis (SCIA2011) (Review Committee)
Y. Mukaigawa	The 13rd International Conference on Computer Vision (ICCV2011) (Programm Committee)
Y. Mukaigawa	3rd AFCV International Workshop on Recent Trends in Computer Vision (Organizer)
Y. Mukaigawa	Pacific-Rim Symposium on Image and Video Technology 2011 (Area Chair)
Y. Mukaigawa	The 25th IEEE Conference on Computer Vision and Pattern Recognition (CVPR2012) (Program Committee)
Y. Mukaigawa	The 11th Asian Conference on Computer Vision (ACCV2012) (Area Chair)
Y. Mukaigawa	The 21st International Conference on Pattern Recognition (ICPR2012) (Technical Program Committee)
Y. Makihara	3rd AFCV International Workshop on Recent Trends in Computer Vision (Organizer)
Y. Makihara	Asian Conference on Pattern recognition 2011 (Program Committee)
Y. Makihara	Pacific-Rim Symposium on Image and Video Technology 2011 (Program Committee)
I. Mitsugami	3rd AFCV International Workshop on Recent Trends in Computer Vision (Organizer)
I. Mitsugami	Asian Conference on Pattern recognition 2013 (Publicity Chair)

Publications in Domestic Meetings

SIG-CVIM, Information Processing Society of Japan	10 papers
Meeting on Image Recognition and Understanding	4 papers
TC-MI, the Institute of Electronics, Information, and Communication Engineers	1 paper

Academic Degrees

Master Degree for Science N. Akae	Low Frame-rate Gait Recognition using Periodic Temporal Super Resolution
Master Degree for Science C. Inoshita	Shape from Single Scattering for Translucent Objects
Master Degree for Science S. Moriguchi	Estimation of Shielding Object Distribution in Scattering Media by Analyzing Light Transport

Grant-in-Aid for Scientific Research

Y. Yagi	Wearable ambient surveillance by lensless omnidirectional sensor and its application to schoolchild crime prevention	¥42,250,000
Y. Mukaigawa	Safe visualization of 3D structure in human body by computational photography	¥41,566,000
Y. Makihara	High-accuracy gait recognition by fluctuation analysis	¥5,460,000
I. Mitsugami	Development of 3D shape reconstruction method for glossy	¥1,560,000

	surface		
D. Muramatsu	Development of multi-modal biometric person authentication method using writing style		¥1,560,000
Entrusted Research			
Y. Yagi	Japan Society for the Promotion of Science	Investigation on academic trend on perceptual information processing	¥2,247,000
Y. Yagi	Japan Science and Technology Agency	Behavior Understanding based on Intention-Gait Model	¥46,398,000
Y. Yagi	Ministry of Education, Culture, Sports, Science and Technology	Human sensing system for criminal investigation	¥23,807,000
Contribution to Research			
Y. Yagi	Y. Yagi		¥2,200,000
Y. Yagi	Yokohama Research Laboratory, Hitachi, Ltd.		¥900,000
Y. Yagi	Omron Co, Ltd.		¥500,000
Cooperative Research			
Y. Yagi	Honda R&D Co, Ltd.		¥6,050,000
Y. Yagi	Olympus Co, Ltd.		¥1,650,000

Department of Reasoning for Intelligence

Original Papers

[1]DirectLiNGAM: A Direct Method for Learning a Linear Non-Gaussian Structural Equation Model, S. Shimizu, T. Inazumi, Y. Sogawa, A. Hyvärinen, Y. Kawahara, T. Washio, P. O. Hoyer and K. Bollen: Journal of Machine Learning Research, 12 (2011) 1225-1248.

[2]Analyzing relationships among ARMA processes based on non-Gaussianity of external influences, Y. Kawahara, S. Shimizu and T. Washio: Neurocomputing, 74 (12-13) (2011) 2212-2221.

[3]Estimating Exogenous Variables in Data with More Variables than Observations, Y. Sogawa, S. Shimizu, T. Shimamura, A. Hyvarinen, T. Washio and S. Imoto: Neural Networks, 24 (8) (2011) 875-880.

[4]Spacecraft telemetry monitoring method based on dimensionality reduction and clustering, T. Yairi, M. Inui, Y. Kawahara, N. Takada: Journal of the Japan Society for Aeronautical and Space Science, 59 (691) (2011) 197-205.

[5]Learning non-linear dynamical systems by alignment of local linear models, M. Joko, Y. Kawahara, T. Yairi: Transactions of the Japanese Society for Artificial Intelligence, 26 (6) (2011) 638-648.

International Conferences

[1]Discovering Causal Structures in Binary Exclusive-or Skew Acyclic Models, Takanori Inazumi, Takashi Washio, Shohei Shimizu, Joe Suzuki, Akihiro Yamamoto and Yoshinobu Kawahara: Proc. of UAI2011: The 27th Conference on Uncertainty in Artificial Intelligence, (2011) 373-382.

[2]Common Substructure Learning of Multiple Graphical Gaussian Models, Satoshi Hara and Takashi Washio: Proc. ofECML-PKDD2011: European Conference on Machine Learning and Principle and Practice of Knowledge Discovery in Databases 2011, Lecture Notes in Computer Science: Springer LNCS, 6912 (2) (2011) 1-16.

[3]Prismatic Algorithm for Discrete D.C. Programming Problem, Yoshinobu Kawahara and Takashi Washio: Proc. of NIPS2011: Twenty-Fifth Annual Conference on Neural Information Processing Systems, (2011) 2106-2114.

[4]Density Estimation based on Mass, K. Ming Ting, T. Washio, J. Wells and T. Liu: Proc. of ICDM2011: The IEEE International Conference on Data Mining 2011, (2011) 715-724.

[5]Size-constrained submodular minimization through minimum norm base, K. Nagano, Y. Kawahara and K. Aihara: Proceedings of the 28th International Conference on Machine Learning (ICML'11), (2011) 977-984.

[6]A Framework for Shopping Path Research (oral), K. Yada, T. Washio and H. Koga: Workshop on Data Mining Marketing, SIAM: SIAM Conference on Data Mining (SDM11), USA, April 28-30, 2011.

[7]Application of DNA Sequence Alignment Algorithm to Classification of Shopping Paths through a Supermarket (oral), K. Ichikawa, E.. Ip, K. Yada and T. Washio: Workshop on Data Mining Marketing, SIAM: SIAM Conference on Data Mining (SDM11), USA, April 28-30, 2011.

[8]A New Approach to Bayesian Estimation over the Curse of Dimensionality (invited), T. Washio: AI-2011 Thirty-first SGAI International Conference on Artificial Intelligence, Workshop on MachineLearning and Intelligent Autonomous Systems,ENGLAND 13-15 DECEMBER 2011.

[9]Analysis of Residence Time in Shopping using RFID Data -An Application of the Kernel density estimation to RFID- (oral), S. Miyazaki, T. Washio and K. Yada: Working note of DMS2011: Workshop on Data Minig For Service:The IEEE International Conference on Data Mining series (ICDM2011),December 11 to 14, 2011,Canada.

Review Papers

High Dimensional Data Mining in Information Explosion Ara, T. Washio, The Journal of the Institute of Electronics Information and Communication Engineers, The Institute of Electronics Information and Communication Engineers, 94[8] (2011), 679-683.

Extension of Frequent Pattern Mining to Graph Sequences, A. Inokuchi, Journal of the Japanese Society for Artificial Intelligence, Ohmsha, 27[3] (2012), 120-127.

Patents

[1]Visualization device, method and program for multivariate date S. Morinaga, Y. Kawahara, T. Ito, Y. Zheng, H. Suematsu, 2012022112

[2]Discriminant model learning device, method and program S. Morinaga, R. Fujimaki, Y. Kawahara, 61/596,313

[3]Optimized query generating device and method, and discriminant model learning method S. Morinaga, R. Fujimaki, Y. Kawahara, 61/596,317

Contributions to International Conferences and Journals

T. Washio	Journal of Data Mining and Knowledge Discovery (Editorial Board)
T. Washio	Asian Conference on Machine Learning (ACML) (Steering Committee)
T. Washio	Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD) (Steering Committee)
T. Washio	The 16th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2012) (Workshop Chair)
T. Washio	2011 International Workshop on Learning and data Mining for Robotics (LEMIR 2011), Program Committee Member (Program Committee)
T. Washio	The 21st International Conference on Inductive Logic Programming (ILP 2011) (Program Committee)
T. Washio	The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2011) (Program Committee)
T. Washio	IEEE International Workshop on Data Mining for Service (DMS2011) (Program Committee)

T. Washio	Second Workshop on Algorithms for Large-Scale Information Processing in Knowledge Discovery (ALSIP 2011)) (Program Committee)
T. Washio	Statistical Analysis and Data Mining (SAM) (Guest Editor)
T. Washio	The 18th ACM SIGKDD Knowledge Discovery and Data Mining (KDD 2012) (Program Committee)
T. Washio	The 21st ACM International Conference on Information and Knowledge Management (CIKM 2012) (Program Committee)
T. Washio	ICDM 2012 IEEE International Conference on Data Mining (Program Committee)
A. Inokuchi	The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program committee)
A. Inokuchi	2011 SIAM International Conference on Data Mining (Program committee)
A. Inokuchi	IADIS European Conference on Data Mining (ECDM'11) (Program committee)
A. Inokuchi	International Workshop on Data Oriented Constructive Mining and Massively Multi-Agent System: Simulations, Models, and Tools (Program committee)
A. Inokuchi	2012 International Conference on Pattern Recognition Applications and Methods (Program committee)
A. Inokuchi	The First International Conference on Social Eco-Informatics (Program committee)
A. Inokuchi	International Conference on Social Computing and its Applications (SCA 2011) (Program committee)
A. Inokuchi	The 3rd Asian Conference on Machine Learning (Program committee)
A. Inokuchi	The 7th International Conference on Advanced Data Mining and Applications (Program committee)
A. Inokuchi	The 16th Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program committee)
A. Inokuchi	The 10th IEEE International Symposium on Parallel and Distributed Processing with Applications (Program Vice-chairs)
A. Inokuchi	IADIS European Conference on Data Mining (ECDM'12) (Program committee)
A. Inokuchi	The 8th International Conference on Advanced Data Mining and Applications (Program committee)
A. Inokuchi	International Journal of Applied Evolutionary Computation (Editorial Review Board)

Publications in Domestic Meetings

The 3rd Forum on Data Engineering and Information Management (DEIM2011)	1 paper
The 25th Annual Conference of The Japanese Society for Artificial Intelligence	7 papers
Special Interest Group on Knowledge-Based Systems, The Japanese Society for Artificial Intelligence	1 paper
Information-Based Inductive Sciences and Machine Learning (IBISML2011)	6 papers
Special Interest Group on Fundamental Problem of Artificial Intelligence, The Japanese Society for Artificial Intelligence	1 paper
Annual Conference of The Institute of Electrical Engineers of Japan	1 paper
The 23rd RAMP Symposium	1 paper
Domestic Conference on Data Oriented Constructive Mining and Simulation	1 paper
Latent Dynamics Workshop	1 paper
Statistics for Biomedical & Social Mathematical Sciences	1 paper
Frontiers of statistical physics for information processing -toward control of information and fluctuation	1 paper

Academic Degrees

bachelor Degree for Engineering M. Ito	A Study on Enumeration of Frequent Patterns from Hyper-graph Sequences
bachelor Degree for Engineering K. Sugimoto	A Study on feature selection using randomized algorithm
Master Degree for Engineering	Estimation of causal structures of binary variables: A boolean algebra approach

T. Inazumi Master Degree for Engineering	A Study on Clustering of a Graph Sequence based on Submodular Optimization
T. Kishimoto Master Degree for Engineering	A Study on Conditional Simulation Approaches for Molecular Structure Change
S. Matsuda Master Degree for Engineering	A Study on the Applications to Marketing Problems of Regularized Learning Methods
Q. Liu Master Degree for Engineering	Robustness Estimation of A Linear Non-Gaussian Acyclic Model
H. Li	

Grant-in-Aid for Scientific Research

T. Washio	Development of Statistical Estimation Principle for Extremely High Dimensional Data and Its Application to Large Scale Data Mining	¥6,500,000
A. Inokuchi	Development of Multidimensional Databases for Analyzing Time Interval Data in Heterogeneous Schemas	¥5,720,000
S. Shimizu	Discovery of reliable causal structures in high-dimensional data	¥1,040,000
Y. Kawahara	Data analysis method for super high dimensinal data using discrete structure	¥910,000

Entrusted Research

T. Washio	National Cerebral and Cardiovascular Center	Practice of Advanced Estimation Theory	¥500,000
A. Inokuchi	Japan Science and Technology Agency	Development of Knowledge Organization and Understanding Support of Massive Graph Sequence Data	¥8,515,000
Y. Kawahara	Japan Science and Technology Agency	Knowledge discovery from super-high dimensional data based on combinatorial computation	¥17,550,000

Contribution to Research

T. Washio	Fujitsu Laboratories Ltd.	¥1,000,000
T. Washio	The Asian Office of Aerospace Research and Development	¥11,147,000

Cooperative Research

T. Washio	Japan Science and Technology Agency	¥1,080,000
T. Washio	Nippon Telegraph and Telephone Co.	¥2,970,000
Y. Kawahara	NEC Co.	¥1,575,000

Department of Knowledge Systems

Original Papers

[1]Evolution and Commercial Deployment of Integrated Technical Knowledge Management System Based on Ontology Engineering, Sunao Takafuji, Yoshinobu Kitamura and Riichiro Mizoguchi: Transactions of the Japanese Society for Artificial Intelligence, 26 (5) (2011) 547-558.

[2]An Ontological Consideration on Essential Properties of the Notion of “Service”, Kouhei Sumita, Yoshinobu Kitamura, Munehiko Sasajima, Sunao Takafuji, Riichiro Mizoguchi: Transactions of the Japanese Society for Artificial Intelligence, 27 (3) (2012) 176-192.

International Conferences

[1]Are Services Functions ?, K. Sumita, Y. Kitamura, M. Sasajima, R. Mizoguchi: Proc. of Third International Conference on Exploring Services Science (IESS 2012), (2012) 58-72.

[2]Dynamic Is-a Hierarchy Generation System Based on User's Viewpoint, K. Kozaki, K. Hihara, and R. Mizoguchi: Proc. of Joint International Semantic Technology Conference (JIST2011), (2011) 96-111.

[3]Dynamic is-a Hierarchy Generation for User Centric Semantic Web, K. Kozaki, K. Hihara, and R. Mizoguchi: Proc. of International Workshop on Ontologies come of Age in the Semantic Web (OCAS), (2011) (USB-Key).

[4]Technical Artifact: An Integrated Perspectives, S. Borgo, M. Franssen, P. Garbacz, Y. Kitamura, R. Mizoguchi, and P. E. Vermaas: Proc. of the Fifth International Workshop on Formal Ontologies Meet Industry (FOMI 2011), (2011) 3-15.

[5]An Ontology of Classification Criteria for Functional Taxonomies, Y. Kitamura, S. Segawa, M. Sasajima, R. Mizoguchi: Proc. of ASME 2011 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (ASME IDETC/CIE 2011), (2011) (CD-ROM).

[6]FOREST: An Ontological Modeling Framework for Product-Related Processes, Y. Kitamura, Y. Koji, R. Mizoguchi: Proc. of the 7th International Conf. of Engineering Design in Integrated Product Development (EDIProD 2011), (2011) 39-49.

[7]River Flow Model of Diseases, R. Mizoguchi, K. Kozakil, H. Kou, Y. Yamagata, T. Imai, K. Waki, K. Ohe: Proc. of 2nd International Conference on Biomedical Ontology (ICBO2011), (2011) 63-70.

[8]An Advanced Strategy for Integration of Biological Measurement Data, H. Masuya, G. V Gkoutos, N. Tanaka, K. Waki, Y. Okuda, T. Kushida, N. Kobayashi, K. Doi, K. Kozaki, R. Hoehndorf, S. Wakana, T. Toyoda, R. Mizoguch: Proc. of 2nd International Conference on Biomedical Ontology (ICBO2011), (2011) 79-86.

[9]Understanding an Ontology through Divergent Exploration, K. Kozaki, T. Hirota, and R. Mizoguchi: Proc. of 8th Extended Semantic Web Conference (ESWC2011), (2011) 305-320.

[10]An Ontological Model to Blend Didactic Instruction and Collaborative Learning, Y. Hayashi, S. Isotani, J. Bourdeau and R. Mizoguchi: Proc. of 17th CRIWG Conference on Collaboration and Technology, (2011) 1-13.

[11]A Taxonomy of Roles, R. Mizoguchi, K. Kozai, Y. Kitamura: Proc. of the Fifth Interdisciplinary Ontology Meeting, (2012) 117-122.

[12]Towards Perspectives for Capturing Functions (oral), Y. Kitamura and R. Mizoguchi: Fifth Interdisciplinary Ontology Meeting, Tokyo, Japan, February 23-24, 2012.

[13]The Ontological Representation of Genetics (oral), H. Masuya and R. Mizoguchi: Fifth Interdisciplinary Ontology Meeting, Tokyo, Japan, February 23-24, 2012.

[14]A Consideration on Identity of Diseases (oral), K. Kozaki, R. Mizoguchi, T. Imai and K. Ohe: Fifth Interdisciplinary Ontology Meeting, Tokyo, Japan, February 23-24, 2012.

[15]Semantic Mechanisms in Clinical Omics DB (oral), J. Nakaya, M. Kimura, R. Mizoguchi, K. Kozaki and H. Tanaka: Fifth Interdisciplinary Ontology Meeting, Tokyo, Japan, February 23-24, 2012.

[16]Engineering Function- From Theory to Deployment - (invited), R. Mizoguchi: 5th Workshop on Formal Ontologies Meet Industry (FOMI 2011), Delft, The Netherlands, July 7-8, 2011.

[17]What Computer Can Do When It Knows Learning/Instructional Theories (invited), R. Mizoguchi:

Third International Conference on Software, Seervices & Semantic Technologies, Bourgas, Bulgaria, September 1-3, 2011.

[18]Bridging the gap between theory and practice (invited), R. Mizoguchi: Workshop on Policy, Practice, and research in Technology Transformed Learning (PPRITTL 2011), Jakarta, Indonesia, September 30 and October 1, 2011.

[19]A Common Model of Didactic and Collaborative Learning for Theory-aware Authoring Support (poster), Y. Hayashi, S. Isotani, J. Bourdeau and R. Mizoguchi: 15th International Conference on Artificial Intelligence in Education (AIED2011), Auckland, New Zealand, June 28th - July 2, 2011.

[20]A Practical Study on Modeling Lesson Plans with an Ontological Engineering Approach (oral), Y. Hayashi, T. Kasai and R. Mizoguchi: 19th International Conference on Computers in Education (ICCE2011), Chiang Mai, Thailand, Nov. 28 - Dec. 2, 2011.

Books

[1]Biomimetic Database and Ontology(Neo-biomimetics Forum) K. Kozaki and R. Mizoguchi, "The New Trends in Next Generation Biomimetic Materials Engineering: Learning from Biodivesrsity", CMC Publishing CO., LTD, (334-339) 2011.

[2]Structuring of Knowledge Based on Ontology Engineering(Hiroshi Komiyama, Kazuhiko Takeuchi, Hideaki Shiroyama and Takashi Mino) R. Mizoguchi, K. Kozaki, O. Saito, T. Kumazawa and T. Matsui, "Sustainability Science: A Multidisciplinary Approach", United Nations University Press, (47-68) 2011.

[3]Application of Ontology Engineering to Biofuel Problems(Hiroshi Komiyama, Kazuhiko Takeuchi, Hideaki Shiroyama and Takashi Mino) O. Saito, K. Kozaki, T. Hirota, R. Mizoguchi, "Sustainability Science: A Multidisciplinary Approach", United Nations University Press, (69-86) 2011.

[4]Structuring Knowledge on a Resource-Circulating Society(Tohru Morioka, Ke isuke Hanaki and Yuichi Moriguchi) T. Kumazawa, T. Matsui and R. Mizoguchi, "Establishing a Resource-Circulating Society in Asia: Challenges and Opportunities", United Nations University Press, (37-51) 2011.

[5]Structuring of Sustainability Knowledge Based on Ontology Engineering(S. Hara, Y. Umeda) T. Kumazawa, K. Kozaki and R. Mizoguchi, "Pioneering Sustainability Science", Osaka University Press, (186-209) 2011.

Patents

[1]In-vehicle information recommendation method and apparatus
R.Misoguchi,M.Sasajima,K.Okamoto,H.Sugimoto,S.Takeuchi, JP2011-262618

Contributions to International Conferences and Journals

R. MIZOGUCHI	International Artificial Intelligence in Education Society (Executive Committee)
R. MIZOGUCHI	Asia-Pacific Society for Computers in Education(APSCE) (Board member)
R. MIZOGUCHI	Steering committee of Joint International Semantic Technology Conferences (JIST) (Board member)
R. MIZOGUCHI	International Association for Ontology Applications (IAOA) (Board member)
R. MIZOGUCHI	IEEE Transactions on Learning Technologies (Associate editor)
R. MIZOGUCHI	ACM Transactions on Interactive Intelligent Systems (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 of Educational Technology & Society (Editorial board)

R. MIZOGUCHI	Asian Semantic Web Conference (Steering committee chair)
R. MIZOGUCHI	Joint International Semantic Technology Conference (Conference Co-Chair)
R. MIZOGUCHI	The 19th International Conference on Computers in Education (ICCE2011) Conf. on AIED/ITS & Adaptive Learning (Poster Coordination Chair)
R. MIZOGUCHI	The 19th International Conference on Computers in Education (ICCE2010) Conf. on AIED/ITS & Adaptive Learning (PC member)
R. MIZOGUCHI	Fifteenth International Conference on Artificial Intelligence in Education: AIED 2011 (Senior Program Committee member)
R. MIZOGUCHI	6th European Conference on Technology Enhanced Learning: Towards Ubiquitous Learning (PC member)
R. MIZOGUCHI	International Conference on Industrial, Engineering & Other Applications of Applied Intelligent Systems:IEA-AIE 2011 (PC member)
R. MIZOGUCHI	International Conference on Knowledge Engineering and Ontology Development: KEOD 2011 (PC member)
R. MIZOGUCHI	6th International Workshop on Metamodels, Ontologies and Semantic Technologies: ONTOBRAS-MOST 2011 (PC member)
R. MIZOGUCHI	8th Extended Semantic Web Conference (PC member)
R. MIZOGUCHI	6th International Conference on Knowledge Capture: KCAP 2011 (PC member)
R. MIZOGUCHI	1st OCAS workshop: Ontologies come of Age in the Semantic Web:OCAS 2011 (PC member)
R. MIZOGUCHI	SHAPES 1.0. The Shape of Things: SHAPE 2011 (PC member)
R. MIZOGUCHI	Third International Conference on Software, Services & Semantic Technologies: S3T 2011 (PC member)
Y. KITAMURA	ASME Journal of Computing and Information Science in Engineering (Associate editor)
Y. KITAMURA	International Journal of Advanced Engineering Informatics (Editorial board)
Y. KITAMURA	The 1st Joint International Semantic Technology Conference (JIST2011) (PC member)
K. KOZAKI	The 10th International Semantic Web Conference (PC member)
M. SASAJIMA	The 5th International Conference on Autonomic and Autonomous Systems(ICAS 2011) (PC member)
M. SASAJIMA	International conference on Internet and Multimedia Systems and Applications (IMSA 2011) (PC member)
M. SASAJIMA	The 2nd Workshop on Social Networks and Social Media Mining on the Web (SNSMW2012) (PC member)
M. SASAJIMA	Journal of Information Processing (Chief Examiner)

Publications in Domestic Meetings

The Japanese Society for Artificial Intelligence	12 papers
The Japan Society of Mechanical Engineers	1 paper
Japanese Society for Information and Systems in Education	2 papers
Japan Society for Educational Technology	2 papers
The Institute of Electronics, Information and communication Engineers	2 papers
Japan Society for Fuzzy Theory and Intelligent Informatics	1 paper
Japan Association for Medical Informatics	3 papers
The Chemical Society of Japan.	1 paper

Academic Degrees

Master Degree for Engineering K. Hihara	Development of a Dynamic Is-a Hierarchy Generation System Based on User's Viewpoint
Master Degree for Engineering S. Nishimura	Studies on Ontology-based Description of Nursing Guidelines and its Deployment
Bachelor Degree for Engineering	Studies on Ontology Refinement Methods based on Similarity among Is-a Hierarchies

T. Masuda

Grant-in-Aid for Scientific Research

R.Mizoguchi	Development of the next-generation knowledge systems using ontological engineering	¥9,620,000
Y.Kitamura	Development of a reference ontology of function and knowledge sharing systems based on an interdisciplinary approach	¥4,030,000
K.Kozaki	Application Platform for Multi-Dimension Knowledge Structuring based on Ontological Engineering	¥2,990,000
R.Mizoguchi	Development of a Basic Technology for Information Integration of Mouse/Rat Phenotypes	¥520,000

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	¥15,015,000
R. MIZOGUCHI	The University of Tokyo	Development of Ontology-based Knowledge Processing Mechanism	¥9,000,000

Contribution to Research

Y.Kitamura	Niigata Mechatronics co., Ltd.	¥120,000
Y.Kitamura	Niigata Machine Techno co., Ltd.	¥450,000
Y.Kitamura	Niigata Mechatronics co., Ltd.	¥120,000

Department of Architecture for Intelligence

Original Papers

[1]Visualization Method of User's File Operation for Recalling Task on Desktop Environment, M. Matsumoto, S. Okano, T. Morita, M. Numao, and S. Kurihara: Transactions on Mathematical Modeling and its Applications (TOM), 4 (3) (2011) 35-48.

[2]Visualization of Damage Progress in Solid Oxide Fuel Cells, K. Fukui, S. Akasaki, K. Satou, J. Mizusaki, K. Moriyama, S. Kurihara, and M. Numao: Journal of Environment and Engineering, 6 (3) (2011) 499-511.

[3]Predicting Student Emotions Resulting from Appraisal of ITS Feedback, P. S. Inventado, R. Legaspi, M. Suarez, and M. Numao: Research and Practice in Technology Enhanced Learning, 6 (2) (2011) 107-133.

International Conferences

[1]Evolving Subjective Utilities: Prisoner's Dilemma Game Examples, K. Moriyama, S. Kurihara, and M. Numao: Proc. 10th International Conference on Autonomous Agents and Multiagent Systems(AAMAS2011), (2011) 233-240.

[2]Mining Frequent Sequences with Flexible Time Intervals, K. Maruo, D. Sodkomkham, K. Fukui, K. Moriyama, S. Kurihara, and M. Numao: Proc. The 5th International Workshop on Data-Mining and Statistical Science (DMSS2011), (2011) 14-19.

[3]Topographic Measure Based on External Criteria for Self-Organizing Map, K. Fukui and M. Numao: Lecture Notes in Computer Science, 6731 (2011) 131-140.

[4]Investigating the Transitions between Learning and Non-learning Activities as Students Learn Online, P. S. Inventado, R. Legaspi, M. Suarez, and M. Numao: Proc. the 4th International Conference on Educational Data Mining, (2011) 367-368.

[5]Clustering Multiple and Flexible Time Intervals in Sequential Patterns Towards Predictive Modeling of Human Gait Behavior, R. Legaspi, D. Sodkomkham, K. Maruo, K. Fukui, K. Moriyama, S. Kurihara, and M. Numao: Proc. International Workshop on Finding Patterns of Human Behaviors in Network and Mobility Data (NEMO), (2011) 40-51.

[6]Time-Interval Clustering in Sequential Pattern Recognition Towards Predictive Modeling of Human Characteristics, R. Legaspi, D. Sodkomkham, K. Maruo, K. Fukui, K. Moriyama, S. Kurihara, and M. Numao: Proc. Workshop on Computation: Theory and Practice (WCTP-2011), (2011) 174-186.

[7]Finding Motifs in Psychophysiological Responses and Chord Sequences, R. Cabredo, R. Legaspi, and M. Numao: Proc. Workshop on Computation: Theory and Practice (WCTP-2011), (2011) 80-91.

[8]Categorizing and Comparing Behaviors of Students Engaged in Self-initiated Learning Online, P. S. Inventado, R. Legaspi, M. Suarez, and M. Numao: Proc. Workshop on Computation: Theory and Practice (WCTP-2011), (2011) 134-145.

[9]Method for Representing User's Context on a PC, M. Matsumoto, S. Okano, T. Morita, M. Numao, and S. Kurihara: Proc. Workshop on Computation: Theory and Practice (WCTP-2011), (2011) 187-197.

[10]Predicting Levels of Rapport in Dyadic Interactions Through Automatic Detection of Posture and Posture Congruence, J. L. Hagad, R. Legaspi, M. Suarez, and M. Numao: Proc. The Third IEEE International Conference on Social Computing, (2011) 261-265.

[11]Observatory: A Tool for Recording, Annotating and Reviewing Emotion-Related Data, P. S. Inventado, R. Legaspi, M. Suarez, and M. Numao: Proc. 2nd International Workshop on Empathic Computing (IWEC-11), (2011) 261-265.

[12]Exploring melodic motif to support affect perception-based music compositional intelligence, R. Legaspi, A. Ueda, T. Nishikawa, K. Fukui, K. Moriyama, S. Kurihara, and M. Numao: Proc. 2nd International Workshop on Empathic Computing (IWEC-11), (2011) 219-225.

[13]Identifying Emotion Segments in Music by Discovering Motifs in Physiological Data, R. Cabredo, R. Legaspi, and M. Numao: Proc. 12th International Society for Music Information Retrieval Conference (ISMIR), (2011) 24-28.

[14]Investigating Transitions in Affect and Activities for Online Learning Interventions, P. S. Inventado, R. Legaspi, M. Suarez, and M. Numao: Proc. the 19th International Conference on Computers in Education (ICCE2011), (2011) 571-578.

[15]Owens Luis - A Proposal of a Smart Office Chair in an Ambient Environment, K. Kiyokawa, M. Hatanaka, K. Hosoda, H. Shigeta, Y. Ishihara, F. Ooshita, H. Kakugawa, S. Kurihara, and K. Moriyama: Proc. 21st International Conference on Artificial Reality and Telexistence, (2011) .

[16]Adaptive interactive device control by using reinforcement learning in ambient information environment, J. Nakase, K. Moriyama, K. Kiyokawa, M. Numao, M. Oyama, and S. Kurihara: Proc. The 1st International Workshop on Ambient Information Technologies (AMBIT 2012), (2012) 24-27.

[17]Implementation of a Smart Office System in an Ambient Environment, H. Shigeta, J. Nakase, Y. Tsunematsu, K. Kiyokawa, M. Hatanaka, K. Hosoda, M. Okada, Y. Ishihara, F. Ooshita, H. Kakugawa, S. Kurihara, and K. Moriyama: Proc. The 1st International Workshop on Ambient Information Technologies (AMBIT 2012), (2012) 28-29.

[18]Owens Luis - A Context-aware Multi-modal Smart Office Chair in an Ambient Environment, K.

Kiyokawa, M. Hatanaka, K. Hosoda, M. Okada, H. Shigeta, Y. Ishihara, F. Ooshita, H. Kakugawa, S. Kurihara, and K. Moriyama: Proc. The 1st International Workshop on Ambient Information Technologies (AMBIT 2012), (2012) 6-9.

[19]Extracting Time Series Motifs for Emotion and Behavior Modeling (oral), M. Numao, R. Cabredo, D. Sodkomkham, K. Maruo, R. Legaspi, K. Fukui, K. Moriyama, and S. Kurihara: The 15th SANKEN International Symposium, Osaka, Japan, Jan. 12-13, 2012.

[20]Human Information Mining as Netizen (invited), S. Kurihara: IEEE International Workshop on Data Mining for Service (DMS2011), Vancouver, Canada, Dec. 11, 2011.

Review Papers

Owens Luis : A Proposal of a Smart Office Chair using Ambient Environment Control, K. Kiyokawa, M. Hatanaka, K. Hosoda, M. Okada, H. Shigeta, Y. Ishihara, F. Ooshita, H. Kakugawa, S. Kurihara, K. Moriyama, Systems, Control and Information, The Institute of Systems, Control and Information Enginners, 56[1] (2012), 14-20.

Sequential Pattern Mining for the Sensor Network Data, S. Kurihara, K. Fukuda, and T. Sugawara, Journal of the Japanese Society for Artificial Intelligence, The Japanese Society for Artificial Intelligence, 27[2] (2012), 112-119.

Books

[1]Extraction of Essential Events with Application to Damage Evaluation on Fuel Cells(H. Ioannis and P. Dimitrios) T. Kitagawa, K. Fukui, K. Sato, J. Mizusaki, and M. Numao, “Smart Innovation, Systems and Technologies”, Springer, 8 (89-108) 2011.

Contributions to International Conferences and Journals

M. NUMAO	New Generation Computing Journal (Area Editor)
M. NUMAO	2nd International Workshop on Empathic Computing (IWEC-11) (Steering Committee)
M. NUMAO	Workshop on Computation: Theory and Practice (WCTP-2011) (Program Committee)
M. NUMAO	The 1st International Workshop for Sensor Data Mining (IWSDM2011) (Program Co-Chairs)
M. NUMAO	The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2011) (Program Committee)
M. NUMAO	7th International Conference on Advanced Data Mining and Applications (ADMA 2011) (Program Committee)
M. NUMAO	12th Pacific Rim International Conference on Artificial Intelligence (PRICAI 2012) (Program Committee)
M. NUMAO	12th Pacific Rim International Conference on Artificial Intelligence (PRICAI 2012) (Publicity Chairs)
S. KURIHARA	8th International Workshop on Networked Sensing Systems (INSS2011) (Workshop co-chair)
S. KURIHARA	International Workshop on Data Oriented Constructive Mining and Multi-Agent Simulation (DOCMAS) (Organizer)
S. KURIHARA	The 11th International Conference on Autonomous Agents and Multiagent Systems (AAMAS2012) (Sponsor-ship co-chair)
S. KURIHARA	The 1st International Workshop on Ambient Information Technologies (Organizer)
S. KURIHARA	IEEE 10th International Conference on Computer and Information Technology (CIT 2011) (Program Committee)
S. KURIHARA	The Seventh International Conference on Autonomic and Autonomous Systems 2011 (Program Committee)
S. KURIHARA	8th International Conference on Networked Sensing Systems (INSS 2011)

	(Workshop co-chair)
S. KURIHARA	IEEE/WIC/ACM International Conference on Intelligence Agent Technology(IAT'11) (Program Committee)
S. KURIHARA	The 1st International Workshop of Sensor Data Mining (IWSDM2011) (Program Co-Chairs)
S. KURIHARA	The First International Conference on Ambient Computing, Applications, Services and Technologies (AMBIENT2011) (Program Committee)
S. KURIHARA	The 2011 FTRA International Workshop on Advanced Future Multimedia Services (AFMS 2011) (Program Committee)
S. KURIHARA	The First International Conference on Intelligent Systems and Application (INTELLI2012) (Program Committee)
S. KURIHARA	The Pacific Rim International Conference on Artificial Intelligence (PRICAI) (Program Committee)
S. KURIHARA	The Eighth International Conference on Autonomic and Autonomous Systems (ICAS2012) (Program Committee)
S. KURIHARA	The 13th International Workshop on Multi-Agent-Based Simulation (MABS'12) (Program Committee)
S. KURIHARA	The 11th IEEE International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom-2012) (Program Committee)
S. KURIHARA	The Second International Conference on Ambient Computing, Applications, Services and Technologies (AMBIENT12) (Program Committee)
S. KURIHARA	IEEE/WIC/ACM International Conference on Intelligence Agent Technology(IAT'12) (Program Committee)
S. KURIHARA	IEEE/WIC/ACM International Conference on Web Intelligence (WI'12) (Program Committee)
K. MORIYAMA	The 2012 IEEE-INSS International Joint Conference on Neural Networks (IJCNN2012) (Program Committee)

Publications in Domestic Meetings

Annual Conference of the Japanese Society for Artificial Intelligence	7 papers
Human Interface	1 paper
SIG-EIN, Japan Society for Software Science and Technology	1 paper
Joint Agent Workshops and Symposium	2 papers
Information-Based Induction Sciences (IBIS) Workshop	1 paper
SIG-DOCMAS, Japanese Society for Artificial Intelligence	3 papers
SIG-ICS, Information Processing Society of Japan	2 papers
SIG-AI, The Institute of Electronics, Information and Communication Engineers (IEICE)	1 paper
SIG-MPS, Information Processing Society of Japan	1 paper

Academic Degrees

Bachelor Degree for Engineering Y. Yamano	Emotion Estimator for Music based on Brain Wave Analysis
Master Degree for Information Science T. Shirai	Estimation of False Rumor Diffusion Model and Prevention Model of False Rumor Diffusion on Twitter
Master Degree for Information Science Y. Konaka	Proposition of the efficient simple storing rule at distribution center by using evolution based approach
Master Degree for Information Science T. Kitagawa	Correlation Analysis of Server Logs Considering Network Structure and Non-periodicity
Docter Degree for Information Science M. Matsumoto	A Study on Personal Human Behavior Mining

Grant-in-Aid for Scientific Research

M. Numao	Construction of Empathic Computing Mechanism	¥6,500,000
S. Kurihara	Environmental Adaptive and Dynamic Cooperative Reformation Mechanism in Multi-Agent Planning	¥3,640,000
S. Kurihara	Construction of Emergence Mechanism of Hierarchal Structure for Large-Scale Complex System	¥2,340,000
K. Fukui	A Study on Mechanical Property Evaluation of a Solid-type Electric Battery Based on Multidisciplinary Data Mining	¥780,000

Entrusted Research

S. Kurihara	JST CREST	Implementation of External Database Cooperation System and Development of Integration Algorithm	¥1,300,000

Contribution to Research

M. Numao	Daikin Industries, Ltd., Director of Environmental Technology Laboratory, Toru INAZUKA	¥400,000

Cooperative Research

S. Kurihara	NEXT Co., Ltd.,	¥200,000

Department of Quantum Information Optics (Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.)"

Original Papers

[1]Optical transmittance degradation in tapered fibers, M. Fujiwara, K. Toubaru and S. Takeuchi: Opt.Exp., 19 (9) (2011) 8596－8601.

[2]Detection of superposition in the orbital angular momentum of photons without excess components and its application in the verification of non-classical correlation, Y. Miyamoto, D. Kawase, M. Takeda, K. Sasaki and S. Takeuchi: J.Opt., 13 (6) (2011) 64027.

[3]Realization of a Knill-Laflamme-Milburn controlled-NOT photonic quantum circuit combining effective optical nonlinearities, R. Okamoto, J.L. O'Brien, H.F. Hofmann and S. Takeuchi: Proc. Natl. Acad. Sci, 108 (25) (2011) 10067－10071.

[4]Development of microfabricated TiO□ channel waveguides, M. Furuhashi, M. Fujiwara, T. Ohshiro, M. Tsutsui, K. Matsubara, M. Taniguchi, S. Takeuchi and T. Kawai: J, 1 (3) (2011) 32102.

[5]Highly Efficient Coupling of Photons from Nanoemitters into Single-Mode Optical Fibers, M. Fujiwara, K. Toubaru, T. Noda, H.Q .Zhao and S. Takeuchi: Nano Lett., 11 (10) (2011) 4362－4365.

International Conferences

[1]Optical Quantum Circuit Combining Tailored Optical Nonlinearities (poster), S. Takeuchi, R. Okamoto, M. Fujiwara, H.Q. Zhao, H.F. Hofmann and J.L. O'Brien: CLEO Europe-EQEC2011, Munich, Germany, May 22-26, 2011.

[2]Collinear Ultra-broadband Parametric Fluorescence Generated from 10％-chirped Quasi Phase Matched Device (poster), A. Tanaka, R. Okamoto, H.H. Lim, S. Subashchandran, M. Okano, S. Kurimura and S. Takeuchi: CLEO Europe-EQEC2011, Munich, Germany, May 22-26, 2011.

