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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.

【Organization】

Divisions	Departments
Division 1	
Information & Quantum Sciences	Quantum System Electronics
	Semiconductor Electronics
	Advanced Electron Devices
	Intelligent Media
	Reasoning for Intelligence
	Knowledge Systems
	Architecture for Intelligence

Divison 2

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

Division 3

Biological & Molecular Sciences	Molecular Excitation Chemistry
	Synthetic Organic Chemistry
	Regulatory Bioorganic Chemistry
	Organic Fine Chemicals
	Structural Molecular Biology
	Cell Membrane Biology
	Biomolecular Science and Engineering

Next Industry Generation	New Industrial Projection
	New Industry Generation Systems
	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	Laboratory of Cell Membrane Structural Biology

Alliance Laboratory	Department of 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

Nanotechnology Open Facilities

Comprehensive Analysis Center
Research Laboratory for Quantum Beam Science
Center for Research Education and Training
International Collaborative Research 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
Academia Industry Relations Office
Office of Information Network
Public Relations Office
Library
Planning Office
Facilities Management Office

Technical

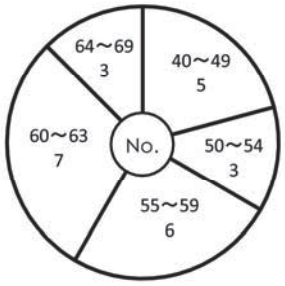
Machine Group
Measurement Group

Administrative Office

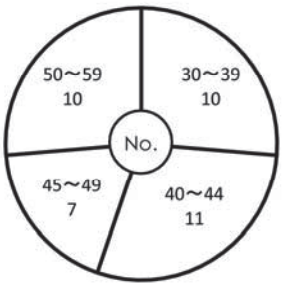
General Affairs Division
Research Cooperation Division

Staffs' Age (years old) –As of 3.31.2013

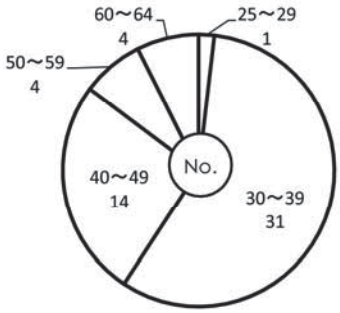
Professors



Associate Professors

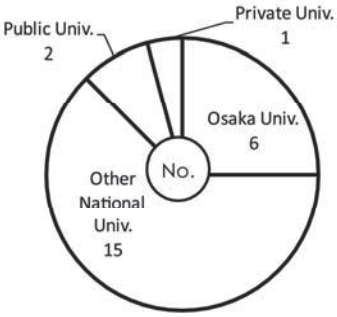


Assistant Professors

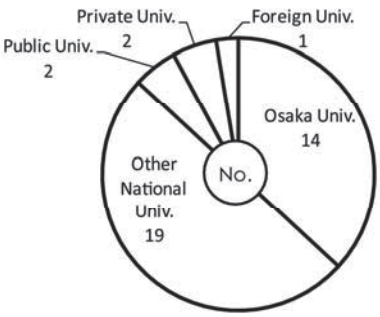


Staffs' Alma Master –As of 3.31.2013

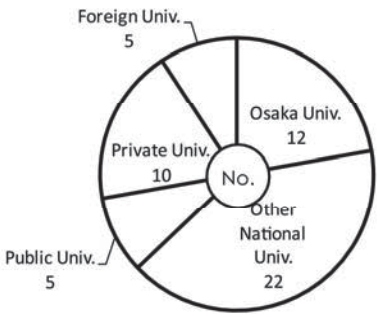
Professors



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. At Present, Professor Yasushi Yagi is a Director. .

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.

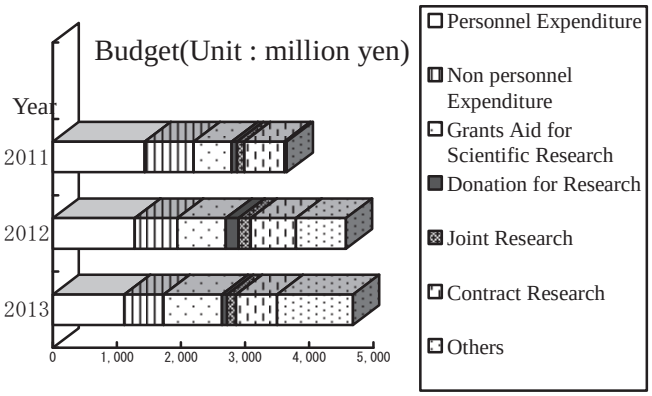
The new organization was highly evaluated, but with change of their structure to National University Agencies in April 2004, our management system needs reshaping. A Board of Directors under the Director has been formed, and Advisory Board has been

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 2013 is 906,812,000yen.



・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
2012	13, 340 (8)	36, 660 (18)	12, 400 (7)	5, 630 (7)

Division / Year	Special Projects	Others	Total
2012	12, 100 (6)	2, 000 (6)	82, 130 (52)

・Cooperative Researches and Contract Researches in the fiscal year 2013-2014 are as follows: Cooperative Researches are carried out with 54 organizations and the budget for the fiscal year 2013-2014 is 142,813,000 yen. The number of Contract Researches is 44 and the budget for the fiscal year 2013-2014 is 636,172,000 yen.

4) International Research

Department of	Callaghan	New Zealand	Carbon naotube humidity sensor

Semiconductor Electronics	Innovation		
	Purdue University	USA	Novel graphene device fabrication
Department of Intelligent Media	Peking University	China	Computer Vision
	Microsoft Research Asia	China	Computer Vision
	Drexel University	USA	Computer Vision
	University of Rajshahi	Bangladesh	Computer Vision
	University of Picardie Jules Verne	France	Computer Vision
Department of Reasoning for Intelligence	Monash University	Australia	Clustering and classification Methods based on Data Mass Density Estimation
	Joseph Fourier University	France	Abstraction Method of Smart Phone Log by Using Data Mining
	University of Helsinki	Finland	Estimation of causal orders in the presence of latent confouning variables
	Max Planck Institute	Germany	Machine Learning for Genome-Wide Association Study
	Joint Institute for Nuclear Research	Russia	Causal Analysis of Continuous Time Markov Process
	The Paul Scherrer Institute	Switzerland	Causal Analysis of Continuous Time Markov Process
	University of North Carolina at Chapel hill	USA	Estimation of causal orders by modeling individual differences
	University of Washington	USA	Algorithms with discrete convexity for machine learning
Department of Knowledge Science	LOA, ISTC-CNR, Italy	Italy	Ontology about artifacts and function
Department of Architecture for Intelligence	De La Sale University	Philippines	Empathic computing
	Carl von Ossietzky	Germany	Developing sustainable

	University Oldenburg		learning-based monitoring system
	Telecom ParisTech	France	Virtual agent
	Interuniversitair Micro-Electronica Centrum vzw (imec)	Belgium	Data mining from vital sensor
Department of Semiconductor Materials and Processes	Slovak Academy of Science	Slovakia	Development of solar cells with high efficiency by use of the surface structure chemical transfer method.
	Bilkent University	Turkey	Research on solar cells with high efficiency by use of the surface structure chemical transfer method.
Department of Advanced Interconnection Materials	Interuniversitair Micro-Electronica Centrum vzw (imec) /Holst Centre	Belgium/Net herlands	advanced interconect and electrode matrials
	NTNU: Norwegian University of Science and Technology	Norway	nanoindentation
Department of Excited Solid-State Dynamics	University College London	UK	Excited-state surface science
Department of Beam Materials Science	University of Sherbrooke	Canada	Monte-Carlo simulation study on radiolysis of high temperature and supercritical water
	Taiwan Semiconductor Manufacturing Company Limited	Taiwan	Electron beam resist characterizations
	Université Paris-Sud	France	Radiation-induced synthesis of metal nanoparticles in ethers THF and PGMEA
	University of	UK	Study on Combination of

	Birmingham		Top-down and Bottom-up Nano-fabrication
Department of Molecular Excitation Chemistry	Korea University	Korea	Advanced Materials Science
	POSTECH: Pohang University of Science and Technology	Korea	Photoresponsible Materials Science
Department of Synthetic Organic Chemistry	Bielefeld University	Germany	Enantioselective organocatalyzed aza-Morita-Baylis-Hillman-type domino reaction
	RWTH Aachen University	Germany	Intramolecular Rauhut-Currier reaction promoted by chiral acid-base organocatalysts
	University of Paris-Sud	France	Pd-SPRIX Catalyzed Reactions
	University de Bourgogne	France	Carbon-carbon Bond Forming Reaction Using a Bifunctional Asymmetric Catalyst
Department of Regulatory Bioorganic Chemistry	Academia Sinca	Taiwan	Development of trinucleotide repeat sensor
	Sick Kids Institute	Canada	The effect of small molecules on trinucleotide repeat expansion
Department of Organic Fine Chemicals	Max-Planck-Society & University of Marburg	Germany	A Semisynthetic Fusicoccane Stabilizes a Protein-Protein Interaction and Enhances the Expression of K+ Channels at the Cell Surface
	Max-Planck-Society & University Hospital Essen	Germany	Stabilization of Physical RAF/14-3-3 Interaction by Cotylenin A as Treatment Strategy for RAS Mutant Cancers
Department of Structural Molecular Biology	Palacký University	Czech Republic	Peptide Crosslinking Mechanism of Radical SAM Enzyme
Department of Cell	Children's Hospital	USA	Functional role of S1P transporter

Membrane Biology	Oakland Research Institute		SPNS2 in skeltal muscle cells
Department of Biomolecular Science and Engineering	Alberta University	Canada	Development of functional indicators
	Oxford University	UK	Development of functional iPS cells
	Indian Institute of Technology Madras	India	Spatiotemporal Ca2+ imaging during cellular slime mold development: A study with ultrasensitive genetically encoded indicators
Specially Appointed Laboratory	Konkuk University	Korea	Resarch and Development of Innovative Nano-biodevices, Based on Single-Molecule Analysis
Laboratory of Microbiology and Infectious Diseases	National Institute of Agronomic Research (INRA)	France	Bile-mediated activation of the multidrug efflux genes in Salmonella enterica
	University of Veterinary Medicine Hannover	Germany	Salmonella Typhimurium Multidrug Efflux Pumps and Triclosan Resistance
Laboratory of Atomic Scale Materials Processing	Interuniversitair Micro-Electronica Centrum vzw (imec)	Belgium	Nonvolatile memory device using Cellulose nanopaper
Department of Functional Nanomaterials and Nanodevices	University of Twente	Netherlands	Fabrivcation of 3DNano-cube for enery conversion
	IBM Research Laboratory	Switzerland	Obsevation of scanning thermal microscope for oxide nanostucutres
	Indian Institute of Technology, Hyderabard	India	Lead free ferroelectic thin film
	Ehwa Woman University	Korea	Obsevation of nano-doman by Kervn force microscopy
	Genova University	Italy	Functional Oxide-MEMS

Department of Nanocharacterization for Nanostructures and Functions	University of Notre Dame	USA	ETEM observation of nanomaterials under catalytic reaction conditions
	Utrecht University	Netherlands	Structural transformation of gold nanorods in gases
	Lawrence Berkeley National Laboratory	USA	High resolution TEM observations of Au nanoparticles supported on metal oxides catalysts
	FEI Company	USA	Development of a high resolution envirionmental TEM
Department of Theoretical Nanotechnology	Korea Institute of Ceramic Engineering and Technology	Korea	Research on ceramics materials
Department of Soft Nanomaterials	Indian Institute of Chemical Biology	India	Cheical Biology Applications of Organic Electron Acceptors
Department of Bio-Nanotechnology	Uppsala University	Sweden	Theoretical studies on DNA manipulations
Department of Bio-Nanotechnology	Rutgers University	USA	Theoretical studies on DNA manipulations
Comprehensive Analysis Center	Carnnegie Institution of Washington	USA	electron density analysis of SrTiO3
Research Laboratory for Quantum Beam Science	Bhabha Atomic Research Centre	India	Analysis of organic semiconductor film with positron

5) Symposia, Seminars, Workshops and Lectures

2013/4/5	Seminar on Computer Vision
2013/5/15	1st Printed Electronics Seminar
2013/5/20-22	The 69th Annual Meeting of Japanese Society of Microscopy
2013/5/22	SEMI Forum Japan 2013 Nanotechnology Platform Kansai
2013/5/23	Osaka University nano-consortium Workshop: Functional oxide nano-electronocs
2013/5/28	1st WBG Consorthium Meeting