[3]Broadband spontaneous parametric fluorescence toward high-resolution quantum optical coherence tomography (poster), M. Okano, R. Okamoto, A. Tanaka, S. Subashchandran, S. Ishida, N. Nishizawa and S. Takeuchi: International Conference on Quantum Information (ICQI), Ottawa, Canada, June 6-8, 2011.

[4]Solid-state photonic quantum phase gates by using fiber-microsphere cavity and diamond NV centers (oral), M. Fujiwara, H.Q. Zhao, A. Tanaka, H. Takashima, K. Toubaru, T. Noda and S. Takeuchi: 20th

International Laser Physics Workshop, Sarajevo, Bosnia and Herzegovina, July 11-15, 2011.

[5]Photonic quantum circuits and their application (invited), S. Takeuchi, R. Okamoto, M. Fujiwara, H.Q. Zhao, H.F. Hofmann and J.L. O'Brien: Conference on Quantum Information & Quantum Control, Toronto, Canada, August 8-12, 2011.

[6]Toward single photon optical nonlinearities for quantum information and quantum metrology (invited), S. Takeuchi, R. Okamoto, M. Fujiwara, H. Takashima, M. Okano, S. Subashchandran, A. Tanaka and K. Toubaru: SPIE Optics ＋ photonics 2011, San Diego, USA, August 21-25, 2011.

[7]Generation of broadband spontaneous parametric fluorescence and its application to quantum optical coherence tomography (poster), M. Okano, R. Okamoto, A. Tanaka, S. Subashchandran, S. Ishida, N. Nishizawa and S. Takeuchi: SPIE Optics ＋ photonics 2011, San Diego, USA, August 21-25, 2011.

[8]Photonic quantum circuits and their application (invited), S. Takeuchi: 11th Asian Quantum Information Science Conference(AQIS'11), Busan, Korea, August 24-27, 2011.

[9]Realization of a photonic quantum circuit combining effective optical nonlinearities (poster), R. Okamoto, J.L. O'Brien, H.F. Hofmann and S. Takeuchi: Quantum Information Processing and Communication(QIPC)2011, Zurich, Swiss, September 5-9, 2011.

[10]Solid-state photonic quantum phase gates by using fiber-microsphere cavity and diamond NV centers (poster), M. Fujiwara, T. Noda, K. Toubaru, A. Tanaka, H.Q Zhao and S. Takeuchi: RIES, Hokkaido Univ. Interbational Symposium、Sapporo, Japan, November 21, 2011.

[11]Photonic quantum circuits and their application (invited), S. Takeuchi: The11thTamura Memorial Symposium, Osaka, Japan, December 3-5, 2011.

[12]Single-shot broadband photon spectroscopy of parametric fluorescence generated from chirped MgSLT crystal towards realization of mono-cycle photonic entanglement (poster), A. Tanaka, R. Okamoto, H.H. Lim, S. Subashchandran, M. Okano, S. Kurimura, L. Zhang, L. Kang, J. Chen, P. Wu, T. Hirohata and S. Takeuchi: The 15th SANKEN International Symposium 2012/The 10th SANKEN Nanotechnology Symposium, Osaka, Japan, January 12-13, 2012.

[13]Realization of ultra-broadband entangled photons and application to quantum sensing (invited), S. Takeuchi, R. Okamoto, M. Okano, A. Tanaka, S. Subashchandran, S. Kurimura, N. Nishizawa: LASE SPIE Photonics west, California, USA, January 21-26, 2012.

[14]Spectral dependence of ultra-low dark count Superconducting single photon detector for the evaluation of broadband parametric fluorescence (invited), S. Subashchandran, R. Okamoto, A. Tanaka, M. Okano, L. Zhang, L. Kang, J. Chen, P. Wu and S. Takeuchi: LASE SPIE Photonics west, California, USA, January 21-26, 2012.

[15]Suppression of photon sidebands in the spectrum of nitrogen vacancy centers in diamond nano-crystals (oral), H.Q. Zhao, M. Fujiwara, S. Takeuchi: LASE SPIE Photonics west, California, USA, January 21-26, 2012.

[16]Near-field coupling of a single NV center to a tapered fiber (oral), T. Schröder, M. Fujiwara, T. Noda, H.Q. Zhao, O. Benson, S. Takeuchi: LASE SPIE Photonics west, California, USA, January 21-26, 2012.

[17]Nano Optical Fibers for Photonic Quantum Information (invited), S.Takeuchi: Quantum Information and Measurement (QIM), Berlin, Germany, March 19-21, 2012.

Review Papers

Photonic Quantum Information Science and Surface Science, S. Takeuchi, Journal of The Surface Science Society of Japan, The Surface Science Society of Japan, 32[12] (2011), 773-778.

High Frequency-Resolved Measurements for Ultra high-Q Microresonators, H. Fujiwara, H. Takashima, S. Takeuchi and K. Sasaki, Journal of SPSJ, The Spectroscopical Society of Japan, 60[6] (2011), 236-237.

Contributions to International Conferences and Journals

S. TAKEUCHI	SPIE Photonics+Optics, Quantum communications and Quantum Imaging (Program Committee Member)
S. TAKEUCHI	Nonlinear optics Quantum optics (Organizing Committee)

Publications in Domestic Meetings

The 24th Quantum Information Technology Symposium	7 papers
Summer School 2011 FIRST Quantum Information Processing Project	2 papers
JSP 2011Fall meetings	12 papers
The 25th Quantum Information Technology Symposium	2 papers
H23 RIES Research Meeting	1 paper
47th JSAP/ 8th OSJ Hokkaido Branch meeting	1 paper
Exploring the new research field in material and life sciences using quantum entangled light	1 paper
59st Spring Meeting, 2012; The Japan Society of Applied Physics	1 paper
67th Annual Meeting of the Physical Society of Japan	1 paper

Academic Degrees

Master Degree for Science M. Iefuji	Adaptive quantum estimation of photonic polarization
Master Degree for Science T. Noda	Coupling of single nanomitters with fiber-coupled microsphere resonators
Master Degree for Science K. Toubaru	Realization on of tapered optical nanofibers and its applications

Grant-in-Aid for Scientific Research

S. Takeuchi	Realization of quantum cybernetics using photonic quantum circuits	¥22,900,000
S. Takeuchi	Realization of an efficient quantum memory for single photons using a diamond color center as a λ-type atom	¥19,100,000
M. Fujiwara	Developing sensitive absorption-based spectroscopy by using nanophotonic structures for single non-fluorescent molecules	¥2,800,000

Entrusted Research

S. Takeuchi	Japan Science and Technology Agency (JST)	Toward the realization of monocycle entangled photons for novel nonlinear quantum optics	¥29,300,000
S. Takeuchi	Japan Society for the Promotion of Science	Realization of entanglement microscope and supersensitive phase measurement	¥19,200,000

Contribution to Research

S. Takeuchi	Research Foundation for Opto-Science and Technology	¥200,000

Department of Quantum Functional Materials

Original Papers

[1]Direct Measurement of the Out-of-Plane Spin Texture in the Dirac-Cone Surface State of a Topological Insulator, S. Souma, K. Kosaka, T. Sato, M. Komatsu, A. Takayama, T. Takahashi, M. Kriener, K. Segawa, and Y. Ando: Physical Review Letters, 106 (21) (2011) 216803/1-4.

[2]Anisotropies in the optical ac and dc conductivities in lightly doped $La_{2-x}Sr_xCuo_4$: the role of deep and shallow acceptor states, M. B. Silva Neto, G. Blumberg, A. Gozar, S. Komiya, and Y. Ando: Journal of Physics: Condenced Matter, 23 (21) (2011) 215602/1-9.

[3]Observation of Dirac Holes and Electrons in a Topological Insulator, A. A. Taskin, Z. Ren, S. Sasaki, K. Segawa, and Y. Ando: Physical Review Letters, 107 (1) (2011) 016801/1-4.

[4]Berry phase of nonideal Dirac fermions in topological insulators, A. A. Taskin, and Y. Ando: Physical Review B, 84 (3) (2011) 035301/1-6.

[5]Extracting the dynamical effective interaction and competing order from an analysis of Raman spectra of the high-temperature $La_{2-x}Sr_xCuO_{4\ superconductor}$, S. Caprara, C. Di Castro, B. Muschler, W. Presterl, R. Hackl, M. Lambacher, A. Erb, S. Komiya, Y. Ando, and M. Grilli: Physical Review B, 84 (5) (2011) 054508/1-10.

[6]Electrochemical synthesis and superconducting phase diagram of $Cu_xBi_2Se_3$, M. Kriener, K. Segawa, Z. Ren, S. Sasaki, S. Wada, S. Kuwabata, and Y. ando: Physical Review B, 84 (5) (2011) 054513/1-5.

[7]Observations of two-dimensional quantum oscillations and ambipolar transport in the topological insulator Bi_2Se_3 achieved by Cd doping, Z. Ren, A. A. Taskin, S. Sasaki, K. Segawa, and Y. Ando: Physical Review B, 84 (7) (2011) 075316/1-6.

[8]Optimizing $B_{i2-x}Sb_xTe_{3-y}Se_y$ solid solutions to approach the intrinsic topological insulator regime, Z. Ren, A. A. Taskin, S. Sasaki, K. Segawa, and Y. Ando: Physical Review B, 84 (16) (2011) 165311/1-6.

[9]Synthesis of Oxosumanenes through Benzylic Oxidation, T. Amaya, M. Hifumi, M. Okada, Y. Shimizu, T. Moriuchi, K. Segawa, Y. ando, and T. Hirao: The Journal of Organic Chemistry, 76 (19) (2011) 8049-8052.

[10]Pair breaking versus symmetry breaking: Origin of the Raman modes in superconducting cuprates, N. Munnikes, B. Muschler, F. Venturini, L. Tassini, W. Prestel, S. Ono, Y. Ando, D. C. Peets, W. N. Hardy, R. Liang, D. A. Bonn, A. Damascelli, H. Eisaki, M. Greven, A. Erb, and R. Hackl: Physical Review B, 84 (14) (2011) 144523/1-13.

[11]Unexpected mass acquisition of Dirac fermions at the quantum phase transition of a topological insulator, T. Sato, K. Segawa, K. Kosaka, S. Souma, K. Nakayama, K. Eto, T. Minami, Y. Ando, and T. Takahashi: Nature Physics, 7 (8) (2011) 840-844.

[12]Topological Superconductivity in $Cu_xBi_2Se_3$, S. Sasaki, M. Kriener, K. Segawa, K. Yada, Y. Tanaka, M. Sato, and Y. Ando: Physical Review Letters, 107 (21) (2011) 217001/1-5.

[13]Investigation of particle-hole asymmetry in the cuprates via electronic Raman scattering, B. Moritz, S. Johnston, T. P. Devereaux, B. Muschler, W. Prestel, R. Hackl, M. Lambacher, A. Erb, S. Komiya, and Y. Ando: Physical Review B, 84 (23) (2011) 235114/1-12.

[14]Topological transition in $Bi_{1-x}Sb_x$ studied as a function of Sb doping, F. Nakamura, Y. Kousa, A. A. Taskin, Y. Takeich, A. Nishide, A. Kakizaki, M. D'Angelo, P. Lefevre, F. Bertran, A. Taleb-Ibrahimi, F. Komori, S. Kimura, H. Kondo, Y. Ando, and I. Matsuda: Physical Review B, 84 (23) (2011) 235308/1-8.

[15]An extended infrared study of the *p, T* phase diagram of the *p*-doped Cu-O plane, D. Nicoletti, P. Di Pietro, O. Limaj, P. Calvani, U. Schade, S. Ono, Y. Ando, and S. Lupi: New Journal of Physics, 13 (2011) 123009/1-26.

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Oscillations Discovered in a Topological Insulator $Bi_{1-x}Sb_x$, A. A. Taskin, K. Segawa, and Y. Ando: Journal of Physics: Conference Series, 334 (2011) 012012/1-5.

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[18]Topological Surface States in Lead-Based Ternary Telluride $Pb(Bi_{1-x}Sb_x)_2Te_4$, S. Souma, K. Eto, M. Nomura, K. Nakayama, T. Sato, T. Takahashi, K. Segawa, and Y. Ando: Physical Review Letters, 108 (11) (2012) 116801/1-5.

International Conferences

[1]Materials-Oriented Research of Topological Insulators and Superconductors (invited), Y. Ando: LT26 Satellite Conference on Topological Insulators and Superconductors, Tsinghua University, Beijing, China, August 18-21, 2011.

[2]Cutting-Edge Experiments on Topological Insulator and Superconductors (invited), Y. Ando: International Workshop on Novel Quantum State in Condensed Matter; Correlation, Frustration and Topology, Ukawa Institute, Kyoto University, Japan, November 18, 2011.

[3]Materials-Oriented Research of Topological Insulators and Superconductors (invited), Y. Ando: 2011 MRS Fall Meeting, Boston, U.S.A., November 28-December 2, 2011.

[4]Probing the Exotic Surface States in Topological Insulators and Superconductors (invited), Y. Ando: FITST-QS2C Workshop on Emergent Phenomena of Correlated Materials, Okinawa, Japan, December 12-15, 2011.

[5]Transport Studies of Topological Insulators and Superconductors (invited), Y. Ando: American Physical Society March Meeting, Boston, U.S.A., February 27-March 2, 2012.

[6]Optical conductivity of exfoliated $Bi_2Sr_2CaCu_2O_{8+\sigma}$ nanocrystals (oral), L. Sandilands, V. Baydina, A. Su, A. Reijnders, T. Pedersen, F. Borondics, G. Gu, S. Ono, Y. Ando, K. Burch: American Physical Society March Meeting, Boston, U.S.A., February 27-March 2, 2012.

[7]Transport properties of new Pb-based Topological Insulators (oral), K. Eto, S. Sasaki, K. Segawa, Y. Ando: American Physical Society March Meeting, Boston, U.S.A., February 27- March 2, 2012.

[8]Recent ARPES study on extremely underdoped LSCO system (oral), Y. He, M. Hashimoto, S. K. Mo, R. He, Y. Ando, S. Komiya, Z. X. Shen: American Physical Society March Meeting, Boston, U.S.A., February 27- March 2, 2012.

[9]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (oral), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: Gordon Research Conference on Superconductivity, Waterville valley resort, U.S.A. June 6-10, 2011.

[10]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (poster), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: 26 t h International Conference on Low Temperature Physics, Beijing, China, August 11-17, 2011.

[11]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (invited), K. Segawa: 24th International Symposium on Superconductivity, Tokyo, Japan, October 24-26, 2011.

[12]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (invited), K. Segawa: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken

Symmetries, Shiga, Japan, November 2-5, 2011.

[13]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (poster), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: FITST-QS2C Workshop on Emergent Phenomena of Correlated Materials, Okinawa, Japan, December 12-15, 2011.

[14]Synthesis and Characterization of New Topological Insulators (invited), K. Segawa: American Physical Society March Meeting, Boston, U.S.A., February 28, 2012.

[15]Point-contact spectroscopy of $Cu_xBi_2Se_3$ (poster), S. Sasaki, M. Kriener, K. Segawa, K. Yada, Y. Tanaka, M. Sato, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

[16]Magnetotransport studies of Dirac Fermions in Topological Insulators (invited), A. Taskin, Z. Ren, S. Sasaki, K. Segawa, and Y. Ando: IOP Workshop on Frontiers of Dirac Electron Systems, Hefei, China, January 4-5, 2012.

[17]About the Superconductivity in $Cu_xBi_2Se_3$ (poster), M. Kriener, K. Segawa, Z. Ren, S. Sasaki, S. Wada, and Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

[18]The Superconducting Phase in $Cu_xBi_2Se_3$ (oral), M. Kriener: Japan-Finland March Meeting for the future in thermoelectrics, Nagoya University, Japan, March 14, 2012.

[19]Experimental Attempts to Observe Spin-Polarized Transport Properties of the Surface States of a Highly Bulk-Insulating Topological Insulator (poster), K. Eto, S. Sasaki, K. Segawa, Y. Ando: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[20]Experimental Attempts to Observe Spin-Polarized Transport Properties of the Surface States of a Highly Bulk-Insulating Topological Insulator (poster), K. Eto, S. Sasaki, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

Review Papers

Electronic Transport Phenomena in the Topological Insulator, Y. Ando, Journal of The Surface Science Society of Japan, The SurfaceScienceSociety of Japan, 32[4] (2011), 189-195.

Mass Acquisition of Dirac Electrons at the Quantum Phase Transition of a Topological Insulator, T.Sato、K.Segawa、T.Takahashi、Y.Ando, Butsuri, The Physical Society of Japan, 67[3] (2012), 184-187.

Contributions to International Conferences and Journals

Y. Ando	Materials & Mechanisms of Superconductivity Conference (M2S 2012) (International Advisory Committee)
Y. Ando	International Conference on Topological Quantum Phenomena (Program Committtee)
Y. Ando	Europhysics Letters (EPL) (Co-Editor)

Publications in Domestic Meetings

ISSP workshop: The States of the Surface Electrons on Topological Insulators	1 paper
2011 Fall meeting of the Physcal Society of Japan	14 papers
the 2nd annual meeting of the MEXT grant-in-Aid for scientific research on innovative areas “topological quantum phenomena in condensed matter with broken symmetries”	2 papers
2012 Annual meeting of the Physcal Society of Japan	7 papers
Second workshop of the surface science for young researchers	1 paper

Academic Degrees

Master Degree for Science R. Yoshida	Growth of High-Quality Single Crystals of Topological Insulator $Bi_{1-x}Sb_x$ and Search for Novel Topological Materials
Master Degree for Science S. Wada	Synthesis of Single Crystals of Transition-Metal-Intercalated Topological Insulators

Grant-in-Aid for Scientific Research

Y.Ando	Creation of Innovative Devices Based on Topological Insulators	¥113,342,000
K.Sedawa	Study on the Mott insulator and electron-doped region in an ambipolar high-Tc cuprate	¥2,210,000
K.Sedawa	Novel phenomea in the elcetron fluids with broken inversion symmetry	¥13,130,000
K.Eto	Magnetic transport studies about candidate materials of pyrochlore oxide topological insulators	¥700,000

Contribution to Research

Y.Ando	Asian Office of Aerospace Research and Development	¥40,278,000

Department of Semiconductor Materials and Processes

Original Papers

[1]Sub-micrometer ultralow power TFT with 1.8 nm NAOS SiO2/20 nm CVD SiO2 gate stack structure, Y. Kubota, T. Matsumoto, S.Imai, M. Yamada, H. Tsuji, K. Taniguchi, S. Terakawa, H. Kobayashi: IEEE Trans. Electron Dev., 58 (4) (2011) 1134-1140.

[2]Chemical states of copper contaminants on SiO_2 surfaces and their removal by ppm-order HCN aqueous solutions, M. Takahashi, Y. Higashi, S. Ozaki, H. Kobayashi: J. Electrochem. Soc., 158 (8) (2011) H825-829.

[3]Nitric Acid Oxidation to Form a Gate Oxide Layer in Sub-Micrometer TFT, T. Matsumoto, Y. Kubota, S. Imai, H. Kobayashi: Electrochem. Soc. Trans., 35 (4) (2011) 217-227.

[4]1.5 V-Operation Ultr-Low Power Circuit of Poly-Si TFTs Fabricated Using Nitric Acid Oxidation of Silicon (NAOS) Method, Y. Kubota, T. Matsumoto, H. Tsuji, N. Suzuki, S. Imai, H. Kobayashi: IEEE Trans. Electron Dev., 59 (2) (2012) 385-392.

[5]Study of density of interface states in MOS structure with ultrathin NAOS oxide, S. Jurecka, H. Kobayashi, W.-B. Kim, M. Takahashi, E. Pincik: , 10 (1) (2012) 210-217.

International Conferences

[1]Nitric acid oxidation method to form a gate oxide layer in sub-micrometer TFT (invited), H. Kobayashi, T. Matsumoto, S. Imai: 219th ECS meeting,May 1-6, 2011. Montreal Convention Center.

[2]Ultra-low power thin film transistors with gate oxide formed by nitric acid oxidation method (invited), H. Kobayashi: 17th International Conference of Applied Physics of Condensed Matter,June 22-24, 2011, Spa Novy Smokovec, High Tatras, Slovakia.

[3]Ultra-low power thin film transistors fabricated by use of nitric acid oxidation method (invited), H. Kobayashi: IIV International Workshop on Semiconductor Surface Passivation,POLAND, September 11 - 15, 2011.

[4]New chemical methods for improvement of energy conversion efficiency of crystalline Si solar cells (invited), H. Kobayashi: International Workshop on Semiconductor Devices and Interfaces, Saudi Arabia, 2011, Nov. 28-29.

[5]Fabrication of Si nanoparticles and application to solar cells (invited), H. Kobayashi: International Workshop at Dankook University, Korea, Nov. 8-9, 2011.

[6]Photoluminescence of Si Nanoparticles Produced from Si Swarf with Photochemical Reactions (invited), T. Matsumoto, J. Furukawa, M. Maeda, S. Terakawa, S. Imai, H. Kobayashi: 2012 RCIQE International Seminar, March 5-6, 2012,Conference Hall, Hokkaido University.

[7]Low temperature oxidation of 4H-SiC surfaces by nitric acid vapor oxidation of SiC (NAVOS) method (oral), T. Matsumoto, H.-S. Joe, W-B. Kim, H. Kobayashi,: The 6th International Symposium on Surface Science,December 11-15, 2011,University of Tokyo.

[8]Dependence minority carrier lifetime on humidity for initial oxidation of Si (oral), F. Franco, Jr., W.-B. Kim, H. Kobayashi: The 6th International Symposium on Surface Science,December 11-15, 2011,University of Tokyo.

[9]Fabrication of low reflectivity Si surfaces with the inverted pyramidal structure by use of Pt catalytic activity (oral), M. Takahashi, T. Fukushima, Y. Seino, A. Ohnaka, H. Kobayashi: The 6th International Symposium on Surface Science,December 11-15, 2011,University of Tokyo.

[10]Ultra-low power thin film transisitors and liquid crystal displays with ultrathin gate oxide layer fabricated by the NAOS (Nitric Acid Oxidation of Si) method (poster), T. Matsumoto, Y. Kubota, M. Yamada, H. Tsuji, K. Taniguchi, S. Imai, S. Terakawa, H. Kobayashi: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[11]Photovoltaic effect of Si nanoparticles fabricated by non-vacuum simple method (poster), M. Maeda, T. Matsumoto, H. Kobayashi: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[12]Ultra-low power thin film transistors with ultrathin gate oxide layer fabricated by the NAOS (Nitric Acid Oxidation of Si) method and application to mobile electronic devices (poster), T. Matsumoto, Y. Kubota, M. Yamada, H. Tsuji, K. Taniguchi, S. Imai, S. Terakawa, H. Kobayashi: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[13]Blue luminescent Si nanoparticles from Si swarf (poster), J. Furukawa, T. Matsumoto, H. Kobayashi: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[14]Humidity condition dependence of the initial stages of Si oxidation (poster), F. Franco Jr., W.-B. Kim, H. Kobayashi: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[15]Photovoltaic effect of Si nanoparticles fabricated by non-vacuum pulverizing method (poster), M. Maeda, T. Matsumoto, H. Kobayashi: The 15th SANKEN International Symposium and the 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[16]Fabrication of Si Nanoparticles from Si Swarf and Application to Photovoltaic Cells (poster), M. Maeda, T. Matsumoto, S. Terakawa, S. Imai, H. Kobayashi: 2012 RCIQE International Seminar,March 5-6, 2012 Conference Hall, Hokkaido University.

Review Papers

Ultralow Power TFT with Stacked Gate Oxide Consisting of Ultrathin Oxide Layer Formed by the Nitric Acid Oxidation of Si (NAOS) Method and CVD-SiO2 Thin Layer, T. Matsumoto, H. Kobayshi, J. Surf. Sci. J, Surface Scienc Society of Japan, 32[6] (2011), 355-360.

Books

[1]Chapter 5 Surface plasmon and nano structured devices for solar cells, 2. Technologies for surface structures with low reflectivity on solar cells(J. Nishii, H. Kikuta) T. Matsumoto, H, Kobayashi, “The state of the art of nanostructured optical devices”, CMC Publishing Co.,Ltd., (152-166) 2011.

Patents

[1]Si nanoparticle sysnthesis, ink, solar cells and semiconductor equipments H. Kobayashi, JP2011-099516

[2]Manufacture of solar cells and semiconductor equipments, and molds for structure transfer H. Kobayashi, M. Maeda, Y. Fukaya, W.-B. Kim, JP2011-175937

[3]Manufacture of semiconductor equipments, manufacture equipments for semiconductor equipments, semiconductor equipments, manufacture program of semiconductor equipments, chemicals for semiconductor devices and materials for structure transfer H. Kobayashi, JP2011-176602

[4]Surafce treatment methods on Si wafers, manufacture methods of semiconductor equipments and solar cells H. Kobayashi, JP2011-224636

[5]Fabrication methods of Si nanoparticle thin layers, semiconductor equipments, manufacture methods of semiconductor equipments, solar cells and manufacture methods of solar cells H. Kobayashi, JP2012-041708

[6]Fabrication methods of Si nanoparticle, the light emitting devices, solar cells and semiconductor appratuses H. Kobayashi, JP2012-041709

[7]Solar cell, method for producing same, and device for producing solar cell H. Kobayashi, WO2012014668

[8]Solar cells, manufacture methods of solar cells and manufacture equipments for solar cells H. Kobayashi, TW2011-100128893

[9]Method and device for manufacturing semiconductor devices, semiconductor device, and transfer member H. Kobayashi, TW2011-100125052

[10]Apparatus for manufacturing semiconductor device and method for manufacturing semiconductor device H. Kobayashi, TW2011-100125045

[11]Solar cell, method for producing same, and device for producing solar cell H. Kobayashi, TW2011-100125049

[12]Semiconductor devices and their manufacture H. Kobayashi, JP2012-054452

[13]Solar cells having Si oxide/Si laminate substrates and their manufacture H. Kobayashi, JP2012-049156

[14]Apparatus for manufacturing semiconductor device and method for manufacturing semiconductor device H. Kobayashi, WO 2012025984

[15]Solar cell, method for producing same, and device for producing solar cell H. Kobayashi, WO 2012011188

[16]Semiconductor apparatus and manufacturing method of same H. Kobayashi, WO 2011114890

[17]Semiconductor device manufacturing method, semiconductor device, and transfer member H. Kobayashi, WO 2011099216

[18]Method and device for manufacturing semiconductor devices, semiconductor device, and transfer member H. Kobayashi, WO 2011099594

[19]Formation method of thin SiO2 film and MOS device thereof H. Kobayashi, JP2011-054868

[20]Cleaning devices and methods of wafers H. Kobayashi, Y. Kedo, JP2011-278566

[21]Fabricatio methods, producing deevices and producing system of solution for semiconductor devices H. Kobayashi, M. Takahashi, K. Seki, JP4947454

[22]Silicon photovoltaic devices, fabrication method and treatment. H. Kobayashi, H. Koinuma, Matsushita Electric industry Co. Ltd., JP4801833

Contributions to International Conferences and Journals

H. Kobayashi	Applied Surface Science (Editor)
H. Kobayashi	IIV International Workshop on Semiconductor Surface Passivation (International Scientific Committee)

Publications in Domestic Meetings

Annual meeting of society of nano science and techinology	1 paper
30th Electronic Materials Symposium	1 paper
Chugoku district solar cell forum	1 paper
DV-Xα meeting	1 paper
Japan Applied Surface Science Meeting	6 papers
Japan Physics Meeting	4 papers
SCEJ Division of Chemical Reaction Engineering, CVD Section meeting	1 paper

Academic Degrees

Master Degree for Science C. Kim	Surface passivation by the nitric acid oxidation method and improvement of energy conversion efficiency for silicon solar cells
Master Degree for Science K. Wang	Removal of metal contaminant and low reflectivity formed by chemical etching on Si surfaces
Master Degree for Science J. Furukawa	Fabrication of Si Nanoparticles from Si Swarf and Blue Luminescence
Master Degree for Science R. Tani	New oxidation process of semiconductor by the nitric acid oxidation method: surface conditions and minor carrier life time
Doctor Degree for Science K. Imamaura	Low temperature formation of SiO2/Si surface by nitric acid oxidation method
Doctor Degree for Science Y. Kubota	Study on Ultra-Thin Silicon Dioxide Layer Formed by Nitric Acid Oxidation Method and Application to Ultra-low Power Poly-Si TFT

Entrusted Research

H. Kobayashi	New Energy and Industrial Technology Development Organization	Development of high-speed and low-cost production method of SiC and SiC solar cells	¥4,600,000
H. Kobayashi	Japan Science and Technology Agency	Research and development of system displays by use of nitric	¥26,754,000

acid oxidation

Contribution to Research

H. Kobayashi Canon Marketing Japan, Inc. ¥20,000,000

Department of Metallic Materials Process

Original Papers

[1]Appearance of a Plateau Stress Region during Dynamic Compressive Deformation of Porous Carbon Steel with Directional Pores, Y.H. Song, M. Tane, H. Nakajima: Scr. Mater., 64 (8) (2011) 797-800.

[2]Nanovoid Formation by Change in Amorphous Structure through the Annealing of Amorphous Al2O3 Thin Films, M. Tane, S. Nakano, R. Nakamura, H. Ogi, M. Ishimaru, H. Kimizuka and H. Nakajima: Acta Mater., 59 (11) (2011) 4631-4640.

[3]Low Young's Modulus in Ti-Nb-Ta-Zr-O Alloys: Cold Working and Oxygen Effects, M. Tane, T. Nakano, S. Kuramoto, M. Hara, M. Niinomi, N. Takesue,T. Yano, H. Nakajima: Acta Mater., 59 (18) (2011) 6975-6988.

[4]Enhancement of nanovoid formation in annealed amorphous Al2O3 including W, R. Nakamura, M. Ishimaru, A. Hirata, K. Sato, M. Tane, H. Kimizuka, T. Shudo, T.J. Konno, H. Nakajima: J. Appl. Phys., 110 (6) (2011) 064324.

[5]Peculiar Formation Mechanism of a Plateau Stress Region during Dynamic Compressive Deformation of Porous Carbon Steel with Oriented Cylindrical Pores, Y.H. Song, M. Tane, H. Nakajima: Acta Mater., 60 (3) (2012) 1149-1160.

[6]Dynamic and Quasi-static Compression of Porous Carbon Steel S30C and S45C with Directional Pores, Y.H. Song, M. Tane, H. Nakajima: Mater. Sci. Eng. A, 534 (2012) 504-513.

[7]On the Anisotropy of Lotus-Type Porous Copper, T. Fiedler, C. Veyhl, I.V. Belova, M. Tane, H. Nakajima, T. Bernthaler, M. Merkel, A. Ochsner, G.E. Murch: Adv. Eng. Mater., 14 (3) (2012) 144–152.

[8]Self-elongated growth of nanopores in annealed amorphous Ta2O5 films, R. Nakamura, K. Tanaka, M. Ishimaru, K. Sato, T.J. Konno,H. Nakajima: Scr. Mater., 66 (3-4) (2012) 182-185.

International Conferences

[1]Fabrication of porous metals withdirectional pores by continuous castingtechnique through thermal decomposition of gascompounds (plenary), H. Nakajima, T. Ide, A. Tsunemi: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[2]Elastic Properties of Nanoporous Amorphous Al2O3 (invited), M. Tane, S. Nakano, R. Nakamura, H. Ogi, M. Ishimaru, H. Kimizuka, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[3]Anisotropic Dynamic Compressive Properties of Lotus-type Porous Carbon Steel (Poster), Y.H. Song, M. Tane, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[4]Fabrication of Lotus-type Porous Aluminum through Continuous Casting Technique (Oral), T. Ide, Y. Iio, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[5]Fabrication of porous AlN/Al composites and its compressive properties (Poster), T. Kujime, T. Ide, Y. Seimiya, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[6]Internal friction of llotus-tye porous copper (Poster), O. Yoshinari, T. Kobayashi, H. Nakajima, T. Ide: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[7]Compressive properties of porous NiAl fabricated by unidirectional solidification (Poster), J.W. Lee, S.K. Hyun, M.S. Kim, T. Ide, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[8]Forming of profiled strip from porous metal by rolling (Poster), H. Tsuruoka, H. Utsunomiya, T. Sakai, S. Suzuki, T. Ide, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[9]Dynamic Compression Behavior of Lotus-type Porous Metals (Invited), M. Tane, Y.H. Song, and H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

[10]Compressive Deformation Behaviors of Porous Carbon Steels with Directional Pores (Poster), Y.H. Song, M. Tane, H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

[11]Fabrication of Lotus-type Porous Aluminum through Continuous Casting Technique under High Humidity (Poster), T. Ide, H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

[12]Distribution of Pores of Lotus-type Porous Copper (Poster), A. Tsunemi, T. Ide, H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

[13]Elastic Properties of Ti-Nb-Ta-Zr-O Alloys (Poster), M. Tane, T. Nakano, S. Kuramoto, M. Hara, M. Niinomi, N. Takesue, T. Yano, H. Nakajima: 2012 TMS Annual Meeting & Exhibition.

[14]Mechnical Behavior of Porous NiAl Fabricated by Unidirectional Solidification (Poster), J.W.Lee, S.K.Hyun, M.S.Kim, T.Ide, H.Nakajima: 2012 TMS Annual Meeting & Exhibition.

[15]Morphology change of metal nanowires through oxidation reactions: Formation of oxide nanotubes and porous nanowires (Oral), R. Nakamura, H. Nakajima: 8th International Conference on Diffusion in Materials (DIMAT2011).

[16]Formation of nanovoids in annealed amorphous oxides (Poster), R. Nakamura, T. Shudo, A. Hirata, M. Ishimaru, H. Nakajima: 8th International Conference on Diffusion in Materials (DIMAT2011).

[17]Fabrication of Nanoporous Oxides through Annealing of Amorphous Oxide Films (Oral), R. Nakamura, T. Shudo, M. Ishimaru, A. Hirata, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[18]Effects of NiO powder on pore formation of lotus-type porouscarbon steel during continuous casting (Poster), M. Kashihara, S. Suzuki, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams (MetFoam2011).

[19]Formation of Nanoporous Structures via Annealing of Amorphous Oxides (Poster), R. Nakamura, T. Shudo, H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

[20]Formation and Growth of Nanovoids in annealed Amorphous Ta2O5 (Poster), K. Tanaka, R. Nakamura, H. Nakajima: Internaitonal Symposium on Materials Science and Innovation for Sustainable Society (Eco-Mates 2011).

Review Papers

Formation of nanoporous structures through structural change and crystallization of amorphous oxides, R. Nakamura, M. Ishimaru, A. Hirata, K. Sato, M. Tane, H. Kimizuka, T. J. Konno, H. Nakajima, Materia Japan, The Japan Institute of metals, 51[3] (2012), 95-101.

Material Functional Properties Created through Pores Formation -Lotus -type Porous Metals-, H. Nakajima, Bulletin of The Iron and Steel Institute of Japan (Ferrum), The Iron and Steel Institute of Japan, 16[9] (2011), 599-606.

Fabrication of hollow nanostructured oxides via oxidation of metal nanoparticles and nanowires and their structural stability, R. Nakamura, H. Nakajima, J. Smart Process. Soc. Mater. Envir. Energy, smart processing society, 1[1] (2012), 20-24.

Books

[1]Mechanical Properties of Lotus-type Porous Metals (I)(H. Nakajima) M. Tane, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (122-126) 2011.

[2]Mechanical Properties of Lotus-type Porous Metals (II)(H. Nakajima) M. Tane, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (127-130) 2011.

[3]Fabrication and mechanical properties of lotus-type porous intermetallics(H. Nakajima) T Ide, N. Nakajima, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (44-48) 2011.

[4]Fabrication of lotus-type porous metals by thermal decomposition method(H. Nakajima) N. Nakajima, T Ide, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (37-42) 2011.

[5]Fabrication of hollow oxide nanostructures using metal oxidation reaction(H. Nakajima) R. Nakamura, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (259-263) 2011.

[6]Fabrication of lotus-type porous metals with unidirectional pores by pressurized gas method(H. Nakajima) H. Nakajima, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (28-35) 2011.

[7]Fabrication of lotus-type porous silicon(H. Nakajima) H. Nakajima, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (50-53) 2011.

[8]Sound absorption in lotus-type porous metals(H. Nakajima) H. Nakajima, "Recent Development in Research of Macro- and Nanoporous Metals", CMC Publishing, (138-140) 2011.

[9]Application of the Kirkendall effect to morphology control of nanowires: Morphology change from metal nanowires to oxide nanotubes(Abbass Hashim) R. Nakamura. H. Nakajima, "Nanowires - Implementations and Applications", InTech, (101-116) 2011.

Grant-in-Aid for Scientific Research

T.Ide	Development of mass production for Porous metal with directional pore	¥2,470,000

Contribution to Research

M.Tane	The Iron and Steel Institute of Japan	¥2,000,000
M.Tane	The Japan Titanium Society	¥400,000
T.Ide	Japan Copper and Brass Association	¥300,000
T.Ide	Japan Aluminium Association	¥300,000

Department of Advanced Interconnection Materials

Original Papers

[1]Effect of Crystal Orientation on Mechanically Induced Sn Whiskers on Sn-Cu Plating, Yukiko Mizuguchi, Yosuke Murakami, Shigetaka Tomiya, Tadashi Asai, Tomoya Kiga and Katsuaki Suganuma: Journal of Electronic Materials, .

[2]Influence of crystallographic orientation of Sn-Ag-Cu on electromigration in flip-chip joint, Kiju Lee*,Keun-Soo Kim,Yutaka Tsukada, Katsuaki Suganuma,Kimihiro Yamanaka, Soichi Kuritani,Minoru Ueshima: Microelectron. Reliab, 51[12] (2011) 2290-2297.

[3]Sn whisker growth during thermal cycling, Katsuaki Suganuma*,Alongheng Baated,Keun-Soo Kim,: Acta Materialia, 59[1] (2011) 7255–7267.

[4]Whisker Growth Behavior of Sn and Sn Alloy Lead-Free Finishes, Kyoko Hamasaki, Norio Nemoto,Tsuyoshi Nakagawa,Alongheng Baated, Kyoko Hamasaki, Sun Sik Kim, Keun-Soo Kim, Katsuaki Suganuma: J. ELECTRON. MATER., 40[11] (2011) 2278-2289.

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[6]Low-temperature Low-pressure Die Attach with Hybrid Silver Particle Paste, K. Suganuma*, S. Sakamoto, N. Kagami, D. Wakuda, K. -S. Kim, M. Nogi: Microelectron. Reliab, 52 (2011) 375–380.

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[9]Electrical conductivity enhancement in inkjet-printed narrow lines through gradual heating, Changjae Kim, Masaya Nogi*, Katsuaki Suganuma: Journal of Micromechanics and Microengineering, 22 (2012) .

[10]Fabrication of Silver Nanowire Transparent Electrodes at Room Temperature, T. Tokuno, M. Nogi*, M. Karakawa, J. Jiu, T. T. Nge, Y. Aso, K. Suganuma: Nano Research, .

[11]Printable and Stretchable Conductive Wirings Comprising Silver Flakes and Elastomer, T. Araki, M. Nogi*, K. Suganuma, M. Kogure, O. Kirihara: IEEE Electron Device Lett., 32 (2011) 1424 - 1426.

[12]Synthesis and High-Temperature Thermoelectric Properties of Ni3GaSb and Ni3InSb, T. Suriwong, K. Kurosaki, S. Thongtem, A. Harnwunggmoung, T. Sugahara*, T. Plirdpring, Y. Ohishi, H. Muta, and S. Yamanaka: J. Alloys Compd, 509 (2011) 4014–4017.

[13]Synthesis and Thermal Conductivities of ZnIn2Te4 and CdIn2Te4 with Defect-Chalcopyrite Structure, T. Suriwong, K. Kurosaki, S. Thongtem, A. Harnwunggmoung, T. Sugahara, T. Plirdpring, Y.: J. Alloys Compd, 509 (2011) 7484–7487.

[14]High-Temperature Thermoelectric Properties of Cu2Ga4Te7 with Defect Zinc-Blende Structure, T. Plirdpring, K. Kurosaki, A. Kosuga, M. Ishimaru, A. Harnwunggmoung, T. Sugahara, Y. Ohishi, H. Muta, and S. Yamanaka: Appl. Phys. Lett., 98 (2011) 172104-1–172104-3.

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International Conferences

[1]Low temperature die-attaching with silver particle pastes (invited), K. Suganuma, S. Sakamoto, N. Kagami and M. Nogi: ASME 2011 Pacific Rim Technical Conference & Exposition on Packaging and Integration of Elctronic and Photonic Systems, MEMS and NEMS.

[2]Properties of Silver Nanowire Transparent Electrodes Fabricated by a Coating Method (oral), T. Takehiro, M. Nogi. , K. Suganuma: IEEE NANO 2011 Conference.

[3]Effect of Ink Viscosity on Electrical Resistivity of Narrow Printed Silver Lines (oral), C. Kim, M. Nogi, K.Suganuma: IEEE NANO 2011 Conference.

[4]Return Loss of Printed Silver Paste Lines with Different Filler Sizes and Their Surface Roughness (oral), K. Natsuki, K. Suganuma, M. Nogi: IEEE NANO 2011 Conference.

[5]Growth mechanism of Sn whiskers in a vacuum and air with thermal cycling (oral), J.-L. Jo, K.-S. Kim, K. Suganuma: MS&T 2011.

[6]Behaviors of Sn surface with whisker generation after thermal cycle (oral), J.-L. Jo, K. Lee, K. Suganuma: International Symposium on materials Science and Innovaytion for Sustainable Society, Eco-Materials and Eco-innovation for Global Sustainabilkity.

[7]Characteristics of die attach joints with Zn high temperature lead-free solders (oral), S.W. Park, K. Suganuma: International Symposium on materials Science and Innovaytion for Sustainable Society, Eco-Materials and Eco-innovation for Global Sustainabilkity.

[8]Advanced in wiring ink technology for printed electronics (Plenary), K.Suganuma: International Symposium on Advanced Packaging Materials, IEEE CPMT.

[9]Heat-resistant die-attach technology for SiC (invited), K. Suganuma: Pb-free Workshop, TMS annual meeting.

[10]Effect of Crystal Orientation on Mechanically Induced Sn Whiskers of Sn-Cu Platings (invited), Y. Mizuguchi, Y. Murakami, S. Tomiya, T. Asai, T. Kiga, K. Suganuma: 2012 TMS Annual Meeting &

Exhibition.

[11]Preparation of rod-shaped and spherical Silvernanoparticles and application for Packaging materials (oral), Jinting Jiu, Takehiro Tokuno, Masaya Nogi, Katsuaki Suganuma: ICEPT-HDP2011.

[12]Preparation of Ag Nanowires and Application in Optoelectronic Devices (oral), Jinting Jiu, Takehiro Tokuno, Masaya Nogi, Katsuaki Suganuma: BIT's 1st Annual World Congress of Nano-S&T-2011.

Review Papers
low-temperature strechable conductive wirings, Katsuaki Suganuma,Masaya Nog,Jinting Jiu,Takehiro Tokuno,Teppei Araki, Japan Institute of Electronics Packaging journal, Japan Institute of Electronics Packaging, 14(6) (2011), 471-476.

everything about printed electronics, Katsuaki Suganuma, NIKKO Green MOOK, JAPAN INDUSTRIAL PUBLISHING CO., (2012), 1-5.

Conductive pastes for electronic devices, Katsuaki Suganuma, Masaya Nogi, Chemistry and Chemical Industry, the Chemical Society of Japan, 59(10) (2011), 496-499.

creating high added value of packaging technology using lead-free solders, Katsuaki Suganuma, Robot, 203 (2011), 34-37.

aming to be lighter and more strechable, Katsuaki Suganuma, Clean Technology, JAPAN INDUSTRIAL PUBLISHING CO., Vo.21 (2011), 68-71.

Patents
[1]onductive layers and their fabrications K. Suganuma, J. Jiu, H. Itoh, T. Ozeki, JP2011-119543

[2]system of utilizing heat waste from boilers K. Suganuma, K. Ohata, S. Nanbu, M. Itoh, H. Akutagawa, T. Matsusita, JP2011-131453

[3]Synthesis of nanoparticles K. Suganuma, J. Jiu, M. Nogi, JP2011-123694

[4]Fabrication of conductive structures K. Suganuma, M. Nogi, T. Tokuno, JP2011-287737

[5]Components of copper patterns and their patterning methods K. Suganuma, M. Nogi, N. Komoda, E. Kang, T. Ohtake, JP2011-249949

[6]conductive adhesive and electrical appliances using thereof K. Suganuma, H. Uchida, K. Shinozaki, Y. Ishibashi, JP2012-021897

[7]Fabrication of transparent and conductive materials K. Suganuma, M. Nogi, J. Jiu, T. Sugahara, H. Uchida, K. Shinozaki, JP2012-053492

[8]Fabrication of conductive patterns and their components for light or micro wave sintering K. Suganuma, M. Nogi, J. Jiu, T. Sugahara, H. Uchida, T. Fujita, JP2012-061816

[9]Transparent and conductive metallic nanowire films and their dispersions K. Suganuma, M. Nogi, J. Jiu, T. Tokuno, M. Ishida, H. Aikyo, T. Yamakawa, T. Niimi, JP2012-076910

Contributions to International Conferences and Journals

K.Suganuma	The 12th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP 2011), Shanghai, China, August 8-11(2011). (International Advisory Board)

K.Suganuma	International Symposium on Materials Science and Innovation for Sustainable Society--- Eco-materials and Eco-innovation for Global Sustainability--- The 21st Iketani Conference (ECO-MATES 2011), Nara, Nov.28-30 (2011). (Organizing Committee)
K.Suganuma	IEEE 11th International Conference on Nanotechnology(IEEE NANO 2011), Portland, USA, August 15-18(2011). (International Advisory Board)
K.Suganuma	2011 International Symposium on Advanced Packaging Materials (APM 2011), Xiamen, China, October 25-28, 2011 (Technical Committee)
K.Suganuma	International Conference on Electronics Packaging (ICEP2011), Japan Institute of Electronics Packaging/ IEEE CPMT Society Japan Chapter, Nara, April 13-15, 2011. (Organizing Committee)

Publications in Domestic Meetings

Nuclear Science and Technology autumn convention	1 paper
Thermoelectrics Society of Japan	1 paper
The Japan Society of Applied Physics	1 paper
Nuclear Science and Technology spring convention	1 paper
Printed Electronics Association section meeting	1 paper
The Japan Wood Society	2 papers
Japan Institute of Electronics Packaging	3 papers
Cellulose society	1 paper
RISH symposium	1 paper

Grant-in-Aid for Scientific Research

K.Suganuma	Whisker growth and formation mechanism of space and aircraft equipment	¥5,590,000
K.Suganuma	bonding at room temperature using metal nano ink	¥1,820,000

Entrusted Research

K.Suganuma	Research of electrically-conducting adhesive	Research of electrically-conducting adhesive	¥525,000
K.Suganuma	Next-generation Printed Electronics	Development of radio frequency radiation for wiring printing TFT chip	¥30,000,000
K.Suganuma	New Energy and Industrial Technology DevelopmentOrganazation	technology for manufacturing of next-generation mask using high-precision processing	¥1,417,000
K.Suganuma	Mizuho Information & Research Institute, Inc.	demonstration of fabrication of semiconductor and metal wiring using short-term laser sintring process	¥350,000,000,000

Contribution to Research

K. Suganuma	DaiselChemical Industries,Ltd	¥500,000
K. Suganuma	Bando Chemical Industries , Ltd	¥500,000
K. Suganuma	Showa Denko K.K.	¥2,000,000
K. Suganuma	C.Uyemura & Co.,Ltd	¥1,000,000
K. Suganuma	Toray Research Center, Inc.	¥300,000
K. Suganuma	Printed Electronics Association	¥6,500,000
K. Suganuma	Kishu Giken Kogyo Co., Ltd	¥3,000,000
K. Suganuma	Nippon Steel Chemical Co., Ltd.	¥500,000

Cooperative Research

K. Suganuma	Siemens AG,Senju Metal Industry Co., Ltd, C. Uyemura & Co., Ltd.	¥3,663,000
K. Suganuma	NOF corporation	¥3,500,000
K. Suganuma	C.Uyemura & Co.,Ltd	¥0,000
K. Suganuma	Fujitsu Ten Limited	¥2,070,000

K. Suganuma	Toppan Forms Co.Ltd	¥0,000
K. Suganuma	Kishu Giken Kogyo Co., Ltd.	¥3,000,000
K. Suganuma	Showa Denko K.K.	¥9,625,000
K. Suganuma	NGK SPARK PLUG CO., LTD.	¥1,000,000
K. Suganuma	C.Uyemura & Co.,Ltd	¥420,000
K. Suganuma	The Yokohama Rubber Company, Limited	¥506,000
K. Suganuma	The Yokohama Rubber Company, Limited	¥990,000
K. Suganuma	Nippon Avionics Co., Ltd	¥1,155,000
K. Suganuma	ITEC co.,LTD	¥16,508,000
K. Suganuma	DIC Corporation	¥2,200,000

Department of Excited Solid-State Dynamics

Original Papers

[1]Transmission-electron diffraction with MeV electron pulses, Y. Murooka, N. Naruse, S. Sakakihara, M. Ishimaru, J. Yang, and K. Tanimura: Appl. Phys. Lett, 98 (2011) 251903-1-3.

[2]Ultrafast relaxation of highly excited electrons in Si: Roles of the L-X intervalley scattering, T. Ichibayashi, S. Tanaka, J. Kanasaki, K. Tanimura, and Th. Fauster: Phys. Rev. B, 84 (2011) 235210-1-11.

[3]Unoccupied dimer-bond state at Si(001) surfaces, Th. Fauster, S. Tanaka and K. Tanimura: Phys. Rev. B, 84 (2011) 235444-1-5.

[4]Femtosecond pulse radiolysis and femtosecond electron diffraction, J. Yang, K. Kan, T. Kondo, Y. Yoshida, K. Tanimura and J. Urakawa: Nucl. Instrum. Method A, 637 (2011) S24-S29.

[5]The role of applied bias and tip electronic structure in the scanning tunneling microscopy imaging of highly oriented pyrolytic graphite, G. Teobaldi, E. Inami, J. Kanasaki, K. Tanimura, and A. Shluger: Phys. Rev. B, 85 (2012) 085433-1-15.

[6]Photoabsorption properties of β-FeSi2 nanoislands grown on Si(111) and Si(001): Dependence on substrate orientation studied by nano-spectroscopic measurements, Nobuyasu Naruse, Yoshiaki Nakamura, Yutaka Mera, Masakazu Ichikawa, Koji Maeda: Thin Solid Films, 519 (2011) 8477-8479.

[7]Intact-sheet double-layer ablation induced by femtosecond-laser excitation of graphite, H. Ohnishi, E. Inami, and J. Kanasaki: Surf. Sci., 605 (2011) 1494-1499.

[8]Scanning tunneling microscopic studies of laser-induced modifications of Si(001)-(2x1) surface, K. Yasui and J. Kanasaki: J. Appl. Phys., 110 (2011) 103516-1-10.

[9]Observation of anomalous peaks in the photoelectron spectra of highly oriented pyrolytic graphite: Folding of the band due to the surface charge density wave transition, S. Tanaka, M. Matsunami and S. Kimura: Phys. Rev. B, 84 (2011) 121411(R)-1-4.

[10]Ultrafast Capture of the Hot Electron by the Surface Defects on the Si (001) Surface, S. Tanaka: Surf. Sci., 606 (2012) 407-413.

International Conferences

[1]Excitonic Instability and Photoinduced Structural Phase Transition (invited), K. Tanimura: The 4th

International Conference on Photo-induced phase transitions and cooperative phenomena.

[2]Transmission electron diffraction by MeV electron pulses with fs-temporal resolution (invited), K. Tanimura: Banff Meeting on Structural Dynamics: Ultrafast Dynamics with X rays and Electrons.

[3]Formation and Growth of interlayer sp3-bonded carbon nano-domains induced by femtosecond laser excitation of graphite (poster), E. Inami, J. Kanasaki, and K. Tanimura: International Symposium on Surface Science - Towards Nano-, Bio-, and Green Innovation -.

[4]Fs-laser induced exfoliation of intact graphene doubly-layers from graphite (poster), J. Kanasaki, H. Ohnishi, E. Inami, K. Tanimura, and K. Nasu: International Symposium on Surface Science - Towards Nano-, Bio-, and Green Innovation -.

[5]Angle-resolved low-energy photoemission study of electronic structure of Si(111)-7x7 (poster), J. Kanasaki, K. Tanimura, Y. Morikawa, and T. Fauster: International Symposium on Surface Science - Towards Nano-, Bio-, and Green Innovation -.

[6]Laser-induced modifications of Si(001)-(2x1) surface studied by means of Scanning Tunneling Microscope (poster), J. Kanasaki, K. Katoh, Y. Imanishi, and K. Yasui: International Symposium on Surface Science - Towards Nano-, Bio-, and Green Innovation -.

[7]Femotscond RF gun based MeV electron diffraction (invited), J. Yang, K. Kan, N. Naruse, Y. Murooka, Y. Yoshida, K. Tanimura: 2011 Particle Accelerator Conference.

[8]Femtosecond Photoinjector and Relativistic Electron Microscopy (oral), J. Yang, K. Kan, N. Naruse, Y. Murooka, Y. Yoshida, K. Tanimura: 2nd International Particle Accelerator Conference.

Review Papers

Ultrashort-bunch Electron RF Gun, J. Yang, K. Kan, T. Kondoh, Y. Murooka, N. Naruse, Y. Yoshida,K. Tanimura, and J. Urakawa, Journal of Vacuum Society of Japan, 55 (2011), 42-49.

Photo-assisted STM and STM Fourier transformation nanospectroscopy, Y. Mera, N. Naruse, K. Maeda, Journal of the Surface Science Society of Japan, 32 (2011), 779-784.

Grant-in-Aid for Scientific Research

K.Tanimura	Dynamical studies of photoinduced structural phase transitions	¥77,090,000
J.Kanasaki	Ultrafast dynamics of photoinjected valence holes in semiconductors	¥2,860,000
N.Naruse	Nanoimaging of optical and static electric fields by electron holography	¥650,000

Department of Accelerator Science

Original Papers

[1]Feed-forward control of the amplitude and the phase of a high-power RF pulse based on the overdrive technique, K. Kawase, Y. Morio, Y. Kon, M. Fujimoto, S. Hirata, J. Shen, R. Kato, A. Irizawa, G. Isoyama, S. Kashiwagi: Nuclear Instruments and Methods in Physicd Research A, 679 (2012) 44.

[2]Development of a sub-MeV X-ray source via Compton backscattering, K. Kawase, M. Kando, T. Hayakawa, I. Daito, S. Kondo, T. Homma, T. Kameshima, H. Kotaki, L.-M. Chen, Y. Fukuda, A. Faenov, T. Shizuma, T. Shimomura, H. Yoshida, R. Hajima, M. Fujiwara, S.V. Bulanov, T. Kimura, T. Tajima: Nuclear Instruments and Methods Physics Research A, 637 (2011) S141-S143.

[3]Longitudinal phase-space and transverse slice emittance measurements of high-brightness electron beams at ISIR, Osaka University, R. Kato, S. Kashiwagi, Y. Morio, K. Furuhashi, Y. Terasawa, G.

Isoyama: Nuclear Instruments and Methods Physics Research A, 637 (2011) S80-S82.

[4]Direct observation of a pressure-induced metal-insulator transition in LiV2O4 by optical studies, A. Irizawa, S. Suga, G. Isoyama, K. Shimai, K. Sato, K. Iizuka, T. Nanba, A. Higashiya, S. Niitaka, and H. Takagi: Physical Review B, 84 (2011) 235116.

[5]L-band Photocathode RF gun at KEK-STF, H. Sugiyama, Y. Takahashi, H. Hayano, J. Urakawa, S. Kashiwagi, G. Isoyama, R. Kato, N. Sugimoto and M. Kuriki: Journal of Physics: Conference Series, 298 (2011) 12015.

[6]Soft-X-Ray Harmonic Comb from Relativistic Electron Spikes, A.S. Pirozhkov, M. Kando, T.Zh. Esirkepov, P. Gallegos, H. Ahmed, E.N. Ragozin, A.Ya. Faenov, T.A. Pikuz, T. Kawachi, A. Sagisaka, J.K. Koga, M. Coury, J. Green, P. Foster, C. Brenner, B. Dromey, D.R. Symes, M. Mori, K.Kawase, T. Kameshima, Y. Fukuda, L. Chen, I. Daito, K. Ogura, Y. Hayashi, H. Kotaki, H. Kiriyama, H. Okada, N. Nishiuchi, T. Imazono, K. Kondo, T. Kimura, T. Tajima, H. Daido, P. Rajeev, P. McKenna, M. Borghesi, D. Neely, Y. Kato, and S.V. Bulanov: Physical Review Letters, 108 (2012) 135004.

[7]Efficient generation of Xe K-shell x rays by high-contrast interaction with submicrometer clusters, Yukio Hayashi, Alexander S. Pirozhkov, Masaki Kando, Yuji Fukuda, Anatoly Faenov, Keigo Kawase, Tatiana Pikuz, Tatsufumi Nakamura, Hiromitsu Kiriyama, Hajime Okada, and Sergei V. Bulanov: Optics Letters, 36 (2011) 1614.

[8]Candidate for the 2+ excited Hoyle state sat Ex ~ 10 MeV in 12C, M. Itoh, H. Akimune, M. Fujiwara, U. Garg, N. Hashimoto, T. Kawabata, K. Kawase, S. Kishi, T. Murakami, K. Nakanishi, Y. Nakatsugawa, B.K. Nayak, S. Okumura, H. Sakaguchi, H. Takeda, S. Terashima, M. Uchida, Y. Yasuda, M. Yosoi, and J. Zenihiro: Physical Review C, 84 (2011) 54308.

[9]Effect of the Laser Contrast Ratio within Picosecond Timescales on Generating a High-Quality Electron Beam by Laser-Plasma Interaction, Hideyuki Kotaki, Masaki Kando, Izuru Daitio, Takashi Kameshima, Keigo Kawase, Liming Chen, Yuji Fukuda, James k. Koga, Hiromitsu Kiriyama, Shuji Kondo, Shuhei Kanazawa, Yoshiki Nakai, Takuya Shimomura, Manabu Tanoue, Atsushi Akutsu, Hajime Okada, Tomohiro Motomura, and Sergei V. Bulanov: Japanese Journal of Applied Physics, 50 (2011) 66401.

[10]Electronic-Structure-Driven Magnetic Ordering in a Kondo Semiconductor CeOs2Al10, Shin-ichi Kimura, Takuya Iizuka, Hidetoshi Miyazaki, Akinori Irizawa, Yuji Muro, and Toshiro Takabatake: Physical Review Letters, 106 (2011) 5604.

[11]Optical Study of charge instability in CeRu2Al10 in comparison with CeOs2Al10 and CeFe2Al10, S. Kimura, T. Iizuka, H. Miyazaki, T. Hajiri, M. Matsunami, T. Mori, A. Irizawa, Y. Muro, J. Kajino, and T. Takabatake: Physical Review B, 84 (2011) 165125.

International Conferences

[1]RF Processing of L-band RF gun for KEK-STF (poster), M. Kuriki, H. Iijima, Y. Masumoto, G. Isoyama, R. Kato, K. Watanabe, H. Hayano, H. Sugiyama, J. Urakawa, Y. Takahashi, S. Kashiwagi: The 2nd International Particle Accelerator Conference (IPAC2011), San Sebastian, Spain,4 to 9 September, 2011.

Contributions to International Conferences and Journals

R. KATO The 34th International Free-Electron Laser Conference (FEL2012), Nara, Japan, August 26-31, 2012 (Local Organaizing Committtee)

Publications in Domestic Meetings

The Particle Accelerator Society of Japan	8 papers
The Physics Society of Japan	3 papers

The Japanese Society for Synchrotron Radiation Research		1 paper
Topical Meeting for FEL & High Power Radiation		4 papers

Academic Degrees

Master Degree for Science J. Shen	Studies on Wavelength Spectra of a Far-infrared FEL
Master Degree for Science S. Hirata	Time-Domain Analysis of Coherent Synchrotron Radiation
Master Degree for Science M. Fujimoto	Gain Evaluation with Temporal Evolution of FEL Power

Grant-in-Aid for Scientific Research

R.Kato	Development of a high resolution slice emittance measurement metyhod	¥780,000
K.Kawase	Upgrading of spectromicroscopy under multi-extreme conditions and the study of strongly-correlated electron systems	¥910,000
A.Irizawa	Development of the two focal points laser oscillator for the intense Compton backscattered gamma-ray source	¥1,040,000

Cooperative Research

G.Isoyama	NEC Corporation	¥550,000

Other Research Fund

G.Isoyama	High-energy Accelerator Research Organization	¥3,000,000

Department of Beam Materials Science

Original Papers

[1]Protein Conformational Changes in the Oxidative-Stress Sensor, SoxR, upon Redox Change of the [2Fe-2S] Cluster Probed with Ultraviolet Resonance Raman Spectroscopy, K. Kobayashi, M. Mizuno, M. Fujikawa, Y. Mizutani: Biochemistry, 50 (2011) 9468-9474.

[2]Identification and functional and spectral characterization of a globin-coupled histidine kinase from Anaeromyxobacter sp. Fw109-5, K. Kitanishi, K. Kobayashi, T. Uchida, K. Ishimori, J. Igarashi, T. Shimizu: J. Biol. Chem., 286 (2011) 35522-35534.

[3]A hydrogen-bonding network formed by the B10-E7-E11 residues of a truncated hemoglobin from Tetrahymena pyriformis is critical for stability of bound oxygen and nitric oxide detoxification, J. Igarashi, K. Kobayashi, A. Matsuoka: J. Biol. Inorg. Chem., 16 (2011) 599-609.

[4]Dissolution Kinetics in Chemically Amplified EUV Resist, H. Yamamoto, T. Kozawa, S. Tagawa, T. Mimura, T. Iwai, and J. Onodera: J. Photopolym. Sci. Technol., 24 (2011) 405-410.

[5]Study on positive-negative inversion of chlorinated resist materials, T.G. Oyama, A. Oshima, H. Yamamoto, S. Tagawa, M. Washio: Appl. Phys. Express, 4 (2011) 076501/1-076501/3.

[6]Nanofabrication of sulfonated polystyrene-g-FEP with silver ion (Ag+) using ion beam direct etching and reduction, H. Tsumokura, A. Oshima, T.G. Oyama, H. Yamamoto, T. Murakami, S. Tagawa, M. Washio: J. Photopolym. Sci. Technol., 24 (2011) 513-516.

[7]Wavelength Dependence of Lithography Resolution in Extreme Ultraviolet Region, T. Kozawa, T. Itani: Appl. Phys. Express, 4 (2011) 126501/1-126501/3.

[8]Backexposure Effect in Chemically Amplified Resist Process upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa, S. Tagawa, R. Ohnishi, T. Endo, R. Sakamoto: Jpn. J. Appl. Phys., 50 (2011) 016504/1-016504/6.

[9]Feasibility Study of Chemically Amplified Resists for Short Wavelength Extreme Ultraviolet Lithography, T. Kozawa, A. Erdmann: Appl. Phys. Express, 4 (2011) 026501/1-026501/3.

[10]Optimum Dissolution Point of Chemically Amplified Resists in Terms of Trade-Off Relationships between Resolution, Line Edge Roughness, and Sensitivity, T. Kozawa, H. Yamamoto, S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 026502/1-026502/5.

[11]Thermalization Distance of Electrons Generated in Poly(4-hydroxystyrene) Film Containing Acid Generator upon Exposure to Extreme Ultraviolet Radiation, T. Kozawa, S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 030209/1-030209/3.

[12]Relationship of Electron Diffusion Length to Line Edge Roughness in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 036505/1-036505/5.

[13]Dynamics of Radical Cation of Poly(styrene acrylate)-Based Chemically Amplified Resist for Extreme Ultraviolet and Electron Beam Lithography, Y. Tajima, K. Okamoto, T. Kozawa, S. Tagawa, R. Fujiyoshi, T. Sumiyoshi: Jpn. J. Appl. Phys., 50 (2011) 06GD03/1-06GD03/3.

[14]Determination of Optimum Thermalization Distance Based on Trade-off Relationship between Resolution, Line Edge Roughness, and Sensitivity of Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, S. Tagawa: J. Photopolym. Sci. Technol., 24 (2011) 137-142.

[15]Effect of Acid Generator Decomposition during Exposure on Acid Image Quality of Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa and S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 076505/1-076505/6.

[16]Assessment and Extendibility of Chemically Amplified Resists for Extreme Ultraviolet Lithography: Consideration of Nanolithography beyond 22nm Half-Pitch, T. Kozawa, H. Oizumi, T. Itani, and S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 076503/1-076503/7.

[17]Geminate Charge Recombination in Liquid Alkane with Concentrated CCl4: Effects of CCl4 Radical Anion and Narrowing of Initial Distribution of Cl, A. Saeki, N. Yamamoto, Y. Yoshida, and T. Kozawa,: J. Phys. Chem. A, 115 (2011) 10166-10173.

[18]Electron Beam Lithography Using Highly Sensitive Negative Type of Plant-Based Resist Material Derived from Biomass on Hardmask Layer, S. Takei, A. Oshima, A. Sekiguchi, N. Yanamori, M. Kashiwakura, T. Kozawa, and S. Tagawa: Appl. Phys. Express, 4 (2011) 106502/1-106502/3.

[19]Theoretical Study of Exposure Latitude of Chemically Amplified Resists Used for Extreme Ultraviolet Lithography, T. Kozawa and S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 106502/1-106502/5.

[20]Analysis of Dose-Pitch Matrices of Line Width and Edge Roughness of Chemically Amplified Fullerene Resist, T. Kozawa, H. Oizumi, T. Itani, and S. Tagawa: Jpn. J. Appl. Phys., 50 (2011) 126501/1-126501/5.

International Conferences

[1]Development of Extreme Ultraviolet Resists: From the Viewpoint of Image Formation in Resist Materials, T. Kozawa: Japanese Journal of Optics, Optical Society of Japan (A publication of The Optical Soiety of Japan) (144-148) 41.

[2]Photoelectron spectra of polystyrene derivative for chemically amplified EUV resist studied by X-ray Photoelectron Spectroscopy (XPS) and ultraviolet photoelectron spectroscopy (UPS) (oral), H. Yamamoto, T. Kozawa, S. Tagawa: RadTech Asia 2011,20-23 June,2011,Tokyo.

[3]Study on Dissolution Behavior of Polymer bound PAG and blended PAG Resists by using Quartz Crystal Microbalance Method (poster), H. Yamamoto, T. Kozawa, S. Tagawa,: 24th International Microprocesses and Nanotechnology Conference,Oct. 30-Nov. 2, 2012, Kobe Meriken Park Oriental Hotel, Kobe, Japan.

[4]Disolution Kinetics and Deprotection Reaction in Chemically Amplified EUV Resists (poster), H. Yamamoto, T. Kozawa, S. Tagawa, T. Mimura, T. Iwai, and J. Onodera: 2011 International Symposium on Extreme Ultraviolet Lithography,October 17, 2011, Miami.

[5]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, and J. Onodera: The 12th Pacific Polymer Conference,13-17 November,2011,Jeju,Korea.

[6]Solvated Electron Reaction with Some Polymer Bound Acid Generators or New Acid Generators (poster), Ravi Joshi, Hiroki Yamamoto, Kazuyuki Enomoto and Seiichi Tagawa: 24th International Microprocesses and Nanotechnology Conference,Oct. 30-Nov. 2, 2012, Kobe Meriken Park Oriental Hotel, Kobe, Japan.

[7]Study on Resist Performance of Polymer Bounded Photo-acid Generators (PAG) and blended PAG (poster), Dang Nguyen Tuan, Hiroki Yamamoto and Seiichi Tagawa: 24th International Microprocesses and Nanotechnology Conference,Oct. 30-Nov. 2, 2012, Kobe Meriken Park Oriental Hotel, Kobe, Japan.

[8]Determination of Optimum Thermalization Distance Based on Trade-off Relationship between Resolution, Line Edge Roughness, and Sensitivity of Chemically Amplified Extreme Ultraviolet Resists (oral), T. Kozawa, S. Tagawa: 28th International Conference of Photopolymer Science and Technology,21-24 June,2011,Chiba University.

[9]Reaction of thermalized electrons in resist materials (invited), T. Kozawa: 14th International Congress of Radiation Research,August 27-September 2, 2011,Warsaw, Poland.

[10]Location Control of Nanoparticles Using the Combination of Top-down and Bottom-up Nano-fabrication (poster), H. Yamamoto, A. Ohnuma, T. Kozawa, B.Ohtani: CRC International Symposium on Green & Sustainable Catalysis: from Theoretical and Fundamental Aspects to Catalyst Design,January 26-27, Hokkaido University.

[11]Limit of Line Edge Roughness at High Exposure Dose in Chemically Amplified Resists (oral), T. Kozawa: 24th International Microprocesses and Nanotechnology Conference,Oct. 30-Nov. 2, 2012, Kobe Meriken Park Oriental Hotel, Kobe, Japan.

[12]Wavelength Dependence of Lithography Resolution in Extreme Ultraviolet Region (oral), T. Kozawa, T. Itani: 2011 International Symposium on Extreme Ultraviolet Lithography,October 17, 2011 at 8:00 AM - October 19, 2011,Miami.

[13]Theoretical study of 11-nm-fabrication using 6.67-nm EUV lithography (oral), T. Kozawa, A. Erdmann: 9th Fraunhofer IISB Lithography simulation Workshop,September 15 - 17, 2011 in Hersbruck.

[14]Modeling and Simulation of Acid Diffusion in Chemically Amplified Resists with Polymer-Bound Acid Generator (oral), T. Kozawa, J. J. Santillan, and T. Itan: 2012 SPIE Advanced Lithography,24 - 28 February 2013,, United States.

Contributions to International Conferences and Journals

T. KOZAWA 24th International Microprocesses and Nanotechnology Conference (Program Committee)

T. KOZAWA 2011 EUVL Symposium (Steering Committee)
T. KOZAWA 2011 EUVL Workshop (Steering Committee)

Publications in Domestic Meetings

Japanese Biochemical Society Meeting	2 papers
Japanese Society of Radiation Chemistry	3 papers
Annual Meeting of the Japan RadiationResearch Society	1 paper
Japanese Chemical Society	4 papers
The Japan Society of Applied Physics	2 papers

Academic Degrees

Master Degree for Science	Mechanism of Activation in Transcription Factor for Oxidative Stress Studied by Pulse Radiolysis	
M. Fujikawa		

Grant-in-Aid for Scientific Research

T. Kozawa	Study on nanoscale reaction and reaction field using multiple quantuma beams	¥13,260,000
T. Kozawa	Study on the size of thermalized electron in condensed matter	¥1,170,000
K. Kobayashi	Structural change of DNA bound to transcription factor response to environmental change	¥2,340,000
H. Yamamoto	Educaiton and control of Nano-topography mechanism in ultrafine fabrication	¥1,040,000

Contribution to Research

T. Kozawa	NEDO, Development of EUV mask inspection tool and resist fundamental technology	¥3,150

Cooperative Research

T. Kozawa	Nissan Chemical Industry	¥1,000,000
T. Kozawa	Taiwan Aemiconductor Manufacturing	¥0,000

Department of Molecular Excitation Chemistry

Original Papers

[1]Evidence for Crystal-Face-Dependent TiO_2 Photocatalysis from Single-Molecule Imaging and Kinetic Analysis, T. Tachikawa, S. Yamashita, and T. Majima: J. Am. Chem. Soc., 133 (18) (2011) 7197-7204.

[2]Direct Measurement of the Dynamics of Excess Electron Transfer through Consecutive Thymine Sequence in DNA, M. J. Park, M. Fujitsuka, K. Kawai, and T. Majima: J. Am. Chem. Soc. (Commun.), 133 (39) (2011) 15320–15323.

[3]Probing the Charge-Transfer Dynamics in DNA at the Single-Molecule Level, K. Kawai, E. Matsutani, A. Maruyama, and T. Majima: J. Am. Chem. Soc., 133 (39) (2011) 15568–15577.

[4]pH-induced Intramolecular Folding Dynamics of i-motif DNA, J. Choi, S. Kim, T. Tachikawa, M. Fujitsuka, and T. Majima: J. Am. Chem. Soc., 133 (40) (2011) 16146–16153.

[5]Structural Relaxation in the Singlet Excited State of Star-Shaped Oligofluorenes having a Truxene or Isotruxene as a Core, M. Fujitsuka, D. W. Cho, H.-H. Huang, J.-Sha Yang, and T. Majima: J. Phys. Chem. B, 115 (46) (2011) 13502-13507.

[6]Self-assembly of Polydeoxyadenylic Acid Studied at the Single-Molecule Level, S. Kim, J. Choi, and T. Majima: J. Phys. Chem. B, 115 (51) (2011) 15399-15405.

[7]HOMO Energy Gap Dependence of Hole-Transfer Kinetics in DNA, K. Kawai, M. Hayashi, and T. Majima: J. Am. Chem. Soc., 134 (10) (2012) 4806–4811.

[8]Single-molecule charge transfer dynamics in dye-sensitized p-type NiO solar cells: influences of insulating Al_2O_3 layers, Z. Bian, T. Tachikawa, S.-C. Cui, M. Fujitsuka, and T. Majima: Chem. Sci., 3 (2)

(2012) 370-379.

[9]Photocatalytic oxidation surfaces on anatase TiO_2 crystal revealed by single-particle chemiluminescence imaging, T. Tachikawa and T. Majima: Chem. Commun., 48 (27) (2012) 3300-3302.

[10]S_2 emission from chemically modified BODIPYs, D. W. Cho, M. Fujitsuka, J. H. Ryu, M. H. Lee, H. K. Kim, T. Majima, and C. Im: Chem. Commun., 48 (28) (2012) 3424-3426.

[11]Interfacial electron transfer dynamics in dye-modified graphene oxide nanosheets studied by single-molecule fluorescence spectroscopy, T. Tachikawa, S.-C. Cui, M. Fujitsuka, and T. Majima: Phys. Chem. Chem. Phys., 14 (12) (2012) 4244-4249.

[12]Generation of Singlet Oxygen during Photosensitized One-Electron Oxidation of DNA, Y. Osakada, K. Kawai, T. Tachikawa, M. Fujitsuka, K. Tainaka, S. Tero-Kubota, and T. Majima: Chem. Eur. J., 18 (4) (2012) 1060-1063.

[13]Excess-Electron Injection and Transfer in Terthiophene-Modified DNA: Terthiophene as a Photosensitizing Electron Donor for Thymine, Cytosine, and Adenine, M. J. Park, M. Fujitsuka, K. Kawai, and T. Majima: Chem. Eur. J., 18 (7) (2012) 2056-2062.

International Conferences

[1]DNA wire (invited), T. Majima: 4th Inter WCU Symp Nanobio Materials & Electronics (WCU-04)/Joint Inst NanoBio-Technology/Univ Münster, Germany, MPI for Molecular Biomedicine & CeNTech/JINBiT, Münster, Germany, May 4-8, 2011.

[2]International Workshop on Nanoplasmonics for Energy and the Environment (invited), T. Majima: International Workshop on Nanoplasmonics for Energy and the Environment, Sanxenxo, Spain, June 8-10, 2011.

[3]DNA Nanowire (invited), T. Majima: Symposium Bio-inspired Materials and Functionalities, Groningen, NL, June 21-22, 2011.

[4]Photoinduced Electron Transfer in a Quantum Dot–Cucurbituril Complex (invited), T. Majima: 2nd International Conference on Cucurbiturils, Cambridge, UK, June 29-July 2, 2011.

[5]Single base mismatch detection based on the charge transfer in DNA (invited), T. Majima: ERC International Symposium 2011, Medical Diagnosis using Bionano sensor, Ansan, Korea, July 8, 2011.

[6]Unfolding Dynamics of Cytochrome c Revealed by Single-Molecule and Ensemble-Averaged Spectroscopy (poster), J. Choi, S. Kim, T. Tachikawa, M. Fujitsuka, and *T. Majima: 5th Asia Oceania Conference on Photobiology, Nara, Japan, July 30-Aug. 1, 2011.

[7]Single-Molecule Imaging of TiO_2 Photocatalytic Reactions (invited), T. Majima: 15th International Conference on Photochemistry, Beijing, China, Aug. 7-12, 2011.

[8]Charge Transfer in DNA (invited), T. Majima: 14th Intl Congress of Radiation Research, Warsaw, Poland, Aug. 28-31, 2011.

[9]Charge Transfer in DNA (invited), T. Majima: 1st International Conference on Bioinspired Solar Energy Utilization, Crete, Greece, Sep. 12-16, 2011.

[10]Single-particle and single-molecule imaging of photocatalytic reactions (invited), T. Majima: Chinese National Conference on Energy and Environment, Shanghai, China, Sep. 21-24, 2011.

[11]Single-Molecule Level Measurement of Charge-Recombination Dynamics in DNA (invited), K. Kawai: PSRC-5 (5th Pacific Symposium on Radical Chemistry), Wakayama, Japan, Sep. 25-28, 2011.

[12]Charge Transfer in DNA (invited), T. Majima: Conference at 1st International Conf on Proton-Coupled Electron Transfers (PCET) 2011, Loire valley, France, Oct. 9-13, 2011.

[13]Single-particle and single-molecule imaging of photocatalytic reactions (invited), T. Majima: International Conference on Environment and Sustainable Development, Shanghai, China, Oct. 21-23, 2011.

[14]Crystal-Face-Dependent TiO_2 Photocatalysis (invited), T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[15]Excess Electron Transfer in Tetrathiophene-Conjugated DNA (invited), *M. Fujitsuka and T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[16]pH-Induced Intramolecular Conformational Changes of i-motif DNA (oral), *J. Choi, S. Kim, T. Tachikawa, M. Fujitsuka and T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[17]Excess Electron Injection and Transfer in Terthiophene-Modified DNA (poster), M. Fujitsuka and *T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[18]Delocalization of Positive Charge in π-Stacked Multi-Benzene Rings in Multi-Layered Cyclophanes (poster), *M. Fujitsuka, M. Shibahara, T. Shinmyozu, and T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[19]Structural Relaxation in the Singlet Excited State of Star-Shaped Oligofluorenes having a Truxene or Isotruxene as a Core (poster), *M. Fujitsuka, D. W. Cho, J. -S. Yang, and T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[20]Self-assembly of Polydeoxyadenylic Acid Studied at the Single-Molecule Level (poster), *J. Choi, S. Kim, and T. Majima: 8th Korea-Japan Symposium on Frontier Photoscience 2011, Seoul, Korea, Oct. 28-31, 2011.

[21]pH-induced conformational changes of i-motif DNA (poster), J. Choi: FIBER International Symposium FIBER Forum2011, Hyogo, Japan, Nov. 6-8, 2011.

[22]Self-Assembly of Polydeoxyadenylic Acid Studied at the Single-Molecule Level (poster), S. Kim: FIBER International Symposium FIBER Forum2011, Hyogo, Japan, Nov. 6-8, 2011.

[23]Crystal-Face-Dependence of TiO_2 Photocatalytic Reactions (oral), T. Majima: The 3rd International Forum on Photoenergy Future (IFPF2011) , Jeju, Korea, Dec. 7, 2011.