2013/5/28-30	Asian Computational Materials Design Workshop
2013/5/29	Kick-off meeting for Topdown Projects
2013/6/16-19	International Workshop on Computational Nano-Materials Design on Green Energy
2013/7/11	The 1st Spying minority in biological phenomena Workshop
2013/7/22-26	Nanotechnology Platform Traing Program for Students in 2013
2013/7/28-8/10	The 1st Spying minority in biological phenomena Training Courses
2013/7/31	2nd Printed Electronics Seminar
2013/8/30-31	2013 Interim report meeting of Funding Program for World-Leading Innovative R&D on Science and Technology
2013/9/2~6	23rd Computational Materials Design Workshop
2013/9/17-18	Mie Universisty - Osaka University Joint Meeting
2013/10/10	3rd Printed Electronics Seminar
2013/10/11	2nd WBG　Consorthium Meeting
2013/10/21-22	Technnologies for Medical Diagnosis and Therapy
2013/11/13	Osaka University nano-consortiumWorkshop: Functional oxide nano-electronocs
2013/11/15	69th Symposium on a special topic and subsequent conference for presenting results of research activities made by the members of the Institute
2013/11/21	Japan-Korea Join Seminar on Material Researches
2013/11/21-22	International Symposium on Single Biomolecule Analysis 2013
2013/11/24-27	9th Korea-Japan Symposium on Frontier Photoscience 2013
2013/12/4-6	Asian Computational Materials Design Workshop
2013/12/17	Joint symposium of "Spying minority in biological phenomena" and "Bio Assembler"
2013/12/17	Workshop of accelerator and applications
2013/12/26-27	ISIR Intra-University Collaboration Meeting
2014/1/9-10	Workshop of high brightness and rf electron gun
2014/1/14	3rd WBG　Consorthium Meeting
2014/1/20	One Day Workshop on Chemical Reactions at Surfaces and Interfaces
2014/1/21-22	The 17th SANKEN International Symposium joined with The 2nd International Symposium of Nano-Macro Materials, Devices, and System Research Alliance Project
2014/1/24	New development of reaction science and materials science by

	single-molecule, single-particle fluorescence imaging
2014/1/25	New development of reaction science and materials science by laser flash photolysis and pulse radiolysis
2014/1/31	New development of Photoresponsible Materials Chemistry
2014/1/31	Symposium:" The Frontline of Nanobio device Research"
2014/2/3-4	1st KANSAI Nanoscience and Nanotechnology International Symposium 9th Handai Nanoscience and Nanotechnology International Symposium 12th SANKEN Nanotechnology Symposium
2014/2/6	4th Printed Electronics Seminar
2014/2/7-8	Pioneer workshop 2014 on nanopore and nanofluidics -Physics and application as Biodevices
2014/2/13-14	Lead-free packaging for spacecraft devices
2014/2/14-16	Asian Computational Materials Design Workshop
2014/2/24-26	24th Computational Materials Design Workshop
2014/2/25-26	Molecule & Material Synthesis Platform School of Nanotechnology Open Facilities in Osaka University
2014/2/27-28	5th Young Researcher Seminar
2014/2/28	KAERI-Osaka University Joint Workshop on Beam Science
2014/3/3	Workshop of materials, process and systems for bio device
2014/3/7～8	2013 Year-end report meeting of Funding Program for World-Leading Innovative R&D on Science and Technology
2014/3/14	Imaging and Sensing Biomolecular Function and Assembly
2014/3/29	Japan Chemical Society Symposium on Photochemistry

Other Lectures and Seminars

2012/4/4	David W.L. Cheung	Department of Computer Science, Hong Kong University	Professor	Security Protection and Integrity Verification for Frequent Itemset Mining
2013/4/1	Mikihiro Shibata	Max Planck Florida Institute for Neuroscience	Post-doctoral Researcher	Direct observation of cultured hippocampal neurons by high-speed atomic force microscopy.

2013/4/4	Daniela Nicklas	Carl von Ossietzky University Oldenburg	Junior Professor	Challenges for dynamic data management: complex events and data streams
2013/4/9	Prof. Robert Hudson	University of Western Ontario	Professor	Expanding the Nucleic Acid Chemist's Toolbox: New Fluorescent Cytidine Analogues
2013/4/23	Fu-Jen Kao	National Yang-Ming University	professor	Stimulated emission based fluorescene detection and lifetime imaging
2013/4/23	Hiroaki Suga	The University of Tokyo	professor	An Encouragement of Nonstandard peptide probes
2014/4/25	Syuji Hisaeda	PerkinElmer Informatics	marketing manager	ChemBioOffice Seminar
2013/5/13	Hiroshi Nikaido	University of California, Berkeley	Professor	Influx and Efflux of Drugs across E. coli Cell Envelope
2013/5/24	Masakazu Agetsuma	Kavli Institute for Brain Science	post-doctoral researcher	Functional contribution of different inhibitory interneuron subtypes to cortical network synchrony.
2013/5/30	Kazuhisa Sato	Tohoku University	Associate Professor	Necessity for Material Strength Study and Information Science in a Solid Battery
2013/5/30	Jeffrey N. Johnston	Vanderbilt University	Professor	Reagent and Reaction Development in the Service of Complex Target Synthesis: Chiral Proton Catalysis, Umpolung Amide Synthesis, and Case Studies in Therapeutic Development
2013/6/2	Do Hyun Ryu	Sungkyunkwan University	Associate Professor	Catalytic Enantioselective Carbon-Carbon Bond Formations with Diazoesters

2013/6/11	Marcel Mayor	University of Basel	Professor	Molecular Electronics: from single molecules to novel integration
2013/7/8	Junsong Yuan	Nanyang Technological University	Assistant Professor	Anomaly Detection in Surveillance Videos
2013/7/17	Shiro Tsukamoto	Anan National College of Technology	Professor	Development of green chemical catalyst supported on S-terminated GaN(0001)
2013/7/19	Pier Giorgio Cozzi	University of Bologna	Associate Professor	Lewis acids Catalyzed Friedel-Crafts Reactions with Ferrocene Alcohols: From Quantum Cellular Automata to new Effective Organocatalysts
2013/7/25	Zhiliang Zhang, Jiangying He	Norwegian University of Science and Technology	Professor	Introduction to Nanomechanics
2013/9/4	Novi Quadrianto	University of Cambridge	Post Doctoral Fellow	GPstruct: Bayesian non-parametric structured prediction model
2013/9/27	Daniele Marre	CNR-SPIN and University of Genova	Seinor Researcher	All-oxide microelectromechanical systems and oxide devices
2013/10/3	Patik Palit	Bhabha Atomic Research Centre	Professor	Ultrafast Dynamics of the Excited States Using Femtosecond Time-Resolved Spectroscopy
2013/11/18	Jaichan Lee	Sungkyunkwan University	Professor	Transition Metal Oxide Superlattices
2013/11/28	Roman Nowak	Aalto University	Professor	Scientific voyage in nanoindentation research
2013/11/28	Zhiquan Liu	Institute of Metal Research, Chinese academy of sciences	Professor	Introduction to TEM.1

2013/11/29	Yuji Morita	Aichi Gakuin University	Associate Professor	Efflux pump related with aminoglycoside resistance of Psuedomonas aeruginosa
2013/12/6	Gayo Diallo	University of Bordeaux Segalen	Associate Professor	Large scale ontology matching with ServOMap
2013/12/9	Michael Kahn	University of Southern California	professor	A Fundamental Switch in Stem Cells and Progenitors; A Tale of Two Coactivators
2013/12/16	Ryouji Asahi	Toyota Central R&D Labs., Inc.	Division Manager	Functional Materials Design1: Optical Materials
2013/12/24	Zhiquan Liu	Institute of Metal Research, Chinese academy of sciences	Professor	Introduction to TEM.2
2014/1/9	Aixin Yan	University of Hong Kong	Assistant Professor	Lability and Liability of Copper Pools in Bacteria --- role of the CusCBA copper efflux system
2014/1/16	Jianrong (Steve) Zhou	Nanyang Technological University	Assistant Professor	Exploration of Palladium-Catalyzed Reactions
2014/1/16	Ryouji Asahi	Toyota Central R&D Labs., Inc.	Division Manager	Functional Materials Design 2: Alloy Material and Methodological Developments
2014/1/22	Jérôme Lacour	University of Geneva	Professor	Cationic helicenes: novel synthetic approaches and extended applications"
2014/1/28	Zhiquan Liu	Institute of Metal Research, Chinese academy of sciences	Professor	Introduction to TEM.2
2014/2/2-3	Sefik Suzer	Bilkent University	professor	XPS for chemicl- and charge- senitive analysis of surface science
2014/2/12	Diane Cabelli	Brookhaven National Laboratory	Chemist	Manganese Chemistry and Reactive Oxygen Species - Radiation Chemistry Studies

2014/2/26	Masao Yamagishi	Tokyo Institute of Technology	Assistant Professor	Convex Optimization for Signal Processing
2014/2/26	Steven DeFeyter	KU Leuven – University of Leuven	Professor	Nanopatterning of graphite and graphene at the solution-solid interface via molecular self-assembly: from fundamentals to applications
2014/2/27	Toshiyuki Kawaharamura	Kochi University of Technology	Assoc. Prof.	Development of functional thin-film deposition method under ambient conditions
2014/2/27	Nobuyuki Zettu	Shinshu University	Assoc. Prof.	Development of ion rechargeable battery with a high-quality molecular crystals fabricated using a flux method
2014/2/27	Shintarou Fujii	Tokyo Institute of Technology	Assis. Prof.	Electronic states of defects in graphene
2014/2/27	Yoshimichi Nakamura	Hachinohe National College of Technology	Assoc. Prof.	Large scale computation of nanomaterials
2014/2/27	Ken-ichi Nakayama	Yamagata University	Assoc. Prof.	Vertical organic transistor devices for high-circuit applications
2014/2/27	Yong-Jin Pu	Yamagata University	Assoc. Prof.	Multi-layered structure for highly-efficient organic electroluminescent devices
2014/2/28	Chang Ho Oh	Hyangyan University	Professor	Gold-Catalyzed Dual Activation of Propargylic Carboxylates
2014/2/28	Susumu Yanagisawa	University of the Ryukyus	Assis. Prof.	Effects of inter-molecular interactions on electroni structure of molecular crystals

2014/2/28	Genki Konayashi	National Institutes of Natural Sciences, Institue for Molecular Science	Specially Appointed Assoc. Prof.	Effects of surface functionalization with oxides on the performance of lithium-rich cathode materials
2014/2/28	Katsutoshi Kobayashi	Nagoya University	Assis. Prof.	Hydrothermal synthesis of ceria nanocrystals and nanocomposites
2014/3/12	Anca Ralescu	University of Cincinnati	Professor	The Silhouette Index for Cluster Validity and Applications
2014/3/24	Hirotomo Nishihara	Tohoku University	associate professor	Charge-discharge charctersitics of Li ion batteries with Si-based anodes and the improvement

7) Public Information Activity

Public information activity of ISIR in 2013 is as follows:

- Bulletin of ISIR 2013 (in both Japanese and English)
- Memoirs of the Institute of Scientific and Industrial Research, Osaka University Vol.70 2013 (in English)
- Annual Report of ISIR (in Japanese)
- SANKEN News Letters, 49-51(in Japanese)
- Report on SANKEN Techno Salon 2013 (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 2013 is 374**.** The details are described in the part of activity of divisions and facilities.

9) Scientific Awards

K.Kaihatsu	Chemical Society of Japan Lecture Award	2013/4/10
Y.Ando	The 17th superconductivity Science and Technology Award	2013/4/16

K.Segawa S.Sasaki	(Forum of Superconductivity Science and Technology, The Society of Non-Traditional Technology)	
Y.Yagi Y.Mukaigawa K.Tanaka	IEEE International Conference on Computational Photography(ICCP2013) Honorable Mention	2013/4/20
K.Nagai	The21st Kihara Memorial Foundation Award for Applied Science	2013/5/15
H.Yoshida	The Japanese Society of Microscopy Encouragement Award	2013/5/21
Y.Yagi Y.Mukaigawa	IAPR International Conference on Machine Vision Applications 2013(MVA2013）Best Poster Award	2013/5/22
K.Kaihatsu	CHEMINAS（Chemistry and Micro－Nano Systems）Poster Award	2013/5/24
Y.Yamazaki	Commendation for honor students from Ono Scholarship Foundation	2013/5/29
Y.Yagi	IPSJ Transactions on Computer Vision and Applications Outstanding Paper Award 2012	2013/6/5
Y.Kitamura	The Japanese Society for Artificial Intelligence (JSAI) Best Paper Award	2013/6/6
Y.Kitamura M.Numao K.Fukui	The Japanese Society for Artificial Intelligence (JSAI) Incentive Award	2013/6/6
M.Taniguchi	2012 KAO Research Initiative Award (The Kao Foundation for Arts and Sciences)	2013/6/13
M.Taniguchi	German Innovation Award「Gottfried Wagener Prize 2013」1st Prize	2013/6/18
F.Takei	The Society of Japanese Women Scientists Encouragement Award	2013/6/30
H.Sasaki S.Takizawa L. Fan	25th International Symposium on Chirality(ISCD-25) Bio Tools Poster Award	2013/7/8
Y.Yagi Y.Makihara D.Muramatsu	The 16th Meeting on Image Recognition and Understanding (MIRU2013) Demonstration presentation award	2013/8/1
Y.Yagi Y.Mukaigawa	The 16th Meeting on Image Recognition and Understanding Award Review Committee（MIRU） Frontier Award	2013/8/1

M. A.Mannan S.Tagawa C.Inoshita		
K.Kawase	Oral Presentation Award, The 10th Annual Meeting of Particle Accelerator Society of Japan	2013/8/5
T.Washio	Japan Society for Simulation Technology　Outstanding Presentation Award	2013/9/13
K.Fujiwara	The Japan Society of Applied Physics(JSAP) Young Scientist Oral Presentation Award	2013/9/16
Thi Thi Nge	ICSE 2013 The Best Presentation Award	2013/9/23
T.Toigawa	56th Meeting of Japanese Society of Radiation Chemistry, Best Poster Award	2013/9/29
M.Tane	MEXT“Grant-in-Aid for Scientific Research on Innovative Areas”　Materials Science on Synchronized LPSO Structure -Innovative Development to Next-generation Lightweight-structural Materials-, Best Presentation Award	2013/9/30
K.Fujiwara	The Japan Society of Applied Physics, Kansai Chapter Poster Award	2013/10/9
H.Sasai S.Takizawa Y.Yoshida A. Fernando	SOC Hokuriku Seminar Best Poster Award	2013/10/25
Novak Mario	Excellent poster presentation at International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries	2013/10/26
T.Majima M.Fujitsuka	BCSJ Award Article	2013/11/15
K.Nagashima	Osaka Science & Technology Center 2nd Nature Industry Award Special Award	2013/11/20
K.Nagashima	2nd NF Foundation R&D Encouragement Award	2013/11/28
H. Yuhui	Osaka Mayor's Prize, Excellent Paper Award	2013/12/3
K.Fujiwara	Materials Research Society Best Poster Award	2013/12/4
Y.Ando	The 30th Inoue Prize for Science	2013/12/10
Thi Thi Nge M.Nogi	2013 ICFPE Best Paper Award	2013/12/10

K.Suganuma		
Y.Matsushita	The 14 th SICE System Integration Division Annual Conference, Outstanding Presentation Award	2013/12/20
K.Nagai	The 10th JSPS Prize	2014/2/10
S.Yamasaki	JSPS IKUSHI PRIZE	2014/2/24
H.Koga	Research Award for Young Scientists of The Japan Institute of Electronics Packaging	2014/3/6
K.Kozaki	Liked Open Data Challenge 2013, Application Track 2nd Prize	2014/3/7
K.Kozaki	Open Data Application Contest, Technology Award	2014/3/13
H.Tanaka A.Hattori K.Fujiwara Naguyen Thi Van Anh	The 4th International Symposium on Terahertz Nanoscience Best Presentation Award	2014/3/14
I.Nozawa	Atomic Energy Society of Japan Outstanding Presentation Award	2014/3/26
Y.Yagi Y.Makihara D.Muramatsu	IAPR Best Paper Award	2014/3/27
S.Yamasaki	Japanese Society for Bacteriology Outstanding Performance Award	2014/3/28

2. Education

ISIR accepts graduate students 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, 2014 is as follows.