[24]Single-molecule imaging of TiO_2 photocatalysis (invited), T. Majima: Symposium on Eco-materials Processing and Design (ISEPD2012), Guilin, China, Jan. 7-10, 2012.

[25]Crystal-Face-Dependent TiO_2 Photocatalysis (oral), T. Majima: SANKEN International Symposium, Osaka, Japan, Jan. 13, 2012.

[26]Single-molecule Fluorescence Imaging of TiO_2 Photocatalysis (invited), T. Majima: AIST－ANNA Seminar on Nanoparticles and Single-Molecules, “Applications of Light ＆ Nanomaterials for the Innovation of Technolory & Life Science“, Kagawa, Japan, Feb. 17, 2012.

[27]Single-Molecule Level Measurement of Charge-Recombination Dynamics in DNA (invited), K. Kawai: 2nd Seminar on Nanoparticles and Single Molecules, Takamatsu, Japan, Aug. 9, 2011.

[28]Charge transfer dynamics in DNA at the single-molecule level (oral), K. Kawai: The 38th International Symposium on Nucleic Acid Chemistry, Sapporo, Japan, Nov. 9-11, 2011.

[29]Excess electron transfer in DNA (invited), *M. Fujitsuka and T. Majima: China-Japan Joint Symposium on Functional Supramolecular Architectures, Beijing Normal University, Beijing, China, October 6-10, 2011.

Review Papers

Conformational Changes of Non-B DNA, J. Choi and T. Majima, Chem Soc Rev., Royal Society of Chemistry, 40[12] (2011), 5893 – 5909.

Recent Approach in Radiation Chemistry towards Material and Biological Science, M. Fujitsuka and T. Majima, J. Phys. Chem. Lett., American Chemical Society, 2[23] (2011), 2965–2971.

Single-Molecule, Single-Particle Approaches for Exploring the Structure and Kinetics of Nanocatalysts, T. Tachikawa and T. Majima, Langmuir, American Chemical Society, 28[24] (2012), 8933-8943.

Books

[1]Photoluminescence Spectroscopy of Single Semiconductor Nanoparticles(Leah Bergman and Jeanne L. McHale) T. Tachikawa and T. Majima, “Handbook of Luminescent Semiconductor Materials”, CRC Press, Taylor & Francis Group, (391-410) 2011.

[2]Delocalization and migration of excitation energy and charge in supramolecular systems(V. Ramamurthy and Yoshihisa Inoue) M. Fujitsuka and T. Majima, “Supramolecular Effects in Photochemical and Photophysical Processes”, John Wiley & Sons, Inc., (517-545) 2011.

[3]Photoinduced Electron Transfer Processes in Biological and Artificial Supramolecules(Jonathan W. Steed and Philip A. Gale) M. Fujitsuka and T. Majima, “Supramolecular Chemistry from Molecules to Nanomaterials, 'Molecular Devices: Electron Transfer' (SMC090)”, John Wiley & Sons, Ltd, (2365-2396) 2012.

[4]Charge Transfer in DNA(Chryssostomos Chatgilialoglu and Armido Studer) M. Fujitsuka and T. Majima, “Encyclopedia of Radicals in Chemistry, Biology & Materials”, John Wiley & Sons, Inc., 3 (1397-1424) 2012.

[5]Charge Transfer in DNA(Chemical Society of Japan) M. Fujitsuka and T. Majima, “New Trend of Nucleic Acid Chemistry”, Kagakudojin, 10 (116-123) 2011.

Contributions to International Conferences and Journals

T. MAJIMA	2011 International Workshop on Nanoplasmonics for Energy and the Environment (Scientific Committee)
T. MAJIMA	2011 Workshop of Research Laboratory for Quantum Beam Science on “Radiation Effects on DNA” (Chairperson)
T. MAJIMA	5th Asia Oceania Conference on Photobiology 2011 (President, Chairperson)
T. MAJIMA	5th Asia Oceania Conference on Photobiology, Session of Biosensors and Bioimagin (Session Chairperson)
T. MAJIMA	5th Asia Oceania Conference on Photobiology, Session of Photochemisry and Photobiology 2011 (Session Chairperson)
T. MAJIMA	1st International Conference on Bioinspired Solar Energy Utilization 2011 (International Committee)
T. MAJIMA	2011 Chinese National Conference on Energy and Environment in Shanghai

	(Advisory board)
T. MAJIMA	5th Pacific Symposium on Radical Chemistry 2011 (Organaizing Committtee)
T. MAJIMA	2011 International Conference on Environment and Sustainable Development (Advisory board)
T. MAJIMA	8th Korea-Japan Symposium on Frontier Photoscience 2011 (Chairperson)
T. MAJIMA	the Asia Oceania Society on Photobiology (President)
T. MAJIMA	Langmuir (Senior Editor)
T. MAJIMA	Rapid Communication in Photoscienece (International Editorial Board)
T. MAJIMA	ChemPlusChem (Editorial Board)
T. MAJIMA	Photochemistry and Photobiology (Associate Editor)

Publications in Domestic Meetings

Japan Photomedicine and Photobiology Meeting	2 papers
Japan Photochemistry Meeting	5 papers
Japan Molecular Science Meeting	1 paper
Japan Radiation Chemistry Meeting	3 papers
Japan Chemical Society Meeting	3 papers
Japan Photomedicine and Photobiology Meeting	2 papers
Japan Photochemistry Meeting	5 papers
Japan Molecule Science Meeting	1 paper
Japan Radiation Chemistry Meeting	3 papers
Japan Chemical Society Meeting	3 papers

Academic Degrees

Master Degree for Engineering M. Hayashi	HOMO energy dependence on the hole-transfer kinetics in DNA
Master Degree for Engineering T. Yonezawa	Design of a Highly Sensitive Water-Soluble Fluorescent Redox Probe for Single Molecule Detection
Master Degree for Engineering S. Kim	Studies of Self-Assembly of Polydeoxyadenylic Acid at the Single-Molecule Level

Grant-in-Aid for Scientific Research

T. Majima	Higher excited-state chemistry and its application to enviromental problems and nano- and biotechnology	¥21,450,000
M. Fujitsuka	Development of molecular devices functionalized by the trigger of higher excited-states	¥3,640,000
M. Fujitsuka	Study on delocalization of charge and excitation energy in polymer chains	¥2,000,000
K. Kawai	Observation of molecular beacon at single molecule level	¥2,470,000
K. Kawai	Construction of DNA molecule wirewith changing the helical torsion and HOMO energy gap	¥2,340,000
T. Tachikawa	Nanoimaging of biocatalytic activity using redox-responsible fluorescnece probe	¥2,080,000
T. Majima	TiO2 photocatalytic reaction mechanism with time- and space-resolved spectroscopic measurements towards the development of high efficient TiOs photocatalysts	¥800,000

Entrusted Research

T. Majima	Japan Science and Technology Agency (JST), CREST	Study on unstable reactive species of CPP	¥15,600,000

Contribution to Research

T.Tachikawa	Kansai research foundation for technology promotion	¥905,000

Cooperative Research

T.Majima	Panasonic Ecology Systems Co., Ltd.	¥1,964,000

Department of Synthetic Organic Chemistry

Original Papers

[1]A Bifunctional Spiro-Type Organocatalyst with High Enantiocontrol: Application to the Aza-Morita-Baylis-Hillman Reactions, S. Takizawa, K. Kiriyama, K. Ieki, H. Sasai: Chem. Commun., 47 (2011) 9227-9229.

[2]Synthesis of Spiro Bis(1,2,3-triazolium) Salts As Chiral Ionic Liquids, Y. Yoshida, S. Takizawa, H. Sasai: Tetrahedron Lett., 52 (2011) 6877-6879.

[3]Chlorinative Cyclization of 1,6-Enynes by Enantioselective Palladium(II)/Palladium(IV) Catalysis, K. Takenaka, S. Hashimoto, S. Takizawa, H. Sasai: Adv. Synth. Catal., 353 (2011) 1067-1070.

[4]Enantioselective Cyclization of 4-Alkenoic Acids via an Oxidative Allylic C-H Esterification, K. Takenaka, M. Akita, Y. Tanigaki, S. Takizawa, H. Sasai: Org. Lett., 13 (2011) 3506-3509.

International Conferences

[1]Exploring a New Asymmetric Reaction Using Chiral Spiro Bis(isoxazoline) Ligand "SPRIX" (invited), H. Sasai: The International Symposium on Physical Organic Chemistry and Synthetic Materials, Tianjin, China, July 2, 2011.

[2]Development of Enantioselective Catalyses Using Chiral Spiro Compounds (invited), H. Sasai: Chirality 2011, Liverpool, UK, July 10-13, 2011.

[3]Development of Novel Chiral Spiro Ligands Bearing Sulfur Donor (poster), S. Takatani, K. Sugimoto, K. Takenaka, H. Sasai: The 16th IUPAC International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS 16), Shanghai, China, July 24-28, 2011.

[4]Development of New Method for an Efficient Synthesis of Spiro Bis(triazole) Derivatives and Their Applications to Asymmetric Catalysis (poster), Y. Yoshida, S. Takizawa, H. Sasai: The 2nd International Symposium on Process Chemistry (ISPC 2011), Kyoto, Japan, August 10-12, 2011.

[5]Enantioselective Carbon-Carbon Bond-Forming Reactions Using Vanadium(V) Complexes (oral), S. Takizawa, J. Kodera, D. Rajesh, T. Katayama, H. Sasai: 4th Aachen-Osaka Joint Symposium, Aachen, German, September 1, 2011.

[6]Development of Novel Chiral Spiro Ligands Bearing Sulfur Donor (oral), S. Takatani, K. Sugimoto, K. Takenaka, H. Sasai: 4th Aachen-Osaka Joint Symposium, Aachen, German, September 1, 2011.

[7]Catalytic Enantioselective Reactions via Pd(II/IV) Catalysis (invited), H. Sasai: 14th Asian Chemical Congress 2011, Bangkok, Thailand, September 5-8, 2011.

[8]Organocatalyzed Domino Process Based on the Aza-Morita-Baylis-Hillman (Aza-MBH) Reaction (poster), S. Takizawa, N. Inoue, S. Hirata, H. Sasai: The 7th International Symposium on Integrated Synthesis (ISIS-7), Kobe, Japan, October 9-10, 2011.

[9]Intramolecular Enantioselective Rauhut-Currier Reaction (poster), T. M.-N. Nguyen, S. Takizawa, H. Sasai: The 7th International Symposium on Integrated Synthesis (ISIS-7), Kobe, Japan, October 9-10, 2011.

[10]Enantioselective Cyclization/Diacetoxylation of Alkynyl Cyclohexadienones Catalyzed by Palladium-Spiro Bis(isoxazoline) Complex (poster), S. C. Mohanta, K. Takenaka, S. Takizawa, T. Suzuki, H. Sasai: 8th AFMC International Medicinal Chemistry Symposium (AIMECS 11), Tokyo, Japan, November 29-December 2, 2011.

[11]Organocatalyzed Domino Process Based on the Aza-Morita-Baylis-Hillman (Aza-MBH) Reaction (oral), S. Hirata, S. Takizawa, N. Inoue, H. Sasai: The 1st Junior International Conference on Cutting-Edge Organic Chemistry in Asia, Xiamen, China, December 9-11, 2011.

[12]Organocatalyzed Domino Process Based on the Aza-Morita-Baylis-Hillman (Aza-MBH) Reaction (oral), S. Hirata, S. Takizawa, N. Inoue, H. Sasai: he 6th International Conference on Cutting-Edge Organic Chemistry in Asia and The 2nd New Phase International Conference on the Cutting-Edge Organic Chemistry in Asia, Hong Kong, China, December 11-15, 2011.

[13]Enantioselective Cyclization of 4-Alkenoic Acids via an Oxidative Allylic C−H Esterification (oral), M. Akita, Y. Tanigaki, K. Takenaka, S. Takizawa, H. Sasai: The 2nd Seleca Minisymposium, Aachen, German, December 13, 2011.

[14]Catalytic Enantioselective Coupling of Phenanthrols (poster), J. Kodera, S. Takizawa, H. Sasai: The 15th SANKEN International Symposium and The 10th SANKEN Nanotechnology Symposium, Osaka, Japan, January 12-13, 2012.

[15]Enantioselective Rauhut-Currier Reaction (oral), S. Takizawa, T. M.-N. Nguyen, A. Grossmann, D. Enders, H. Sasai: Osaka-Aachen Mini-symposium, Osaka, Japan, March 12, 2012.

[16]Enantioselective C-C Bond-Forming Reactions Using Vanadium(V) Complexes (poster), S. Takizawa, J. Kodera, D. Rajesh, T. Katayama, H. Sasai: 243rd ACS National Meeting, San Diego, USA, March 25-29, 2012.

Review Papers

Development of Enantioselective Domino Reaction Promoted by Acid-Base Organocatalyst, H. Sasai, S. Takizawa, Manufacturing & Technology, Manufacturing & Technology Promotion Association, 63 (2011), 70-73.

Books

[1]"Halogen-free" requirement for basic materials: epoxy resin(JST Innonation Plaza Osaka) J. Ichihara, “Co-creation and concert; The keyword of industry-university cooperation success”, Adthree Publishing Co.,Ltd., (187-193) 2011.

[2]Immobilization of Multicomponent Asymmetric Catalysts (MACs)(S. Itsuno) S. Takizawa, H. Sasai, “Polymeric Chiral Catalyst Design and Chiral Polymer Synthesis”, John Wiley & Sons, (293-322) 2011.

Publications in Domestic Meetings

Annual Meeting of The Chemical Society of Japan	11 papers
Symposium on Organic Reaction	3 papers
Symposium on Organometallic Chemistry	2 papers
Symposium on Progress in Organic Reactions and Syntheses	1 paper
Symposium on Molecular Chirality	5 papers
Congress of Heterocyclic Chemistry	1 paper
Hokkaido University GCOE Symposium on Synthetic Chemistry	1 paper

Academic Degrees

Master Degree for Science K. Ieki	Development of Acid-Base Organocatalyst having Spiro Backbone and Its Application to the Enantioselective Aza-MBH Reaction
Master Degree for Science Y. Ishizaka	Study on Ir-catalyzed Asymmetric Hydrogen Auto-transfer Process
Master Degree for Science	Synthesis of Enantiopure Spiro Bis(triazole) Derivatives and Their Applications to Asymmetric Catalysis

Y. Yoshida

Grant-in-Aid for Scientific Research

H. Sasai	Development of Catalytic Skeletal Constructing Reactions Utilizing Spiro-type Ligands	¥4,420,000
H. Sasai	Development of Domino Reactions Based on Novel Organocatalysts	¥3,510,000
S. Takizawa	Development of Nanozyme As a Highly Active Asymmetric Catalyst	¥780,000

Entrusted Research

H. Sasai	Japan Science and Technology Agency, Core Research for Evolutional Science & Technology	Control of Chirality by Immobilized Ligands Based on Metal-bridging Polyme	¥1,950,000
J. Ichihara	Japan Science and Technology Agency, Feasibility study	Development of Halogen-free Synthesis Method of Common Epoxy-compounds by Powder Reaction System	¥260,000

Contribution to Research

H. Sasai	Hoansha Foundation	¥2,000,000
H. Sasai	Nagase & Co.,Ltd.	¥1,000,000
H. Sasai	Nissan Chemical Industries, Ltd.	¥400,000
J. Ichihara	Kyodo Printing Co., Ltd.	¥200,000

Cooperative Research

J.Ichihara	JX Nippon Oil & Energy Corp.	¥1,040,000

Other Research Fund

H. Sasai	Japanese-German Graduate Externship Program	¥870,000
J. Ichihara	Osaka University UIC "Gap Fund" (University Industry Collaboration)	¥3,150,000

Department of Regulatory Bioorganic Chemistry

Original Papers

[1]Ligand-Assisted Complex of Two DNA Hairpin Loops, C. Hong, M. Hagihara, K. Nakatani: Angew. Chem. Int. Ed., 50 (2011) 4390-4390.

[2]Molecular-Glue-Triggered DNA Assembly to Form a Robust and Photoresponsive Nano-Network, C. Wang, F. Pu, Y. Lin, J. Ren, C. Dohno, K. Nakatani, X. Qu: Chem. Eur. J., 17 (2011) 8189-8197.

[3]Control of DNA hybridization by photoswitchable molecular glue, C. Dohno, K. Nakatani: Chem. Soc. Rev., 40 (2011) 5718-5729.

[4]Interstrand Cross-Link for Discrimination of Methylated Cytosines, C. Dohno, T. Shibata, K. Nakatani: Chem. Lett., 40 (2011) 852-854.

[5]Small Molecule Modulates Hairpin Structures in CAG Trinucleotide Repeats, M. Hagihara, H. He, K. Nakatani: ChemBioChem., 12 (2011) 1686-1689.

[6]Tandem Arrays of TEMPO and Nitronyl Nitroxide Radicals with Designed Arrangements on DNA, H. Atsumi, K. Maekawa, D. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: Chem. Eur. J., 18 (2012) 178-183.

[7]Naphthyridine tetramer with a preorganized structure for 1:1 binding to a CGG/CGG sequence, C. Dohno, I. Kohyama, C. Hong, K. Nakatani: Nucleic. Acids. Res., 40 (2012) 2771-2781.

[8]Chemoselective cyclization of unprotected linear peptides by α-ketoacid–hydroxylamine amide-ligation, T. Fukuzumi, L. Ju, J. W. Bode: Org. Biomol. Chem., 10 (2012) accepted.

[9]A Small Molecule Regulates Hairpin Structures in d(CGG) Trinucleotide Repeats, M. Hagihara, H. He, M. Kimura, K. Nakatani: Biorg. Med. Chem. Lett., 22 (2012) 2000-2003.

International Conferences

[1]Development of tetrameric naphthyridine derivatives for DNA and RNA containig a GG-mismatch (poster), I. Kohyama, C. Dohno, C. Hong, K. Nakatani: XVth Symposium on Chemistry of Nucleic Acid Components, Czech Republic, 2011, Jun. 5-10.

[2]Photoswitchable molecular glue for hybridization of nucleic acids. (poster), C. Dohno, S. Uno, K. Nakatani: XVth Symposium on Chemistry of Nucleic Acid Components, Czech Republic, 2011, Jun. 5-10.

[3]Antisense-Induced G-Quadruplex Structures Interfere with Reverse Transcription by HIV-1 Reverse Transcriptase (poster), M. Hagihara, K. Nakatani: RNA 2011, the 16th Annual Meeting of the RNA Society, Japan, 2011, Jun. 14-18.

[4]Development of a method for detecting small molecule-miRNA interactions (poster), A. Murata, Y. Harada, T. Fukuzumi, S. Umemoto, S. Im, M. Hagihara, K. Nakatani: RNA 2011, the 16th Annual Meeting of the RNA Society, Japan, 2011, Jun. 14-18.

[5]Periodic electron spin arrays on DNA duplex (poster), H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: ISAC2011, UK, 2011, Jul. 26-29.

[6]Synthesis of dimeric naphthyridine derivatives connected at the 7 position (poster), M. Toda, H. He, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[7]Synthesis of DNA containing hydrophobic region and its interaction with lipid bilayer membrane (poster), S. Makishi, T. Shibata, M. Okazaki, C. Dohno, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[8]Factors determining the binding of small molecules to the single nucleotide bulge in double stranded DNA and RNA (poster), T. Otabe, J. Zhang, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[9]Ligand-assisted complex of two DNA hairpin loops (poster), C. Hong: FIBER international Symposium, Japan, Nov. 6-8.

[10]Synthesis of hydrophobic DNA and its localization on lipid bilayer membrane surface (poster), S. Makishi: FIBER international Symposium, Japan, Nov. 6-8.

[11]Naphthyridine tetramer functions as a molecular glue for DNA and RNA (poster), C. Dohno, I. Kohyama, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[12]Synthesis of hydrophobic DNA interacting with liposome (poster), T. Shibata, S. Makishi, C. Dohno, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[13]Localization of hydrophobic DNA on lipid bilayer membrane surface (poster), S. Makishi, T. Shibata, M. Okazaki, C. Dohno, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[14]Evaluation of Xanthone and Thioxanthone Derivatives as Fluorescent Displacement Assay Indicator Based on Their Structure-Binding Studies to RNA (poster), S. Umemoto, S. Im, J. Zhang, M. Hagihara, A. Murata, Y. Harada, T. Fukuzumi, T. Wazaki, S. Sasaoka, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[15]Binding of the ligand to the (CGG)n in the RNA hairpin loop (poster), C. Hong, M. Hagihara, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[16]Electron spin arrays on DNA nanostructures (oral), H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[17]Ligand-Assisted Assembly and Functionalization of DNA Nanostructure (oral), K. Nakatani, C. Dohno, H. Atsumi: International Symposium on Innovative Nanobiodevices (ISIN2012), Japan, 2012, Mar. 21-22.

[18]Design and synthesis of RNA binding ligand for regulating gene expression (poster), C. Dohno, I. Kohyama, K. Nakatani: 243rd American Chemical Society National Meeting, USA, 2012, Mar. 25-28.

[19]Fluorescence-based binding assay of hydrophobic DNA to the lipid bilayer membrane (poster), T. Shibata, S. Makishi, C. Dohno, K. Nakatani: 243rd American Chemical Society National Meeting, USA, 2012, Mar. 25-28.

[20]Controlling DNA Hybridization and Assembly by Small Organic Molecules (invited), K. Nakatani: Bioinspired Materials and Functionalities, The Netherlands, 2011. Jun. 21-22.

[21]Ligand Inducible Fluorescencne: Tools for Ligand Discovery and PCR Monitoring (invited), K. Nakatani: 12th Conference on Methods and Application of Fluorescece Spectroscopy, France, Sep. 11-14.

[22]Controlling DNA and RNA Assembly by Small Organic Molecules (invited), K. Nakatani: The 15th Korea-Japan Seminar on Organic Synthesis, Korea, 2011, Sep. 30-Oct. 3.

[23]Ligand-Assisted Complex of Two DNA and RNA Hairpin Loops (invited), K. Nakatani: Asian 3 Round Table on Nucleic Acids 2011 China, Oct. 14-16.

[24]Small Molecules binding to DNA and RNA; Design and Application (invited), K. Nakatani: Seminor at Hubei University, China, 2011. Oct. 14.

Review Papers

Creating new DNA polymerases, F. Takei, K. Nakatani, kagaku, kagakudoujinn, 66[22] (2011), 74-75.

China and Korea in transition, K. Nakatani, Kagaku, Kagakudoujinn, 67[4] (2012), 47-49.

Patents

[1] Synthesis and application of primers for the increasing fluorescent signal during PCR amplification,K. Nakatani, F.Takei, C. Dohno, JP-2012-51551

Publications in Domestic Meetings

6th Annual Meeting of Japanese Society for Chemical Biology	1 paper
Symposium 2011 on Antisense, Gene, and Delivery	1 paper
5th Joint Symposium of Biorelevant Chemistry	4 papers
The Uehara Memorial Foundation Symposium 2011	1 paper
The 34th Annual Meeting of the Molecular Biology Society of Japan	1 paper

50th Annual Meeting of the Society of Electron Spin Science and Technology 1 paper
92th annual meeting of chemical society of Japan 10 papers

Academic Degrees

Doctoral Degree for Science H. Atsumi	Electron Spin Arrays with Designed Arrangements on the DNA Nanostructures
Doctoral Degree for Science S. Umemoto	Studies on the methods to evaluate interaction of RNA with small molecules
Doctoral Degree for Science C. Hong	Studies on Regulation of the RNA Secondary Structures by Using Small Organic Molecules
Master Degree for Science I. Kohyama	Studies on novel DNA and RNA binding ligands for CGG/CGG sequence for regulating biological functions
Master Degree for Science T. Otabe	Studies on synthesis and properties of novel triethynylethane derivatives and development of synthetic ligands for RNA bulges
Master Degree for Science L. Chen	Studies on reengineering of adenine riboswitch
Master Degree for Science M. Toda	Syntheis of dimeric naphthyridine derivatives connected at the 7 position for nucleic acids recognition and construction of nano rectangular solid by DNA origami
Master Degree for Science S. Makishi	Nanostructures on the surface of lipid bilayer membrane by using DNAs with hydrophobic regions

Grant-in-Aid for Scientific Research

K. Nakatani	Riboswitch reengineering using a synthetic 8-substituted purine library	¥17,290,000
C. Dohno	Photoresponsive RNA-binding ligands for regulation of RNA functions	¥10,010,000
A. Murata	Gene regulation by small molecule-modulated miRNA pathway	¥2,470,000

Entrusted Research

C. Dohno	Japan Science and Technology Agency, PREST	Biochemical functions emerging from DNA containing hydrophobic regions	¥18,525,000
K. Nakatani	National Institute of Biomedical Innovation	Development of Research Basis for accelerating the Drug Discovery targeting Functional ncRNA	¥76,000,000

Cooperative Research

K. Nakatani	Nitto Kasei Co., LTD.	¥2,520,000
K. Nakatani	FURUKAWA ELECTRIC ADVANCED ENGINEERING CO.,LTD.	¥1,573,000

Other Research Fund

F. Takei	Osaka univ.	¥800,000

Department of Organic Fine Chemicals

Original Papers

[1]Phosphopeptide-dependent 14-3-3z fluorescence labeling by fusicoccins, M. Takahashi, A. Kawamura, N. Kato, T. Nishi, I. Hamachi, J. Ohkanda: Angew. Chem. Int. Ed., 51 (2) (2012) 509-512.

[2]Antibacterial and antifungal activities of new acylated derivatives of epigallocatechin gallate, Y.

Matsumoto, K. Kaihatsu, K. Nishino, M. Ogawa, N. Kato, A. Yamaguchi: Frontiers in Antimicrobials, Resistance and Chemotherapy, 3 (Article 53) (2012) 1-10.

[3]An enzyme catalyzing O-prenylation of the glucose moiety of fusicoccin A, a diterpene glucoside produced by the fungus Phomopsis amygdali, M. Noike, C. Liu, Y. Ono, Y. Hamano, T. Toyomasu, T. Sassa, N. Kato, T. Dairi: ChemBioChem, 13 (4) (2012) 566-573.

[4]Protein recognition of hetero-/homoleptic ruthenium (II) tris(bipyridine)s for a-chymotrypsin and cytochrome c, Y. Yamaguchi,N. Kato,H. Azuma, T. Nagasaki, J. Ohkanda: Bioorg. Med. Chem. Lett., 22 (6) (2012) 2354-2358.

International Conferences

[1]Inhibition of reverse transcription of influenza A virus genome RNA by peptide nucleic acids. (invited), K. Kaihatsu, N. Kato: International conference & exhibition in virology-2011, September 4-9, 2011, Baltimore, MA, USA.

[2]Phosphopeptide-dependent fluorescent labeling of 14-3-3 zeta protein by fusicoccins (poster), GJ. Ohkanda, M. Takahashi, A. Kawamura, N. Kato, T. Nishi, I. Hamachi: Gordon Research Conference Bioorganic Chemistry, NH, USA, June 12-17, 2011.

[3]Bipyridine metal complexes for protein surface recognition (invited), J. Ohkanda: 14th Asian Chemical Congress, Bangkok, Thailand, September 6, 2011.

[4]Diagnosis of influenza virus strain by hairpin-type peptide nucleic acid (oral), K. Kaihatsu, S. Sawada, S. Nakamura, T. Nakaya, N. Kato.: International Union of Microbiological Societies (IUMS) 2011 Congress, September 14-16, 2011, Sapporo, Hokkaido.

[5]Phosphopeptide-dependent fluorescence labeling of 14-3-3 zeta protein by fusicoccins (poster), J. Ohkanda, M. Takahashi, A. Kawamura, N. Kato, T. Nishi, I. Hamachi: FRANCE-JAPAN WORKSHOP Bio-inspired approaches:Micro- & Nano- Architectures, Materials & Imaging,Bordeaux, France, October 11-12, 2011.

[6]Inhibition of influenza virus infection by epigallocatechin-3-O-gallate (EGCG) fatty acid monoesters (invited), K. Kaihatsu: The 4th International Conference on O-CHA (Tea) culture and Scinece, Shizuoka, Japan, October 26-28, 2011.

[7]Genome specific diagnosis of influenza virus strains by hairpin-type. peptide nucleic acid. (poster), K. Kaihatsu, S. Nakamura, T. Nakaya, N. Kato.: 7th Handai Nanoscience and nanotechnology International Symposium ,November 10, 2011. Ibaraki, Osaka, Japan.

[8]High-sensitivity virus genome RNA getection by azobenzene-linked bis-peptide nucleic acids (poster), K. Kaihatsu, N. Kato: 38th International Symposium on Nucleic Acid Chemistry, Nov. 18-19, 2011, Sapporo, Hokkaido, Japan.

[9]First direct and visual diagnostic for A/H1N1 influenza by bis-peptide nucleic acid (oral), K. Kaihatsu, S. Nakamura, T. Nakaya, N. Kato.: 38th International Symposium on Nucleic Acid Chemistry, Nov. 18-19, 2011, Sapporo, Hokkaido, Japan.

[10]Toward Detecting Protein-Protein Interactions by a Chemical Probe: Fusicoccin Analogs for Ligand-dependent 14-3-3 Labeling (poster), J. Ohkanda, M. Takahashi, N. Kato, T. Nishi, I. Hamachi, M. Noda, S. Uchiyama: The 15th SANKEN International Symposium 2012, Osaka, Japan, January 12, 2012.

[11]High Sensitive Detection of Virus Genome RNA by Azobenzene Linked Bis-Peptide Nucleic Aci (poster), S. Sawada, N. Kato, K. Kaihatsu: The 15th SANKEN International Symposium 2012, Osaka,

Japan, January 12, 2012.

Review Papers

Recent developments in anti-influenza A virus drugs and their combination therapires., K. Kaihatsu, D.L. Barnard, Mini-review in Organic Chemistry, Bentham Science Publishers, 9 (2012), 3-10.

Bivalent inhibitors for disrupting protein surface-substrate interactions and for dual inhibition of protein prenyltransferases, K. Washida, Annual Report of Osaka University, Academic Achievements 2010-2011, 100 papers selection, Osaka University, 12 (2012), 42.

Books

[1]Drug discovery for protein-protein interactions based on low-molecular-weight agents The Chemical Society of Japan, The Chemical Society of Japan, (46) 2012.

Patents

[1]Antibacterial agent K. Kaihatsu, Y. Matsumoto, WO2011/013825

[2]Azobenzene compound K. Kaihatsu, N. Shota, N. Goto.Yasunaga, T. Nakaya, N. Kato, JP2012-081288

Contributions to International Conferences and Journals

K. KAIHATSU J. Antivirals & Antiretrovirals (Editorial Bord Member)

Publications in Domestic Meetings

Japan Chemical Society Meeting	4 papers
Annual Meeting of JSBBA 2012	3 papers
14th Biomolecular Chemistry Forum	2 papers
Chemical Biology in Japan Annual meeting	1 paper
Yukigousei Kagakukyoukai Sen-ichiya	1 paper
Biooptics Conference	1 paper
Riken Chemical Biology Forum	1 paper

Academic Degrees

Doctor Degree for Science S. Sawada	(PNA)2/DNA triplex formation efficiency of azobenzene-tethered hairpin-type peptide nucleic acid
Master Degree for Science T. Kanno	Inhibition of influenza virus infection to cells by peptide nucleic acid
Master Degree for Science M. Takahashi	Phospholigand-dependent labeling of 14-3-3 proteins in cells by fusicoccin-based fluorescent probes
Bachelor Degree for Science R. Ishida	Chemical modification of fusicoccin H produced by mutated strain of P. amygdali

Grant-in-Aid for Scientific Research

J. Ohkanda	Design of organic molecules for regulating protein-protein interactions	¥2,730,000
J. Ohkanda	Detecting intracellular 14-3-3 proteins by fusicoccins	¥1,300,000
K. Kaihatsu	Development of transcription regulation method using photosensitive hairpin-type peptide nucleic acid	¥1,170,000

Contribution to Research

N. Kato	MBR Co., Ltd.	¥250,000
N. Kato	Nobuo Kato	¥1,000,000
N. Kato	MORITA CHEMICAL INDUSTRIES CO., LTD.	¥500,000
N. Kato	MBR Co., Ltd.	¥250,000

Cooperative Research

N. Kato	TMRC Co., Ltd.	¥2,500,000

N. Kato	Japan BCG Laboratory ADJU	¥1,500,000
K. Kaihatsu	Protectea, LTD.	¥263,000

Department of Structural Molecular Biology

Original Papers

[1]Hepatitis B Virus Envelope L Protein-Derived Bio-Nanocapsules: Mechanisms of Cellular Attachment and Entry into Human Hepatic Cells., M. Yamada, A. Oeda, J. Jung, M. Iijima, N. Yoshimoto, T. Niimi, S.-Y. Jeong, E. K. Choi, K. Tanizawa, and S. Kuroda: J. Controlled Release, in press (2012) .

[2]An Unusual Subtilisin-like Serine Protease Is Essential for Biogenesis of Quinohemoprotein Amine Dehydrogenase., T. Nakai, K. Ono, S. Kuroda, K. Tanizawa, and T. Okajima: J. Biol. Chem., 287 (9) (2012) 6530–6538.

[3]Structural insights into the substrate specificity of bacterial copper amine oxidase obtained by using irreversible inhibitors., T. Murakawa, H. Hayashi, M. Taki, Y. Yamamoto, Y. Kawano, K. Tanizawa, and T. Okajima: J. Biochem., 151 (2) (2012) 167–178.

[4]Fluorophore-labeled nanocapsules displaying IgG Fc-binding domains for the simultaneous detection of multiple antigens., M. Iijima, T. Matsuzaki, N. Yoshimoto, T. Niimi, K. Tanizawa, and S. Kuroda: Biomaterials, 32 (34) (2011) 9011–9020.

[5]Efficient and rapid purification of drug- and gene-carrying bio-nanocapsules, hepatitis B virus surface antigen L particles, from Saccharomyces cerevisiae., Jung, J., Iijima, M., Yoshimoto, N., Sasaki, M., Niimi, T., Tatematsu, K., Jeong, S.Y., Choi, E.K., Tanizawa, K., and Kuroda, S.: Protein Expression and Purification, 78 (2) (2011) 149-155.

[6]A short-chain dehydrogenase involved in terpene metabolism from Zingiber zerumbet., S. Okamoto, F. Yu, H. Harada, T. Okajima, J. Hattan, N. Misawa, and R. Utsumi: FEBS J., 278 (16) (2011) 2892-2900.

[7]LIM domains regulate protein kinase C activity: a novel molecular function., A. Maturana, N. Nakagawa, N. Yoshimoto, K. Tatematsu, M. Hoshijima, K. Tanizawa, and S. Kuroda: Cell Signal., 23 (5) (2011) 928-934.

International Conferences

[1]Evidence for Conformational Changes of Topaquinone during the Catalytic Reaction of Bacterial Copper Amine Oxidase. (invited), T. Okajima, A. Hamaguchi, S. Kikukawa, T. Nakai, T. Murakawa, H. Hayashi, and K. Tanizawa: The Third International Conference on Cofactors (ICC-03), Turku, Finland, July 10-15, 2011.

[2]Time-resolved analysis of catalytic reaction of copper amine oxidase from Arthrobacter globiformis. (poster), H. Yamaguchi, M. Kataoka, H. Oya, A. Tominaga, M. Ohtsu, T. Okajima, and K. Tanizawa: Twenty-Second Congress and General Assembly of the International Union of Crystallography (IUCr22), Madrid, Spain, 22–30 August, 2011.

[3]Detection of the reaction intermediates catalyzed by a copper amine oxidase. (poster), M. Kataoka, H. Oya, A. Tominaga, M. Otsu, T. Okajima, K. Tanizawa, and H. Yamaguchi: Twenty-Second Congress and General Assembly of the International Union of Crystallography (IUCr22), Madrid, Spain, 22–30 August, 2011.

[4]Tissue and Cell Specific Delivery of Strong Anti-inflammatory Protein Using Bionanocapsule (poster), K. Tatematsu, K. Okamoto, S. Kuroda, and K. Tanizawa: Bio-inspired approaches: Micro- & Nano-Architectures, Materials & Imaging, Bordeaux, France, 11-12 Octber, 2011.

Review Papers

Structure, Function and Mechanism of Biosynthesis of Built-in Type Cofactors., T. Okajima, T. Nakai, and K. Tanizawa, Seikagaku, The Japanese Biochemical Society, 83[8] (2011), 691-703.

Contributions to International Conferences and Journals

K. TANIZAWA	Journal of Biochemistry (Section Chief Editor)
K. TANIZAWA	Journal of Nutritional Science and Vitaminology (Editorial Board)

Publications in Domestic Meetings

Joint Annual Meeting of Biochemistry and Molecular Biology (BMB2011)	5 papers
Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry	2 papers
Annual Meeting of Kansai Branch of Japan Society for Bioscience, Biotechnology, and Agrochemistry	1 paper

Academic Degrees

Master Degree for Science J. Yagi	Expression and Biochemical Analysis of Membrane-bound Sensor Histidine Kinase WalK Involved in Bacterial Cell Wall Biosynthesis
Master Degree for Science T. Daguchi	Roles of Peripheral Genes in Biogenesis of Quinohemoprotein Amine Dehydrogenase
Master Degree for Frontier Biosciences H. Ito	Structure and Function of an [Fe-S]-cluster-binding Protein Essential for Biogenesis of Quinohemoprotein Amine Dehydrogenase
Master Degree for Frontier Biosciences K. Yamada	Development of Antibody-bound Nucleic Acid Carrier Targeting Inflammatory Cardiac Myocytes
Master Degree for Frontier Biosciences H. Iwasaki	Development of Bio-nanocapsules Possessing Binding Ability for Various Antibodies
Doctor Degree for Frontier Biosciences M. Yamada	Studies on the Hepatocellular Attachment and Entry of HBV Envelope-derived Bio-nanocapsule and Its Liposome Complex

Grant-in-Aid for Scientific Research

K. Tanizawa	Development of highly efficient protein delivery system utilizing import mechanism of peroxisome	¥1,040,000
T. Nakai	Biogenesis process of quinohemoprotein aminedehydrogenase accompanying multi-step posttranslational modification reactions	¥2,990,000

Entrusted Research

K. Tanizawa	Bio-oriented Technology Research Advancement Institution (BRAIN)	Establishment of Methods for Preparation of Modified Bionanocapsules and Their Mass Production	¥6,000,000
T. Okajima	Adaptable and Seamless Technology transfer Program through target-driven R&D	Development of Novel Antibiotics Effective for Multi-drug Resistant Bacteria (MRSA, VRE)	¥520,000

Contribution to Research

K.Tanizawa	Vitamin B Research Committee	¥145,000
T.Nakai	Protein Research Foundation	¥800,000

Department of Cell Membrane Biology

Original Papers

[1]Structures of the multidrug exporter AcrB reveal a proximal multisite drug-binding pocket, R. Nakashima, K. Sakurai, S.Yamasaki, K. Nishino, A. Yamaguchi: Nature, 480 (7378) (2011) 565-569.

[2]AcrA dependency of the AcrD efflux pump in Salmonella enterica serovar Typhimurium, S. Yamasaki, S. Nagasawa, M. Hayashi-Nishino, A. Yamaguchi, and K. Nishino: The Journal of Antibiotics, 64 (6) (2011) 433-437.

[3]Evaluation of multidrug efflux pump inhibitors by a new method using microfluidic channels, Y. Matsumoto, K. Hayama, S. Sakakihara, K. Nishino, H. Noji, R. Iino, A. Yamaguchi: PLoS One, 6 (4) (2011) e18547.

International Conferences

[1]Mechanism of multidrug recognition by the RamR regulatory protein required for the induction of the AcrAB multidrug efflux pump (poster), S. Yamasaki, E. Nikaido, K. Sakurai, R. Nakashima, A. Yamaguchi, K. Nishino: The 15th SANKEN International Symposium 2012, The 10th SANKEN Nanotechnology Symposium.

[2]Immuno-electron tomography for elucidation of localization of the mutidrug efflux pumps in Salmonella (poster), M. Hayashi-Nishino, A. Yamaguchi, K. Nishino: 7th Handai Nanoscience and Nanotechnology International Symposium.

[3]Peristaltic Mechanism of Multidrug Efflux Transporter AcrB Revealed by the Crystal Structure of AcrB with High-Molecular-Weight Drugs (poster), R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: 7th Handai Nanoscience and Nanotechnology International Symposium.

[4]Deveropment of novel therapeutic strategies to tackle multidrug-resistant pathogens (poster), M. Hayashi-Nishino, R. Nakashima, K. Sakurai, A. Yamaguchi, K. Nishino: FRANCE-JAPAN WORKSHOP, Bio-inspired approaches:Micro- & Nano- Architectures, Materials & Imaging, Bordeaux, France, Oct. 11-12, 2011.

[5]Peristaltic mechanism of multidrug efflux transport (poster), A. Yamaguchi, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino: FRANCE-JAPAN WORKSHOP, Bio-inspired approaches:Micro- & Nano-Architectures, Materials & Imaging, Bordeaux, France, Oct. 11-12, 2011.

[6]Antibiotic Augmenting Activities of Phe-Arg-β-Naphthylamide Based on its Membrane Permeabilizing Effects (poster), Y. Matsumoto, K. Nishino, A. Yamaguchi: 51st Interscience Conference on Antimicrobial Agents and Chemotherapy(ICAAC), Chicago, USA, Sep. 17-20, 2011.

[7]Effect of efflux pump inhibition versus outer membrane permeabilization to antimicrobial activities of ciprofloxacin and erythromycin against Pseudomonas aeruginosa (poster), Y. Matsumoto, K. Nishino, A. Yamaguchi: International Union Microbiological Societies 2011 Congress/The 84th Annual Meeting of Japanese Society for Bacteriology, Hokkaido, Japan, Sep. 6-10, 2011.

[8]AcrA dependency of the AcrD efflux pump in Salmonella enterica serovar typhimurium (poster), S. Yamasaki, S. Nagasawa, M. Hayashi-Nishino, A. Yamaguchi, K. Nishino: International Union Microbiological Societies 2011 Congress/The 84th Annual Meeting of Japanese Society for Bacteriology, Hokkaido, Japan, Sep. 6-10, 2011.

[9]Functional analysis of mammalian SPNS2, a sphingosine 1-phosphate transporter (poster), Y. Hisano, A. Yamaguchi, T. Nishi: FASEB Summer Research Conferences, Lysophospholipid Mediators in Health and Disease, IL Ciocco, Lucca, Italy, Aug. 14-19, 2011.

[10]The Reguration of the AcrAB multidrug efflux pump in Salmonella (oral), S. Yamasaki, E. Nikaido, K. Sakurai, R. Nakashima, A. Yamaguchi, K. Nishino: France 4th Symposium on Antimicrobial Resistance in Animals and the Environment, Tours, France, Jun. 27-29, 2011.

[11]Structural basis of multidrug efflux (invited), A. Yamaguchi: The 80th Anniversary Commemoration of Osaka University International Symposium Series,June 22, 2011 in Groningen.

Review Papers

Multidrug recognition mechanism of xenobiotic efflux transporter, R. Nakashima, A. Yamaguchi, Cell Technology, Gakken Medical Shujunsha Co., Ltd., 31[5] (2012), 529-534.

Elucidation of transport mechanism of bacterial xenobiotic efflux protein, A. Yamaguchi, R. Nakashima, CHEMISTRY, KAGAKUDOJIN, 67[74] (2012), 74.

Patents

[1] The analysis method which uses the micro device for analysis of bacterial antimicrobial susceptibility, Y. Matsumoto, K. Hayama, S. Sakakihara, K. Nishino, A. Yamaguchi, H. Noji, R. Iino, JP2011-200036

Publications in Domestic Meetings

The 132th Annual Meeting of the Pharmaceutical Society of Japan	1 paper
The 85th Annual Meeting of Japanese Society for Bacteriology	5 papers
The 46th Annual Meeting of the Paeudomonas Aeruginosa Infection Society	1 paper
The 40th Annual Meeting of the Society for Bacterial Drug Resistance	1 paper
Annual Meeting 2011 and General Assembly of the Crystallographic Society of Japan	1 paper
The 59th Annual Meeting of Japanese Society of Chemotherapy, Western Japan Branch/The 54th Annual Meeting of the Japanese Association for Infectious Diseases, Central Japan Branch	1 paper
The 33rd Symposium on Biomembrane-Drug Interaction	4 papers
The 64th Annual Meeting of Japanese Society for Bacteriology, Kansai Branch	1 paper
The 58th Annual Meeting of Japanese Society of Chemotherapy, Eastern Japan Branch/The 60th Annual Meeting of the Japanese Association for Infectious Diseases, Eastern Japan Branch	1 paper
The 84th Annual Meeting of the Japanese Biochemical Society	4 papers
The 5th Wakate Colosseum for Bacteriology	1 paper
Transient Macromolrcular Complexes	1 paper
The 59th Annual Meeting of the Japanese Society of Chemotherapy	1 paper
The 58th Annual Meeting of the Japanese Biochemical Society, Kinki Branch	1 paper

Academic Degrees

Bachelor Degree for Pharmaceutical Science K. Hayashi	Substrate recognition mechanism of RND type efflux transporter
Master Degree for Pharmaceutical Sciences S. Yamasaki	Multidrug recognition mechanism of xenobiotic efflux transporter
Master Degree for Pharmaceutical Sciences A. Ohno	Physiological functions of Salmonella xenobiotic transporter MacAB

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	¥1,300,000
T. Nishi	Comprehensive analysis of the export mechanism of bioactive lipids from the cells and identification of the universal	¥9,490,000

	mechanism of the bioactive lipid transporters		
Entrusted Research			
A. Yamaguchi	National Institute of Biomedical Innovation	Development of novel inhibitors that counteract infectious diseases by drug resistant bacteria	¥48,143,000
Cooperative Research			
A.Yamaguchi	Fine Co., Ltd		¥0,000
Other Research Fund			
R. Nakashima	JSPS International Collaborations, Supporting International Joint Research,/France		¥2,500,000

Department of Biomolecular Science and Engineering

Original Papers

[1]Generation of chicken monoclonal antibodies against the a1, a2, and a3 subunit isoforms of vacuolar-type proton ATPase., Sun-Wada, G.-H., Tabata, H., Kuhara, M., Kitahara, I., Takashima, Y., and Wada, Y.: Hybridoma, 30 (2) (2011) 199-203.

[2]The a3 isoform vacuolar type H^+ -ATPase promotes distant metastasis in the mouse B16 melanoma cells., Nishisho T, Hata K, Nakanishi M, Morita Y, Sun-Wada GH, Wada Y, Yasui N, Yoneda T.: Mol Cancer Res, 9 (7) (2011) 845-855.

[3]Vacuolar H(+)-ATPase subunits Voa1 and Voa2 cooperatively regulate secretory vesicle acidification, transmitter uptake, and storage., Saw NM, Kang SY, Parsaud L, Han GA, Jiang T, Grzegorczyk K, Surkont M, Sun-Wada GH, Wada Y, Li L, Sugita S: Mol Biol Cell, 22 (18) (2011) 3394-3409.

[4]Prorenin receptor is essential for normal podocyte structure and function., Oshima Y, Kinouchi K, Ichihara A, Sakoda M, Kurauchi-Mito A, Bokuda K, Narita T, Kurosawa H, Sun-Wada GH, Wada Y, Yamada T, Takemoto M, Saleem MA, Quaggin SE, Itoh H.: J Am Soc Nephrol, 22 (12) (2011) 2203-2212.

[5]An expanded palette of genetically encoded Ca^{2+} indicators., Zhao Y, Araki S, Wu J, Teramoto T, Chang Y, Nakano M, Abdelfattah AS, Fujiwara M, Ishihara T, Nagai T, Campbell RE: Science, 6051 (333) (2011) 1888-1891.

[6]Quantitative comparison of genetically encoded Ca^{2+} indicators in cortical pyramidal cells and cerebellar Purkinje cells., Yamada Y, Michikawa T, Hashimoto M, Horikawa K, Nagai T, Miyawaki A, Hausser M, Mikoshiba K.: Front Cell Neurosci, 18 (5) (2011) 1-10.

[7]Conjugation of both on-axis and off-axis light in Nipkow disk confocal microscope to increase availability of incoherent light source., : Cell Struct Fun, 36 (2) (2011) 237-246.

[8]Ca^{2+} Regulation of Mitochondrial ATP Synthesis Visualized at the Single Cell Level., Nakano M, Imamura H, Nagai T, Noji H: ACS Chemical Biology, 7 (6) (2011) 709‐715.

[9]Facilitated intracellular transport of TrkA by an interaction with nerve growth factor., Nomura M, Nagai T, Harada Y, Tani T.: Developmental Neurobiology, 71 (7) (2011) 634-649.

[10]Chromophore-assisted light inactivation of HaloTag fusion proteins labeled with eosin in living cells., Takemoto K, Matsuda T, McDougall M, Klaubert DH, Hasegawa A, Los GV, Wood KV, Miyawaki A, Nagai T.: ACS Chem Biol., 6 (5) (2011) 401-406.

[11]Imaging the dynamics of intracellular protein translocation by photoconversion of phamret-cybr/ROM., Yang L, Matsuda T, Raviraj V, Ching YW, Braet F, Nagai T, Soon LL.: , 242 (3) (2011) 250-261.

International Conferences

[1]Endocytic organelles in mouse gastrulae: multiple roles in spatiotemporal signalling during early embryogenesis. (invited), Wada Y: 第 63 回日本細胞生物学会, 6/20, 2011, Sapporo.

[2]Endocytic regulation of BMP signalling during mouse gastrulation. (invited), Wada Y: EMBO workshop on Lineage Commitments, Lueven, Belgium, Provinciehuis, May 25-27, 2011.

[3]Delivery of endosome to vacuole via microautophagy in visceral endoderm of mouse embryo. (poster), Sun-Wada GH and Wada Y: EMBO workshop on Lineage Commitments, Lueven, Belgium, Provinciehuis, May 25-27, 2011.

[4](Pro)renin Receptor is Essential for Expression of Slit Diaphragm Proteins in Murine Podocytes. (oral), Ichihara, A, Oshima, Y., Kurauchi-Mito, A., Kurosawa, H., Sun-Wada, GH., Wada, Y., Yamada, T., Takemoto, M., Saleem, MA., Quaggin, SE., Itoh, H: High Blood Pressure Research, Orlando, FL, USA, 20-24, Sep, 2011.

[5]High performance genetically-encoded auto-luminescent Ca2+ indicators, SuperBRACs. (oral), Nagai T: Focus on Microscopy 2011.

[6]Autoluminescent imaging tools for comnibing use with optogenetic technology. (invited), Nagai T: 44th Annual Meeting of the Japanese Society of Developmental Biologists.

[7]Auto-luminescent Genetically-Encoded Ratiometric Indicator for Real-time Ca2+ Imaging at the Single Cell Level. (invited), Nagai T: ICAS 2011.

[8]Invention of high performance bright luminescent proteins used as a nanolight source. (invited), Nagai T: Academia Sinica & Joint Workshop on ”Innovative use of light and nano/bio materials".

[9]Invention of high performance bright luminescent proteins used as a nanolight source (invited), Nagai T: 「光の利用と物質材料・生命機能」領域会議.

[10]Auto-luminescent imaging tools for combining use with optogenetic technology (invited), Nagai T: 第 63 回日本細胞生物学会大会.

[11]光で拓くナノバイオテクノロジー (invited), 永井　健治: 北海道大学 ナノテクノロジー・ナノサイエンス概論□.

[12]Toward deciphering biological phenomena by genetically-encoded molecular spies (invited), Nagai T: IFReC Imaging-Immunology Interactive Seminar.

[13]Toward invention of high performance genetically-encoded luminescent indicators for functional imaging in living organisms. (invited), Nagai T: 日独修好 150 周年記念シンポジウム「人類の未来を拓く研究者のグランドチャレンジを支える日独の取り組み」.

[14]Auto-luminescent imaging tools for combining use with optogenetic technology. (oral), Nagai T: Workshop on single cell analysis.

[15]Imaging Probes for Neuronal Cell Biology. (invited), Nagai T: OIST Developmental Neurobiology Course.

[16]小数性生物学とは (invited), 永井　健治: JST・さきがけ「光の利用と物質材料・生命機能」第一期生研究交流会.

[17]蛍光・化学発光タンパク質を使って (invited), 永井　健治: 第 20 回浜松医科大学メディカルフォトニクス・コース.

[18]大自然からの素晴らしい贈り物ー緑色蛍光タンパク質とイクオリンー (invited), 永井　健治: 第２０回日本バイオイメージング学会学術集会　公開シンポジウム.

[19]蛍光・化学発光タンパク質を用いたバイオイメージング技術の現状と展望 (invited), 永井　健治: 第２０回日本バイオイメージング学会学術集会.

[20]蛍光タンパク質を使用した分子動態計測と化学発光タンパク質による次世代バイオイメージング (invited), 永井　健治: 第４９回日本生物物理学会年会.

[21]What should we learn from light emitting organisms? Efficient energy transfer and its application for bioimaging (invited), Nagai T: 第４９回日本生物物理学会年会.

[22]Halo Tag テクノロジーによる分子機能の時空間的光不活性化と超高輝度化学発光タンパク質によるリアルタイムイメージング (invited), 永井　健治: 2011 Promega New Technology Seminar.

[23]シンポジウム：１分子生物学と生化学の狭間に潜むナノシステム動作力学の理解を目指して (oral), 永井　健治: 第８４回日本生化学会大会.

[24]遺伝的にコードされた分子スパイによる生命現象の解明に向けて (invited), 永井　健治: 名古屋大学医学部セミナー.

[25]Imaging tools applicable in conjunction with optogenetic technology (invited), Nagai T: 生理学研究所研究会「超階層シグナル伝達研究の新展開」.

[26]New Horizon of Photonic Bioimaging. (invited), Nagai T: "光イメージングに関する国際シンポジウム ＆ WS2011 サチライトシンポジウム：ヒトの生物時計ー時間隔離実験 50 周年記念ー.

[27]Spying biological events in living cells by genetically-encoded functional indicators. (invited), Nagai T: The third RIES-CIS international Symposium.

[28]これまでの道のりと将来にむけて (invited), 永井　健治: 東京女子医科大学 G-COE 若手育成合宿.

[29]Auto-luminescent genetically encoded ratiometric indicator for real-time Ca2+ imaging at the single cell level. (invited), Nagai T: SPIE Smart Nano+Micro Materials and Devices 2011.

[30]Genetically-encoded technologies to quantitatively visualize and manipulate biomolecule in living cells (invited), Nagai T: 第 34 回日本分子生物学会年会.

[31]Auto-luminescent functional probes applicable in conjunction with photo-manipulation technology including optogenetic tools (invited), Nagai T: Promega Dynamic Connection.

[32]個と多数の狭間が織りなす生命現象の解明を目指して (invited), 永井　健治: 数理連携 10 の根本問題の発掘.

[33]生理機能の光操作と可視化技術 (invited), 永井　健治: 東京大学 医学共通講義 III 機能生物学入門 新基盤生命学講義　細胞分子薬理学.

[34]Revolutionary bioimaging with super-duper luminescent proteins. (invited), Nagai T: Molecular Imaging and Systems Biology.

[35]Conformational fluctuations of Ras revealed by single molecule fluorescence resonance energy transfer. (invited), Y. Arai: Innovative NanoBiodevice based on Single-Molecule Analysis.

[36]Photoactivatable Ca^{2+} Indicator to Visualize Biological Events in Single Arbitrary Cells Within Tissues / Whole Body. (oral), Matsuda T.: Gordon Research Conferences, Calcium Signalling, Colby College, USA, June 26-July 1, 2011.

Review Papers

Calcium imaging in living cells and organisms by using bioluminescent proteins., S.Saito, T.Nagai, SEIRUTSU BUTHURI, THE BIOPHYSICAL SOCIETY OF JAPAN, 299[52] (2011), 30-31.

Intrer-cellular signal propagation in Dictiostelium aggregation process., K.Horikawa, T.Nagai, SEIBUTSU NO KAGAKU IDEN, NTS, 65 (2011), 87-91.

Functional visualization of living cells and organisms by using bioluminescent proteins., S.Saito, T.Nagai, KAGAKU TO SEIBUTSU, Japan Society for Bioscience, Biotechnology, and Agrochemistry, 49 (2011), 555-559.

Contributions to International Conferences and Journals

T.NAGAI　　日米先端科学(JAFoS)シンポジウム (Chief PGM)

Publications in Domestic Meetings

The 84th Annual Meeting of Japan Endocrine Society	2 papers
Project Meeting of Innovative use of light and materials/life	1 paper
63th Annual Meeting of the Japan Society for Cell Biology	1 paper
IFReC Imaging-Immunology Interactive Seminar	1 paper
JST・さきがけ「光の利用と物質材料・生命機能」第一期生研究交流会	1 paper
第 20 回浜松医科大学メディカルフォトニクス・コース	1 paper
20th Annual Meeting of Bioimaging Society	1 paper
The 49th Annual Meeting of the Biophysical Society of Japan	1 paper
2011 Promega New Technology Seminar	1 paper
The 84th Annual Meeting of the Japanese Biochemical Society	1 paper
生理学研究所研究会「超階層シグナル伝達研究の新展開」	1 paper
東京女子医科大学 G-COE 若手育成合宿	1 paper
The 34th Annual Meeting of the Molecular Biology Society of Japan	1 paper
Promega Dynamic Connection	1 paper
数理連携 10 の根本問題の発掘	1 paper
新学術領域「動く細胞と場のクロストークによる秩序の生成」第 1 公開シンポジウム「動く細胞と場を読む」	1 paper
the 17th workshop of fluorescence microscopy	3 papers
the 18th workshop of fluorescence microscopy	1 paper
生理研研究会-超階層シグナル伝達研究の新展開-	1 paper

Grant-in-Aid for Scientific Research

T. Nagai	Development of molecular probes and photonic tools for bio-manipulation	¥65,260,000
T. Nagai	Spying minority in biological phenomena -Toward bridging dynamics between individual and ensemble processes-	¥16,770,000
K. Saito	Real-time imaging of formation and depletion of synapses by using split RLuc-Venus fusion protein.	¥5,460,000
Y. Arai	Fluorescence signal enhancement by metal nano-particles for highly-stable single molecule imaging system.	¥2,600,000
T. Matsuda	Development of rational design of the bright fluorescent protein based on the 3D-structure	¥4,420,000
T. Matsuda	Photoactivatable Ca2+ indicator to visualize biological events in	¥4,680,000

	single arbitrary cells within tissues / whole body		
Y. Wada	Intracellualar signalling cascades and cellular communications during the early embryogenesis		¥10,140,000

Entrusted Research

T. Nagai	New Energy and Industrial Technology Development Organization	Development of absorption-enhanced microscopy based on novel principle and its application for bioscience	¥18,460,000
T. Nagai	Japan Science and Technology Agency	Invention of high performance bright luminescent proteins used as a nanolight source	¥16,380,000

Contribution to Research

T. Nagai	Takeda Science Foundation	¥10,000,000
T. Nagai	suharakinennzaidann	¥1,000,000

Cooperative Research

T. Nasgai	OPTO-LINE, Inc.	¥8,285,000
T. Nasgai	Nikon Instech Co.,Ltd.	¥6,160,000
T. Nasgai	Nikon Co.,Ltd.	¥2,090,000
T. Nasgai	Panasonic Corporation	¥550,000

Specially Appointed Laboratory

Original Papers

[1]Development of Microfabricated TiO2 Channel Waveguides, Masayuki Furuhashi, Masazumi Fujiwara, Takahito Ohshiro, Makusu Tustsui, Kazuki Matsubara, Masateru Taniguchi, Shigeki Takeuchi, Tomoji Kawai: AIP Advances, 1 (3) (2011) 032102(1-5).

[2]Study on transport pathway in oxide nanowire growth by using spacing-controlled regular array, Annop Klamchuen, Takeshi Yanagida, Masaki Kanai, Kazuki Nagashima, Keisuke Oka, Sakon Rahong, Meng Gang, Mati Horprathum, Masaru Suzuki, Yoshiki Hidaka, Shoichi Kai, Kawai Tomoji: Applied Physics Letters, 99 (19) (2011) 193105(1-3).

[3]Gate Manipulation of DNA Capture into Nanopores, Yuhui He, Makusu Tustsui, Chun Fan, Masateru Taniguchi, Tomoji Kawai: ACS Nano, 5 (10) (2011) 8391-8397.

[4]Spatial Nonuniformity in Resistive-Switching Memory Effects of NiO, Keisuke Oka, Takeshi Yanagida, Kazuki Nagashima, Masaki Kanai, Tomoji Kawai, Jin-Soo Kim, Bae Ho Park: Journal of the American Chemical Society, 133 (32) (2011) 12482-12485.

[5]Single-molecule sensing electrode embedded in-plane nanopore, Makusu Tustsui, Sakon Rahong, Yoko Iizumi, Toshiya Okazaki, Masateru Taniguchi, Tomoji Kawai: Scientific Reports, 1 (2011) 1-6.

[6]Controlling DNA Translocation through Gate Modulation of Nanopore Wall Surface Charges, Yuhui He, Makusu Tustsui, Chun Fan, Masateru Taniguchi, Tomoji Kawa: ACS NANO, 5 (7) (2011) 5509-5518.

[7]Essential role of catalyst in vapor-liquid-solid growth of compounds, Masaru Suzuki, Yoshiki Hidaka, Takeshi Yanagida, Annop Klamchuen, Masaki Kanai, Tomoji Kawai and Shoichi Kai: Physical Review E, 83 (2011) 061606(1-4).

[8]Electrical Detection of Single Methylcytosines in a DNA Oligomer, Makusu Tustsui, Kazuki Matsubara, Takahito Ohshiro, Masayuki Furuhashi, Masateru Taniguchi, Tomoji Kawai: Journal of the American Chemical Society, 133 (23) (2011) 9124-9128.

[9]Intrinsic Mechanisms of Memristive Switching, Kazuki Nagashima, Takeshi Yanagida, Keisuke Oka, Masaki Kanai, Annop Klamchuen, Jin-Soo Kim, Bae Ho Park, Tomoji Kawai: NANO LETTERS, 11 (5)

(2011) 2114-2118.

[10]Dopant homogeneity and transport properties of impurity-doped oxide nanowires, Annop Klamchuen, Takeshi Yanagida, Masaki Kanai, Kazuki Nagashima, Keisuke Oka, Shu Seki, Masaru Suzuki, Yoshiki Hidaka, Shoichi Kai and Tomoji Kawai: Applied Physics Letters, 98 (5) (2011) 053107(1-3).

[11]Unsymmetrical hot electron heating in quasi-ballistic nanocontacts, Makusu Tsutsui, Tomoji Kawai, Masateru Taniguchi: Scientific Reports, 2 (2012) 217.

[12]Electrical detection of single pollen allergen particles using electrode-embedded microchannels:, Chihiro Kawaguchi, Tetsuya Noda, Makusu Tsutsui, Masateru Taniguchi, Satoyuki Kawano and Tomoji Kawai: Journal of Physics:Condensed Matter, 24 (2012) 164202.

[13]Single-nanoparticle detections using a low-aspect ratio pore: ACS, Makusu Tsutsui, Sadato Hongo, Yuhui He, Masateru Taniguchi, Nobuhiro Gemma, Tomoji Kawai: ACS Nano, 6 (2012) 3499-3505.

International Conferences

[1]Development of Gating Nanopores for Single-Molecule DNA Electrical Sequencing (invited), T. Kawai: NHGRI Advanced Sequencing Technology Development Meeting, San Diego, USA, April 06-07, 2011.

[2]Gating Nanopores for Single-Molecule DNA Electrical Sequencing (invited), T. Kawai: 한국세라믹학회 2011 년 춘계총회 및 연 구발표회 (2011), 水原, 韓国, April 21-22, 2011.

[3]Nanotechnology for advanced devices---Thin film formation, nanofabrication and device application in electronics and biotechnology--- (oral), T. Kawai: Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Science Seminar, Hefei, May 26-30, 2011.

[4]Gating Nanopores for Single-Molecule DNA Electrical Sequencing (invited), T. Kawai: ISMM 2011 in Conjunction with the KBCS Spring Meeting, Seoul, Korea, June 02-04, 2011.

[5]Gating Nanopores for Single-Molecule DNA Electrical Sequencing (invited), T. Kawai: GeneExpression Systems & Appasani Research Conferences (ARCEI.ORG) Jointly Presents, Fourth International Epigenomics, Sequencing & SNiPs-2011, Boston, USA, July 11-12, 2011.

[6]Development of Gating Nanopores for Next-Next DNA Sequencing using Mechanically Controllable Break-Junctions (invited), M. Taniguchi: ASME-JSME-KSME Jpint Fluids Engineering Conference 2011, Hamamatsu, July 24-29, 2011.

[7]Mechanical Controlled Break Junction to Gating Nanopore for Single Biomolecule Electrical Sequencing (oral), T. Kawai: 11th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN 2011), St. Petersburg, Russia, October 3-7, 2011.

[8]Gating Nanopores for Single-Molecule DNA Electrical Sequencing (invited), T. Kawai: IEEE Nanotechnology Materials and Devices Conference 2011 (IEEE NMDC 2011), Jeju, Korea, October 18-21, 2011.

[9]Scanning Probe Microscope for DNA Sequencing and Cell Surgery (invited), T. Kawai: 2011 년 가을학술논문발표회 및 임시총회 (2011) The Korean Physical Society Autumn Meeting 2011, Busan, Korea, October 19-21, 2011.

[10]Innovative Nano-Biodevices for DNA and related molecules: STM and Gating Nanopore (invited), T. Kawai: ASIASENSE 2011(The 5th International Conference on sensors),Jeju, Korea, October 23-26, 2011.

[11]Nanotechnology for Single Molecular DNA Sequencing —STM and Gating Nanopore— (plenary), T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium -Nanoscience and Nanotechnology in the Next Ten Years-, Suita, Japan, November 10-11, 2011.

[12]Innovative Nano-Biodevices for DNA and related molecules: STM and Gating Nanopore (invited), T. Kawai: Research Institute for Electronic Science, Hokkaido University International Symposium, Sapporo, Japan, November 21-22, 2011.

[13]Nanotechnology for Single Molecular DNA Sequencing—STM and Gating Nanopore— (plenary), T. Kawai: 33rd International Symposium on Dry Process (DPS2011), Kyoto, Japan, November 10-11, 2011.

[14]Innovative Nano-Biodevices for DNA and related molecules: STM and Gating Nanopore (invited), T. Kawai: BMMP-12, Nagoya, Japan, January 24-27, 2012.

[15]Research on the Detection of DNA single molecule using Nano Pore (invited), T. Kawai: Seminar on Hoseo University BK21, Asan, Korea, January 17, 2012.

[16]Gating-Nanopores for Single Molecule DNA Sequencing (plenary), T. Kawai: Nanopores Conference 2012 - Zing conferences, Puerto Celero, Spain, February 06-10, 2012.

[17]DNA sequencing by Nanopore devices and its application to Health Science (invited), T. Kawai: Chiang Mai University、the Health Science Seminar, Chiang Mai, Thailand, February 27-29, 2012.

[18]Innovative Nano-Biodevices for DNA and related molecules: STM and Gating Nanopore (invited), T. Kawai: DNA Nanotechnology: From Structure to Function, Shanghai, China, May 16-18, 2012.

[19]Single Molecule Electrical Sequencing of DNA and RNA Using Integrated Gating Nanopores (plenary), T. Kawai: ISIN 2012　(International Symposium on Innovative Nanobiodevices), Nagoya, Japan, May 21-22, 2012.

[20]In-plane gating nanopore for single-molecule electrical DNA sequencing (poster), M. Tsutsui, R. Sakon, M. Taniguchi, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium -Nanoscience and Nanotechnology in the Next Ten Years-, Suita, Japan, November 10-11, 2011.

[21]Electrode-embedded in-plane nanopore for electrical DNA sequencing (poster), M. Tsutsui, R. Sakon, Y. He, M. Taniguchi, T. Kawai: ISIN 2012　(International Symposium on Innovative Nanobiodevices), Nagoya, Japan, May 21-22, 2012.

[22]Single-Molecule Tunnel-Current Detection Towards a Sequencing of Oligonucleotides (poster), T. Ohshiro, K. Matsubara, M. Tustsui, M. Furuhashi, M. Taniguchi, T. Kawai: G l obal Technology Congress, 1st Next Generation Sequencer Congress, San Francisco, USA, July 07-08, 2011.

[23]Single-Molecule Indntification of DNA/RNA Towards Tunnel-Current Based Genome Sequencing (invited), T. Ohshiro: ISIN 2012　(International Symposium on Innovative Nanobiodevices), Nagoya, Japan, May 21-22, 2012.

[24]Development of microfabricated TiO2 channel waveguide and the effect of a gap (poster), M. Furuhashi, M. Fujiwara, T. Ohshiro, M. Tustsui, K. Matsubara, M. Taniguchi, S. Takeuchi, T. Kawai: The 6th International Symposium on Surface Science and Nanotechnology(ISSS-6), Tokyo, Japan, December 11-15, 2011.

[25]Properties of a TiO2 channel waveguide with a submicrometer-scale gap (poster), M. Furuhashi, T. Ohshiro, M. Tustsui, K. Matsubara, M. Taniguchi, T. Kawai: ISIN 2012　(International Symposium on

Innovative Nanobiodevices), Nagoya, Japan, May 21-22, 2012.

[26]DNA Translocation through Nanopore under Salt Gradinet (poster), Y. He, M. Tsutsui, M. Taniguchi, T. Kawai: ISIN 2012　(International Symposium on Innovative Nanobiodevices), Nagoya, Japan, May 21-22, 2012.

Patents

[1]Method, equipment, and application of control of translational velocity Tomoji Kawai, Makusu Tsutsui, Masateru Taniguchi, JP2012-17325

[2]Method and equipment for analysis of a single particle Tomoji Kawai, Makusu Tsutsui, Masateru Taniguchi, PCT/JP2012/56372

[3]Method and equipment for determination of bese sequence of polynucleotides Tomoji Kawai, Takahito Ohshiro, Kazuki Matsubara, Masayuki Furuhashi, Makusu Tsutsui, Masateru Taniguchi, JP2012-77975

Publications in Domestic Meetings

The 72nd Fall Meeting, 2011 (JSAP)	7 papers
The 59th Spring Meeting, 2012 (JSAP)	5 papers
The 92nd Annual Meeting (CSJ)	2 papers
JSPS/JST open symposium	1 paper
4th BioCreation Networking Symposium	1 paper
JEMIMA 32th workshop	1 paper
Genome conference for next generation sequencer	1 paper
Genome conference	1 paper
Lecture of state-of-art science and technology	1 paper
31th Symposium on Capillary Electrophoresis	1 paper
Seminar on industrialization of regenerative medicine	1 paper
3rd Open Symposium of Emergent Chemistry of Molecular Nano systems	1 paper
Open symposium of FIRST	1 paper
Report on nanotechnology network	1 paper
The 60th annual meeting (JSAC)	1 paper

Grant-in-Aid for Scientific Research

T. Kawai	Fabrication of Nano channel for single bio-molecule analysis	¥9,100,000,000
T. Kawai	Programed Self-emergent chemistry of Transition metal oxide nano-structure	¥20,280,000,000
T. Kawai	Emergence in Chemistory	¥14,690,000,000

Entrusted Research

T. Kawai	MEXT(Ministry of Education,Culture,Sports,Science & Technology in Japan)	Handai Multi-Functional Nanofoundry	¥108,000,000,000

Laboratory of Microbiology and Infectious Diseases

Original Papers

[1]Antibacterial and antifungal activities of new acylated derivatives of epigallocatechin gallate, Y. Matsumoto, K. Kaihatsu, K. Nishino, M. Ogawa, N. Kato, Yamaguchi A: Front. Microbiol., 3 (2012) 53.

[2]A microfluidic device for simple and rapid evaluation of multidrug efflux pump inhibitors, R. Iino, K. Nishino, H. Noji, A. Yamaguchi, Y. Matsumoto: Front. Microbiol., 3 (2012) 40.

[3]Covalently linking the Escherichia coli global anaerobic regulator FNR in tandem allows it to function as an oxygen stable dimer, Y. Shan, Q. Pan, J. Liu, F. Huang, H. Sun, K. Nishino, A. Yan: Biochem. Biophys. Res. Commun., 419 (2012) 43-48.

[4]Physiological role of bacterial multidrug efflux pumps, K. Nishino: Yakugaku Zasshi, 132 (2012) 45-50.

[5]Structures of the multidrug exporter AcrB reveal a proximal multisite drug-binding pocket, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: Nature, 480 (2011) 565-569.

[6]The multidrug efflux pump MdtEF protects against nitrosative damage during the anaerobic, Y. Zhang, M. Xiao, T. Horiyama, Y. Zhang, X. Li, K. Nishino, A. Yan: J. Biol. Chem., 286 (2011) 26576-26584.

[7]AcrA dependency of the AcrD efflux pump in Salmonella enterica serovar Typhimurium, S. Yamasaki, S. Nagasawa, M. Nishino, A. Yamaguchi, K. Nishino: J. Antibiot. (Nature Publishing Group), 64 (2011) 433-437.

[8]Evaluation of multidrug efflux pump inhibitors by a new method using microfluidic channels, Y. Matsumoto, K. Hayama, S. Sakakihara, K. Nishino, H. Noji, R. Iino, A. Yamaguchi: PLoS One, 6 (2011) e15847.

International Conferences

[1]Mechanisim of multidrug recognition by the RamR regulatory protein required for the induction of the AcrAB multidrug efflux pump (poster), S. Yamasaki, E. Nikaido, K. Sakurai, R. Nakashima, A. Yamaguchi, K. Nishino: 15th SANKEN International Symposium / 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[2]Immuno-electron tomography for elucidation of localization of the multidrug efflux pumps in Salmonella (invited), M. Nishino, A. Yamaguchi, K. Nishino: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[3]Peristaltic mechanism of multidrug efflux transporter AcrB revealed by the crystal structure of AcrB with high-molecular-weight drugs (poster), Nakashima R, Sakurai K, Yamasaki S, Nishino K, Yamaguchi A: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[4]The regulation of the AcrAB multidrug efflux pump in Salmonella typhimurium (oral), Yamasaki S, Nikaido E, Sakurai K, Nakashima R, Yamaguchi A, Nishino K: JSPS-INRA collaborative project meeting, 14 October 2011, France.

[5]The structural analysis of RamR (oral), Sakurai K, Nakashima R, Yamaguchi A, Nishino K: JSPS-INRA collaborative project meeting, 13 October 2011, Nouzilly, France.

[6]Development of novel therapeutic strategies to tackle multidrug-resistant pathogens (poster), Nishino M, Nakashima R, Sakurai K, Yamaguchi A, Nishino K: France-Japan Workshop (Bio-inspired approaches: Micro- & Nano- Architectures, Materials & Imaging),October 11th-12th, 2011,Institut Européen de Chimie et Biologie - Bordeaux.

[7]Peristaltic mechanism of multidrug efflux transport (poster), Yamaguchi A, Nakashima R, Sakurai K, Yamasaki S, Nishino K: France-Japan Workshop (Bio-inspired approaches: Micro- & Nano- Architectures, Materials & Imaging),October 11th-12th, 2011,Institut Européen de Chimie et Biologie - Bordeaux.

[8]Antibiotic augmenting activities of Phe-Arg-ß-Naphtylamide based on its membrane permeabilizing effects (poster), Matsumoto Y, Nishino K, Yamaguchi A: American Society for Microbiology 51st ICAAC Meeting,September 17-20, 2011,Chicago.

[9]AcrA dependency of the AcrD efflux pump in Salmonella enterica serovar Typhimurium (poster), Yamasaki S, Nagasawa S, Nishino M, Yamaguchi A, Nishino K: International Union of Microbiological Societies 2011 Congress,6-10 September 2011,Sapporo.

[10]Effect of efflux pump inbibition versus outer membrane permeabilization to antimicrobial activities of ciprofloxacin and erythromycin against Pseudomonas aeruginosa (poster), Matsumoto Y, Nishino K, Yamaguchi A: International Union of Microbiological Societies 2011 Congress,6-10 September 2011,Sapporo.

[11]The regulation of the AcrAB multidrug efflux pump in Salmonella (oral), Yamasaki S, Nikaido E, Sakurai K, Nakashima R, Yamaguchi A, Nishino K: JSPS-INRA collaborative project meeting, 25 June 2011, Nouzilly, France.

[12]Regulation of AcrAB multidrug efflux pump in Salmonella enterica serovar Typhimurium in response to indole and paraquat (poster), Nikaido E, Shirosaka I, Yamaguchi A, Nishino K: 4th Symposium on Antimicrobial Resistance in Animals and the Environment,27-29 June 2011,France.

[13]Role of AcrA on the function of the AcrD multidrug efflux pump in Salmonella enterica serovar Typhimurium (poster), Yamasaki S, Yamasaki S, Nagasawa S, Nishino M, Yamaguchi A, Nishino K: 4th Symposium on Antimicrobial Resistance in Animals and the Environment,27-29 June 2011,France.

[14]Development of novel therapeutic strategies to tackle multidrug-resistant pathogens (poster), Yamasaki S, Yamasaki S, Ono A, Hayashi K, Fukushima A, Matsumoto, Y, Nishino M, Sakurai K, Nakashima R, Yamaguchi A, Nishino K: 4th Symposium on Antimicrobial Resistance in Animals and the Environment,27-29 June 2011,France.

[15]Altered expression of multidrug efflux- and invasion-related genes Salmonella Typhimurium clinical isolates with mutations in ramR or at the RamR DNA-binding site (poster), Baucheron S, Nishino K, Mulvey M, Cloeckaert A, Giraud E: 4th Symposium on Antimicrobial Resistance in Animals and the Environment,27-29 June 2011,France.

[16]The multidrug efflux pump MdtEF protects against nitrosative damage during the anaerobic respiration in Escherichia coli (poster), Zhang Y, Xiao M, Horiyama T, Zhang Y, Li X, Nishino K, Yan A: Gordon Research Conference on Multidrug Efflux Systems,June 12-17, 2011, Switzerland.

[17]The roles of drug efflux pumps in bacterial multidrug resistance and virulence (invited), Nishino K: Seminar at Faculty of Veterinary Medicine, Ghent University, 7 October 2011, Ghent, Belgium.

[18]Drug resistance and virulence roles of bacterial multidrug efflux pumps (invited), Nishino K: International Union of Microbiological Societies 2011 Congress,6-10 September 2011,Sapporo.

[19]Multidrug efflux pumps and development of therapeutic strategies to control infectious diseases (invited), Nishino K: The Uehara Memorial Foundation Symposium 2011,6-8 June,2011.

Review Papers

Bacterial drug efflux protein and survival strategy, K. Nishino, Infection Inflammation Immunity, A medicinal gate company, 41 (2011), 335-338.

Antibiotics efflux transporter, K. Nishino, Modern Medical Laboratory, Igaku-Shoin, 39 (2011), 677-684.

Bacterial multidrug resistance and virulence mediated by multidrug efflux pumps, K. Nishino, Antibiotics & Chemotherapy, Iyaku (Medicine and Drug) Journal Co., Ltd., 27 (2011), 1495-1503.

Books

[1]Medical treatment-anti-microbe medicine for infection(T. Honda) K. Nishino, “The first step of illustration for infection and microbiology”, Yodosha, ISBN 978-4-7581-2023-4 (133-141) 2011.

[2]Microbiology field(Pharmaceutical Society of Japan) K. Nishino, “Pharmacy term dictionary”, Tokyo Kagaku Dojin, ISBN9784807906772 (552) 2012.