Field / Course	Science	Engineering	Engineering Science	Pharma-ceutical Science	Information Science and Technology	Frontier Biosciences	Total
Master Course	38	39	18	1	14	-	110
Doctor Course	25	22	5	1	10	5	68
Total	63	61	23	2	24	5	178

Number of students who had obtained Master's or Doctor's Degree in 2014 is as follows.

Field / Degree	Science	Engineering	Pharma-ceutical Science	Information Science and Technology	Frontier Biosciences	Total
Master Degree	15	25	1	5	-	46
Doctor Degree	7	4	0	1	0	12
Total	22	29	1	6	0	58

3. International Exchange

1) Exchange Agreement

At Present, academic exchange agreements are concluded with the following 27 organizations.

○Faculty of Natural Science, Otto-von-Gueriche University Magdeburg (Germany)
○Pukyong National University,Basic Science Research Institute(Korea)
○Forschungszentrum Jülich GmbH (Germany)
○University College London (U.K.)
○College of Natural Sciences, Pusan National University (Korea)
○Research Institute of Industrial Science, Hanyang University (Korea)
○College of Science, National Taiwan University (Taiwan)
○Centre National de la Researche scientifique : CNRS (France)
○Rwth Aachen University (Germany)
○College of Natural Science, Chungnam National University (Korea)
○Peking University,The School of Electronics Engineering and Computer Science (China)
○College of Science, National Taiwan Normal University (Taiwan)

○Faculty of Science, University of Geneva (Switzerland)
○Inner Mongolia Normal University (China)
○College of Science and Technology, Korea University (Korea)
○Department of Physics, Indian Institute of Technology Delhi (India)
○University of Augsburg(Germany)
○Kyungwon University ,Gachon Bionano Research Institute(Korea)
○College of Computer Studies, De La Salle University (Philippine)
○School of Environmental Science and Engineering/Department of Chemical Engineering, Pohang University of Science and Technology(Korea)
○Department of Chemistry, Korea Advanced Institute Science and Technology (Korea)
○Faculty of Science, Assiut University(Egypt)
○Interuniversity Micro Electronics Center (Belgium)
○University of Bordeaux 1(France)
○Faculty of Chemistry, Bielefeld University(Germany)
○The Biotechnology Institute, University of Minnesota(U.S.A)
○Korea Institute of Ceramic Engineering and Technology(Korea)

2) Foreign Researchers and Students

Number of foreign researchers and students staying in ISIR as of March 31, 2014 is 83 in total. Details are, Assistant Professor(include of specially appointed staffs) (6), Specially Appointed Associate Professor(1), Specially Appointed Researcher(14), Part-time Employee (15), Graduate Students (38: Doctor Course,26, Master Course,12), Special Research Students (2), Research Students (6).

Their nationalities are; China(30), Korea(9), India(8), Thailand(5), Indonesia(4), Bangladesh(3), France(3), Viet Nam(3), Russia(3), Taiwan(2), Philippine(2), Mexico(2), Malaysia (2), Egypt(2), U.S.A.(1), Costa Rica(1), Croatia(1),Turkey(1),Myanmar (1).

Number of Foreign visitors in 2013 is 80.Their nationalities are; U.S.A.(15), China(11), Korea(6), Germany(4), Belgium(4), France(3), Italia(3), India(8), Switzerland(2),Singapore(2),Thailand(2),Taiwan(1),Turkey(1),Canada(1),England(1), Croatia(1),Norway(1), Finland(1), Philippine(1)

3) International Conferences and Symposiums

Number of presentations (plenary, invited, oral and poster in various international conferences and symposia) by staff of ISIR is 507 in total.

Number of ISIR staffs who have been working as committee members of International Conferences or Editorial Board of international academic journals are 138

in total. For more details, see the part of activity of divisions and facilities.

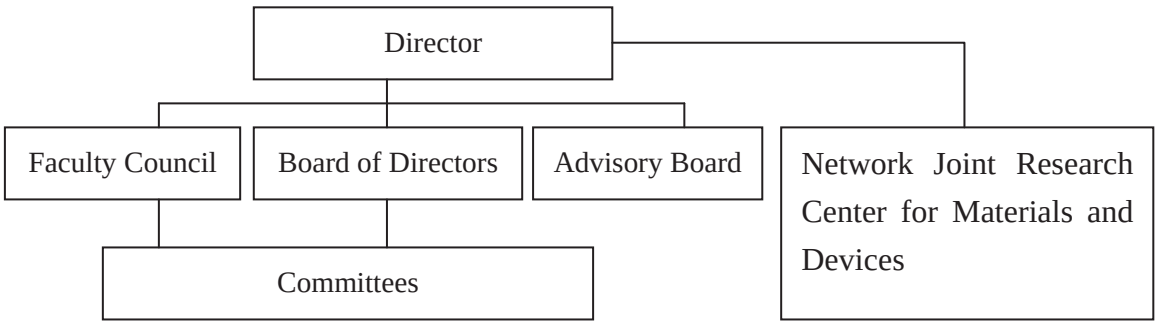
4. Concluding Remarks

(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 Nanoscience and Nanotechnology Center started in April 2002. In addition, the total repair of the old buildings into the earthquake-resistant structures has been completed in 2010. A new building named "SANKEN Incubation Building" has been completed in 2010 for open innovation by academia-industry collaboration.

(3) Education

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

ISIR has 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) 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 Center for Collaborative Research Education and Training was started for promoting the foreign exchange. It 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/index_e.html). 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

Outlines

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 an application system based on a disease ontology published as Linked Data
- 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 Quantum System Electronics

Associate Professor: Shigehiko HASEGAWA
Assistant Professor: Shuichi EMURA
Assistant Professor: Yi-Kai ZHOU
Graduate Students: Sota SANO, Akihiro YAMAGUCHI, Takahito MORI
Undergraduate Student: Shota YAMAUCHI

Outlines

The department of Quantum System Electronics makes research on materials engineering, mainly semiconductors and related materials, toward fabrication of novel photonic devices, electronic devices, and spintronic devices. Materials design, materials synthesis (crystal growth) and processing, materials characterization, and device application, these four elements form the pillars of our materials research approach. Molecular beam epitaxy is main technology used in materials synthesis to enable the fabrication of a wide variety of compositionally modulated materials as well as the synthesis of visionary materials in thermal equilibrium states. Electron diffraction, X-ray diffraction, STM, EXAFS and Raman scattering are carried out for materials characterization and structure investigation, photoluminescence and optical absorption for optical characterization, Hall measurement for electrical characterization, and SQUID and alternating gradient magnetometers for magnetic characterization. In device application, basic researches on photonic devices, electronic devices, and spintronic devices are conducted.

Current Research Projects

1. Crystal Growth and Properties of Diluted Magnetic Semiconductors

Diluted magnetic semiconductors are gathering great interest as a candidate for new functional materials. Nitride-based magnetic semiconductors such as GaCrN and GaGdN have been grown using by radio-frequency plasma-assisted molecular beam epitaxy (PA-MBE). It was reported that these materials showed hysteresis loops in their magnetization curves, which are characteristic to ferromagnetism, even at room temperature. In addition, tunnel magnetoresistance effect was observed for GaCrN/AlN/GaCrN tunnel diodes. For GaGdN, it was found that GaGdN films with high Gd concentration were still coherently grown on GaN. With increasing the Gd concentration, the c-axis lattice parameter in GaGdN increased linearly. Moreover, an ordered phase with a quadruple-periodicity along the [001] direction in the wurtzite structure was found to be formed throughout the films. In 2013, growth parameter

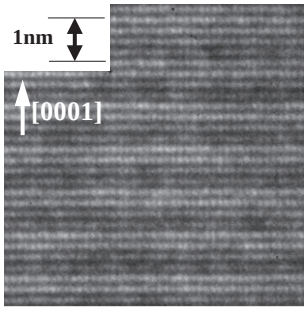


Fig. 1. High-resolution cross-sectional TEM image for a GaGdN film coherently grown on GaN. A modulated structure with a quadruple-periodicity along the [0001] direction in the wurtzite structure is formed.

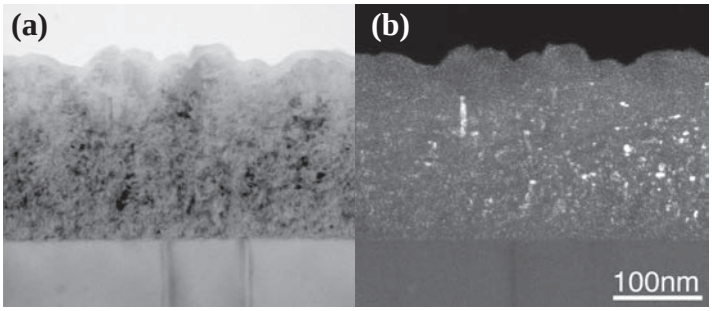


Fig. 2. Cross-sectional TEM images for Gd-doped GaN grown under a Ga flux less than the stoichiometric V/III ratio of GaN growth. (a) Bright field image. (b) Dark field image.

dependence of highly Gd-doped GaN films was investigated in detail. It was found that under Ga fluxes beyond the stoichiometric V/III ratio of GaN growth, GaGdN films were coherently grown as mentioned above. On the other hand, for Ga fluxes less than the stoichiometric V/III ratio of GaN growth, nano-scaled particles were segregated in the GaN matrix. The film showed a ferromagnetic behaviour below 70 K.

2. Spin Injection from Ferromagnets into III-Nitride Semiconductors and Nanoscaled Characterization of Their Magnetic Properties

Spin injection from ferromagnets into III-Nitride semiconductors and 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). SP-STM was used to investigate surface morphologies and current-voltage (*I*-*V*) characteristics of Fe and Co islands epitaxially grown on GaN. It was found that tunnel magnetoresistance (MR) images of Fe islands derived from the *I*-*V* characteristics reflected the direction of their magnetization. Based on the findings, we demonstrated spin injection and detection in a four-terminal nonlocal configuration for the device with Co/GaN junctions at RT (see Fig. 3). Positive MR effect in the four-terminal (4T) nonlocal configuration was observed at RT while negative MR effect did in the local configuration. This indicates that spin injection and detection in the device with Co/GaN interfaces are successfully performed. Since 2012, we have investigated structural and magnetic properties of Fe_4N grown on GaN as one of promising novel materials for ferromagnetic electrodes to GaN. In 2013, we examined growth parameter dependence of γ'-Fe_4N growth on GaN by using PA-MBE toward the fabrication of four-terminal devices with γ'-Fe_4N/GaN junctions.

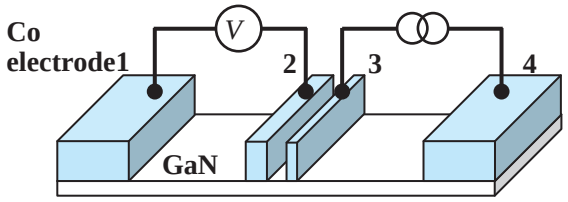


Fig. 3. Schematic drawing for four-terminal devices with Co/GaN junctions for observing MR effect in local/nonlocal configurations.

3. XAFS Characterization of New Functional Materials

XAFS and XANES are spectroscopy-based new characterization techniques 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, has been characterized and it was showed that the Gd (Cr) atoms substitutionally occupy the group III sites. In 2012 – 2013, GaGdN/AlGaN and GaDyN/AlGaN multi-quantum well (MQW) structures and the MQW in rod form, so-called quantum disk, including Gd or Dy are vigorously examined on the coordination of Gd (Dy) by the XAFS and XANES method. As the new results, i) we found the gettering effect in the GaDyN/AlGaN MQW structures. The doped ion Dy is favorable to gather at the interfaces of GaDyN and AlGaN. ii) A vacancy of nitrogen ion adjacent to the Gd or Dy ion was found from the analysis of XANES spectrum. The simulation of the XAFS spectra around the Gd L_{III}-edge indicates the nitrogen vacancy at the one of the three equivalent legs. This effort opens the new technique to identify the vacancy and to decide the coordination environment of the vacancy. The first-principle calculation involving the structure dynamics by the collaborative investigation with associate Prof. Shirai (This Institute) gave the completely same results. Now, we push forward elaboration and generalization in this technology more.

Department of Semiconductor Electronics

Professor: Kazuhiko MATSUMOTO
Associate Professors: Koichi INOUE, Kenzo MAEHASHI
Specially Appointed Associate Professor: Yasuhide OHNO
Assistant Professor: Yasushi KANAI (2013.8.1-)
Guest Researcher: Masato MIYAKE
Graduate Students: Yusuke YAMASHIRO, Takashi IKUTA, Keisuke KOSHIDA
Nursakinah Binti Mohd Zaifuddin, Takeshi OE
Kohei SEIKE, Masatoshi NAKAMURA
Under Graduate Students: Yusuke ISHIBASHI, Masayuki OKANO
Supporting Staff: Reiko YAMAUCHI

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

Position-Controlled Direct Graphene Synthesis on Silicon Oxide Surfaces Using Laser Irradiation

We have demonstrated a simple method of directly synthesizing graphene on dielectric surfaces using laser irradiation without a carbon source gas. The position of the graphene synthesis was precisely controlled. Moreover, channels were formed during graphene synthesis by scanning the laser beam across the substrate. The resulting device showed typical ambipolar transport behavior, which indicates that

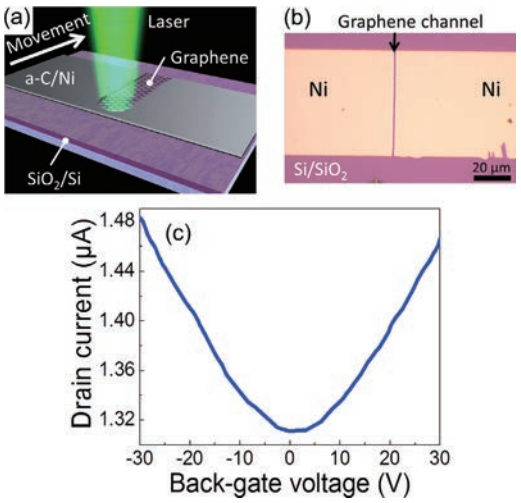


Fig. 1. (a) Schematic of graphene-channel formation by scanning the laser beam, (b) optical image of the device and (c) transfer characteristics of the device

the channel consisted of graphene and that the device acted as a field-effect transistor (FET). Our laser irradiation technique does not require transfer processes and carbon source gases, and is a promising method for graphene synthesis and fabricating graphene FETs.

Direct Electrical Detection of DNA Hybridization Based on Electrolyte-Gated Graphene FETs

DNA hybridization was electrically detected by graphene FETs. Probe DNA was modified on the graphene channel by a pyrenebased linker material. The drain current was changed by the full-complementary (FC) DNA while no current change was observed after adding non-complementary (NC) DNA, indicating that the graphene FET detected the DNA hybridization. In addition, the number of DNAs was estimated by the simple plate capacitor model. These results will help to pave the way for future biosensing applications based on graphene FETs.

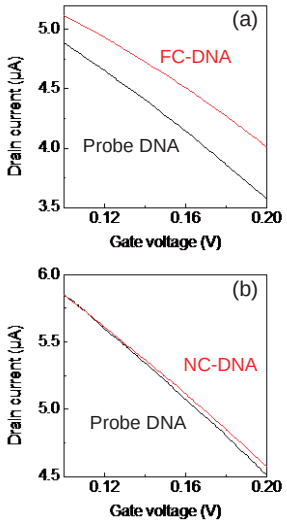


Fig. 2. Transfer characteristics of a probe-DNA-modified graphene FET before and after (a) FC DNA and (b) NC DNA added.

Electric-field-induced band gap of bilayer graphene in ionic liquid

Ionic liquid-gated graphene FETs were fabricated to generate a band gap in bilayer graphene. The transfer characteristics of the graphene FETs revealed that the transconductance when using the ionic-liquid gate was significantly higher than that when using the back gate, because an electrical double layer formed in the ionic liquid with 200-fold the capacitance of a 300-nm-thick SiO_2 layer. The results indicate that the ionic-liquid-gate structure enables application of an effective electric field. Moreover, an increase in the resistance of the bilayer graphene was clearly observed as the magnitude of the electric-field intensity was increased, owing to the creation of the band gap. From measurements of electrical characteristics as a function of temperature, a band gap of 235 meV was created in bilayer graphene at an ionic-liquid-gate voltage of -3.0 V.

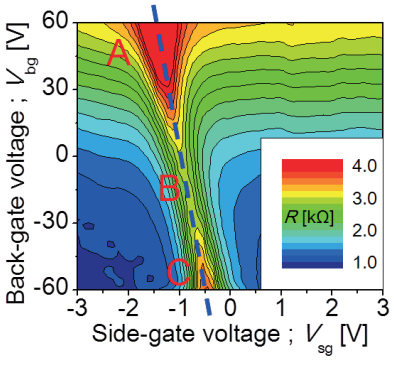


Fig. 3. Resistance contour plots as a function of the back- and side-gate voltage in bilayer.

Department of Advanced Electron Devices

Associate Professor: Koichi SUDOH, Toshihiro OKAMOTO
Assistant Professor: Takafumi UEMURA
Graduate Students: Junto TSURUMI, Guangyu CHI

Outlines

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

Current Research Projects

Void Structure Formation in Si Substrates by Surface-Diffusion-Driven Evolution

Silicon-on-nothing (SON) structures are formed in Si substrates through by surface-diffusion-driven shape evolution of high-aspect-ratio hole patterns. We have clarified the mechanism of the SON formation by experiment and simulations based on continuum theory for surface-diffusion-driven evolution (Fig. 1). We have found that the number of void layer can be controlled by the aspect-ratio of holes. We have also demonstrated that nano-membranes of single-crystal Si can be fabricated by etching of the top Si layer in the SON structures (Fig. 2).

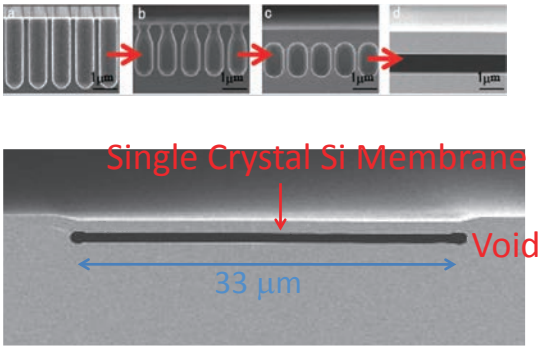


Fig.1 Void formation by surface-diffusion-driven evolution of hole patterns on Si(001) substrates.

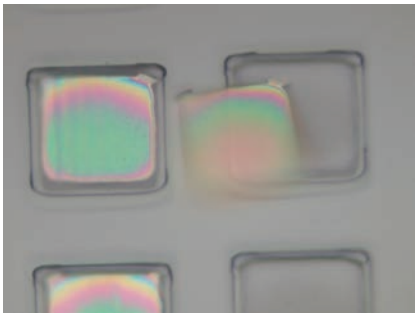


Fig.2 Fabrication of single-crystal Si nano-membranes using silicon-on-nothing structures.

Department of Intelligent Media

Professor:	Yasushi YAGI
Associate Professor:	Yasuhiro MUKAIGAWA (2013.4.1-2014.1.31)
Assistant Professor:	Yasushi MAKIHARA, Ikuhisa MITSUGAMI
Specially Appointed Associate Professor:	Junqiu WANG (2014.1.1-2014.2.28)
Specially Appointed Lecturer:	Daigo MURAMATSU
Specially Appointed Assistant Professor:	Junqiu WANG (2013.4.1-2013.12.31)
	Al Mansur
Postdoctoral Researcher:	Trung Thanh NGO (2013.4.1-2014.3.31)
	Mitsuru NAKAZAWA
	Md. Abdul MANNAN (2013.4.1-2014.1.31)
	Rasyid AQMAR, Masataka NIWA (2013.4.1-)
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	Makiko FUJIMOTO (2013.4.1-2014.10.15)
Supporting Staff:	Aya IIYAMA, Yoko IRIE
	Yshiko MATSUMOTO (2013.4.1-2014.3.31)
	Yoshimi OHKOHCHI, Mika IGUCHI

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

Full-dimensional Sampling and Analysis of BSSRDF

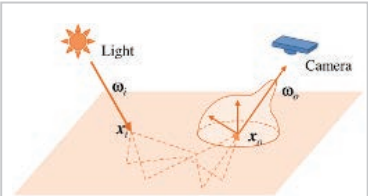


Fig.1 BSSRDF

Full-dimensional (8-D) BSSRDF completely expresses the various light interactions on object surface such as reflection and subsurface scattering. However, it is difficult to sample full-dimensional BSSRDF because it requires a lot of illuminations and observations from every direction. There are many researches which approximated BSSRDF as a low-dimensional function by only considering the medium as homogeneous or assuming isotropic scattering. Therefore, in this paper, we show a novel sampling and analyzing method for full-dimensional BSSRDF in real scenes. We sample this full-dimensional BSSRDF using a polyhedral mirror system to place a lot of virtual cameras and projectors. In addition, we propose a method of decomposition of BSSRDF into isotropic and anisotropic components for scattering analysis.

Descattering of Transmissive Observation using Parallel High-frequency Illumination

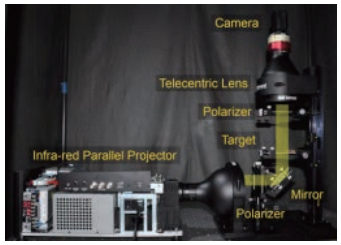


Fig.2 Measurement system

The inner structures of an object can be measured by capturing transmissive images. However, the recorded images of a translucent object tend to be unclear due to strong scattering of light inside the object. In this paper, we propose a descattering approach based on Parallel High- frequency Illumination. We show in this paper that the original high-frequency illumination method and the various ex- tended techniques can be uniformly defined as a separation of overlapped and non-overlapped light rays. Also, we show that transmissive light rays do not overlap each other by constructing a parallel projection/measurement system for performing both illumination and observation. We have developed a measurement system that consists of a camera and projector with telecentric lenses and have evaluated descattering effects by extracting transmissive light rays.

Gait Verification System for Criminal Investigation

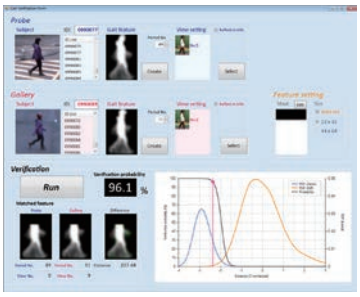


Fig.3 Gait Verification System

We developed the first gait verification system for criminal investigation using footages from surveillance cameras. The system is designed so that the criminal investigators as non-specialists on computer vision-based gait verification can, independently, use it to verify unknown perpetrators as suspects or ex-convicts in criminal investigations. Each step of the gait verification process is proceeded by interactive operation on a graphics-user interface. Eventually, for each pair of compared subjects selected by a user, the system outputs a posterior probability on a verification result, which indicates that compared subjects are the same, with the consideration of various circumstances of the subjects such as the size, frame-rate, observation views, and clothing of subjects.

Department of Reasoning for Intelligence

Professor: Takashi WASHIO
Associate Professors: Shohei SHIMIZU, Yoshinobu KAWAHARA
Specially Appointed Researcher: Atsunori KANEMURA
Visiting Researcher: Tsuyoshi UENO
Graduate Students: Marina DEMESHKO, Lu WANG, Itsuki UMEMURA, Kazumasa SUGIMOTO, Naoki TANAKA, Patrick Blöbaum (2013.10.1-2014.2.28)
Under Graduate Students: Takeru KAMON, Kohei OTSUKI, Shogo OKADA
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, called “big 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 big data by using computers. These techniques are named data mining and machine learning. 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 three research projects.

Current Research Projects

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 medical patients data on their inspection, diagnosis, therapy and medicine dose, 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 some important information and discover useful knowledge from such data acquired from large scale and complex structured systems. In this year, we studied advanced machine learning and data mining methods for searching models and reasoning on the models based on given data having thousands of dimensions. Based on these techniques, we also developed new methods for clustering, classification and estimation, and obtained more efficiency and accuracy than the conventional methods.

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 in the presence of latent confounders. Existence of latent confounders is a major difficulty in causal discovery.

Combinatorial approach to knowledge discovery from high-dimensional data

Intelligent information processing technologies for large-scale and high-dimensional data (so called, *Big Data* technologies) grow increasingly important due to recent accelerating technical progresses in data acquisition and accumulation. It is often the case that data used in such processing has explicit combinatorial structures, such as groups or connectivity among variables. We study theories and techniques for developing fast algorithms that make more interpretable or more accurate intelligent data processing by using such structures based on the discrete convexity, such as submodularity. In this year, we mainly developed fast algorithms for structured sparse learning, a machine learning technique with combinatorial structures in data. And, we applied these algorithms to several real-world problems in gene data analysis or computer vision, and confirmed the utility of the algorithms in each application.

Department of Knowledge Systems

Associate Professors:	Yoshinobu KITAMURA, Kouji KOZAKI
Specially Appointed Assistant Professor:	Yuki YAMAGATA
Specially Appointed Researcher:	Munehiko SASAJIMA
Graduate Students:	Satoshi NISHIMURA, Ryosuke FUKUI, Takeshi MASUDA, You KOBAYASHI
Under Graduate Students:	Yoshiki HIROHATA, Kyohei TADA
Supporting Staff:	Michiko KURODA(-2013.12.31)

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 2013, several collaborative research projects with researchers in various domains have 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. Furthermore, a new book “Theory and Practice of Ontological Engineering” has been published in April, 2012 which discusses the latest result on ontological theories and practical application of them. These results are implemented using HOZO, an environment for ontology building/utilization, has been developed in our department. The latest achievements include the following; 1) We developed a web-based application to browse a disease ontology published as Linked Open Data (LOD) which is widely used for publishing and sharing data on the Web. It allows the users to browse causal chains of diseases with related data in other LODs and 3D images of anatomical parts in which abnormal state the diseases appear. It got “the second prize in application track” in Linked Open Data Challenge Japan 2013. 2) We provided web APIs to use functions of the browsing system for the disease ontology. Using the APIs, we integrated a mouse phenotype database with the disease ontology based on an abnormal state ontology in the collaboration with experts of RIKEN. 3) We developed a prototype of information

literacy ontology for international comparisons of educations for information literacy. 4) We extended an ontology exploration tool which supports the users to explore ontologies according to their viewpoints and obtain chains of related knowledge. We organized a hands-on session to use the system in an international workshop and obtained some feedbacks from participants.

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. In 2013, a paper on a phase-oriented model of function along the product life-cycle and an evolutional model along the evolutional history of creatures has been published in the highly competitive international journal. Another international journal paper on a special issue on function shows perspectives for capturing functions, which can explain the functions used in practical situation.

Furthermore, we have generalized this framework into a goal-oriented modeling framework for procedural knowledge. In the collaborative research with public hospitals, we have described models of the nursing procedures and developed a tablet-style knowledge browsing tool as described below. In addition, we have identified an essential definition of the concept of “services” In 2013, the paper on this issue got the JSAI best paper award.