Patents

[1]The analysis method which uses the micro device for analysis of bacterial antimicrobial susceptibility Y. Matsumoto, K. Hayama, S. Sakakihara, K. Nishino, A. Yamaguchi, H. Noji, R. Iino, 2011-200036

Contributions to International Conferences and Journals

K. NISHINO	Frontiers in Micirobiology (Antimicrobials, Resistance and Chemotherapy) (Associate Editor)
K. NISHINO	3rd ASM Conference on Antimicrobial Resistance (Program Advisory Committee)
K. NISHINO	Antimicrobial Agents and Chemotherapy (Ad-Hoc Reviewer)
K. NISHINO	Biol. Pharm. Bull. (Ad-Hoc Reviewer)
K. NISHINO	PLoS ONE (Ad-Hoc Reviewer)
K. NISHINO	African Journal of Agricultural Research (Ad-Hoc Reviewer)
K. NISHINO	Journal of Antibiotics (Ad-Hoc Reviewer)
K. NISHINO	Journal of Antimicrobial Chemotherapy (Ad-Hoc Reviewer)
K. NISHINO	Microbes and Environments (Ad-Hoc Reviewer)
K. NISHINO	Archives of Microbiology (Ad-Hoc Reviewer)
K. NISHINO	Recent Patents on Anti-Infective Drug Discovery (Ad-Hoc Reviewer)
K. NISHINO	FEMS Microbiology Letters (Ad-Hoc Reviewer)
K. NISHINO	International Journal of Molecular Sciences (Ad-Hoc Reviewer)
K. NISHINO	BMC Systems Biology (Ad-Hoc Reviewer)
S. YAMASAKI	Journal of Antimicrobial Chemotherapy (Ad-Hoc Reviewer)

Publications in Domestic Meetings

2011 Asahi Glass Foundation Research Support Meeting	1 paper
Transient Macromolecular Complexes Public Symposium	1 paper
6th General Meeting of Japan Transporter Research Association	1 paper
Scientific research meeting of the Waksman foundation	1 paper
Transient Macromolecular Complexes Group Meeting	1 paper
85th General Meeting of Japanese Society for Bacteriology	4 papers
40th Research Meeting of Society for Bacterial Drug Resistance	1 paper
59th Japanese Society of Chemotherapy western branch general meeting and 54th Japanese Association for Infectious Diseases Nakanihon district scientific meeting, a joint society	1 paper
33rd Symposium on the interaction between biomembranes and medicine	2 papers
Crystallographic Society of Japan annual convention in the Heisei 23 fiscal year, and a general meeting	1 paper
Academic lecture meeting of the Institute of Scientific and Industrial Research, Osaka University	1 paper
64th Annural Meeting of Western Branch of Japanese Society for Bacteriology	1 paper
60th Japanese Association for Infectious Diseases East Japan district scientific meeting and 58th Japanese Society of Chemotherapy East Japan branch general meeting, Joint society	1 paper
84th Annual Meeting of Japanese Biochemical Society	2 papers
63rd Annual Meething of Japan Society for Cell Biology	1 paper
59th General Meeting of Japanese Society of Chemotherapy	1 paper

Academic Degrees

Master Degree for Pharmaceutical Science A. Ono	Physiology functional elucidation of the xenobiotic transporter MacAB in Salmonella

Grant-in-Aid for Scientific Research

K. Nishino	Regulation of bacterial multidrug resistance and virulence modulated by drug efflux pumps and development novel	¥47,220,000

	therapeutics to control infectious diseases	
M. Nishino	Inhibitor development and the functional elucidation of the drug efflux transporter which participates in multidrug resistance and pathogenic revelation	¥2,210,000

Contribution to Research

K. Nishino	The Uehara Memorial Foundation	¥2,000,000
M. Nishino	Institute for Fermentation	¥3,000,000

Cooperative Research

K. Nishino	Axel Cloeckaert (INRA, France)	¥2,500,000
K. Nishino	Aixin Yan (University of Hong Kong)	¥200,000
K. Nishino	Aixin Yan (University of Hong Kong)	¥360,000
K. Nishino	Daiichi-Sankyo	¥0,000
K. Nishino	Fine	¥5,000,000
K. Nishino	Filip Van Immerseel (Ghent University)	¥0,000
K. Nishino	Corinna Kehrenberg (Tierärztliche Hochschule Hannover)	¥0,000
M. Nishino	Yasuko Rikihisa (Ohio State University)	¥0,000
K. Nishino	Takeshi Noda, Tamotsu Yoshimori (Osaka University)	¥0,000
K. Nishino	Yutaka Terao, Shigetada Kawabata (Osaka University)	¥0,000

Laboratory of Atomic Scale Materials Processing

Original Papers

[1]Essential Role of Catalyst in Vapor-Liquid-Solid Growth of Compounds, T. Yanagida, M. Kanai, T. Kawai: Phys. Rev. E, 83 (2011) 061606.

[2]Intrinsic Mechanisms of Memristive Switching, K. Nagashima, T. Yanagida, M. Kanai, T. Kawai: Nano Lett., 11 (2011) 2114-2118.

[3]Spatial Nonuniformity in Resistive-Switching Memory Effects of NiO, T. Yanagida, K. Nagashima, M. Kanai, T. Kawai: J. Am. Chem. Soc., 133 (2011) 12482-12485.

[4]Study on transport pathway in oxide nanowire growth by using spacing-controlled regular array, T. Yanagida, M. Kanai, K. Nagashima, S. Rahong, M. Gang, M. Horprathum, T. Kawai: Appl. Phys. Lett., 99 (2011) 193105.

[5]Dual Defects of Cation and Anion in Memristive Nonvoatile Memory of Metal Oxides, T. Yanagida, K. Nagashima, M. Kanai, B. Xu, H. Katayama-Yoshida, T. Kawai: J. Am. Chem. Soc., 134 (2012) 2535-2538.

International Conferences

[1]Memristive Switching in a Single Oxide Nanowire (invited), T. Yanagida: 2012 RCIQE International Workshop for Green Electronics.

[2]Memristive Switching in a Single Oxide Nanowire (invited), T. Yanagida: IEEE Nanotechnology Materials and Devices Conference.

[3]Resistive Switching in a Single Oxide Nanowire (invited), T. Yanagida: Villa Conference on Complex Oxide Heterostructures.

[4]Intrinsic nature of nonvolatile resistive switching extracted by a single oxide nanowire (oral), K. Nagashima, T. Yanagida, M. Kanai, T. Kawai: The 11th International Symposium on Sputtering & Plasma Processes.

[5]Crucial Role of Impurity Doping Dynamics on Transport Properties of VLS Grown SnO2 Nanowires (poster), T. Yanagida, M. Kanai, K. Nagashima, T. Kawai: The 11th International Symposium on Sputtering & Plasma Processes.

[6]Nonvolatile Memory Phenomena within a Single Oxide Nanowire (oral), T. Yanagida, K. Nagashima, M. Kanai, T. Kawai: International Workshop on Quantum Nanostructures and Nanoelectronics.

[7]Memristor using a Single Oxide Nanowire –Performance in Ultra Small Memory and Intrinsic Mechanism– (oral), K. Nagashima, T. Yanagida, M. Kanai, T. Kawai: 24th International Microprocesses and Nanotechnology Conference.

[8]Spatially Controlled Uniform Oxide Nanowire Arrays by Ultra-thin AAO Membrane Mask (poster), G. Meng, T. Yanagida, M. Kanai, K. Nagashima, S. Rahong, M. Horprathum, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[9]Integration of Oxide Nanowires in Microfluidic Chip for Long DNA Molecules Manipulation (poster), S. Rahong, T. Yanagida, M. Kanai, G. Meng, K. Nagashima, M. Horprathum, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[10]Dynamic Dopant Incorporation Rule on Semiconductor Oxide Nanowire Growth (poster), T. Yanagida, M. Kanai, K. Nagashima, G. Meng, S. Rahong, M. Horprathum, B. Xu, F. Zhuge, Y. He, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[11]Nano-scale Origin of Non-volatile Resistive Switching Phenomena in Nickel Oxide (poster), T. Yanagida, K. Nagashima, T. Kawai, H. Katayama-Yoshida: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[12]Nature of Memristive Switching Revealed by Self-assembled Oxide Nanowire (poster), K. Nagashima, T. Yanagida, M. Kanai, S. Rahong, G. Meng, M. Horprathum, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

[13]A Oxide Nanowire Exposed Nanoscale Mechanisms of Memristor (poster), K. Nagashima, T. Yanagida, M. Kanai, S. Rahong, G. Meng, M. Horprathum, B. Xu, F. Zhuge, Y. He, T. Kawai: The 15th SANKEN International Symposium 2012,Jan12-13,2012,Japam.

[14]Facile Patterning of Sub 20 nm Uniform Oxide Nanowires by Ultra-thin Anodic Aluminum Oxide Membrane Mask (poster), G. Meng, T. Yanagida, M. Kanai, K. Nagashima, S. Rahong, M. Horprathum, B. Xu, F. Zhuge, Y. He, T. Kawai: The 15th SANKEN International Symposium 2012,Jan12-13,2012,Japam.

[15]Manipulation of Long DNA molecule by Oxide Nanowires Embedded in Microfluidic Chip (poster), S. Rahong, T. Yanagida, M. Kanai, G. Meng, K. Nagashima, M. Horprathum,T. Kawai: The 15th SANKEN International Symposium 2012,Jan12-13,2012,Japan.

[16]Crucial Role of Dopant Incorporation Dynamics on Transport Properties of Semiconductor Oxide Nanowires (poster), T. Yanagida, M. Kanai, K. Nagashima, G. Meng, S. Rahong, M. Horprathum, B. Xu, F. Zhuge, Y. He, T. Kawai: The 15th SANKEN International Symposium 2012,Jan12-13,2012,Japan.

Review Papers

Exploring Performance of Ultra-Small Device and Physical Mechanisms in Memristor Using Metal Oxide Nanowire, K. Nagashima, T. Yanagida, M. Kanai, T. Kawai, （The Bulletin of the Society of Nano Science and Technology）, Society of Nano Science and Technology, 10[1] (2011), 19-25.

Publications in Domestic Meetings

Scientific Research in Innovative Areas 'Emergence in Chemistry' Symposium	1 paper
Society of Nano Science and Technology	1 paper
The Japan Society of Applied Physics	3 papers
The Society of Chemical Engineers, Japan	2 papers
Symposium on the Physics of Excitation	1 paper

Grant-in-Aid for Scientific Research

T.Yanagida	Ultimate small device using self-organized oxide nanowires towards green inovation	¥55,892,000

Contribution to Research

T.Yanagida	Takeshi Yanagida	¥900,000
K.Nagashima	Kazuki Nagashima	¥700,000
K.Nagashima	Funding of Okurakzsumichi	¥1,000,000
K.Nagashima	Funding of Thermo/Electroenergy technilogy	¥1,000,000
K.Nagashima	Funding of Ion engineering	¥500,000
K.Nagashima	Funding of rOzawa/Yoshikawa electronics	¥3,000,000

Laboratory of Cellulose Nanofiber Materials

Original Papers

[1]Low-temperature Low-pressure Die Attach with Hybrid Silver Particle Paste, K. Suganuma, S. Sakamoto, N. Kagami, D. Wakuda, K. -S. Kim, M. Nogi: Microelectron. Reliab, 52 (2011) 375–380.

[2]Effects of Delignification in the Production of Plant-based Cellulose Nanofibers for Optically Transparent Nanocomposites, Y. Okahisa, K. Abe, M. Nogi, A. N. Nakagaito, T. Nakatani, H. Yano: Compos. Sci. Technol, 71 (2011) 1342–1347.

[3]Printable and Stretchable Conductive Wirings Comprising Silver Flakes and Elastomer, M. Nogi, K. Suganuma, M. Kogure, O. Kirihara: IEEE Electron Device Lett., 32 (2011) 1424 - 1426.

[4]Fabrication of Silver Nanowire Transparent Electrodes at Room Temperature, T. Tokuno, M. Nogi, M. Karakawa, J. Jiu, T. T. Nge, Y. Aso, K. Suganuma: Nano Research, 4 (2011) 1215-1222.

[5]The transparent crab: preparation and nanostructural implications for bioinspired optically transparent nanocomposites, Md. Iftekhar Shams, Masaya Nogi, Lars A. Berglund and Hiroyuki Yano: Soft Mater, 8 (2011) 1369-1373.

[6]Electrical conductivity enhancement in inkjet-printed narrow lines through gradual heating, Changjae Kim, Masaya Nogi and Katsuaki Suganuma: Journal of Micromechanics and Microengineering, 22 (2012) 035016.

[7]The Effective Young’s Modulus of Bacterial and Microfibrillated Cellulose Fibrils in Fibrous Networks, Supachok Tanpichai, Franck Quero, Masaya Nogi, Hiroyuki Yano, Robert J Young, Tom Lindstrom, William W Sampson, and Stephen J. Eichhorn*: Biomacromolecules, (2012) .

[8]Printed Silver Nanowire Antennas with Low Signal Loss at High-Frequency Radio, Natsuki Komoda, Masaya Nogi, Katsuaki Suganuma, Kazuo Kohno, Yutaka Akiyama, Kanji Otsuka: Nanoscale, (2012) .

[9]Inkjet-printed lines with well-defined morphologies and low electrical resistance on repellent pore-structured polyimide films, Changjae Kim, Masaya Nogi, Katsuaki Suganuma, Yo Yamato: ACS Applied Materials & Interfaces, (2012) .

International Conferences

[1]Inkjet printing of well-defined and narrow conductive lines on polymeric substrates with chemical treated coating layers , C. Kim, M. Nogi, K. Suganuma: The 15th SANKEN International Symposium / The 10th SANKEN Nanotechnology Symposium (Osaka, Japan, 2011.1. 12-13).

[2]Transparent electrodes with network structures of silver nanowires , T. Tokuno, M. Nogi, J. Jiu, K. Suganuma: The 15th SANKEN International Symposium / The 10th SANKEN Nanotechnology Symposium (Osaka, Japan, 2011.1. 12-13).

[3]Silver nanowire printed line; Relationship of Heating temperature and its conductivity , N. Komoda, M. Nogi, K. Suganuma: The 15th SANKEN International Symposium / The 10th SANKEN Nanotechnology Symposium (Osaka, Japan, 2011.1. 12-13).

[4]Stretchable and conductive wirings having various electrical properties to different volume fraction of silver flakes , T. Araki, M. Nogi, K. Suganuma, K. Kihara, O. Kirihara: 7th Handai Nanoscience and Nanotechnology INternational Symposium (Osaka Japan, 2011.11.10-11).

[5]Inkjet Printing of Conductive Lines : Improvement of Line Morphology and Electrical Conductivity , C. J. Kim, M. Nogi, K. Suganuma: 7th Handai Nanoscience and Nanotechnology INternational Symposium (Osaka Japan, 2011.11.10-11).

[6]Electrical conductivity enhancement of silver nanowire transparent electrodes at low temperature , T. Tokuno, M. Nogi, J. Jiu, K. Suganuma: 7th Handai Nanoscience and Nanotechnology INternational Symposium (Osaka Japan, 2011.11.10-11).

[7]Silver nanowire flexible antenna for printed electronics , N. Komoda, M. Nogi, K. Kohno, K. Otsuka, K. Suganuma: 7th Handai Nanoscience and Nanotechnology INternational Symposium (Osaka Japan, 2011.11.10-11).

[8]Preparation of Ag Nanowires and Application in Optoelectronic Devices (oral), Jinting Jiu, Takehiro Tokuno, Masaya Nogi, Katsuaki Suganuma: BIT's 1st Annual World Congress of Nano-S&T-2011 (Dalian, China, 2011.10.23-26).

[9]Preparation and characterization of bacterial cellulose/chitosan porous scaffolds (oral), Thi Thi Nge, Masaya Nogi, Hiroyuki Yano, Junji Sugiyama: IAWS 2011 (Stockholm Sweden, 2011.8.31-9.2).

[10]Properties of Silver Nanowire Transparent Electrodes Fabricated by a Coating Method (oral), Takehiro Tokuno, Masaya Nogi, Katsuaki Suganuma: IEEE Nano 2011 (Portland, U.S.A, 2011.8.15-19).

[11]Effect of Ink Viscosity on Electrical Resistivity of Narrow Printed Silver Lines (oral), ChangJae Kim, Masaya Nogi, Katsuaki Suganuma: IEEE Nano 2011 (Portland, U.S.A, 2011.8.15-19).

[12]Return Loss of Printed Silver Paste Lines with Different Filler Sizes and Their Surface Roughness (oral), Natsuki Komoda, Katsuaki Suganuma, Masaya Nogi: IEEE Nano 2011 (Portland, U.S.A, 2011.8.15-19).

[13]Preparation of rod-shaped and spherical Silvernanoparticles and application for Packaging materials (oral), Jinting Jiu, Masaya Nogi, Katsuaki Suganuma: ICEPT-HDP2011 (Shanghai, China, 2011. 8. 8-11 2011).

[14]Size Effect on Resistivity of Narrow Printed Tracks (oral), ChangJae Kim, Masaya Nogi, Katsuaki Suganuma: ICEP2011 (Nara, Japan, 2011.4.13-15).

[15]Room temperature fabrication of silver nanowire transparent electrodes (oral), T. Tokuno, M. Nogi,

M. Karakawa, J. Jiu, Y. Aso, K. Suganuma: International Conference of Solid State Devices and Materials 2011 (Nagoya Japan, 2011.9.28-30).

[16]Road to "Printed Electronics on Nanopaper" (invited), M. Nogi: International Seminar for JSPS-LIPI Joint Reserch Program（Japan, Oct 2011).

[17]Low temperature wirings and conductive films with Ag nano inks (invited), M. Nogi, K. Suganuma: LOPE-C 2011（Frankfurt, German, 2011.6.30）.

Review Papers
Printable and Stretchable Conductive Wirings, Masaya Nogi, Teppei Araki, Katsuaki Suganuma, Masaro Kogure, Osamu Kirihara, Kobunshi, The Society of Polymer Science, Japan, 61 [3] (2012), 118-121.

Conductive pastes for electronic devices, Katsuaki Suganuma, Masaya Nogi, Chemistry and Chemical Industry, the Chemical Society of Japan, 59[10] (2011), 496-499.

Books
[1]High strechable conductive wirings(M. Ohshima) Masaya Nogi, Teppei Araki, Katsuaki Suganuma, "NIKKO GREEN MOOK", JAPAN INDUSTRIAL PUBLISHING CO., LTD., (108-112) 2012.

Patents
[1]Synthesis of nanoparticles K. Suganuma, J. Jiu, M. Nogi, JP2011-123694

[2]Fabrication of conductive structures Fabrication of conductive structures, JP2011-287737

[3]Components of copper patterns and their patterning methods K. Suganuma, M. Nogi, N. Komoda, E. Kang, T. Ohtake, JP2011-249949

[4]Fabrication of transparent and conductive materials K. Suganuma, M. Nogi, J. Jiu, T. Sugahara, H. Uchida, K. Shinozaki, JP2012-053492

[5]Fabrication of conductive patterns and their components for light or micro wave sintering K. Suganuma, M. Nogi, J. Jiu, T. Sugahara, H. Uchida, T. Fujita, JP2012-061816

[6]Transparent and conductive metallic nanowire films and their dispersions K. Suganuma, M. Nogi, J. Jiu, T. Tokuno, M. Ishida, H. Aikyo, T. Yamakawa, T. Niimi, JP2012-076910

Publications in Domestic Meetings

The Japan Wood Society	2 papers
Japan Institute of Electronics Packaging	3 papers
The Japan Society of Applied Physics	2 papers
Cellulose society	1 paper
RISH symposium	1 paper

Grant-in-Aid for Scientific Research

M.Nogi	Fabrications of bio-nanofiber printed electronics	¥55,764,000

Cooperative Research

M. Nogi	KRI	¥4,000,000

Beam Application Frontier Research Laboratory

Original Papers
[1]Dynamics of Radical Cation of Poly(styrene acrylate)-Based Chemically Amplified Resist for Extreme Ultraviolet and Electron Beam Lithography, Yasuharu Tajima, Kazumasa Okamoto, Takahiro Kozawa, Seiichi Tagawa, Ryoko Fujiyoshi, Takashi Sumiyoshi: Japanese Journal of Applied Physics, 50 (2011) 06GD03/1-06GD03/3.

[2]Theoretical Study on Reactivity of Photoacid Generators for EUV Lithography, Masayuki Endo and Seiichi Tagawa: J. Photopolym. Sci. Technol., 24 (2011) 205-210.

[3]Theoretical Study of Photoacid Generators for Extreme Ultraviolet Resists, Masayuki Endo and Seiichi Tagawa: Japanese Journal of Applied Physics, 50 (2011) 06GD04/1-06GD04/4.

[4]Electron beam lithography using highly sensitive negative type of plant-based resist material derived from biomass on hardmask layer, Satoshi Takei, Akihiro Oshima, Atsushi Sekiguchi, Naomi Yanamori, Miki Kashiwakura, Takahiro Kozawa, Seiichi Tagawa: Applied Physics Express, 4 (2011) 106502/1-106502/3.

[5]Study on Positive-Negative Inversion of Chlorinated Resist Materials, Tomoko Gowa Oyama, Akihiro Oshima, Hiroki Yamamoto, Seiichi Tagawa, and Masakazu Washio: Applied Physics Express, 4 (2011) 076501/1-076501/3.

[6]Evaluation of Resist Sensitivity in Extreme Ultraviolet/Soft X-ray Region for Next-generation Lithography, Tomoko Gowa Oyama, Akihiro Oshima, Masakazu Washio, and Seiichi Tagawa: AIP Advances, 1 (2011) 042153/1-042153/5.

[7]Acid Generation Mechanism for Extreme Ultraviolet Resists Containing Pinanediol Monosulfonate Acid Amplifiers: A Pulse Radiolysis Study, Kazuyuki Enomoto, Koji Arimitsu, Atsutaro Yoshizawa, Ravi Joshi, Hiroki Yamamoto, Akihiro Oshima, Takahiro Kozawa, Seiichi Tagawa: , 51 (2012) 046502/1-046502/6.

International Conferences

[1]The effect of substituent on photoacid generators for EUV resist (poster), M.Endo,S.Tagawa: RadTech Asia 2011, Yokohama, Japan, 2011, 6/20-23.

[2]Theoretical evaluation of polymer bound photoacid generators for EUV resist (poster), M.Endo,S.Tagawa: 2011 International Symposium on Extreme Ultraviolet Lithography, Miami, Florida, USA, 2011, 10/17-19.

[3]Theoretical Study of Ionization of Polymers for EUV Resist (poster), M.Endo,S.Tagawa: 24th International Microprocesses and Nanotechnology Conference, Kyoto, Japan, 2011, 10/24-27.

[4]Solvated Electron Reaction with Some Polymer Bound Acid Generators or New Acid Generators (poster), R.Joshi, H.Yamamoto, K.Enomoto,S.Tagawa: 24th International Microprocesses and Nanotechnology Conference, Kyoto, Japan, 2011, 10/24-27.

[5]Study on Resist Performance of Polymer Bounded Photo-acid Generators (PAG) and blended PAG (poster), Dang Nguyen Tuan, H.Yamamoto,S.Tagawa: 24th International Microprocesses and Nanotechnology Conference, Kyoto, Japan, 2011, 10/24-27.

[6]Theoretical study on structural effects of polymer ionization for EUV resist (poster), M.Endo,S.Tagawa: 2012 SPIE conference, San Jose, California, USA, 2012, 2/12-16.

Publications in Domestic Meetings

The Japan Society of Applied Physics Autumn Meeting	1 paper
Symosium on Radiation Chemistry, Japanese Society of Radiation Chemistry	3 papers
Symosium on Macromolecules, The Society of Polymer Science, Japan	1 paper

Department of Disease Glycomics

Original Papers

[1]N-Glycosylation profiling of recombinant mouse extracellular superoxide dismutase produced in Chinese hamster ovary cells., H. Korekane, A. Korekane, Y. Yamaguchi, M. Kato, Y. Miyamoto, A. Matsumoto, T. Hasegawa, K. Suzuki, N. Taniguchi, T. Ookawara.: Glycoconj. J., 28 (2011) 183-196.

[2]Pathway to diabetes through attenuation of pancreatic beta cell glycosylation and glucose transport., K. Ohtsubo, M.Z. Chen, J.M. Olefsky, J.D. Marth: Nat. Med., 17 (9) (2011) 1067-1075.

[3]Brain-specific expression of N-acetylglucosaminyltransferase IX (GnT-IX) is regulated by epigenetic histone modifications., Y. Kizuka, S. Kitazume, M. Yoshida, N. Taniguchi: J. Biol. Chem., 286 (36) (2011) 31875-31884.

[4]Core fucosylation of μ heavy chains regulates assembly and intracellular signaling of precursor B cell receptors., W. Li, Q. Liu, Y. Pang, J. Jin, H. Wang, H. Cao, Z. Li, X. Wang, B. Ma, Y. Chi, R. Wang, A. Kondo, J. Gu, N. Taniguchi: J. Biol. Chem., 287 (4) (2012) 2500-2508.

[5]Searching for partners., N. Taniguchi: Proteomics, 12 (1) (2012) 9-10.

International Conferences

[1]Regulation of Brain-Specific GnT-IX (Vb) Expression by Neural Histone-Code (invited), N. Taniguchi: Gordon Research Conference/The 2011 Glycobiology, Barga, Italy, May 8-13, 2011.

[2]Brain-specific expression of N-acetylglucosamiltransferase IX(GnT-IX) is regulated by a neural histone code (invited), N. Taniguchi: Workshop on “The development of Glycobiology in China”, Shanghai, China, June 24-26, 2011.

[3]Role of nucleotide sugars in "glycan cycle" (invited), N. Taniguchi: Second Joint Austria/Japan Seminar on Comparative and Developmental Glycobiology, Vienna, Austria, Aug.20, 2011.

[4]Fucosylated alpha-fetoprotein(AFP):Structural Baseis and development of antibody-lectin enzyme immunoassay (invited), N. Taniguchi: HUPO 2011 10th World Congress, Geneva, Switzerland, Sep. 4-7, 2011.

[5]Systems Glycobiology Approach for understanding glycan functions in disease (invited), N. Taniguchi: The 31st Naito Conference, Sapporo, Japan, Sep. 13-16, 2011.

[6]From snapshots to movies (invited), N. Taniguchi: The 31st Naito Conference, Sapporo, Japan, Sep. 13-16, 2011.

[7]Epigenetic histone modifications regulate brain specific expression of N-acetylglucosaminyltransferase-IX (GnT-IX) (poster), N. Taniguchi: 2011 Annual Conference of the Society for Glycobiology, Seattle, U.S.A., Nov. 9-12, 2011.

[8]Branched N-glycans and their implications for cell adhesion, signaling and clinical application for cancer biomarker and therapeutics (oral), N. Taniguchi: RIKEN-MPI Symposium, Dortmund, Germany, Mar. 5-7, 2012.

[9]Systems Glycobiology Approach in Biomarker Discovery and Therapeutics (oral), N. Taniguchi: 6th Glycan Forum, Berlin, Germany, Mar. 18-22, 2012.

[10]Hypoxia-induced sialyl-Tn antigen expression facilitates tumor metastasis (oral), Ohtsubo K, Takamatsu S, Okuyama H, Kurosawa TM, Inoue M and Taniguchi N.: 21st International Symposium on Glycoconjugates (GLYCO- 21), Vienna, Austria, Aug. 21-26, 2011.

[11]Hypoxia-induced Sialyl-Tn carbohydrate antigen expression facilitates tumor metastasis (oral), Ohtsubo K, Takamatsu S, Okuyama H, Inoue M, Kurosawa T and Taniguchi N: The 31st Naito Conference, Sapporo, Japan, Sep. 13-16, 2011.

Contributions to International Conferences and Journals

N. TANIGUCHI	Antioxidant and Redox Signaling (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	Journal of Biological Chemistry (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	International Journal of Oncology (Editor)
N. TANIGUCHI	Glycoconjugate Journal (Review Editor)
N. TANIGUCHI	Proteomics (Senior Editor)
N. TANIGUCHI	GlycoT (Scientific Advisory Board)

Publications in Domestic Meetings

The 30th Annual Meeting of the Japanese Society of Carbohydrate Research	2 papers
The 84th Annual Meeting of the Japanese Biochemical Society	2 papers
2011 Annual Meeting of the Japanese Proteomics Society/ The 9th JHUPO Conference	1 paper
The 15th Workshop of Enterohemorrhagic Escherichia coli infection	1 paper
The 51st Annual Scientific Meeting of the Japanese Society of Nuclear Medicine	1 paper
The 21st Annual Meeting of the JMARS	1 paper
The 20th Annual Meeting of the Japanese Association for Metastasis Research	1 paper
The 71st Okazaki Conference on "New perspectives on molecular science of glycoconjugates"	1 paper
70th Annual Meeting of the Japanese Cancer Association	1 paper

Academic Degrees

Ph.D. in Medicine, Doctor of Medical Science M. Sano	N-glycans of SREC-I, an endothelial cell receptor for Acetylated Low Density Lipoprotein: Essential role of ligand binding, trafficking and stability.

Grant-in-Aid for Scientific Research

K. Ohtsubo	Development of novel antidiabetes drugs by targeting an antidiabetic factor “GnT-IVa”	¥4,550,000
C. Gao	Molecular mechanism of early-onset Chronic Obstructive Pulmonary Disease caused by genetic mutation for Fut8	¥5,200,000

Department of Functional Nanomaterials and Nanodevices

Original Papers

[1]Self-Assembled Growth of Spinel $(Fe,Zn)_3O_4$-Perovskite $BiFeO_3$ Nanocomposite Structures Using Pulsed Laser Deposition, T. Sakamoto, A. N. Hattori, T. Kanki, K. Hattori, H. Daimon, H. Akinaga, and H. Tanaka: Jpn. J. Appl. Phys, 51 (2012) 035504(1-4).

[2]Non-Destructive Estimation of Depletion Layer Profile in Nb-doped SrTiO3/(La,Ba)MnO3 n-p+ Heterojunction Diode Structure by Hard X-ray Photoemission Spectroscopy, H. Tanaka, I. Satoh, T. Kanki, E. Ikenaga, M. Kobata, J.-J. Kim, S. Ueda and K. Kobayashi: Appl. Phys. Lett., 98 (2011) 133505-1-3.

[3]Preparation of Ferroelectric Field Effect Transistor based on sustainable stolongly correlated

(Fe,Zn)3O4 oxide semiconductor and their electrical transport properties, J. Takaobushi, T. Kanki, T. Kawai and H. Tanaka: Appl. Phys. Lett., 98 (2011) 102506-1-3.

[4]Identifying valence band structure of transient phase in VO_2 thin film by hard x-ray photoemission, T. Kanki, H. Takami, S. Ueda, A. N. Hattori, K. Hattori, H. Daimon, K. Kobayashi, H. Tanaka: Physical Review B, 84 (2011) 085107（1-5）.

[5]Position-, size-, and shape-controlled highly crystalline ZnO nanostructures, A. N. Hattori, A. Ono, and H. Tanaka: Nanotechnology, 22 (2011) 415301-415305.

[6]Extremely reduced hollow metal nanomasks for direct epitaxial growth of functional oxide nanostructures, N.-G Cha, T. Kanki and H. Tanaka: Nanotechnology, 22 (2011) 185306-185311.

[7]High Temperature-Coefficient of Resistance at Room Temperature in W-doped VO2 Thin Films on Al2O3 Substarte and Thier Thickness Dependence, H. Takami, K. Kawatani, T. Kanki and H. Tanaka: Jpn. J. Appl. Phys., 50 (2011) 055804(3).

[8]Observation of a tunneling magnetoresistance effect in magnetic tunneling junctions with a high resistance ferromagnetic oxide Fe2.5Mn0.5O4 electrode, E. Shikoh, T. Kanki, H. Tanaka, T. Shinjo, M. Shiraishi: Solid State Commun., 151 (2011) 1296-1299.

[9]Graphene Formation on 4H-SiC(0001) Surface Flattened by Catalyst-Assisted Chemical Etching in HF Solution, K. Nishitani, H. Sakane, A. N. Hattori, T. Okamoto, K. Kawai, J. Uchikoshi, Y. Sano, K. Yamauchi, M. Morita, and K. Arima: ECS Transactions, 41 (2011) 241-248.

[10]Damage-Free Dry Polishing of 4H-SiC Combined with Atmospheric-Pressure Water Vapor Plasma Oxidation, H. Deng, T. Takiguchi, M. Ueda, A. N. Hattori, N. Zettsu, K. Yamamura: Jpn. J. Appl. Phys., 50 (2011) 08ＪＧ05（1-4）.

[11]Plasma assisted polishing of single crystal SiC for obtaining atomically flat strain-free surface, K. Yamamura, T. Takiguchi, M. Ueda, H. Deng, A. N. Hattori, N. Zettsu: Manufacturing Technology, 60 (2011) 571-574.

[12]Highly-integrity finishing of 4H-SiC(0001) by plasma-assisted polishing, K. Yamamura, T. Takiguchi, M. Ueda, H. Deng, A. N. Hattori, N. Zettsu: Journal of the Japan society for abrasive technology, 55 (2011) 534-539.

[13]Atomically Smooth Gallium Nitride Surfaces Prepared by Chemical Etching with Platinum Catalyst in Water, J. Murata, T. Okamoto, S. Sadakuni, A. N. Hattori, K. Yagi, Y. Sano, K. Arima, and K. Yamauchi: Journal of the Electrochemical Society, 159 (2012) Ｈ417-Ｈ420.

International Conferences

[1]Nano scale template deposition for preparation of functional oxide nano-wire, nano-box, and nano-dot materials (oral), H. Tanaka, T.Kusizaki, K. Fujiwara, A. Hattori: 2011 MRS Fall Meeting,Boston, MA , USA, Nov.28-Dec.2 ,2011.

[2]Control of self-assembled nano-scale electron domains in high quality VO2 thin films and application for nano-oxide device (oral), H.Tanaka,H. Takami, K.Kawatani, T. Kanki Hidekazu Tanaka, Hidefumi Takami, Kenichi Kawatani, Teruo Kanki: The 15th International Conference on Thin Films (ICTF-15),Kyoto, Japan,Nov. 9, 2011.

[3]Multi Dimensional Oxide Nano Heterostructures for Spintronics Application (invited), H.Tanaka Hidekazu Tanaka, Hidefumi Takami, Kenichi Kawatani, Teruo Kanki: BIT's 1st Annual World Congress of Nano-S&T,Dalian, China,Oct. 23-26, 2011.

[4]SPM-based novel nanofabrication for oxides - Total control of Oxide Nanostructure (invited), H.Tanaka Hidekazu Tanaka, Hidefumi Takami, Kenichi Kawatani, Teruo Kanki: The Korean Physical Society (KPS) Fall meeting,Busan,Korea,from Oct. 19-21, 2011.

[5]Multi-dimensional Nanostructured Oxide Devices (invited), H.Tanaka Hidekazu Tanaka, Hidefumi Takami, Kenichi Kawatani, Teruo Kanki: 2011 International Conference on Solid State Devices and Materials (SSDM 2011),Ngoya,Aichi,Sep.28-30,2011.

[6]Integrated Nano-Template for Oxide Nano-Electronics (invited), H. Tanaka, T. Kusizaki, K. Fujiwara, A. Hattori: The 6th International symposium on Integrated Molecular/Materials Engineering(ISIMME-6),Beijing,China,June.6-9,2011.

[7]Surface Nanopatterning for Spintronics (invited), H.Tanaka: The Manufacturing at the Nanoscale; Overcoming Barriers to Commercialization Symposium （The Nanotech Conference and Expo 2011）,Boston, MA , USA,June.13-16,2011.

[8]Self-assembled growth of ferromagnetic semiconductor-ferroelectric insulator nanocomposite structures using a pulsed laser deposition method (poster), T. Sakamoto, A. N. Hattori, T. Kanki, H.Tanaka: MNC 2011,24th International Microprocesses and Nanotechnology Conference,,Kyoto,Oct.24-27,2011.

[9]Fabrication of functional oxide nanostructures and the electronic application utilizing stochastic resonance (oral), T. Kanki, H. Takami, K. Kawatani, and H. Tanaka : MNC 2011,24th International Microprocesses and Nanotechnology Conference,,Kyoto,Oct.24-27,2011.

[10]Identifying valence band structure of M2 phase from mixed phases in VO2 thin film (poster), T.Kanki, H.Takami, S. Ueda, A.N. Hattori, K.Hattori, H.Daimon, K.Kobayashi, H.Tanaka: 2011MRS Fall Meeting,Boston, MA , USA, Nov.28-Dec.2 ,2011.

[11]Fabrication of epitaxial VO2 nanostructured thin films and their electronic properties (poster), H.Takami, T. Kanki, K.Kawatani and H.Tanaka: 2011MRS Fall Meeting,Boston, MA , USA, Nov.28-Dec.2 ,2011.

[12]UHV in-situ Photoluminescence for GaN(0001) Substrates in Different Preparations (poster), A. N. Hattori, K. Hattori, Y. Moriwaki, A. Yamamoto, H. Daimon, K. Endo: International Symposium on Surface Science6,Funabori,Tokyo,Dec.11-16th,2012.

[13]Position-, Size-, and Shape-controlled highly crystalline ZnO nanostructures (poster), A. N. Hattori, A. Ono, H. Tanaka: International Symposium on Surface Science6,Funabori,Tokyo,Dec.11-16th,2012.

[14]Position-, Size-, and Shape-controlled highly crystalline ZnO nanostructures (poster), A. N. Hattori, A. Ono, H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[15]Observation of Local Electrochemical Phase Change in Resistive Switching Devices (invited), K. Fujiwara, Y. Konno, Y. Nakamura, M. J. Rozenberg, and H. Takagi: 19th International Conference on Composites/Nano-Engineering, Shanghai, China, July 24-31, 2011.

[16]Electric-field modulation of transport properties in charge-ordered $LuFe_2O_4$ (poster), K. Fujiwara and H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[17]Fabrication of (Fe,Mn)3O4 nanowires using a sidewall deposition method (poster), T. Kushizaki, K.

Fujiwara, A. N. Hattori, T. Kanki and H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[18]Ferromagnetic oxide nanowire structures fabricated by sidewall deposition method (poster), T. Kushizaki, K. Fujiwara, A. N. Hattori, T. Kanki and H. Tanaka: The 15th SANKEN internatinal symposium 2012, Suita, Osaka, Jan. 12-13th, 2012.

[19]Controlled Growth Position and Aligned Magnetic Domains in Self-organized Fe/LaSrFeO4 Nanostructure (poster), K. Okada, T. Sakamoto, K. Fujiwara, A. Hattori, T. Kanki, and H. Tanaka: The 15th SANKEN internatinal symposium 2012, Suita, Osaka, Jan. 12-13th, 2012.

[20]Position-selective Growth of Self-organized Fe Nanopillars on Substrates with Patterned Nanodots (poster), K. Okada, T. Sakamoto, A. Hattori, T. Kanki, and H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[21]Modultion of Metal-Insulator Transition Temperature in W-doped VO2 Thin Films : Toward Mott devices (invited), H. Takami, K.Kawatan, T. Kanki, S. Ueda,K. Kobayashi, H. Tanaka: 19th International Conference on Composites/Nano-Engineering, Shanghai, China, July 24-31, 2011.

[22]Fabrication of the three dimensionally nanopatterned MgO substrates (poster), Y.Fujiwara, A. N. Hattori, , H. Tanaka: International Symposium on Surface Science6,Funabori,Tokyo,Dec.11-16th,2012.