3. 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. In recent years, we focused on an application of the procedural knowledge modeling technology described above to practical training of novice nurses. Cooperating with domain experts, we investigated problems to be solved and improved the ontology-based knowledge browsing tool on tablet computers. It has been deployed in a real training course in Osaka Kouseinenkin hospital and in education in Osaka University. On this issue, two invited survey papers have been published in two societies’ journals and we got the JSAI incentive award.

4. Development of a Biomimetic Ontology for Materials Engineering Based on Biological Diversity

For biomimetic research, it is important to develop a biomimetic database which enables us to find a huge variety of knowledge across different domains. To realize such database, an interoperability of knowledge between them is necessary. We have been developing a biomimetic ontology which systematizes biomimetic knowledge and a search system using the ontology. In 2013, we developed a prototype of biomimetic ontology and a search system based on data which are provided by biologists. We also developed some technologies to extend the ontology semi-automatically using documents and the existing Linked Open Data.

Department of Architecture for Intelligence

Professor:	Masayuki NUMAO
Assistant Professors:	Koichi MORIYAMA, Ken-ichi FUKUI
Graduate Students:	Paul Salvador INVENTADO, Danaipat SODKOMKHAM, Ira PUSPITASARI, Yu YAMANO, Yoshiyuki OKADA, Vanus VACHIRATAMPORN, Yusuke SAKAMOTO, Graciela Nunez NARZAEZ, Nattapong THAMMASAN
Under Graduate Students:	Wataru FUJITA
Research Students:	Wasin KALINTHA (2013.10.1 -)
Exchange Students:	Mondheera PITUXCOOSUVARN (-2013.8.31) , Kevin FISCHER
Supporting Staff:	Misuzu YUKI (-2013.10.30), Megumi TANABE(2013.11.1-), Azusa HIRABAYASHI (2013.11.1-), Mika KUSAKABE (2013.11.1-)

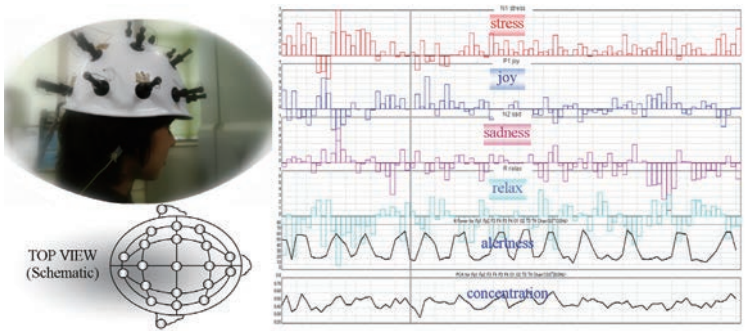
Outlines

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

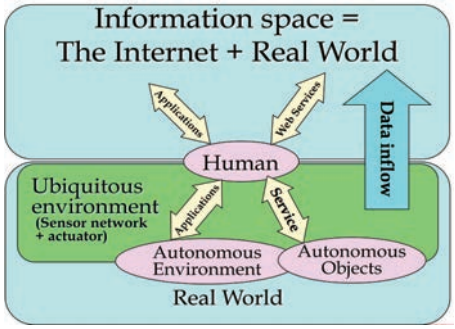
This department is developing a computer with learning ability, for which it researches efficient learning algorithms, acquisition of background knowledge for learning, application to Intelligent Tutoring Systems. These are applied to adaptive user interfaces. The conventional adaptive user interfaces 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

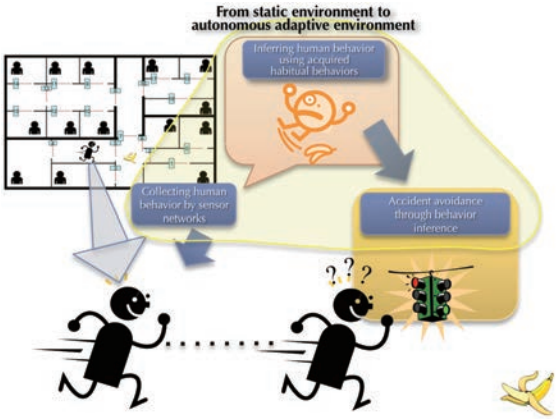
To have an instructional plan guide the learning process is significant to various teaching styles and an important task in an ITS. Though various approaches have been used to tackle this task, the compelling need is for an ITS to improve on its own the plans established in a dynamic way. We hypothesize 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.)

Professor:	Shigeki TAKEUCHI
Assistant Professor:	Ryo OKAMOTO
Assistant Professor:	Masazumi FUJIWARA
Post Doctoral Fellow:	Masayuki OKANO
Post Doctoral Fellow:	Takafumi ONO
Post Doctoral Fellow:	Hideaki TAKASHIMA
Intl. Guest Researcher:	Mohamed Almokhtar (-2013.8.31)
Graduate Students:	Akira TANAKA, Yu ETOH, Satoshi OHYAMA, Syunya KAMIOKA, Tatsuro SAGAWA, Kazuma YOSHIDA
Undergraduate Students:	Yasuko OE, Yuichi NAGAMATSU
Supporting Staff:	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

Experimental demonstration of an entanglement-enhanced microscope

Differential interference contrast microscope is widely used in biology and medicine as a non-invasive measuring technique in unstained objects. However, its measurement accuracy and depth resolution are determined by the signal-to-noise ratio limited by the standard quantum limit. In our previous study, we showed that the standard quantum limit can be beaten by using photons having quantum correlation. Hence, as a next step, we have demonstrated an entanglement enhanced microscope with a sensitivity beyond the

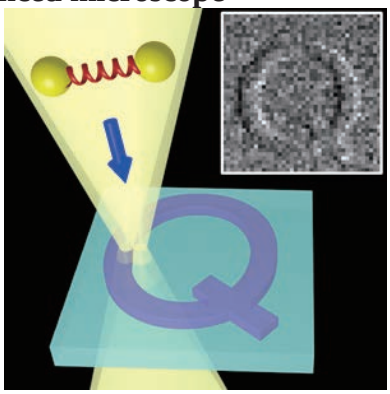


Fig.1: Obtained image by using an entanglement enhanced microscope

standard quantum limit by using quantum mechanical light as a probe light source (Nat. Commun. 4, 2426 (2013)). An image of a Q shape carved in relief on the glass surface was obtained with better visibility than with a classical light source. The signal-to-noise ratio was 1.35±0.12 times better than that limited by the standard quantum limit. The result means that one can observe living body cells with higher precision, and thus the entanglement-enhanced microscope might be applicable to the wide field including biology and medicine. In addition to this study, we applied technique of the data mining to the anomaly detection of the quantum state included in the large number of quantum state. We proposed and demonstrated a new method to identify the anomaly of quantum state with high precision (Phys. Rev. A 89, 022104 (2014)).

- **Demonstration of dispersion cancellation in high-resolution regime toward ultrahigh-resolution quantum optical coherence tomography**

Optical coherence tomography (OCT) based on low-coherence interferometer has been utilized in medicine, especially opthamology. However, the resolution is highly limited due to the dispersion in the sample. As an alternative method, quantum optical coherence tomography (QOCT) based on two-photon interferometer of quantum entangled photon pairs has better axial resolution and can compensate the group velocity dispersion effect. We have demonstrated the dispersion cancellation in high-resolution regime of 3-4 μm. With a 25-mm thick water as a model of a human eye, the original resolution of 4.2 μm (Fig. 2 (a)) in OCT degrades to 37 μm (Fig. 2 (c)). In contrast, the original resolution of 3.0 μm (Fig. 2 (b)) in QOCT remains even with the dispersion (Fig. 2 (d)). This dispersion tolerance can enable us to observe internal structure of the sample in deep position with high resolution.

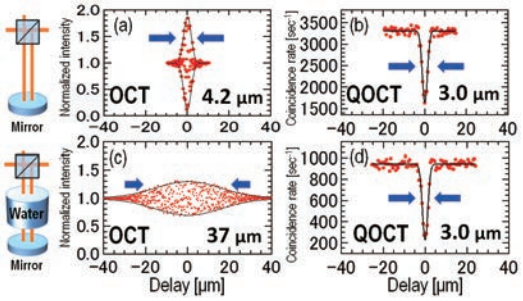


Fig. 2 : OCT (a) and QOCT (b) signals for a mirror sample and OCT (c) and QOCT (d) signals with a dispersion media (a 25-mm water).

High resolution measurement of zero-phonon-line of nitrogen vacancy centers in nanodiamonds using a Fabry-Perot interferometer

Micro- and Nano- photonic devices coupled with single light emitters have been attracting attention recently as key systems to realize optical quantum information devices such as single/entangled photon sources, quantum information processors, and quantum phase gates/memories. In various light emitters, Nitrogen vacancy (NV) centers in nanocrystalized diamond have advantages for physical stability, high emission efficiency, and compatibility with the many kinds of the photonic devices. However, the linewidth of the zero-phonon-line (ZPL) of the NV centers in the nanodiamonds have not been investigated in enough detail.

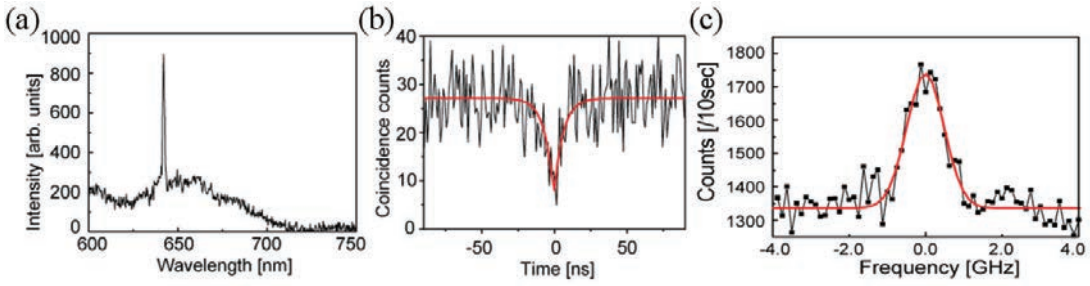


Fig. 3 (a) Photoluminesece spectrum, (b) second-order photon correlation histogram, (c) high resolution photoluminescence spectrum.

Here, we report high resolution photoluminescence (PL) spectroscopy of the NV centers in the diamond nanocrystals at cryogenic temperatures. Fig. 3(a) shows a PL spectrum obtained from the diamond nanocrystals. An intense ZPL at around 637 nm and broad phonon sideband in the range of 650 – 750 nm were observed. Fig. 3(b) shows the second-order photon correlation histogram of the PL. It clearly exhibits anti-bunching at time zero with $g^{(2)}(0) = 0.29$, indicating single NV center. Fig. 3(c) shows a high resolution PL spectrum of the ZPL by using a Fabry-Perot interferometer. The Gaussian fit to the data shows a frequency linewidth of 1.2 GHz, which was almost same order with the NV center in the bulk diamond crystal. This result shows that the long coherence time of the NV centers can be maintained even when the nanodiamonds are coupled to the micro- and nano-photonic devices.

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
- Fabrication of ultra-low reflectivity Si surfaces by surface structure chemical transfer method
- Si nanoparticles produced from Si swarf for light emitting and battery materials
- 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 single crystals and top-notch transport measurements of novel materials, such as topological insulators and topological 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 a relatively new 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 time reversal symmetry. 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 a topological superconductor, which is predicted to host Majorana fermions on the surface. Majorana fermions are peculiar in that particles are their own antiparticles, and they were originally conceived as a model for 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) Topological surface transport in epitaxial SnTe thin films grown on Bi_2Te_3

Although SnTe was found by our group to be a topological crystalline insulator (TCI) last year, its surface transport properties has not been observed due to the difficulty in preparing sufficiently bulk-insulating samples. We have succeeded in growing high-quality thin films of SnTe with the MBE technique by using a novel buffer layer, Bi_2Te_3. Thanks to the high mobility of the topological surface state of SnTe, this heterostructure allowed us to detect the Shubnikov-de Haas oscillations coming from the topological surface state of SnTe. It was confirmed that two different

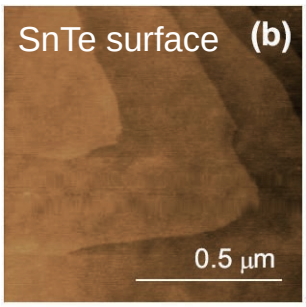

Fig. 1 AFM image of a SnTe thin film grown by MBE on a Bi_2Te_3 buffer layer. Large, atomically flat terraces demonstrate its high quality.

types of Dirac cones, which are peculiar to TCIs, indeed coexist in the surface state. This is the first experiment to detect the characteristic Dirac fermions on the topological surface state of a TCI with transport measurements.

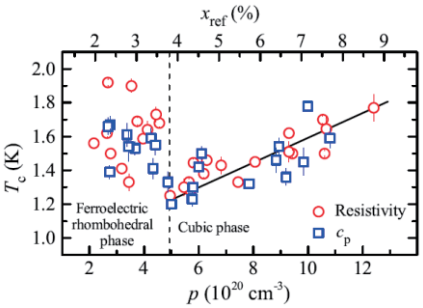

Fig. 2 T_c vs p plot of the In-doped SnTe superconductor. The vertical dashed line marks the critical In doping, p_c, to separate the two different structural phases.

2) Unusual nature of fully gapped superconductivity in In-doped SnTe

The phase diagram of the new candidate topological superconductor $Sn_{1-x}In_xTe$ was not well understood. We have established the phase diagram of this material, which allowed us to conclude that the existence of the topological superconductivity in $Sn_{1-x}In_xTe$ is likely to be restricted to a narrow range of In doping near 4%.

3) Anomalous dressing of Dirac fermions in the topological surface state of Bi_2Se_3, Bi_2Te_3, and Cu-Doped Bi_2Se_3

By using ultra-high resolution angle-resolved photoemission spectroscopy (ARPES) developed by Prof. Shin's group at ISSP, University of Tokyo, we have succeeded in observing the hitherto-undetected strong coupling between Dirac fermions and low-energy phonons on the surface of topological insulators. This coupling shows up as a new mode and is likely to be indicative of the novel collective mode called Spin-Plasmon which is peculiar to the topological surface state where the spin and the momentum are locked to each other.

4) Robust protection from backscattering in the topological insulator $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$

In collaboration with Prof. Komori's group at ISSP, University of Tokyo, we studied the momentum dependence of the electron scattering in the topological surface state to evaluate the robustness of the topological protection. The technique employed was the so-called quasiparticle interference, which uses STM to detect the standing waves of electrons that emerge as a result of impurity scattering. It was found that not only the 180° backscattering but also a wide range of backscattering angles of 100°–180° is effectively prohibited in the topological surface state. The unexpectedly robust protection from backscattering is a good news for applications.

5) Fermiology of the strongly spin-orbit coupled superconductor $Sn_{1-x}In_xTe$: Implications for topological superconductivity

In 2012, we discovered that SnTe is a new type of topological material called topological crystalline insulator. We also found in 2012 that the superconductor $Sn_{1-x}In_xTe$, which is derived from SnTe, presents signatures of surface Andreev bound states that are indicative of a topological nature of its superconducting state. In our ARPES studies of the $Sn_{1-x}In_xTe$ superconductor done in collaboration with Profs. Sato and Takahashi at Tohoku University, we have determined the Fermi surface of $Sn_{1-x}In_xTe$ and demonstrated that its normal state above T_c preserves the topological surface state.

Department of Semiconductor Materials and Processes

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Specially appointed administrative: Chika KUROSAKI

Outlines

The modern society is based on semiconductor technology. Our research is aiming to improve the characteristics of semiconductor products 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) highly efficient laser light.

Current Research Projects

Ultra-low reflectivity polycrystalline silicon surfaces formed by surface structure chemical transfer method [paper 3]

A nanocrystalline Si layer can be formed by the surface structure chemical transfer (SSCT) method in which a platinum mesh is instantaneously contacted with polycrystalline Si wafers immersed in hydrogen peroxide plus hydrofluoric acid solutions (Fig. 1). The polycrystalline Si surface after the SSCT method possesses an ultra-low reflectivity. The nanocrystalline Si layer possesses a 100–150 nm thickness, and gives a photoluminescence with a peak maximum at ~670 nm, indicating band-gap widening. The minority carrier lifetime of as-sliced Si wafers greatly increases after the

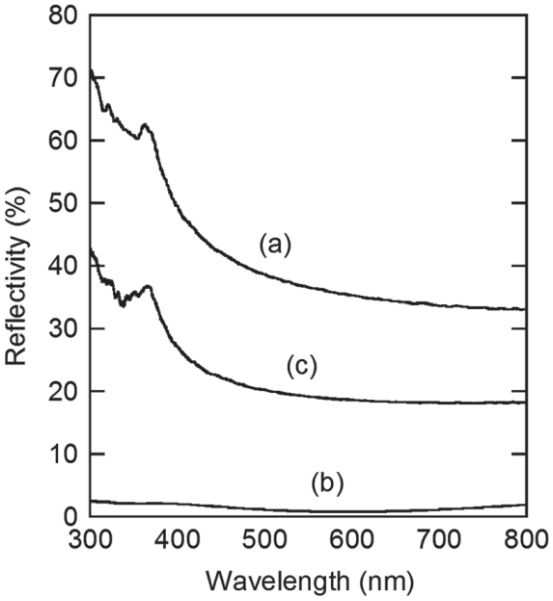

Fig. 1 Reflectance spectra of the polycrystalline Si surfaces before (a) and after (b) the SSCT method. Reflectance spectra of a pyramidal textured Si surface formed on Si(100) surfaces by anisotropic alkaline etching is shown by curve (c) for reference.

SSCT method most probably due to the enlargement of the nanocrystalline Si band-gap.

Metal Removal and Defect Passivation Performed on Si Wafers for Solar Cell Use by HCN Treatments [paper 6]

Cleaning of Si wafers for solar cell use with HCN solutions can remove metal contaminants almost completely. Fe and Ni atoms with ~2 × 10^{11} and ~3 × 10^{10} atoms/cm^2 concentrations reside on Si even after formation of pyramidal textured Si surfaces produced by anisotropic alkaline etching. The Fe and Ni concentrations decrease to less than ~6 × 10^9 atoms/cm^2 (i.e., detection limit of a total-reflection X-ray fluorescence (TXRF) spectrometer for Fe) and ~1 × 10^{10} atoms/cm^2, respectively, after cleaning with pH 11.5 HCN solutions containing 1.5 M isopropanol (IPA). Minority carrier lifetime for the pyramidal textured p-type single crystalline Si specimens increases from 58 to 220 μs by the HCN treatment with IPA. The micro-roughness on Si(111) surfaces treated with HCN solutions containing IPA is much less (i.e., 0.27 nm) than that without IPA (i.e., 0.52 nm). Adsorption of IPA on Si retards the etching rate from 32.7 to 8.6 nm/min, leading to enhancement of anisotropic etching, thus resulting in the formation of more complete pyramidal structure. Cleaning with pH 11.5 HCN solutions without IPA increases reflectivity due to isotropic etching, while that with IPA slightly decreases it due to the formation of more complete pyramidal textured surfaces. The increase in the minority carrier lifetime caused by HCN cleaning with IPA is attributable to i) removal of metal contaminants, ii) passivation of Si dangling bond defect states by CN^- ions, and iii) a decrease in the defect density due to a decrease in the micro-roughness.

Si nanoparticles fabricated from Si swarf by photochemical etching method [paper 7]

Si nanoparticles are produced from Si swarf which is a waste during slicing Si ingots to produce Si wafers for solar cell use. The beads mill method produces flake-like Si with scores of nanometers width from Si swarf. Subsequent photochemical dissolution with light longer than 560 nm wavelength in a 0.5 % HF solution results in sphere-shaped Si nanoparticles of 1–7 nm diameter. Si nanoparticles dispersed in ethanol show blue photoluminescence at ~400 nm (3.1 eV) under UV irradiation (Fig. 2), indicating band-gap widening due to the quantum confinement effect. The band-gap energy of most of the Si nanoparticles is estimated to be 2.5–3.3 eV from the PL spectra, corresponding to the Si nanoparticle size of 1.9–3.2 nm. On the other hand, Si nanoparticles produced by immersion in the HF solution in the dark show much weaker blue photoluminescence. These results demonstrate that the Si dissolution reaction is greatly enhanced by photo-generated holes.

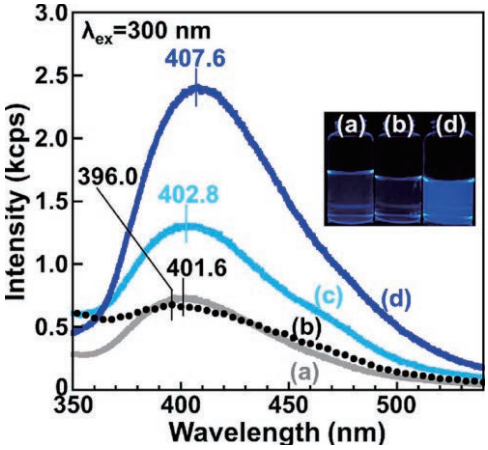

Fig. 2 PL spectra of ethanol solutions containing Si nanoparticles before etching (filtered Si swarf) (a), after immersion in an HF solution for 42 h in the dark (b), and after photochemical dissolution for 6 h (c) and 42 h (d). The inserted photographs show blue PL for the ethanol solutions a, b, and d under UV irradiation of 365 nm wavelength light.

Department of Advanced Hard Materials

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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 several topics of the metallic materials science and engineering. For example, lotus-type porous metals (lotus metals) developed by this department are the unique materials which exhibit extraordinary superior mechanical strength.

In this year, we newly developed an inverse Voigt-Reuss-Hill approximation which could determine the elastic properties of single crystal from those of the polycrystal with texture. By using the developed inverse Voigt-Reuss-Hill approximation, the elastic properties of an Mg–Zn–Y alloy single crystal with a long-period stacking ordered structure were clarified. Furthermore, the elastic properties of single-crystalline ω phase in titanium were revealed, using the inverse Voigt-Reuss-Hill approximation.

Current Research Projects

Elastic properties of an Mg–Zn–Y alloy single crystal with a long-period stacking ordered structure

The elastic properties of an $Mg_{85}Zn_6Y_9$ (at.%) alloy single crystal with a long-period stacking-ordered (LPSO) structure were investigated, the properties having remained unclear because of the difficulty in growing large single crystals. Directionally solidified (DS) $Mg_{85}Zn_6Y_9$ alloy polycrystals consisting of a single phase of the 18R-type LPSO structure were prepared using the Bridgman technique. The DS polycrystal had the texture in which the crystallographic <11 $\bar{2}$ 0> direction was preferentially oriented along the solidification direction. As a result, the DS polycrystal exhibited the macroscopic

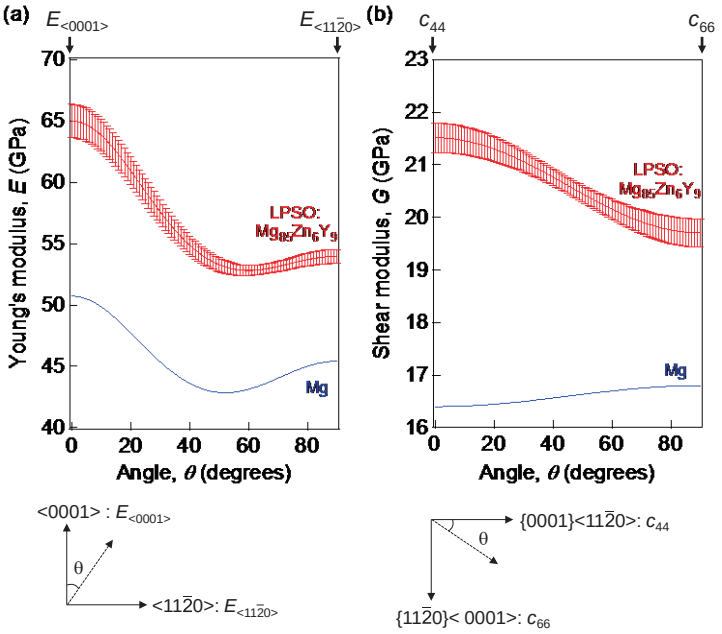

Fig. 1 Elastic properties of $Mg_{85}Zn_6Y_9$ alloy single crystal with LPSO structure and pure Mg single crystal: (a) Young's modulus and (b) shear modulus.

hexagonal elastic symmetry. For the DS polycrystals with the hexagonal elastic symmetry, the elastic-stiffness components were measured by resonant ultrasound spectroscopy. By analyzing the elastic stiffness of DS polycrystals on the basis of a newly developed inverse Voigt–Reuss–Hill approximation which could determine the elastic properties of single crystal from those of polycrystal with texture, the elastic stiffness components of the single-crystalline LPSO phase were determined. It was revealed that Young's modulus and shear modulus were clearly higher than those of pure magnesium, as shown in Fig. 1 (a) and (b), respectively. These findings were validated by first-principles calculations based on density functional theory combined with the Voigt-Reuss-Hill approximation.

Elastic properties of single-crystalline ω phase in titanium

The elastic properties of single-crystalline ω (hexagonal) phase in pure Ti were studied. Understanding the elastic properties is important for the development of biomedical titanium alloys with a low Young's modulus. However, the elastic properties have remained unclear because of the difficulty in growing a large single crystal. In this work, pure titanium consisting of α (hexagonal close-packed) phase was severely deformed by high-pressure torsion (HPT) processing, to obtain polycrystalline specimens consisting of a single phase of ω phase. The deformed ω phase polycrystal had the strong texture exhibiting macroscopic hexagonal elastic symmetry. For the ω-phase polycrystal, the complete set of elastic stiffness components was measured by resonant ultrasound spectroscopy combined with laser Doppler interferometery and electromagnetic acoustic resonance. By analyzing the elastic stiffness of the ω-phase polycrystal on the basis of the inverse Voigt–Reuss–Hill approximation, the elastic stiffness components of the single-crystalline ω phase were determined at room temperature (RT). Figure 2 (a) shows the Young's modulus of ω phase single crystal, where the Young's modulus of α phase is also shown for comparison. The Young's modulus of the ω phase along <0001> was found to be clearly higher than that along <11 $\bar{2}$ 0>, and the shear modulus also exhibited anisotropy as shown in Fig. 2 (b). Importantly, the Young's modulus and shear modulus of the metastable ω phase were higher than those of the α phase, which was stable at room temperature.

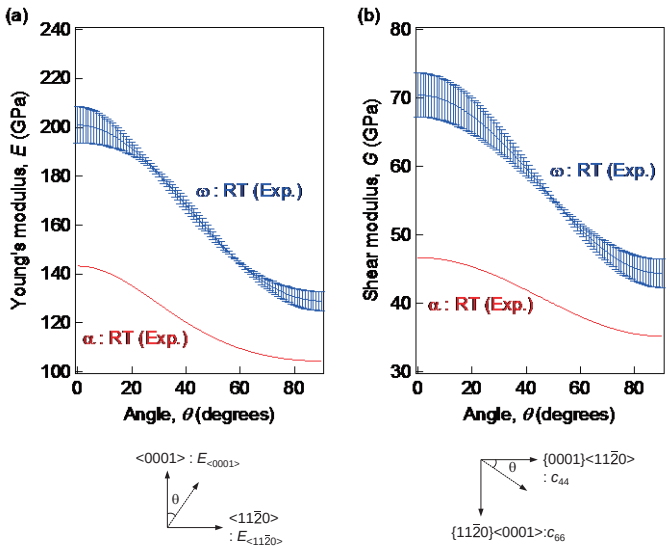

Fig. 2 Elastic properties of ω and α phases in pure Ti: (a) Young's modulus and (b) shear modulus.