[23]Epitaxial VO2 Nanolines Fabricated by Using a Nanoimprint Lithography (poster), H.Takami, K.Kawatani, T.Kanki and H.Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[24]Three-dimensionally-nanopatterned MgO substrates for the fabrication of the epitaxial transition metal oxide nanowire (poster), Y.Fujiwara, A. N. Hattori, , H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[25]Electronic control of huge metal-insulator domains (poster), K. Kawatani, H. Takami, T. Kanki, H. Tanaka: 7th Handai Nanoscience and Nanotechnology International Symposium, Suita, Osaka, November, 10-11, 2011.

[26]Fabrication of epitaxial VO2 nanostructured thin films using a nanoimprint lithography technique (poster), H.Takami, K.Kawatani, T.Kanki, H.Tanaka: Workshop on Oxide Electronics 18, Napa Valley, California, USA, Sep.26 - Sep.28, 2011.

Review Papers

Electronic material development for new concept signal transmitter driven by noise, T. Kanki,H.Tanaka, Low Temperature Center News, Low Temperature Cente,Osaka Univ, 155 (2011), 5-9.

Establishment of processes for nanoscale functional oxides, Hidekazu Tanaka, Teruo Kanki, Nam-Goo Cha, Azusa Hattori, Nanotech Japan Bulletin, Nanotech Japan, 4 (2011), No.12.

Books

[1]tructure, Morphology, and Stoichiometry of GaN(0001) Surfaces Through Various Cleaning Procedures(A. Innocenti, N. Kamarulzaman) A. N. Hattori, K. Endo, “Stoichiometry and Materials Science”, InTech, (83-104) 2012.

Publications in Domestic Meetings

The 59th Spring Meeting, 2012The Japan Soceity of Applied Physcs	8 papers
The 50th Spring Meeting, 2012 The Japan Soceity of Applied Physcs	1 paper
2011 Fall Meeting,The Physical Society of Japan	3 papers

The 72st Autumn Meeting, 2011The Japan Soceity of Applied Physcs 7 papers

Academic Degrees

Master Degree for Science	Creation of perfect position-controlled $(Fe,Zn)_3O_4$-$BiFeO_3$ 3-dimensional nanostructures by self-assembled crystal growth	
T. Sakamoto		

Grant-in-Aid for Scientific Research

H,Tanaka	Novel Nano-electronics based on Strongly Correlated Oxides	¥22,880,000
H,Tanaka	Nano-spintronics based on self-organized oxide nanostructures	¥5,850,000
T.Kanki	Electronic material development for new concept signal transmitter driven by noise	¥2,470,000
T.Kanki	Bio-functional application of nano-electronic materials and creation of bio-mimetic devices	¥8,840,000
Y.Fujiwara	Mechanism of electric-field-induced resistive switching in binary transition metal oxides	¥650,000

Entrusted Research

H.Tanaka	NEDO	Development of Spintronics devices using High temperature sustainable Fe oxide ferromagnetic semiconductor	¥8,970,000

Contribution to Research

H.Tanaka	The Asahi Glass Foundation	¥2,000,000

Cooperative Research

H.Tanaka	Naturetechnology Co. Ltd.	¥660,000

Department of Advanced Nanofabrication

Original Papers

[1]Femtosecond pulse radiolysis study on geminate ion recombination in n-dodecane, T. Kondoh, J. Yang, K. Norizawa, K. Kan, Y. Yoshida: Radiat. Phys. Chem., 80 (2011) 286-290.

[2]Development of femtosecond photocathode RF gun, K. Kan, J. Yang, T. Kondoh, Y. Yoshida: Nucl. Instr. Meth. A, 659 (2011) 44-48.

[3]Ultrafast pulse radiolysis, J. Yang, T. Kondoh, K. Kan, Y. Yoshida: Nucl. Instr. Meth. A, 629 (2011) 6-10.

[4]Femtosecond pulse radiolysis and femtosecond electron diffraction, J. Yang, K. Kan, T. Kondoh, Y. Yoshida, K. Tanimura: Nucl. Instr. Meth. A, 637 (2011) S24-S29.

[5]Collective energy loss of attosecond electron bunches, A. Ogata, T. Kondoh, K. Norizawa, J. Yang, Y. Yoshida: Nucl. Instr. Meth. A, 637 (2011) S95-S98.

[6]Transmission-electron diffraction by MeV electron pulses, Y. Murooka, N. Naruse, S. Sakakihara, M. Ishimaru, J. Yang, K. Tanimura: Appl. Phys. Lett., 98 (2011) 251903.

[7]Proposal for generation of high-intensity monochromatic cherenkov radiation in THz range by femtosecond electron bunches impurity-doped semiconductor tube, K. Kan, J. Yang, K. Norizawa, T. Kondoh, Y. Yoshida, A. Ogata: Radiat. Phys. Chem., 80 (2011) 1323-1326.

[8]Multimode terahertz-wave generation using coherent Cherenkov radiation, K. Kan, J. Yang, A. Ogata, T. Kondoh, K. Norizawa, Y. Yoshida: Appl. Phys. Lett., 99 (2011) 231503.

[9]Development of femtosecond photocathode RF gun, K. Kan, J. Yang, T. Kondoh, Y. Yoshida: Nucl. Instr. Meth. A, 659 (2011) 44-48.

[10]Measurement of the Ion Beam Pulse Radiolysis Using Scintillator, T. Kondoh, J. Yang, K. Kan, Y. Yoshida: JAEA Takasaki Annual Report 2010, (2012) 144.

[11]Femtosecond pulse radiolysis study of geminate ion recombination in biphenyl-dodecane solution, T. Kondoh, J. Yang, K. Norizawa, K. Kan, T. Kozawa, A. Ogata, S. Tagawa, Y. Yoshida: Radiat. Phys. Chem., (2012) in press.

[12]Radiation-induced radicals in hydrated magnesium sulfate, A. Tani, N. Hasegawa, K. Norizawa, T. Yada, M. Ikeya: Radiat. Meas., (2012) in press.

International Conferences

[1]Dynamic Transmission Electron Microscopy using Femtosecond MeV Electron Beam (invited), J. Yang: The 3rd Asian Core Workshop on Advanced Quantum-Beam Sources and Applications,Feb. 23-24, KAERI INTEC, Korea.

[2]Femotscond RF gun based MeV electron diffraction (invited), J. Yang, K. Kan, N. Naruse, Y. Murooka, Y. Yoshida, K. Tanimura: 2011 Particle Accelerator Conference,4-9 September, 2011.

[3]Multimode Terahertz-wave Generation Using Femtosecond Electron Beam (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, K. Norizawa, Y. Yoshida: The 15th SANKEN International Symposium and The 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[4]Electron capture in polymer model compound studied by femtosecond pulse radiolysis for advanced nano-fabrication (poster), T. Kondoh, J. Yang, K. Norizawa, K. Kan, T. Toigawa, A. Ogata, H. Kobayashi, S. Tagawa, Y. Yoshida: The 15th SANKEN International Symposium and The 10th SANKEN Nanotechnology Symposium,Jan12-13,2012,Japan.

[5]Time-Dependent Behavior of Short Lived Active Species in Polymer Model Compound Studied by Femtosecond Pulse Radiolysis for Advanced Nano-Fabrication (poster), T. Kondoh, J. Yang, K. Norizawa, K. Kan, A. Ogata, H. Kobayashi, S. Tagawa, Y. Yoshida: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

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[8]Observation of Solvation and Pre-solvation of Electrons in Alcohol Radiolysis (poster), K. Norizawa, T. Kondoh, K. Kan, J. Yang, T. Kozawa, Y. Yoshida: 7th Handai Nanoscience and Nanotechnology International Symposium,Nov.10-11,2011、Japan.

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[11]Femtosecond Pulse Radiolysis System on Primary Process of Radiation Chemistry (oral), Y. Yoshida、J. Yang, T. Kondoh, K. Norizawa, K. Kan, T. Kozawa, A. Ogata, S. Tagawa: 12th Tihany Symposium on

Radiation Chemistry,August 27 - September 1, 2011, Zalakaros, HUNGARY.

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[17]Photoinjector Based MeV Electron Microscopy (poster), J. Yang, K. Kan, T. Kondoh, Y. Yoshida: DIPAC2011,May16-18 2011,Hamburg, Germany.

[18]Femtosecond pulse radiolysis study of excess electron in ionic liquids (oral), T. Kondoh, J. Yang, Y. Yoshida, R. Nagaishi, M. Taguchi, K. Takahashi, R. Katoh: 2nd International Workshop on Radiation Effects in Nuclear Technology,28-29 February,Tokyo,Japan.

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Development of RF gun for ultrashort pulse beam, J. Yang, K. Kan, T. Kondoh, Y. Murooka, N. Naruse, Y. Yoshida, K. Tanimura, J. Vacuum Society of Japan, The Vacuum Society of Japan, 55 (2012), 42-49.

Solvation process and geminate ion recombination in ionic-liquid, T. Kondoh, J. Yang, Y. Yoshida, Radiation Chemistry, Japanese Society of Radiation Chemistry, 91 (2011), 33-38.

Ultrafast Electron Deffraction using photocathode RF gun, N. Naruse, Y. Murooka, J. Yang, K. Tanimura, Particle Accelerator Society of Japan, Particle Accelerator Society of Japan, 7[4] (2011), 261-270.

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[1]Laser, plasma and particle beam(A. Ogata) A. Ogata, K. Kan, J. Yang, “Laser, plasma and particle beam”, Osaka Univ. Publisher, (1-308) 2012.

Publications in Domestic Meetings

Annual Meeting of Particle Accelerator Society of Japan	5 papers
6th Takasaki Symposium on Quantum Beam Application	1 paper
Meeting of AESJ	9 papers

54th meeting of Japanese Society of Radiation Chemistry	6 papers
Meeting of Beam Physics 2011	1 paper
3rd Workshop on Electron Microscopy	1 paper
Meeting of NIFS collabolation	1 paper
Meeting of high blightness/rf electron gun	2 papers
Meeting of metamaterial	2 papers
Annual Meeting of CSJ	2 papers
JPS Meeting	1 paper
The 59th Spring Meeting of JSAP	1 paper

Grant-in-Aid for Scientific Research

Y. Yoshida	Attosecond and femtosecond pulse radiolysis study	¥41,600,000
J. Yang	Study of femtosecond time-resolved electron microscopy	¥15,340,000
K. Kan	Inverse Cherenkov radiation using terahertz-metamaterial and femtosecond electron beam	¥4,030,000

Entrusted Research

J. Yang, K. Kan	AIST	Investigation on detection of unauthorized drugs and explosives using high-power terahertz-wave	¥525,000

Cooperative Research

Y. Yoshida	Japan Atomic Energy Agency	¥0,000
Y. Yoshida	Japan Atomic Energy Agency	¥0,000
Y. Yoshida	Hiroshima International University	¥0,000
Y. Yoshida	Kanazawa University	¥0,000

Other Research Fund

K. Kan	NIFS collabolation	¥23,000
K. Kan	Osaka Univ. (Metamaterial, M. Hangyo)	¥28,000

Department of Nanocharacterization for Nanostructures and Functions

Original Papers

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[2]Systematic Morphology Changes of Gold Nanoparticles Supported on CeO_2 during CO Oxidation, T. Uchiyama, H. Yoshida, Y. Kuwauchi, S. Ichikawa, S. Shimada, M. haruta and S. Takeda: Angew. Chem. Int. Ed., 50 (2011) 10157-10160.

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[12]Growth of higher manganese silicides from amorphous manganese-silicon layers synthesized by ion implantation, M. Naito, R. Nakanishi, N. Machida, T. Shigematsu, M. Ishimaru, J. A. Valdez, K. E. Sickafus: Nucl. Instrum. Methods Phys. Res. B, 272 (2012) 446-449.

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International Conferences

[1]Environmental transmission electron microscopy of electron-beam-induced changes of Au/TiO_2 catalysts in reactant gases (oral), Y. Kuwauchi, H. Yoshida, T. Uchiyama, T. Akita, H. Kohno, S. Takeda,: 2011MRS Spring Meeting, San Francisco, USA, April 25-29, 2011.

[2]In-situ Characterization of Nanoparticle Catalysts during CVD Growth of Carbon Nanotubes by Environmental TEM (oral), H.Yoshida, Y.Homma, S.Takeda: 2011MRS Spring Meeting, San Francisco, USA, April 25-29, 2011.

[3]In-situ Environmental TEM Study of the Shape Change of Pt Nanoparticles Supported on CeO_2 in Gases (oral), H. Yoshida, Y. Kuwauchi, H. Kohno, S. Shimada, M. Haruta, S. Takeda: 2011MRS Spring Meeting, San Francisco, USA, April 25-29, 2011.

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[5]Atomic scale observation of iron catalyzed carbon nanotube growth by environmental TEM (invited), H. Yoshida, Y. Homma, S. Takeda: 8th International Symposium on Atomic Level Characterizations for New Materials and Devices, Seoul, Korea, May 22-27, 2011.

[6]High resolution environmental TEM of metal nanoparticle catalysis (invited), GS. Takeda, H. Yoshida: 5th Congress of the International Union of Microbeam Analysis Societies, Seoul, Korea, May 22-27, 2011.

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[9]Temperature-Dependent Shape Changes of Platinum Nanoparticles Supported on CeO_2 during CO Oxidation (poster), H. Yoshida, Y. Kuwauchi, H. Kohno, M. Haruta, S. Takeda: 7th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, November 10-11, 2011.

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[11]Atomic-Scale Analysis on the Role of Molybdenum in Iron-Catalyzed Carbon Nanotube Growth (poster), H. Yoshida, S. Takeda: 7th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, November 10-11, 2011.

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[13]Operand Study of Nanoparticle Catalysts by Environmental Transmission Electron Microscopy (invited), S. Takeda: The 15th SANKEN International Symposium, Osaka, Japan, January 12-13, 2012.

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[16]Chemical short-range order in amorphous semiconductors (invited), M. Ishimaru: European Materials Research Society 2011 Spring Meeting, Nice, France, May 9-13, 2011.

[17]Thermoelectric properties of $Cu_2Ga_4Te_7$ with defect-zincblende structure (poster), T. Plirdpring, K. Kurosaki, A. Kosuga, M. Ishimaru, Y. Ohishi, H. Muta, S. Yamanaka: European Materials Research Society 2011 Spring Meeting, Nice, France, May 9-13, 2011.

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2011.

[22]Radiation-induced amorphous and long-period structures in GaN (oral), M. Ishimaru: 16th International Conference on Radiation Effects in Insulators, Beijing, China, August 14-19, 2011.

[23]Electron diffraction study on radiation-induced amorphous structures (invited), M. Ishimaru: International Workshop on Ion Beam Applications of Functional Materials, Jinan, Shandong, China, August 19-22, 2011.

[24]Fabrication of nanoporous oxides through annealing of amorphous oxide films (oral), R. Nakamura, T. Shudo, M. Ishimaru, A. Hirata, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams, Busan, Korea, September 18-21, 2011.

[25]Elastic properties of nanoporous amorphous Al_2O_3 (invited), M. Tane, S. Nakano, R. Nakamura, H. Ogi, M. Ishimaru, H. Kimizuka, H. Nakajima: 7th International Conference on Porous Metals and Metallic Foams, Busan, Korea, September 18-21, 2011.

[26]Fabrication of nanoscale junctions utilizing thin-film edges (invited), H. Kaiju, K. Kondo, M. Ishimaru, Y. Hirotsu, A. Ishibashi: BIT's 1st Annual World Congress of Nano-S&T, Dalian, China, October 23-26, 2011.

[27]Formation of higher manganese silicides in the amorphous manganese-silicon thin films synthesized by ion implantation (poster), M. Naito, R. Nakanishi, N. Machida, T. Shigematsu, M. Ishimaru: 15th International Conference on Thin Films, Kyoto, Japan, November 8-11, 2011.

Review Papers

Application of In-situ Environmental Transmission electron Microscopy for Characterizing Nanoparticle Catalysts, S. Takeda and H. Yoshida, Catalysts & Catalysis, Catalysis Society of Japan, 53[4] (2011), 235-240.

Formation of nanoporous structures through structural change and crystallization of amorphous oxides, R. Nakamura, M. Ishimaru, A. Hirata, K. Sato, M. Tane, H. Kimizuka, T. J. Konno, H. Nakajima, Materia Japan, The Japan Institute of Metals, 51 (2012), 95-101.

Books

[1]In-situ TEM observation of carbon nanotube growth S. Takeda and H. Yoshida, "Handbook of Carbon Nanotubes and Graphene", Corona Publishing Co., Ltd., (Section 3.4) 2011.

Contributions to International Conferences and Journals

S. Takeda	7th Handai Nanoscience and Nanotechnology International Symposium (The chairman of the organizing committee)
M. ISHIMARU	9th Polish-Japanese Joint Seminar on Micro and Nano Analysis (Advisory Committee)
M. ISHIMARU	The Nuclear Materials 2012 (Session Organizer)

Publications in Domestic Meetings

The Japanese Society of Microscopy 2011	1 paper
JPS 2011 Autumn Meeting	1 paper
Japan New Diamond Forum	1 paper
Young Researcher's Workshop, The Japanese Society of Microscopy	1 paper
The Japanese Society of Microscopy, The Japanese Society of Microscopy	1 paper
59th Meeting of the Japan Society of Applied Physics	3 papers
JPS the 67th Annual Meeting	3 papers
Catalysis Society of Japan	1 paper
The Japan Institute of Metals	6 papers

Academic Degrees

Master Degree for Engineering H. Omote	In-situ Observation of the Oxidation of Pt Nanoparticle Catalysts by Enviromental TEM
Master Degree for Engineering H. Yamamura	Investigation of the Visualization of Adsorbed Molecules on Au Nanoparticle Catalysts

Grant-in-Aid for Scientific Research

S. Takeda	Atomistic and electronic structural analysis of the catalyst mechanism of metal nanoparticles in gases	¥25,740,000
M. Ishimaru	Spontaneous nano-scale phase separation and synthesis of low-dimensional nanomaterials	¥1,170,000

Entrusted Research

M. Ishimaru	Ministry of Economy, Trade and Industry	Structural Analysis of Complex Metallic Glasses	¥2,100,000

Contribution to Research

S. Takeda	FEI Company Japan Ltd.	¥500,000
S. Takeda	UBE Scientific Analysis Laboratory, Inc	¥2,000,000
S. Takeda	SHOWA DENKO K. K.	¥1,000,000

Cooperative Research

M. Ishimaru	Institute for Materials Research, Tohoku University	¥220,000

Department of Theoretical Nanotechnology

Original Papers

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[2]Tunable Spin Polarization in Bismuth Ultrathin Film on Si(111), A. Takayama, T. Sato, S. Souma, T. Oguchi, T. Takahashi: Nano Letters, 12 (4) (2012) 1776-1779.

[3]Role of van der Waals interaction in crystalline ammonia borane, Kunihiko Yamauchi, Ikutaro Hamada, Hongbin Huang, Tamio Oguchi: Applied Physics Letters, 99 (2011) 181904/1-3.

[4]Theoretical investigation of magnetoelectric effects in Ba2CoGe2O7, Kunihiko Yamauchi, Paolo Barone, Silvia Picozzi: Physical Review B, 84 (2011) 165137/1-6.

[5]Orbital degrees of freedom as origin of magnetoelectric coupling in magnetite, Kunihiko Yamauchi, Silvia Picozzi: Physical Review B, 85 (2012) 085131/1-5.

[6]Magnetically driven ferroelectric atomic displacements in orthorhombic YMnO3, D. Okuyama, S. Ishiwata, Y. Takahashi, K. Yamauchi, S. Picozzi, K. Sugimoto, H. Sakai, M. Takata, R. Shimano, Y. Taguchi, T. Arima, Y. Tokura: Physical Review B, 84 (2011) 054440/1-6.

[7]Structural study of α-boron at high pressure, H. Shirai, H. Dekura, Y. Mori, Y. Fujii, H. Hyodo, K. Kimura: Journal of the Physical Society of Japan, 80 (2011) 084601/1-13.

[8]Metallic Properties of Graphite at High Pressures, K. Shirai, N. Nakae, A. Yanase: AIP Conference Proceedings, 1399 (2011) 763-764.

[9]Efficient method for Li doping of α-rhombohedral boron, H. Dekura, K. Shirai, A. Yanase: Physical

Review B, 84 (2011) 094117/1-13.

[10]Raman scattering and isotopic phonon effects in dodecaborides, H Werheit, V Filipov, K Shirai, H Dekura, U Schwarz, M Armbrüster: Journal of Physics: Condensed Matter, 23 (2011) 065403.

International Conferences

[1]Phase stability and superconductivity of boron at high pressures (oral), K. Shirai, H. Dekura: 17th Int. Symp. Boron, Borides and Related Materias, 9/11-17 2011, Instanbul, Turkey.

[2]Superconductivity of Icosahedron-Based Semiconducting Boron (poster), K. Shirai, H. Dekura: E-MRS 2011 Fall Meeting, September 19 - 23, 2011, Warsaw University of Technology, Poland.

[3]Material design for superconductivity on semiconducting boron (oral), K. Shirai: Quantum Simulations and Design, International Focus Workshop, September 27 - 29, 2011, Max-Planck-Institut für Physik komplexer Systeme, Germany.

[4]Material design for superconductivity on semiconducting boron (poster), K. Shirai, H. Dekura, N. Uemura: The 14th Asian Workshop on First-Principles Electronic Structure Calculations, October 31-November 2, 2011, The University of Tokyo, Japan.

[5]Material design for superconductivity on semiconducting boron (poster), K. Shirai, H. Dekura, N. Uemura: New Science Created by Materials with Nano Spaces: From Fundamentals to Applications, Sendai, Japan, November 23-36, 2011.

[6]Novel mechanisms for multiferroicity and magnetoelectric effects in transition metal oxides (invited), K. Yamauchi: The 14th Asian Workshop on First-Principles Electronic Structure Calculations, Tokyo, Japan, October 31-November 2, 2011.

[7]Ab-initio Theoretical Studies on Charge-Order Induced Ferroelectricity and Magnetoelectric Effects (invited), K. Yamauchi: Electronic Ferroelectricity – ELF2012, Vietri Sul Mare, Italy, March 23, 2012.

[8]Theoretical studies on non-linear magnetoelectric effects induced by single-site spin-orbit coupling (poster), K. Yamauchi, S. Picozzi: SPINTECH6, Matsue, Japan, August 1-5, 2011.

[9]Optical response of dye-titania systems from time-dependent density-functional theory (poster), H. Momida, T. Ohno: 11th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN-2011), St. Petersburg, Russia, October 3-7, 2011.

Review Papers

Why specific heat?, K. Shirai, Butsuri, Physical Society of Japan, 66 (2011), 567-568.

Books

[1]Part III, Chapter 5, Applications to Ferroelectrics and Piezoelectrics(H. Akai, K. Shirai) T. Oguchi, “Development of DFT theory”, Springer-Japan, (275-292) 2011.

[2]Modern Thermodynamics K. Shirai, “Modern Thermodynamics”, Kyoritu Pub., (1-309) 2011.

Grant-in-Aid for Scientific Research

T. Oguchi	Strategic state-of-the-art solid state chemistry for new functional materials : Exploring for new multi-functional materials	¥8,000,000
K. Shirai	Superconductivity search on icosahedron-based boron systems	¥1,200,000

Entrusted Research

T.Oguchi	NEDO Hydro-Star	Computational study on the properties and microscopic kinetics of hydrogen storage materials	¥10,128,000

T.Oguchi	JST CREST	Exploring for new functional materials with unusual ionic states and coordinations	¥18,200,000

Cooperative Research

K.Shirai	FUJITSU LABORATORIES	¥1,000,000

Department of Soft Nanomaterials

Original Papers

[1]Solution-processable n-type OFET materials based on carbonyl-bridged bithiazole and dioxocyclopentene-annelated thiophenes, M. Nitani, Y. Ie, H. Tada, Y. Aso: Chem. Asian. J., 6 (9) (2011) 2352-2361.

[2]Synthesis and properties of polymer having electronegative terthiophene pendants based on cyclopenta[c]thiophene, Y. Ie, A. Yoshimura, S. Takeuchi, K. Osakada, Y. Aso: Chem. Lett., 40 (9) (2011) 1039-1040.

[3]Electron-transporting oligothiophenes containing dicyanomethylene-substituted cyclopenta[b]thiophene: chemical tuning for air-stability in OFETs, Y. Ie, K. Nishida, M. Karakawa, H. Tada, Y. Aso: J. Org. Chem., 76 (16) (2011) 6604-6610.

[4]The frontiers of quinoidal stability in long oligothiophenes: raman spectra of dicationic polaron pairs, S. R. González, Y. Ie, Y. Aso, J. T. L. Navarrete, J. Casado: J. Am. Chem. Soc., 113 (41) (2011) 16350-16353.

[5]Completely encapsulated oligothiophenes: synthesis, properties, and single-molecule conductance, Y. Ie, M. Endou, S. K. Lee, R. Yamada, H. Tada, Y. Aso: Angew.Chem. Int. Ed., 50 (50) (2011) 11980-11984.

[6]Fabrication of silver nanowire transparent electrodes at room temperature, T. Tokuno, M. Nogi, M. Karakawa, J. Jiu, T. T. Nge, Y. Aso, K. Suganuma: Nano Res., 4 (12) (2011) 1215-1222.

[7]Encapsulated oligothiophenes having electron-affinity characteristics, M. Endou, Y. Ie, Y. Aso: Chem. Commun., 48 (4) (2012) 540-542.

[8]A Spin-carrying naphthalenediimide derivative with azobenzene unit, M. Nakagawa, H. Akutsu, J. Yamada, M. Karakawa, Y. Aso, S. Fall, T. Heiser, S. Nakatsuji: Chem. Lett., 41 (2) (2012) 175-177.

International Conferences

[1]Novel fulleropyrrolidine derivatives for organic photovoltaic cells (poster), M. Karakawa, T. Nagai, Y. Ie, Y. Aso: The 15th SANKEN International Symposium 2012, Osaka, Japan, January 12-13, 2011.

[2]Functionalized oligothiophene molecular wires and tripodal anchoring groups for molecular electronics (plenary), Y. Aso: 14th International Symposium on Novel Aromatic Compounds (ISNA-14), Eugene, Oregon USA, July 24-29, 2011.

[3]Synthesis, structure, properties, and single-molecule conductance of completely encapsulated oligothiophenes (poster), Y. Ie, M. Endou, S. K. Lee, R. Yamada, H. Tada, Y. Aso: 14th International Symposium on Novel Aromatic Compounds (ISNA-14), Eugene, Oregon USA, July 24-29, 2011.

[4]Synthesis, properties, and n-type OFET performances of electronegative π-conjugated systems containing dicyanomethylene-substituted cyclopenta[b]thiophene (poster), Y. Ie, K. Nishida, M. Karakawa, Y. Aso: 10th International Symposium on Functional p-Electron Systems (Fpi10), Beijing, China, Oct 13-17, 2011.

[5]Organic photovoltaic properties of novel PCBM analogous (poster), M. Karakawa, T. Nagai, Y. Ie, Y. Aso: 10th International Symposium on Functional p-Electron Systems (Fpi10), Beijing, China, Oct 13-17, 2011.

[6]Synthesis, properties, and photovoltaic performances ofcopolymers containing difluorodioxocyclopentene-annelated thiophene or naphtho[2,3-c]thiophene-4,9-dione (oral), Y. Ie, J. Huang, M. Karakawa, Y. Aso: 21st International Photovoltaic Science and Engineering Conference (PVSEC-21), Fukuoka, Japan, November 28- December 2, 2011.

[7]Synthesis and properties of polythiophenes bearing oligothiophene side chains for organic electronics materials (poster), M. Karakawa, Y. Ie, Y. Aso: 7th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, Nov 10-11, 2011.

[8]Development of conjugated oligomers containing carbonyl-bridged bithiazole for solution-processable n-type organic field-effect transistors (poster), M. Nitani, Y. Ie, Y. Aso: 7th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, Nov 10-11, 2011.

[9]Novel fullerene derivatives including PCBM analogous for organic photovoltaic cells (poster), M. Karakawa, T. Nagai, Y. Ie, Y. Aso: The 3th International Symposium on Emergence of Highly Elaborated π–space and Its Function, 2011, Tsukuba, Japan, Nov 10-11, 2011.

[10]Development of conjugated oligomers based on carbonyl-bridged bithiazole for solution-processable n-type organic field-effect transistors (poster), M. Nitani, Y. Ie, Y. Aso: The 3th International Symposium on Emergence of Highly Elaborated π–space and Its Function, 2011, Tsukuba, Japan, Nov 10-11, 2011.

[11]Completely encapsulated oligothiophenes: synthesis, structure, properties, and single-molecule conductance (invited), Y. Ie: China-Japan Joint Symposium on Current and Future Molecular Electronics, Nanjing, China, October 25, 2011.

Review Papers

Development of pi-conjugated systems bearing annelated-structure with electronegative substituents and their application to n-type organic field-effect transistor, Y. Ie, Journal of Synthetic Organic Chemistry, Japan, The Society of Synthetic Organic Chemistry, Japan, 70 (2012), 24-35.

Books

[1]Recent trend of organic electronics materials(K. Suganuma) Y. Ie, “Printed Electolonics”, NIKKO Green MOOK, (50-54) 2012.

Grant-in-Aid for Scientific Research

Y. Aso	Development of Molecular Electronics on the Basis of the Synthesis of Precisely Designed Molecular Wires	¥10,660,000
Y. Aso	Functions of Highly Elaborated π-Space Based on the Synthesis of Extended π-Electron Systems and Application to Electronics	¥5,850,000
Y. Ie	Development of Electronegative Three-dimensional Conjugated Systems	¥1,820,000
M. Karakawa	Relationship between p-n Property and Terminal Structure on Organic Semiconductor Materials	¥1,950,000
M. Nitani	Development of Novel n-Type Semiconducting Polymers Applicable for Organic Transistors	¥1,690,000
Y. Aso	Emergence of Highly Elaborated π-Space and its Function	¥6,370,000

Entrusted Research

Y.Ie	PRESTO, JST	Development of n-Type Organic Semiconductor Materials towards Bulk Heterojunction Solar Cells	¥18,980,000

Y.Ie	A-Step, JST	Development of Branched Perfluoroalkyl Compounds towards Low Refractive Index Materials	¥1,700,000

Contribution to Research

Y.Ie	The Iwatani Naoji Foundation	¥2,000,000

Cooperative Research

Y.Aso	Daikin Industries, Ltd.	¥2,750,000
Y.Aso	Sumitomo Chemical Company, Limited	¥1,012,000

Department of Bio-Nanotechnology

Original Papers

[1]Single-molecule sensing electrode embedded in-plane nanopore, M. Tsutsui, S. Rahong, Y. Iizumi, T. Okazaki, M. Taniguchi, T. Kawai: Scientific Reports, 1 (Article number:46) (2011) 1-6.

[2]Molecular Rotation in Self-Assembled Multidecker Porphyrin Complexes, H.Tanaka, T.Ikeda, M.Takeuchi, K.Sada, S.Shinkai, T.Kawai: ACS NANO, 5 (12) (2011) 9575-9582.

[3]Direct Manipulation of a Single Potassium Channel Gate with an Atomic Force Microscope Probe, M.Kitta, T.Ide, M.Hirano, H.Tanaka, T.Yanagida, T.Kawai: SMALL, 7 (16) (2011) 2379-2383.

[4]Dependence of Single-Molecule Conductance on Molecule Junction Symmetry, M.Taniguchi, M.Tustsui, R.Mogi, T.Sugawara, Y.Tsuji, K.Yoshizawa, T.Kawai: Journal of the American Chemical Society, 133 (30) (2011) 11426-11429.

[5]Imaging of Transverse Electron Transfer through a DNA Molecule by Simultaneous Scanning Tunneling and Frequency-Modulation Atomic Force Microscopy, Y.Maeda, T.Matsumoto, T.Kawai: Acs Nano, 5 (4) (2011) 3141-3145.

[6]Unsymmetrical hot electron heating in quasi-ballistic nanocontacts, M.Tsutsui, T.Kawai, M.Taniguchi: Scientific Reports, 2 (Article number:217) (2012) 1-7.

[7]Development of Microfabricated TiO2 Channel Waveguides, M.Furuhashi, M.Fujiwara, T.Ohshiro, M.Tustsui, K.Matsubara, M.Taniguchi, S.Takeuchi, T.Kawai: AIP Advances, 1 (3) (2011) 032102(1-5).

[8]Gate Manipulation of DNA Capture into Nanopores, Y.He, M.Tustsui, C.Fan, M.Taniguchi, T.Kawai: ACS Nano, 5 (10) (2011) 8391-8397.

[9]Controlling DNA Translocation through Gate Modulation of Nanopore Wall Surface Charges, Y.He, M.Tustsui, C.Fan, M.Taniguchi, T.Kawai: ACS NANO, 5 (7) (2011) 5509-5518.

[10]Electrical Detection of Single Methylcytosines in a DNA Oligomer, M.Tustsui, K.Matsubara, T.Ohshiro, M.Furuhashi, M.Taniguchi, T.Kawai: Journal of the American Chemical Society, 133 (23) (2011) 9124-9128.

International Conferences

[1]Heat dissipation in a current-carrying quasiballistic atom-sized contact (poster), M. Tsutsui, M. Taniguchi, T. Kawai: The 15th SANKEN International Symposium 2012.

[2]In-plane gating nanopore for single-molecule electrical DNA sequencing (poster), M. Tsutsui, R. Sakon, M. Taniguchi, T. Kawai: 7th Handai Nanoscience and Nanotechnology International Symposium.

[3]Electrode-embedded in-plane nanopore for electrical DNA sequencing (poster), M. Tsutsui, R. Sakon, Y. He, M. Taniguchi, T. Kawai: International Symposium on Innovative Nanobiodevices.

[4]Development of Gating Nanopores for Next-Next DNA Sequencing using Mechanically Controllable Break-Junctions (invited), M. Taniguchi: ASME-JSME-KSME Jpint Fluids Engineering Conference 2011.

[5]Fabrication Method of Plastic Micropores for Artificial Lipid Bilayer Formation (poster), H. Tanaka: 19th International Colloquium on Scanning Probe Microscopy (ICSPM19

[6]Molecular Rotation in Self-Assembled Multidecker Porphyrin Complexes (poster), H. Tanaka: 19th International Colloquium on Scanning Probe Microscopy (ICSPM19)

[7]Partial Sequencing of a Single DNA Molecule with a Scanning Tunnelling Microscope (invited), H. Tanaka: Osaka University – RUG symposium entitled "Bio-inspired Materials and Functionalities",June 22, 2011 in Groningen.

[8]Single Molecule Electrical Sequencing of DNA and RNA (poster), M. Taniguchi: International Symposium on Nanobiotechnology meets Holonic Commuication,23-24 March,2012,Nagoya University.

[9]Single-Molecule Electrical Sequencing Technology (poster), M. Taniguchi: The 15th SANKEN International Symposium 2012, The 10th SANKEN Nanotechnology Symposium.

[10]Third-Generation DNA Sequencing Technology Using Single-Molecule Analysis (invited), M. Taniguchi: China-japan Joint Symposium on Current and Future Molecular Electronics,24-25 October,2011,Beijing.

Review Papers

Development and Application of Rapid Fabrication of Teflon Micropores as a Platform of Stable Lipid Bilayer Formation, Hiroyuki Tanaka, Journal of The Surface Science Society of Japan, The Surface Science Society of Japan, 32[7] (2011), 445-450.

Patents

[1]ContMethod and apparatus for electric control of single-biomolecule velocity in a fluidic channel. M. Taniguchi, M. Tsutsui, T. Kawai, 2012-17325

[2]Method and an apparatus for a single molecule analysis. M. Taniguchi, S. Hongo, M. Tsutsui, T. Kawai, JP2012-056372

Contributions to International Conferences and Journals

M. Taniguchi Japanese Journal of Applied Physics (Associate Editor)

Publications in Domestic Meetings

The 72nd Fall Meeting on the Japan Society of Applied Physics, 2012	1 paper
The 59th Spring Meeting on the Japan Society of Applied Physics, 2012	1 paper
The 92nd Annual Meeting on the Chemical Society of Japan	3 papers
JST-PRESTO "Structures and Control of Interfaces" Research Area Symposium for Advanced Interface Science -New Developments in Multi diciplinary Research on BioiInterface	1 paper
Symposium on Capillary Electrophoresis	1 paper
60th Symposium on Macromolecules	1 paper

Grant-in-Aid for Scientific Research

M. Taniguchi	Development of method control the speed of single molecules using gating nanopores	¥14,430,000
M. Taniguchi	Development of light-gating nanopores	¥3,770,000
M. Tsutsui	Development of electrostatic-force-controlled single-molecule switches	¥780,000

Entrusted Research

Hiro. Tanaka	Japan Science and	Nanopore-based single-molecule	¥2,964,000

Technology Agency DNA sequencing

Contribution to Research

M.Taniguchi Inamori Foundation ¥1,000,000

Department of Nanotechnology for Environmental and Energy Applications

Original Papers

[1]Direct Measurement of the Out-of-Plane Spin Texture in the Dirac-Cone Surface State of a Topological Insulator, S. Souma, K. Kosaka, T. Sato, M. Komatsu, A. Takayama, T. Takahashi, M. Kriener, K. Segawa, and Y. Ando: Physical Review Letters, 106 (21) (2011) 216803/1-4.

[2]Anisotropies in the optical ac and dc conductivities in lightly doped $La_{2-x}Sr_xCuo_4$: the role of deep and shallow acceptor states, M. B. Silva Neto, G. Blumberg, A. Gozar, S. Komiya, and Y. Ando: Journal of Physics: Condenced Matter, 23 (21) (2011) 215602/1-9.

[3]Observation of Dirac Holes and Electrons in a Topological Insulator, A. A. Taskin, Z. Ren, S. Sasaki, K. Segawa, and Y. Ando: Physical Review Letters, 107 (1) (2011) 016801/1-4.

[4]Berry phase of nonideal Dirac fermions in topological insulators, A. A. Taskin, and Y. Ando: Physical Review B, 84 (3) (2011) 035301/1-6.

[5]Extracting the dynamical effective interaction and competing order from an analysis of Raman spectra of the high-temperature $La_{2-x}Sr_xCuO_{4\ superconductor}$, S. Caprara, C. Di Castro, B. Muschler, W. Presterl, R. Hackl, M. Lambacher, A. Erb, S. Komiya, Y. Ando, and M. Grilli: Physical Review B, 84 (5) (2011) 054508/1-10.

[6]Electrochemical synthesis and superconducting phase diagram of $Cu_xBi_2Se_3$, M. Kriener, K. Segawa, Z. Ren, S. Sasaki, S. Wada, S. Kuwabata, and Y. ando: Physical Review B, 84 (5) (2011) 054513/1-5.

[7]Observations of two-dimensional quantum oscillations and ambipolar transport in the topological insulator Bi_2Se_3 achieved by Cd doping, Z. Ren, A. A. Taskin, S. Sasaki, K. Segawa, and Y. Ando: Physical Review B, 84 (7) (2011) 075316/1-6.

[8]Optimizing $B_{i2-x}Sb_xTe_{3-y}Se_y$ solid solutions to approach the intrinsic topological insulator regime, Z. Ren, A. A. Taskin, S. Sasaki, K. Segawa, and Y. Ando: Physical Review B, 84 (16) (2011) 165311/1-6.

[9]Synthesis of Oxosumanenes through Benzylic Oxidation, T. Amaya, M. Hifumi, M. Okada, Y. Shimizu, T. Moriuchi, K. Segawa, Y. ando, and T. Hirao: The Journal of Organic Chemistry, 76 (19) (2011) 8049-8052.

[10]Pair breaking versus symmetry breaking: Origin of the Raman modes in superconducting cuprates, N. Munnikes, B. Muschler, F. Venturini, L. Tassini, W. Prestel, S. Ono, Y. Ando, D. C. Peets, W. N. Hardy, R. Liang, D. A. Bonn, A. Damascelli, H. Eisaki, M. Greven, A. Erb, and R. Hackl: Physical Review B, 84 (14) (2011) 144523/1-13.