Department of Advanced Interconnection Materials

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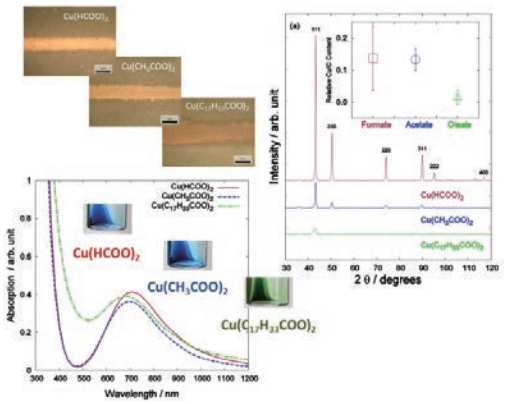
Outlines

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

Cu Salt Ink Formulation for Printed Electronics using Photonic Sintering

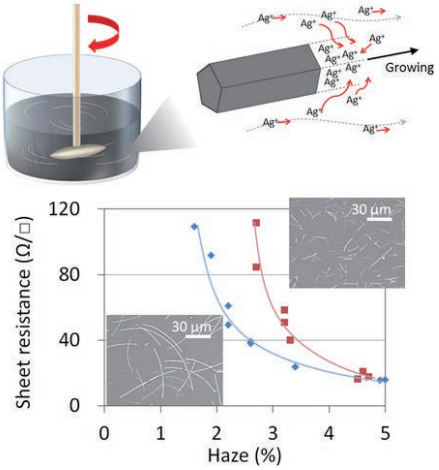


We formulate copper salt precursor inks for photonic sintering using high-intensity pulsed light (HIPL). The inks can be developed through controllable crystal field splitting states. The inks' light absorption properties are extremely sensitive to the carbon chain lengths of the ligands. The wires formed by sintered copper formate complex ink via the HIPL method achieved a low resistivity of 5.6×10^{-5} Ω cm, but the resistivity increased with increasing contains carbon contents, suggesting residual carbon have negative effects on the electrical conductivity. We find in this study that high light absorptivity and low carbon inks would lead to a lower environmental load in future by reducing both energy usage and carbon oxide gas emissions.

Low haze transparent electrodes and highly conducting air dried films with ultra-long silver nanowires synthesized by one-step polyol method

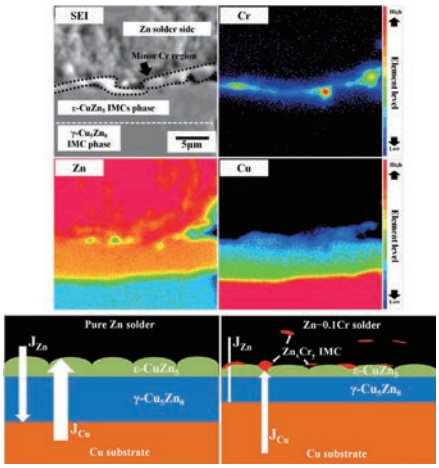
We reported that the haze can be easily reduced by increasing the length of AgNWs.

Ultra-long (u-long) AgNWs with lengths in the range of 20–100 μm and a maximum length of 230 μm have been successfully synthesized by adjusting the reaction condition of the polyol method. Compared to typical AgNWs (with diameter and length of 70 nm and 10 μm, respectively) and ITO, a transparent electrode consisting of u-long AgNWs demonstrated a low haze of 3.4%–1.6% and a low sheet resistance of 24–109 Ω/sq. at a transmittance of 94%–97%. Even when fabricated at room temperature, the electrodes composed of u-long AgNWs achieved a sheet resistance of 19 Ω/sq. at a transmittance of 80%, which is six orders of magnitude lower than that of typical AgNWs.



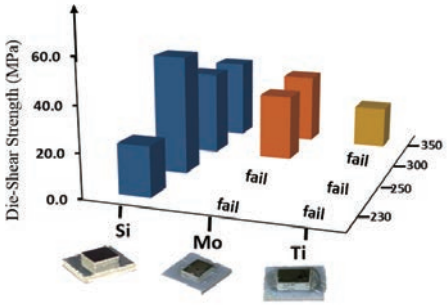
Retarding intermetallic compounds growth of Zn high-temperature solder and Cu substrate by trace element addition

The interfacial reaction between elements (Ca, Mn, Cr, and Ti) added to Zn alloys and Cu substrate were investigated, focusing on IMCs grown by isothermal aging. The reaction layers included two types of Cu–Zn IMCs phases. The joining interface with trace elements containing Zn solder reduced the growth rate of the IMCs. In particular, the addition of 0.1 wt% Cr to pure Zn solder decreased the growth rate of the IMCs by approximately 50 %. We propose assumed mechanism that a phase containing the small Cr atoms exists between the solder and e-CuZn5, which suppresses the diffusion of metal atoms. To summarize, the Cr additive showed beneficial effects in terms of suppressing the growth of IMCs during the solid-state isothermal aging.



Thermo-mechanical stress driven Ag direct bonding

The soldering process has recently encountered with the limitation for ultra-fine pitch electrodes in integrated circuits (ICs) because of the reliability issues in both the manufacturing process and the product life time. We propose an alternative method based on the direct Ag film bonding that can be processed in a considerably low temperature without applying pressure. This method utilizes the stress migration and hillock growth on sputtered Ag films for bonding. we have investigated the bonding processes with various substrate materials to control the thermal stress in Ag film s. The bonding property is evaluated by die-shear strength tests with various bonding temperature. We have found that higher thermal stress based on thermal expansion mismatch between Ag film and substrate material to achieve lower bonding temperature.



Department of Excited Solid-State Dynamics

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Designated Researcher Giret YVELIN
Support Staff Misako SHIMIZU

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,

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. The structural changes occurs in the temporal regime of 10-13 s. Therefore, direct trace of structural changes need special technique to capture the ultrafast changes. We developed transmission electron diffractometer with 100-fs temporal resolution. As topics of the second categories, we have studied carrier dynamics in semiconductors (III-V and Si) using femtosecond two-photon photoemission spectroscopy.

Current Research Projects

1. Ultrafast carrier dynamics in semiconductors 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 carriers, which play crucial roles in several photoinduced reactions in solids, it is essential to study the ultrafast carrier dynamics with resolving their evolutions in

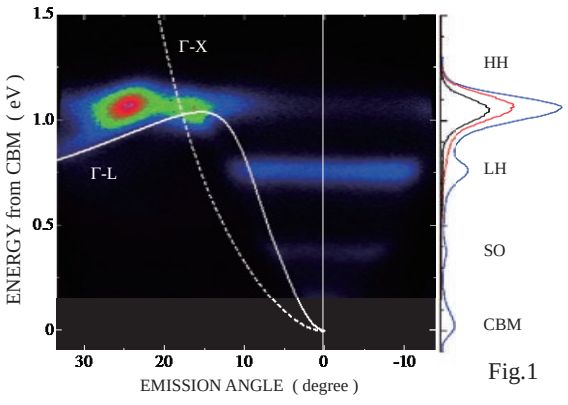

Fig.1

momentum and energy spaces. Use of femtosecond laser for pump and probe pulses has a strong advantage for resolving the carrier dynamics directly in energy and momentum spaces. 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 nascent distribution of hot electrons injected by 1.57-eV fs pulses in InSb are 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 has shed new light for understanding photoinduced effects in semiconductors.

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. Important point to 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 for laser-induced order-disorder transformation of Au, which show the ultrafast melting induced by laser excitation at 3.20 eV.

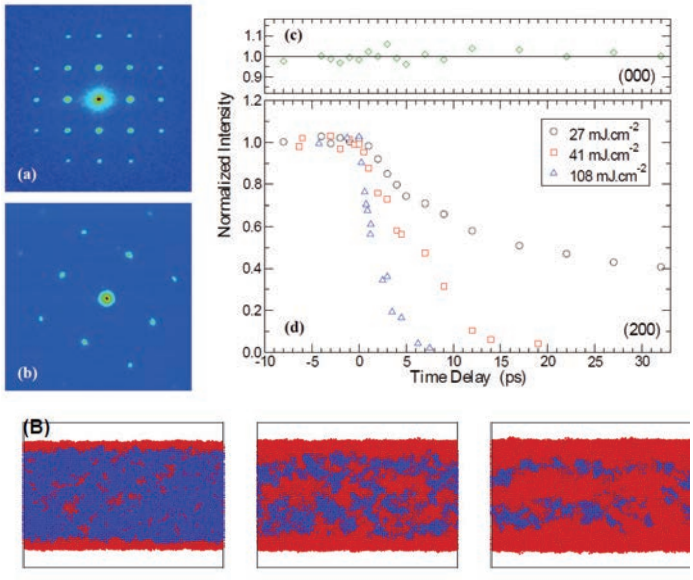

Fig.2

Theoretical analysis combining ab-initio calculation and classical molecular dynamics allow us to reconstruct atomic images of Au crystals during solid-liquid transition (see the lower figures in Fig.2). Blue and Red region correspond solid and liquid phases. It is clear that the mechanism of melting changes from heterogeneous to homogeneous melting, and that at the highest fluence of 108 $mJcm^{-2}$, non-thermal melting is induced, where electronic effects on atomic potential play crucial role in the disordering process. The diffractometer is now under reconstruction to achieve greatly higher performances toward ultrafast atomic imaging.

Department of Accelerator Science

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Assistant Professors: Keigo KAWASE
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Specially Appointed Professor: Shigemasa SUGA
Graduate Students: Masaki FUJIMOTO, Hiroki OHSUMI, Masaki YAGUCHI, Sousuke FUNAKOSHI, Ryota TSUTSUMI

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.

Current Research Projects

Upgrade of the L-Band Electron Linac

As part of ongoing effort to upgrade the L-band electron linac, we have developed a grid pulser for the thermionic electron gun used in a new operation mode of the linac for FEL (27 MHz mode). In the traditional mode for FEL using the conventional grid pulser (108 MHz mode), an electron pulse of a 8 μs duration is extracted from the gun and a multi-bunch electron beam at 9.2 ns intervals is accelerated with the linac using the sub-harmonic buncher system of the fundamental frequency of 108 MHz. The new grid pulser generates electron pulses of a 5 ns duration at 37 ns intervals or a 27 MHz repetition frequency. Because the number of bunches decreases to one-quarter in the electron pulse, charge per bunch can be increased 4 times higher whereas the beam loading remains the same, so that FEL gain and the peak power of the FEL micropulse will drastically increase and accordingly expected is significant reduction of the saturation time of the FEL power. Figure 1 shows the time-resolved energy spectrum of the electron beam of a 15 MeV

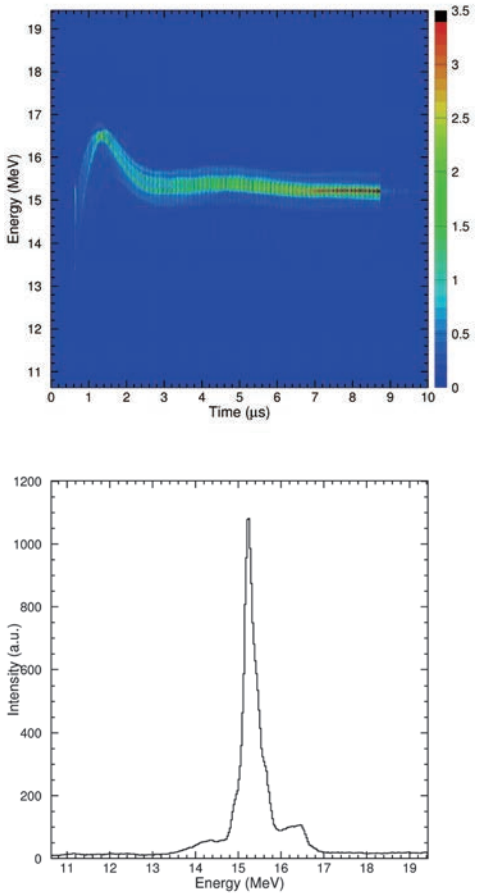

Fig.1. Time-resolved energy spectrum of electron beam produced by the 27 MHz grid pulser (top) and the projection energy spectrum (bottom).

energy in the 27 MHz mode with a current of 1.6 A extracted from the electron gun, which is 2.7 times higher than that obtained in the 108 MHz mode, 0.6 A. Nevertheless, the energy spread of the electron beam is 2.2 % (FWHM) as shown in the lower panel of Fig. 1, which is, in spite of the higher beam current, comparable to the energy spread in the conventional operation mode.

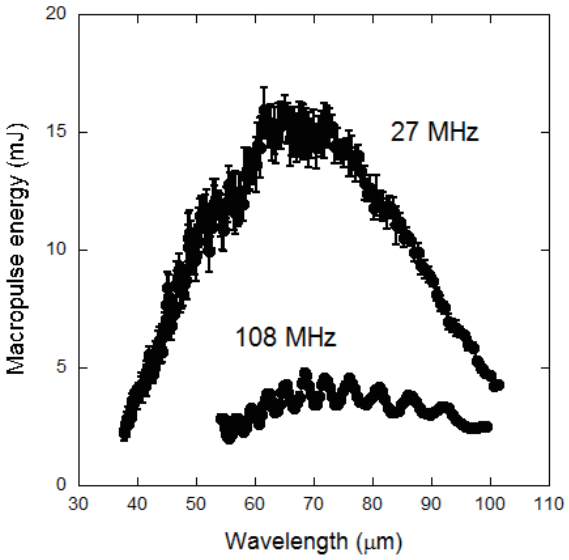

Fig. 2. The output energy of the FEL macropulse produced by the 27 MHz grid pulser (upper), which was enhanced to 4 times compared with that by the present grid pulser (lower).

Development of Free Electron Laser

The THz FEL we are working on for upgrade operates in the wavelength range from 25 to 150 μm (2 to 12 THz). Figure 2 shows macropulse energies of the FEL measured by varying the wiggler gap and plotted as a function of the FEL wavelength. The FEL was operated in the 108 MHz mode and the 27 MHz mode with the injection current of 1.6 A. The macropulse energy in the 27 MHz mode is much higher than that in the 108 MHz mode and the maximum energy is 15 mJ at wavelengths around 68 μm (4.4 THz). This value is increased to 4 times or more in comparison with the conventional one. Considering that the number of micro-pulses is decreased to one fourth, it is estimated that the energy per micropulse is increased to 16 times or more. This suggests that it is in a completely new operating region of the THz-FEL that cannot be explained by the conventional theory.