[11]Unexpected mass acquisition of Dirac fermions at the quantum phase transition of a topological insulator, T. Sato, K. Segawa, K. Kosaka, S. Souma, K. Nakayama, K. Eto, T. Minami, Y. Ando, and T. Takahashi: Nature Physics, 7 (8) (2011) 840-844.

[12]Topological Superconductivity in $Cu_xBi_2Se_3$, S. Sasaki, M. Kriener, K. Segawa, K. Yada, Y. Tanaka, M. Sato, and Y. Ando: Physical Review Letters, 107 (21) (2011) 217001/1-5.

[13]Investigation of particle-hole asymmetry in the cuprates via electronic Raman scattering, B. Moritz, S. Johnston, T. P. Devereaux, B. Muschler, W. Prestel, R. Hackl, M. Lambacher, A. Erb, S. Komiya, and Y. Ando: Physical Review B, 84 (23) (2011) 235114/1-12.

[14]Topological transition in $Bi_{1-x}Sb_x$ studied as a function of Sb doping, F. Nakamura, Y. Kousa, A. A. Taskin, Y. Takeich, A. Nishide, A. Kakizaki, M. D'Angelo, P. Lefevre, F. Bertran, A. Taleb-Ibrahimi, F. Komori, S. Kimura, H. Kondo, Y. Ando, and I. Matsuda: Physical Review B, 84 (23) (2011) 235308/1-8.

[15]An extended infrared study of the *p, T* phase diagram of the *p*-doped Cu-O plane, D. Nicoletti, P. Di Pietro, O. Limaj, P. Calvani, U. Schade, S. Ono, Y. Ando, and S. Lupi: New Journal of Physics, 13 (2011) 123009/1-26.

[16]Additional Evidence for the Surface Origin of the Peculiar Angular-Dependent Magnetoresistance Oscillations Discovered in a Topological Insulator $Bi_{1-x}Sb_x$, A. A. Taskin, K. Segawa, and Y. Ando: Journal of Physics: Conference Series, 334 (2011) 012012/1-5.

[17]Tunable Dirac cone in the topological insulator $Bi_{2-x}Sb_xTe_{3-y}Se_y$, T. Arakane, T. Sato, S. Souma, K. Kosaka, K. Nakayama, M. Komatsu, T. Takahashi, Z. Ren, K. Segawa, and Y. Ando: Nature Communications, 3 (2012) 636/1-5.

[18]Topological Surface States in Lead-Based Ternary Telluride $Pb(Bi_{1-x}Sb_x)_2Te_4$, S. Souma, K. Eto, M. Nomura, K. Nakayama, T. Sato, T. Takahashi, K. Segawa, and Y. Ando: Physical Review Letters, 108 (11) (2012) 116801/1-5.

International Conferences

[1]Materials-Oriented Research of Topological Insulators and Superconductors (invited), Y. Ando: LT26 Satellite Conference on Topological Insulators and Superconductors, Tsinghua University, Beijing, China, August 18-21, 2011.

[2]Cutting-Edge Experiments on Topological Insulator and Superconductors (invited), Y. Ando: International Workshop on Novel Quantum State in Condensed Matter; Correlation, Frustration and Topology, Ukawa Institute, Kyoto University, Japan, November 18, 2011.

[3]Materials-Oriented Research of Topological Insulators and Superconductors (invited), Y. Ando: 2011 MRS Fall Meeting, Boston, U.S.A., November 28-December 2, 2011.

[4]Probing the Exotic Surface States in Topological Insulators and Superconductors (invited), Y. Ando: FITST-QS2C Workshop on Emergent Phenomena of Correlated Materials, Okinawa, Japan, December 12-15, 2011.

[5]Transport Studies of Topological Insulators and Superconductors (invited), Y. Ando: American Physical Society March Meeting, Boston, U.S.A., February 27-March 2, 2012.

[6]Optical conductivity of exfoliated $Bi_2Sr_2CaCu_2O_{8+\sigma}$ nanocrystals (oral), L. Sandilands, V. Baydina, A. Su, A. Reijnders, T. Pedersen, F. Borondics, G. Gu, S. Ono, Y. Ando, K. Burch: American Physical Society March Meeting, Boston, U.S.A., February 27-March 2, 2012.

[7]Transport properties of new Pb-based Topological Insulators (oral), K. Eto, S. Sasaki, K. Segawa, Y. Ando: American Physical Society March Meeting, Boston, U.S.A., February 27- March 2, 2012.

[8]Recent ARPES study on extremely underdoped LSCO system (oral), Y. He, M. Hashimoto, S. K. Mo, R. He, Y. Ando, S. Komiya, Z. X. Shen: American Physical Society March Meeting, Boston, U.S.A., February 27- March 2, 2012.

[9]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (oral), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: Gordon Research Conference on Superconductivity, Waterville valley resort, U.S.A. June 6-10, 2011.

[10]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (poster), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: 26 t h International Conference on Low Temperature Physics, Beijing, China, August 11-17, 2011.

[11]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (invited), K. Segawa: 24th International Symposium on Superconductivity, Tokyo, Japan, October 24-26, 2011.

[12]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (invited), K. Segawa: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2-5, 2011.

[13]Physical properties of bulk-superconducting $Cu_xBi_2Se_3$ (poster), K. Segawa, M. Kriener, Z. Ren, S. Sasaki, and Y. Ando: FITST-QS2C Workshop on Emergent Phenomena of Correlated Materials, Okinawa, Japan, December 12-15, 2011.

[14]Synthesis and Characterization of New Topological Insulators (invited), K. Segawa: American Physical Society March Meeting, Boston, U.S.A., February 28, 2012.

[15]Point-contact spectroscopy of $Cu_xBi_2Se_3$ (poster), S. Sasaki, M. Kriener, K. Segawa, K. Yada, Y. Tanaka, M. Sato, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

[16]Magnetotransport studies of Dirac Fermions in Topological Insulators (invited), A. Taskin, Z. Ren, S. Sasaki, K. Segawa, and Y. Ando: IOP Workshop on Frontiers of Dirac Electron Systems, Hefei, China, January 4-5, 2012.

[17]About the Superconductivity in $Cu_xBi_2Se_3$ (poster), M. Kriener, K. Segawa, Z. Ren, S. Sasaki, S. Wada, and Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

[18]The Superconducting Phase in $Cu_xBi_2Se_3$ (oral), M. Kriener: Japan-Finland March Meeting for the future in thermoelectrics, Nagoya University, Japan, March 14, 2012.

[19]Experimental Attempts to Observe Spin-Polarized Transport Properties of the Surface States of a Highly Bulk-Insulating Topological Insulator (poster), K. Eto, S. Sasaki, K. Segawa, Y. Ando: 7^{th} Handai Nanoscience and Nanotechnology International Symposium.

[20]Experimental Attempts to Observe Spin-Polarized Transport Properties of the Surface States of a Highly Bulk-Insulating Topological Insulator (poster), K. Eto, S. Sasaki, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Shiga, Japan, November 2, 2011.

Review Papers

Electronic Transport Phenomena in the Topological Insulator, Y. Ando, Journal of The Surface Science Society of Japan, The Surface Science Society of Japan, 32[4] (2011), 189-195.

Mass Acquisition of Dirac Electrons at the Quantum Phase Transition of a Topological Insulator, T.Sato、K.Segawa、T.Takahashi、Y.Ando, Butsuri, The Physical Society of Japan, 67[3] (2012), 184-187.

Contributions to International Conferences and Journals

Y. Ando	Materials & Mechanisms of Superconductivity Conference (M2S 2012) (International Advisory Committee)
Y. Ando	International Conference on Topological Quantum Phenomena (Program Committtee)

Y. Ando	Europhysics Letters (EPL) (Co-Editor)	
Publications in Domestic Meetings		
ISSP workshop: The States of the Surface Electrons on Topological Insulators		1 paper
2011 Fall meeting of the Physical Society of Japan		14 papers
The 2nd annual meeting of MEXT Grant-in-aid for scienctific research on innovative areas "Topological quantum phenomena in condensed matter with broken symmerties"		2 papers
The 67th annual meeting of the Physical Society of Japan		7 papers
The 2nd workshop for young researchers in surface science		1 paper
Grant-in-Aid for Scientific Research		
Y.Ando	Creation of Innovative Devices Based on Topological Insulators	¥113,342,000
Contribution to Research		
Y.Ando	Asian Office of Aerospace Research and Development	¥40,278,000

Department of Nano-Intelligent Systems

Original Papers

[1]DirectLiNGAM: A Direct Method for Learning a Linear Non-Gaussian Structural Equation Model, S. Shimizu, T. Inazumi, Y. Sogawa, A. Hyvärinen, Y. Kawahara, T. Washio, P. O. Hoyer and K. Bollen: Journal of Machine Learning Research, 12 (2011) 1225-1248.

[2]Analyzing relationships among ARMA processes based on non-Gaussianity of external influences, Y. Kawahara, S. Shimizu and T. Washio: Neurocomputing, 74 (12-13) (2011) 2212-2221.

[3]Estimating Exogenous Variables in Data with More Variables than Observations, Y. Sogawa, S. Shimizu, T. Shimamura, A. Hyvarinen, T. Washio and S. Imoto: Neural Networks, 24 (8) (2011) 875-880.

[4]Spacecraft telemetry monitoring method based on dimensionality reduction and clustering, T. Yairi, M. Inui, Y. Kawahara, N. Takada: Journal of the Japan Society for Aeronautical and Space Science, 59 (691) (2011) 197-205.

[5]Learning non-linear dynamical systems by alignment of local linear models, M. Joko, Y. Kawahara, T. Yairi: Transactions of the Japanese Society for Artificial Intelligence, 26 (6) (2011) 638-648.

International Conferences

[1]Discovering Causal Structures in Binary Exclusive-or Skew Acyclic Models, Takanori Inazumi, Takashi Washio, Shohei Shimizu, Joe Suzuki, Akihiro Yamamoto and Yoshinobu Kawahara: Proc. of UAI2011: The 27th Conference on Uncertainty in Artificial Intelligence, (2011) 373-382.

[2]Common Substructure Learning of Multiple Graphical Gaussian Models, Satoshi Hara and Takashi Washio: Proc. ofECML-PKDD2011: European Conference on Machine Learning and Principle and Practice of Knowledge Discovery in Databases 2011, Lecture Notes in Computer Science: Springer LNCS, 6912 (2) (2011) 1-16.

[3]Prismatic Algorithm for Discrete D.C. Programming Problem, Yoshinobu Kawahara and Takashi Washio: Proc. of NIPS2011: Twenty-Fifth Annual Conference on Neural Information Processing Systems, (2011) 2106-2114.

[4]Density Estimation based on Mass, K. Ming Ting, T. Washio, J. Wells and T. Liu: Proc. of ICDM2011: The IEEE International Conference on Data Mining 2011, (2011) 715-724.

[5]Size-constrained submodular minimization through minimum norm base, K. Nagano, Y. Kawahara and K. Aihara: Proceedings of the 28th International Conference on Machine Learning (ICML'11), (2011) 977-984.

[6]A Framework for Shopping Path Research (oral), K. Yada, T. Washio and H. Koga: Workshop on Data Mining Marketing, SIAM: SIAM Conference on Data Mining (SDM11).

[7]Application of DNA Sequence Alignment Algorithm to Classification of Shopping Paths through a Supermarket (oral), K. Ichikawa, E.. Ip, K. Yada and T. Washio: Workshop on Data Mining Marketing, SIAM: SIAM Conference on Data Mining (SDM11).

[8]A New Approach to Bayesian Estimation over the Curse of Dimensionality (invited), T. Washio: AI-2011 Thirty-first SGAI International Conference on Artificial Intelligence, Workshop on MachineLearning and Intelligent Autonomous Systems.

[9]Analysis of Residence Time in Shopping using RFID Data -An Application of the Kernel density estimation to RFID- (oral), S. Miyazaki, T. Washio and K. Yada: Working note of DMS2011: Workshop on Data Minig For Service:The IEEE International Conference on Data Mining series (ICDM2011).

Review Papers
High Dimensional Data Mining in Information Explosion Ara, T. Washio, The Journal of the Institute of Electronics Information and Communication Engineers, The Institute of Electronics Information and Communication Engineers, 94[8] (2011), 679-683.

Extension of Frequent Pattern Mining to Graph Sequences, A. Inokuchi, Journal of the Japanese Society for Artificial Intelligence, Ohmsha, 27[3] (2012), 120-127.

Patents
[1]Visualization device, method and program for multivariate date S. Morinaga, Y. Kawahara, T. Ito, Y. Zheng, H. Suematsu, 2012022112

[2]Discriminant model learning device, method and program S. Morinaga, R. Fujimaki, Y. Kawahara, 61/596,313

[3]Optimized query generating device and method, and discriminant model learning method S. Morinaga, R. Fujimaki, Y. Kawahara, 61/596,317

Contributions to International Conferences and Journals

T. Washio	Journal of Data Mining and Knowledge Discovery (Editorial Board)
T. Washio	Asian Conference on Machine Learning (ACML) (Steering Committee)
T. Washio	Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD) (Steering Committee)
T. Washio	The 16th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2012) (Workshop Chair)
T. Washio	2011 International Workshop on Learning and data Mining for Robotics (LEMIR 2011), Program Committee Member (Program Committee)
T. Washio	The 21st International Conference on Inductive Logic Programming (ILP 2011) (Program Committee)
T. Washio	The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2011) (Program Committee)
T. Washio	IEEE International Workshop on Data Mining for Service (DMS2011) (Program Committee)
T. Washio	Second Workshop on Algorithms for Large-Scale Information Processing in Knowledge Discovery (ALSIP 2011)) (Program Committee)
T. Washio	Statistical Analysis and Data Mining (SAM) (Guest Editor)
T. Washio	The 18th ACM SIGKDD Knowledge Discovery and Data Mining (KDD 2012) (Program Committee)
T. Washio	The 21st ACM International Conference on Information and Knowledge

	Management (CIKM 2012) (Program Committee)
T. Washio	ICDM 2012 IEEE International Conference on Data Mining (Program Committee)
A. Inokuchi	The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program committee)
A. Inokuchi	2011 SIAM International Conference on Data Mining (Program committee)
A. Inokuchi	IADIS European Conference on Data Mining (ECDM'11) (Program committee)
A. Inokuchi	International Workshop on Data Oriented Constructive Mining and Massively Multi-Agent System: Simulations, Models, and Tools (Program committee)
A. Inokuchi	2012 International Conference on Pattern Recognition Applications and Methods (Program committee)
A. Inokuchi	The First International Conference on Social Eco-Informatics (Program committee)
A. Inokuchi	International Conference on Social Computing and its Applications (SCA 2011) (Program committee)
A. Inokuchi	The 3rd Asian Conference on Machine Learning (Program committee)
A. Inokuchi	The 7th International Conference on Advanced Data Mining and Applications (Program committee)
A. Inokuchi	The 16th Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program committee)
A. Inokuchi	The 10th IEEE International Symposium on Parallel and Distributed Processing with Applications (Program Vice-chairs)
A. Inokuchi	IADIS European Conference on Data Mining (ECDM'12) (Program committee)
A. Inokuchi	The 8th International Conference on Advanced Data Mining and Applications (Program committee)
A. Inokuchi	International Journal of Applied Evolutionary Computation (Editorial Review Board)

Publications in Domestic Meetings

The 3rd Forum on Data Engineering and Information Management (DEIM2011)	1 paper
The 25th Annual Conference of The Japanese Society for Artificial Intelligence	7 papers
Special Interest Group on Knowledge-Based Systems, The Japanese Society for Artificial Intelligence	1 paper
Information-Based Inductive Sciences and Machine Learning (IBISML2011)	6 papers
Special Interest Group on Fundamental Problem of Artificial Intelligence, The Japanese Society for Artificial Intelligence	1 paper
Annual Conference of The Institute of Electrical Engineers of Japan	1 paper
The 23rd RAMP Symposium	1 paper
Domestic Conference on Data Oriented Constructive Mining and Simulation	1 paper
Latent Dynamics Workshop	1 paper
Statistics for Biomedical & Social Mathematical Sciences	1 paper
Frontiers of statistical physics for information processing -toward control of information and fluctuation	1 paper

Academic Degrees

bachelor Degree for Engineering M. Ito	A Study on Enumeration of Frequent Patterns from Hyper-graph Sequences
bachelor Degree for Engineering K. Sugimoto	A Study on feature selection using randomized algorithm
Master Degree for Engineering T. Inazumi	Estimation of causal structures of binary variables: A boolean algebra approach
Master Degree for Engineering T. Kishimoto	A Study on Clustering of a Graph Sequence based on Submodular Optimization
Master Degree for Engineering	A Study on Conditional Simulation Approaches for Molecular Structure Change

S. Matsuda Master Degree for Engineering	A Study on the Applications to Marketing Problems of Regularized Learning Methods	
Q. Liu Master Degree for Engineering	Robustness Estimation of A Linear Non-Gaussian Acyclic Model	
H. Li		

Grant-in-Aid for Scientific Research

T. Washio	Development of Statistical Estimation Principle for Extremely High Dimensional Data and Its Application to Large Scale Data Mining	¥6,500,000
A. Inokuchi	Development of Multidimensional Databases for Analyzing Time Interval Data in Heterogeneous Schemas	¥5,720,000
S. Shimizu	Discovery of reliable causal structures in high-dimensional data	¥1,040,000
Y. Kawahara	Data analysis method for super high dimensinal data using discrete structure	¥910,000

Entrusted Research

T. Washio	National Cerebral and Cardiovascular Center	Practice of Advanced Estimation Theory	¥500,000
A. Inokuchi	Japan Science and Technology Agency	Development of Knowledge Organization and Understanding Support of Massive Graph Sequence Data	¥8,515,000
Y. Kawahara	Japan Science and Technology Agency	Knowledge discovery from super-high dimensional data based on combinatorial computation	¥17,550,000

Contribution to Research

T. Washio	Fujitsu Laboratories Ltd.	¥1,000,000
T. Washio	The Asian Office of Aerospace Research and Development	¥11,147,000

Cooperative Research

T. Washio	Japan Science and Technology Agency	¥1,080,000
T. Washio	Nippon Telegraph and Telephone Co.	¥2,970,000
Y. Kawahara	NEC Co.	¥1,575,000

Department of Nanodevices for Medical Applications

Original Papers

[1]Ligand-Assisted Complex of Two DNA Hairpin Loops, C. Hong, M. Hagihara, K. Nakatani: Angew. Chem. Int. Ed., 50 (2011) 4390-4390.

[2]Molecular-Glue-Triggered DNA Assembly to Form a Robust and Photoresponsive Nano-Network, C. Wang, F. Pu, Y. Lin, J. Ren, C. Dohno, K. Nakatani, X. Qu: Chem. Eur. J., 17 (2011) 8189-8197.

[3]Control of DNA hybridization by photoswitchable molecular glue, C. Dohno, K. Nakatani: Chem. Soc. Rev., 40 (2011) 5718-5729.

[4]Interstrand Cross-Link for Discrimination of Methylated Cytosines, C. Dohno, T. Shibata, K. Nakatani: Chem. Lett., 40 (2011) 852-854.

[5]Small Molecule Modulates Hairpin Structures in CAG Trinucleotide Repeats, M. Hagihara, H. He, K. Nakatani: ChemBioChem., 12 (2011) 1686-1689.

[6]Tandem Arrays of TEMPO and Nitronyl Nitroxide Radicals with Designed Arrangements on DNA, H. Atsumi, K. Maekawa, D. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: Chem. Eur. J., 18 (2012) 178-183.

[7]Naphthyridine tetramer with a preorganized structure for 1:1 binding to a CGG/CGG sequence, C. Dohno, I. Kohyama, C. Hong, K. Nakatani: Nucleic. Acids. Res., 40 (2012) 2771-2781.

[8]Chemoselective cyclization of unprotected linear peptides by α-ketoacid–hydroxylamine amide-ligation, T. Fukuzumi, L. Ju, J. W. Bode: Org. Biomol. Chem., 10 (2012) accepted.

[9]A Small Molecule Regulates Hairpin Structures in d(CGG) Trinucleotide Repeats, M. Hagihara, H. He, M. Kimura, K. Nakatani: Biorg. Med. Chem. Lett., 22 (2012) 2000-2003.

International Conferences

[1]Development of tetrameric naphthyridine derivatives for DNA and RNA containig a GG-mismatch (poster), I. Kohyama, C. Dohno, C. Hong, K. Nakatani: XVth Symposium on Chemistry of Nucleic Acid Components, Czech Republic, 2011, Jun. 5-10.

[2]Photoswitchable molecular glue for hybridization of nucleic acids. (poster), C. Dohno, S. Uno, K. Nakatani: XVth Symposium on Chemistry of Nucleic Acid Components, Czech Republic, 2011, Jun. 5-10.

[3]Antisense-Induced G-Quadruplex Structures Interfere with Reverse Transcription by HIV-1 Reverse Transcriptase (poster), M. Hagihara, K. Nakatani: RNA 2011, the 16th Annual Meeting of the RNA Society, Japan, 2011, Jun. 14-18.

[4]Development of a method for detecting small molecule-miRNA interactions (poster), A. Murata, Y. Harada, T. Fukuzumi, S. Umemoto, S. Im, M. Hagihara, K. Nakatani: RNA 2011, the 16th Annual Meeting of the RNA Society, Japan, 2011, Jun. 14-18.

[5]Periodic electron spin arrays on DNA duplex (poster), H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: ISAC2011, UK, 2011, Jul. 26-29.

[6]Synthesis of dimeric naphthyridine derivatives connected at the 7 position (poster), M. Toda, H. He, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[7]Synthesis of DNA containing hydrophobic region and its interaction with lipid bilayer membrane (poster), S. Makishi, T. Shibata, M. Okazaki, C. Dohno, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[8]Factors determining the binding of small molecules to the single nucleotide bulge in double stranded DNA and RNA (poster), T. Otabe, J. Zhang, K. Nakatani: Sixth Cambridge Symposium on Nucleic Acids Chemistry and Biology, UK, 2011, Sep. 4-7.

[9]Ligand-assisted complex of two DNA hairpin loops (poster), C. Hong: FIBER international Symposium, Japan, Nov. 6-8.

[10]Synthesis of hydrophobic DNA and its localization on lipid bilayer membrane surface (poster), S. Makishi: FIBER international Symposium, Japan, Nov. 6-8.

[11]Naphthyridine tetramer functions as a molecular glue for DNA and RNA (poster), C. Dohno, I. Kohyama, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[12]Synthesis of hydrophobic DNA interacting with liposome (poster), T. Shibata, S. Makishi, C. Dohno, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[13]Localization of hydrophobic DNA on lipid bilayer membrane surface (poster), S. Makishi, T. Shibata, M. Okazaki, C. Dohno, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[14]Evaluation of Xanthone and Thioxanthone Derivatives as Fluorescent Displacement Assay Indicator Based on Their Structure-Binding Studies to RNA (poster), S. Umemoto, S. Im, J. Zhang, M. Hagihara, A. Murata, Y. Harada, T. Fukuzumi, T. Wazaki, S. Sasaoka, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[15]Binding of the ligand to the (CGG)n in the RNA hairpin loop (poster), C. Hong, M. Hagihara, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[16]Electron spin arrays on DNA nanostructures (oral), H. Atsumi, K. Maekawa, S. Nakazawa, D. Shiomi, K. Sato, M. Kitagawa, T. Takui, K. Nakatani: The 38th International symposium on Nucleic acids chemistry 2011, Japan, 2011, Nov. 9-11.

[17]Ligand-Assisted Assembly and Functionalization of DNA Nanostructure (oral), K. Nakatani, C. Dohno, H. Atsumi: International Symposium on Innovative Nanobiodevices (ISIN2012), Japan, 2012, Mar. 21-22.

[18]Design and synthesis of RNA binding ligand for regulating gene expression (poster), C. Dohno, I. Kohyama, K. Nakatani: 243rd American Chemical Society National Meeting, USA, 2012, Mar. 25-28.

[19]Fluorescence-based binding assay of hydrophobic DNA to the lipid bilayer membrane (poster), T. Shibata, S. Makishi, C. Dohno, K. Nakatani: 243rd American Chemical Society National Meeting, USA, 2012, Mar. 25-28.

[20]Controlling DNA Hybridization and Assembly by Small Organic Molecules (invited), K. Nakatani: Bioinspired Materials and Functionalities, The Netherlands, 2011. Jun. 21-22.

[21]Ligand Inducible Fluorescencne: Tools for Ligand Discovery and PCR Monitoring (invited), K. Nakatani: 12th Conference on Methods and Application of Fluorescece Spectroscopy, France, Sep. 11-14.

[22]Controlling DNA and RNA Assembly by Small Organic Molecules (invited), K. Nakatani: The 15th Korea-Japan Seminar on Organic Synthesis, Korea, 2011, Sep. 30-Oct. 3.

[23]Ligand-Assisted Complex of Two DNA and RNA Hairpin Loops (invited), K. Nakatani: Asian 3 Round Table on Nucleic Acids 2011 China, Oct. 14-16.

[24]Small Molecules binding to DNA and RNA; Design and Application (invited), K. Nakatani: Seminor at Hubei University, China, 2011. Oct. 14.

Review Papers

Creating new DNA polymerases, F. Takei, K. Nakatani, kagaku, kagakudoujinn, 66[22] (2011), 74-75.

China and Korea in transition, K. Nakatani, Kagaku, Kagakudoujinn, 67[4] (2012), 47-49.

Patents

[1] Synthesis and application of primers for the increasing fluorescent signal during PCR amplification,K. Nakatani, F.Takei, C. Dohno, JP-2012-51551

Publications in Domestic Meetings

6th Annual Meeting of Japanese Society for Chemical Biology 1 paper

Symposium 2011 on Antisense, Gene, and Delivery	1 paper
5th Joint Symposium of Biorelevant Chemistry	4 papers
The Uehara Memorial Foundation Symposium 2011	1 paper
The 34th Annual Meeting of the Molecular Biology Society of Japan	1 paper
50th Annual Meeting of the Society of Electron Spin Science and Technology	1 paper
92th annual meeting of chemical society of Japan	10 papers

Academic Degrees

Doctoral Degree for Science H. Atsumi	Electron Spin Arrays with Designed Arrangements on the DNA Nanostructures
Doctoral Degree for Science S. Umemoto	Studies on the methods to evaluate interaction of RNA with small molecules
Doctoral Degree for Science C. Hong	Studies on Regulation of the RNA Secondary Structures by Using Small Organic Molecules
Master Degree for Science I. Kohyama	Studies on novel DNA and RNA binding ligands for CGG/CGG sequence for regulating biological functions
Master Degree for Science T. Otabe	Studies on synthesis and properties of novel triethynylethane derivatives and development of synthetic ligands for RNA bulges
Master Degree for Science L. Chen	Studies on reengineering of adenine riboswitch
Master Degree for Science M. Toda	Syntheis of dimeric naphthyridine derivatives connected at the 7 position for nucleic acids recognition and construction of nano rectangular solid by DNA origami
Master Degree for Science S. Makishi	Nanostructures on the surface of lipid bilayer membrane by using DNAs with hydrophobic regions

Grant-in-Aid for Scientific Research

K. Nakatani	Riboswitch reengineering using a synthetic 8-substituted purine library	¥17,290,000
C. Dohno	Photoresponsive RNA-binding ligands for regulation of RNA functions	¥10,010,000
A. Murata	Gene regulation by small molecule-modulated miRNA pathway	¥2,470,000

Entrusted Research

C. Dohno	Japan Science and Technology Agency, PREST	Biochemical functions emerging from DNA containing hydrophobic regions	¥18,525,000
K. Nakatani	National Institute of Biomedical Innovation	Development of Research Basis for accelerating the Drug Discovery targeting Functional ncRNA	¥76,000,000

Cooperative Research

K. Nakatani	Nitto Kasei Co., LTD.	¥2,520,000
K. Nakatani	FURUKAWA ELECTRIC ADVANCED ENGINEERING CO.,LTD.	¥1,573,000

Other Research Fund

F. Takei	Osaka univ.	¥800,000

Handai Multi-Functional Nanofoundry

Original Papers

[1]Fabrication of robust PbLa(Zr,Ti)O3 capacitor structures using insulating oxide encapsulation layers for FeRAM integration, T. Saito, T. Tsuji, K. Izumi, Y. Hirota, N. Okamoto, K. Kondo, T. Yoshimura, N. Fujimura, A. Kitajima, A. Oshima: Electronics Letters, 47 (2011) 486-489.

[2]Development of Function-graded Proton Exchange Membrane for PEFC Using Heavy Ion Beam Irradiation, F. Shiraki, T. Yoshikawa, A. Oshima, Y. Oshima, Y. Takasawa, N. Fukutake, T. G. Oyama, T. Urakawa, H. Fujita, T. Takahashi, T. Oka, H. Kudo, T. Murakami, Y. Hama, M. Washio: Nucl. Instr. and Meth. B, 269 (2011) 1777-1781.

[3]Study on Positive-Negative Inversion of Chlorinated Resist Materials, T. G. Oyama, A. Oshima, H. Yamamoto, S. Tagawa, M. Washio: Applied Physics Express, 4 (2011) 076501-1-3.

[4]Nanofabrication of Sulfonated Polystyrene-g-FEP with Silver Ion (Ag+) using Ion Beam Direct Etching and Reduction, H. Tsubokura, A. Oshima, T. G. Oyama, H. Yamamoto, T. Murakami, S. Tagawa, Masakazu Washio: J. Photopolym. Sci. Technol., 24 (5) (2011) 513-516.

[5]Electron beam lithography using high-sensitive negative type of plant-based resist material derived from biomass on hardmask layer, S. Takei, A. Oshima, A. Sekiguchi, N. Yanamori, M. Kashiwakura, T. Kozawa, S. Tagawa: Applied Physics Express, 4 (2011) 106502-1-3.

[6]Generation of Spin in Bipolar Conductors, M. Sakai, T. Sakuraba, Z. Honda, S. Hasegawa, A. Kitajima, K. Higuchi, A. Oshima, O. Nakamura: Jpn. J. Appl. Phys., 5 (2011) 103002-1-9.

[7]Evaluation of resist sensitivity in extreme ultraviolet/soft x-ray region for next-generation lithography, Tomoko Gowa Oyama, Akihiro Oshima, Masakazu Washio, Seiichi Tagawa: AIP Advances, 1 (2011) 042153-1-5.

[8]Micro- / Nano-fabrication of Crosslinked Poly(L-lactic acid) Using EB-nanoimprint Lithography, Satoshi Okubo, Naotsugu Nagasawa, Akinobu Kobayashi, Tomoko Gowa Oyama, Mitsumasa Taguchi, Akihiro Oshima, Seiichi Tagawa, Masakazu Washio: Applied Physics Express, 5 (2012) 027303-1-3.

[9]Electron-Beam-Induced Decomposition Mechanisms of High-Sensitivity Chlorinated Resist ZEP520A, Tomoko Gowa Oyama , Kazuyuki Enomoto, Yuji Hosaka, Akihiro Oshima, Masakazu Washio, Seiichi Tagawa: Applied Physics Express, 5 (21012) 036501-1-3.

[10]Negative Magnetoresistance Generated by Combination of Spin–Orbit Interaction and Applied Magnetic Field, M.Sakai, D.Kodama, T.Sakuraba, Z.Honda, S.Hasegawa, A.Kitajima, A.Oshima, K.Higuchi, O.Nakamura: Jpn. J. Appl. Phys., 51 (2012) 023001-1-7.

[11]Nano- and Micro-fabrications of Polystyrene Having Atactic and Syndiotactic Structures using Focused Ion Beams Lithography, A.Oshima, S.Okubo, T. G.Oyama, M.Washio, S.Tagawa: Radiat. Phys. Chem., 81 (2012) 584-588.

International Conferences

[1]Nanofabrication of Sulfonated Polystyrene-g-FEP with Silver Ion (Ag+) using Ion Beam Direct Etching and Reduction (invited), H. Tsubokura, A. Oshima, T. G. Oyama, H. Yamamoto, T. Murakami, S. Tagawa, Masakazu Washio: 28th International Conference of Photopolymer Science and Technology (ICPST-27).

[2]Nano-/Micro-Fabrication of Crosslinked PTFE using EB Nanoimprint Lithography (poster), A. Kobayashi, S. Okubo, H. Tsubokura,T. Takahashi, T. G. Oyama, A. Oshima, S. Tagawa M.Washio: RadTech Asia-2011.

[3]Study on Reduction of Metal Ions in Functionalized Poly (tetrafluoroethylene-co-hexafluoropropylene) by Ion Beam Irradiation (poster), H. Tsubokura, H. Fujita, T. Takahashi, T. G. Oyama, H. Yamamoto, T. Murakami, A. Oshima, S. Tagawa, M. Washio: RadTech Asia-2011.

[4]Micro-fabrication of Biodegradable Polymers Using Focused Ion Beams (poster), S.Okubo, T.Takahashi, T. Gowa, N.Nagasawa, M.Taguchi, A.Oshima, S.Tagawa, M.Washio: RadTech Asia-2011.

[5]Positive-Negative Inversion of ZEP Resists Induced by High Dose EB Irradiation (poster), T.G.Oyama , H.Tsubokura , H.Yamamoto, A.Oshima , S.Tagawa, M.Washio: RadTech Asia-2011.

[6]EB-Nanoimprint Lithography Using Crosslinked PTFE Molds (oral), A. Oshima, T. Takahashi, T. G. Oyama, T. Miura, M. Washio, S. Tagawa: RadTech Asia-2011.

[7]X-ray Imaging with Resist Materials for Elemental Mapping (poster), T.G.Oyama, A.Oshima, S.Tagawa, M.Washio: 14th International Congress of Radiation Research (ICRR-2011).

[8]Nano- /Micro-Fabrication of Polymeric Materials using Focused Ion Beams (oral), M. Washio, S. Tagawa, A. Oshima, T. Gowa Oyama, S. Okubo, H. Tsubokura, T. Takahashi: 14th International Congress of Radiation Research (ICRR-2011).

[9]Nano- and Micro-fabrications of Polystyrene Having Atactic and Syndiotactic Structures using Ion Beam lithography (poster), A. Oshima, S. Okubo, T. G. Oyama, M. Washio, S. Tagawa: 37th International Conference on Micro and Nano Engineering (MNE2011).

[10]Electron and Ion Beam Fabrication Using Positive-Negative Inversion of Chlorinated Resist Materials (poster), T.G.Oyama, H.Tsubokura, A.Oshima, S.Tagawa, M.Washio: 37th International Conference on Micro and Nano Engineering (MNE2011).

[11]Micro-/Nano-fabrication of Crosslinked Poly(Lllactic acid) Using Electron Beam Nanoimprint Lithography (poster), S.Okubo, A.Kobayashi, T.Gowa, N.Nagasawa, M.Taguchi, A.Oshima, S.Tagawa, M.Washio: 37th International Conference on Micro and Nano Engineering (MNE2011).

[12]Characterization of Proton Exchange Membranes for PEFC Prepared by Heavy Ion Beam (poster), T. Yoshikawa, R.Tsuchida, S. Hiraiwa, T. Murakami, A. Oshima, Y. Hama, M. Washio: 12th Pacific Polymer Conference (PPC-12).

[13]Study on functionally graded PEMs fabricated by EB irradiation for direct methanol fuel cell (poster), R.Tsuchida, S.Hiraiwa, T.Yoshikawa, H.Fujita, T.Tatsumi,A.Oshima, M.Washio: 12th Pacific Polymer Conference (PPC-12).

[14]Development of Functionally Gradient Thin PEMs based on Cross-linked PTFE (poster), S.Hiraiwa, R.Tsuchida, H.Fujita, T.Yoshikawa, A.Oshima, M.Washio: 12th Pacific Polymer Conference (PPC-12).

[15]Evaluation of Al-doped ZnO top electrodes for PbLaZrTiOx capacitors. (poster), T.Tsuji, Y.Takada, N.Okamoto, T.Saito, K.Kondo, T.Yoshimura, N.Fujimura, A.Kitajima, A.Oshima: 2011 MRS Fall Meeting.

[16]Micro-Fabrication of Crosslinked Poly (tetrafluoroethylene) Using EB Nanoimprint Lithography (poster), A. Kobayashi, A. Oshima, S. Tagawa and M. Washio: TSRP-2012.

[17]Study on Fabrication of Functionalized Polymer with Patterned Nano-scale Silver Metal using Radiation Reduction Technique (poster), H. Tsubokura, R. Tsuchida, T. Tatsumi, T. G. Oyama, T. Murakami, A. Oshima, S. Tagawa, M. Washio: 33rd Australasian Polymer Symposium.

[18]10nm Resolution Electron Beam Lithography at 30keV Acceleration Voltage Using Hydrogen Silsesquioxane (HSQ) as a Negatibe Resist (poster), C.Q.Dine, A.Kitajima, A. Oshima, S.Tagawa: 7th Handai Nanoscience and Nanotechnology International Symposium.

[19]Characterization of Thin Yttrium Film Surfaces with Annealing (poster), A.Kitajima, Cong Que Dine, A. Oshima, S.Hasegawa: 7th Handai Nanoscience and Nanotechnology International Symposium.

Publications in Domestic Meetings

The Japan Society of Applied Physics	9 papers
The Society of Chemical Engineers	3 papers
Japanese Society of Radiation Chemistry	4 papers
Chemical Society of Japan	2 papers
Japan Radioisotope Association	3 papers
The Committee of Battery Technology	2 papers
The Physical Society of Japan	1 paper

Grant-in-Aid for Scientific Research

A. Oshima	Fabrication of high aspect multi-nanoarray electrodes using quantum beam	¥2,340,000

Comprehensive Analysis Center

Original Papers

[1]The Diels-Alder reaction of C60 and cyclopentadiene in mesoporous silica as a reaction medium, S. Minakata, T. Nagamachi, K. Nakayama, T. Suzuki and T. Tanaka: Chem. Commun., 47 (2011) 6338-6340.

International Conferences

[1]Ir catalyzed oxidative desymmetrization of diols (invited), T. Suzuki: 2nd Annual World Congress of Catalytic Asymmetric Synthesis (WCCAS-2011), August 9-11, 2011,Beijing, China.

[2]Oxidative Desymmetrization of Diols by Iridium Catalysts (poster), T. Suzuki、D. Zhou、K. Asano、H. Sasai: AIMECS11,29 Nov-2 Dec ,2011,Tokyo.

Review Papers

Organic Synthesis Involving Iridium-Catalyzed Oxidation, T. Suzuki, Chem. Rev., ACS, 111 (2011), 1825-1845.

Publications in Domestic Meetings

The 92th Annual Meeting of the Chemical Society of Japan	1 paper
The 132th Annual Meeting of the Pharmaceutical Society of Japan	1 paper
The 59th Annual Conference on Mass Spectrometry	2 papers
BMAS 2010	1 paper

Grant-in-Aid for Scientific Research

T. Suzuki	The Development of innovative organic reaction using hydrogen autotransfer process	¥2,340,000

Contribution to Research

T.Suzuki	Nitto Kasei Co. Ltd. Research Foundation	¥500,000

Reserch Laboratory for Quantum Beam Science

Original Papers

[1]Radical-induced degradation mechanism of perfluorinated polymer electrolyte membrane, R. Uegaki, Y. Akiyama, S. Tojo, Y. Honda, S. Nishijima: J. Power Sources, 196 (23) (2011) 9856-9861.

International Conferences

[1]Annihilation process of positron in degraded Nafion®-117 (oral), Y Honda, Y. Aoyagi, S Tojo, Y

Akiyama, Nishijima: 10th International workshop on Positron and Positronium chemistry,September 5-9, 2011,Slovakia.

Entrusted Research

Y.Honda	Development of PEFC Technologies aiming for Practical Application／Development of Technology for Next-Generation Fuel Cells,(H22-H23)	Development of A New Evaluation System of Polymer Electrolyte Membrane for Fuel Cell	¥9,987,000