Application of High Intensity THz Radiation

We conduct study on applications and characterization of THz Radiation. One of the THz applications is the high-speed spectroscopic imaging with the raster scan method by taking advantage of monochromatic THz radiation with the macropulse energy exceeding 10 mJ. A sample for imaging is thin pellets of copper oxides (CuO, Cu_2O) mixed into polypropylene powder. CuO and Cu_2O have absorption peaks at wavelengths of 67 μm and 68 μm, respectively (Fig. 3 top). The samples were irradiated and scanned by FEL beams of wavelengths tuned to the respective absorption peaks and inverted images of the samples for the two slightly-different wavelengths (Fig. 3 bottom).

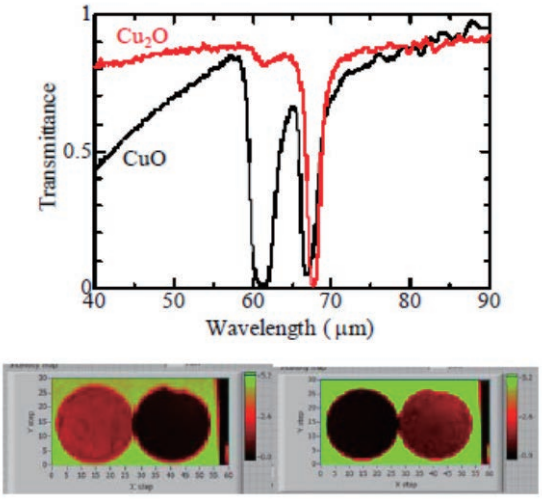

Fig.3. THz absorption spectra of copper oxide CuO, Cu_2O (top). Lower images are obtained by THz radiation with peak wavelengths of 67 μm (bottom left) and 68 μm (bottom right), respectively. Since the difference in absorption wavelength between CuO (right) and Cu_2O (left), the transmitted light intensity is inverted.

Department of Beam Materials Science

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Assistant Professor: Kazuo KOBAYASHI
Assistant Professor: Hiroki YAMAMOTO
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Supporting Staff: Kinuko WATANABE

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

Water at Extreme Conditions

The radiolysis of water is regarded as a trigger of radiation effects, and to elucidate the process will be important on the fruitful support to evaluate and control the radiation effects. At room temperature, it is recognized that the radiolysis of water begins with energy deposition at early times ($<10^{-15}$ sec), nonhomogeneous formation of free radicals and molecular products in isolated nano-scale space (by 10^{-12} sec), and subsequently undergo diffusion chemical reactions (by 10^{-7} sec). As the process is supposed to dramatically accelerate at high temperature condition, the use of the highly time-resolved technique will become important. By using a picosecond time-resolved pulse-probe system, temporal behavior of a hydrated electron (e^-_{aq}) was investigated. The transient absorption signals in picosecond to nanosecond time region were successfully obtained even at supercritical regime. Based on the results, time dependent yields of e^-_{aq} were evaluated (Fig. 3). Decay kinetics at high temperatures exhibited a significant difference, the fast decay components observed within 1 ns should indicate the accelerated diffusion reactions. Although the reaction with OH radical (e^-_{aq} + OH → OH^-) is known to be predominant at room temperature, the reaction with counter ion (e^-_{aq} + H_3O^+ → H + H_2O) will be gradually competitive as the dielectric constant of water is dramatically lowering at high temperature.

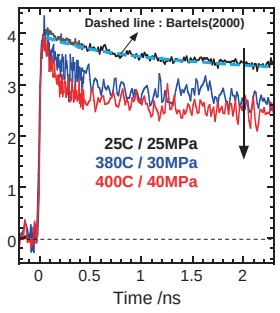


Fig. 3. Time dependent yield of the hydrated electron at room temperature and supercritical condition.

Redox-Dependent DNA Distortion in a SoxR Protein–Promoter Complex Studied using Fluorescence Probes

Members of the MerR family activate transcription in response to a variety of environmental stresses in bacteriaand regulate transcription via a DNA distortion mechanism. The [2Fe-2S] transcriptional factor SoxR, a member of the MerR family, functions as a sensor of oxidative stress in *Escherichia coli*. SoxR is regulated by the reversible oxidation and reduction of the [2Fe-2S] clusters. In the oxidized state, transcription is activated by distorting the target DNA promoter region to initiate transcription by RNA polymerase. The inactive reduced state of the protein remains uncharacterized. The redox-dependent conformational change of the promoter DNA was directly observed by site-specifically replacing the adenine (A) and cytosine (C) bases of the promoter oligonucleotide with the fluorescent probes 2-aminopurine (2Ap) and pyrrolo-dC, respectively. Four distinct 20-mer duplex oligonucleotides constructs were synthesized to incorporated 2Ap or pyrrolo-dC bases in the SoxR binding sequence at specific positions (**Figs. 1, 2**). Reduction of the [2Fe-2S] cluster in SoxR-DNA complex dramatically weakened the fluorescence intensity of the 2Ap moieties incorporated into the central part of the DNA. By contrast, the fluorescence of 2Ap moieties incorporated into other regions of A and the fluorescence of pyrrolo-dC moieties in the central region of the DNA (C3 and C3') was reduced only to a small degree by the reduction. These results strongly suggested that the redox change caused a large conformational change within the region confined to the central A-T base pairs in the promoter region of the DNA

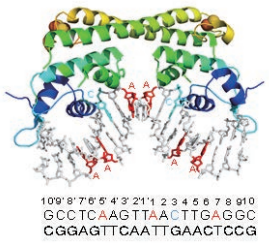


Fig. 1 Structure of the SoxR-*soxs* promoter complex. The palindromic sequence of the 20-bp DNA fragment is shown in the *lower*, in which the 2Ap or pyrrolo-dC fluorophores were incorporated at individual positions in place of A (red) or C (light blue).

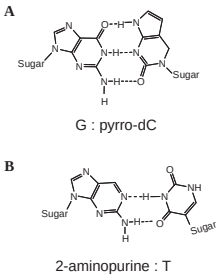
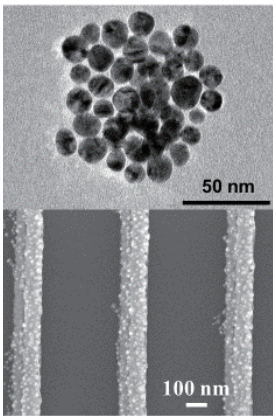


Fig. 2 Structures of the pyrrolo-dC base-paired with G (A) and 2Ap base-paired C (B).

Controlled arrangement of Nanoparticles Capped with Protecting Ligand on Au Nanopatterns Using Combination of Top-down and Bottom-up Nanofabricaiton

We present a novel and simple method of controlled arrays of gold (Au) nanoparticles capped with protecting ligand on Au nanopatterns fabricated combining electron beam lithography and self-assembly techniques. We succeeded in nano reaction field which is controlled arrays of Au capped with protected ligand on the resulting Au nano-patterns such as line and space and dots. Spherical Au nanoparticles capped with water-soluble dithiols were immobilized above Au nanopatterns. This method enables the fabrication of arrays of Au nanoparticles capped with protecting ligand on the resulting Au nano-patterns. It is very important to get fundamental insight into controlled arrangement Au nanoparticles into accurate position for various applications in optoelectonics, catalysis, plasmonics, medicine. This fabrication technique supplies interesting application such as novel devices and biosensing application.

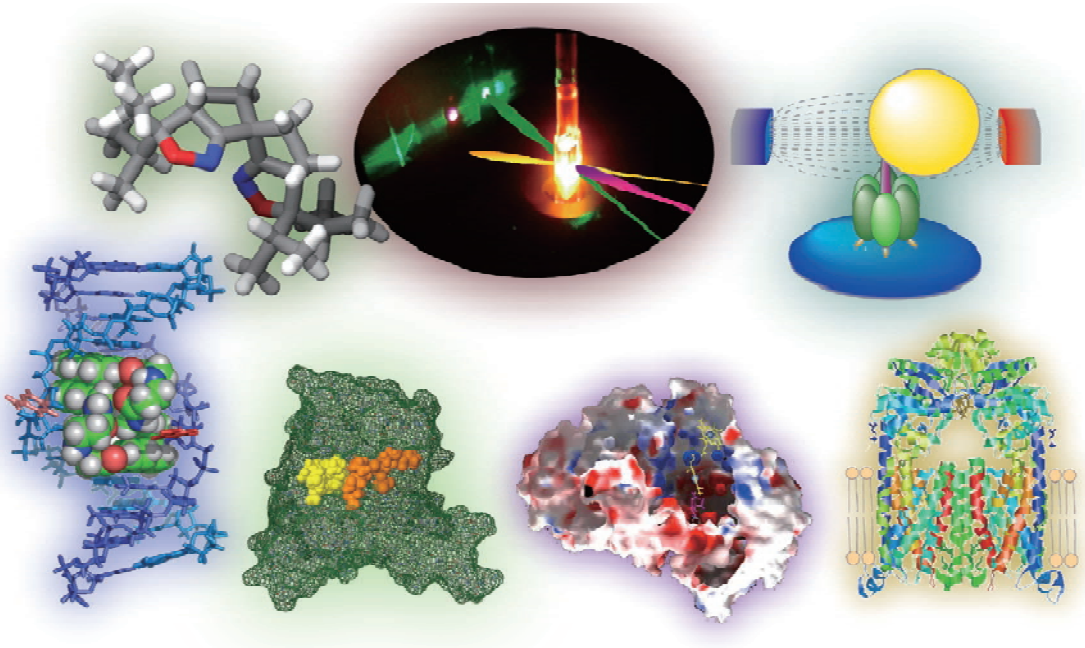


Division of Biological and Molecular Sciences

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, energy transformation, membrane transport, energy transport, and the mechanism of gene expression.

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



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Kenshi NAKANO
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Outlines

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

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

Current Research Projects

Multi-beam Chemistry

Multi-beam chemistry has been studied using pulse radiolysis-laser flash photolysis combined method, two-color two-laser photolysis, and so on. From these studies, we have clarified various reaction processes of excited states of short-lived intermediates. This year, we have investigated intramolecular electron transfer from higher excited state of Sb- and Ge tetraphenylporphyrins. It was revealed that introduction of the electron donor group at meso position of porphyrins realized electron transfer faster than that in the porphyrins bearing the electron donor as an axial coordination group. In addition, we have realized time-resolved resonant Raman spectroscopy by combination of pulse radiolysis and pulse laser. By applying this method to star-shaped oligofluorenes, we have clarified the structural change upon oxidation process. The present method will be a powerful method to clarify structural change as well as various reaction pathways of radical ion species.

Detection of Single-Nucleotide Variations by Monitoring the Blinking of Fluorescence

We have established a system to measure the charge-transfer rate through DNA and have demonstrated that the charge-transfer rate varies depending on the DNA sequence and the presence of a mismatch. However, the charge-transfer rate is determined by the transient absorption measurement, which is labor-intensive and requires a significant amount of sample (>1 nmol), making it essentially incompatible with high-throughput applications. We demonstrated the development of a new detection method for single-nucleotide variations based on observation of the blinking of fluorescence at the single-molecule level. Single-nucleotide variations cause changes in the charge-transfer dynamics of DNA, which can be read out by monitoring the fluorescence blinking. Each sequence was found to give a unique blinking off-time (τ_{off}) value, indicating that single-nucleotide variations can be detected by measuring the τ_{off}.

Mechanisms of Photocatalytic Reactions

Photocatalysis has attracted much attention for effective utilization of solar light energy in environmental purification, organic synthesis, and water splitting for hydrogen generation. We successfully synthesized plasmonic photocatalysts by the modification of TiO_2 mesocrystals with Au nanoparticles by a simple impregnation method. The Au NP sensitizers show a strong photoelectrochemical response in the visible-light region (400−800 nm) due to their surface plasmon resonance. The diffuse reflectance spectroscopy measurements demonstrate that a substantial part of electrons, injected from Au to TiO_2 through the plasmon excitation, directionally migrate from the basal surfaces to the edges of the plate-like mesocrystals through the TiO_2 nanocrystal networks and are temporally stored there for further reactions. This anisotropic electron flow significantly retarded the charge recombination of these electrons with the holes in the Au nanoparticles, thereby improving the visible-light-photocatalytic activity by more than an order of magnitude, as compared to that of conventional Au/TiO_2 nanoparticle systems.

Electron Transfer in i-motif DNA with a Tetraplex Structure and DNA-Protein interaction

The electron transfer of i-motif conjugated with pyrene (Py) and anthraquinone (AQ) has investigated using fluorescence up-conversion and transient absorption spectroscopic methods. The results reveal that the direct electron transfer from Py in the singlet excited state (^{1}Py*) to AQ in i-motif occurs competitively with the electron injection from ^{1}Py* to the neighbor deoxyuridine (dU) moiety yielding the contact ion pair, $Py^{\bullet+}$-$dU^{\bullet-}$. The rate constants for two electron transfer processes were determined to be 6.9×10^{11} and 4.0×10^{11} s^{-1}, respectively. Moreover, it is found that the electron transfer in i-motif DNA occurs efficiently, while it does not occur in a duplex DNA, suggesting that i-motif can act as a good electron carrier in nano-electronic device due to the hemiprotonated $C:C^+$ base-pairs as well as its compact structure. Furthermore, we demonstrated that the conformation of G-quadruplex, which is a non-B DNA and shows a heterogeneous in the absence of RecA, converged to the specific G-quadruplex with one double-chain-reversal loop upon association of RecA protein.

Department of Synthetic Organic Chemistry

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	Yasushi YOSHIDA, Mohamed Ahmed ABOZEID
	Kazuhiko WAKITA, Michitaka SUZUKI, Makoto SAKO
	Masashi SHIGENOBU, Yoshihiro NAGATA
	Chihiro AZUMA, Kenta KISHI, Yoshiki TAKEUCHI
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Under Graduate Student:	Takahiro DOI
Supporting Staff:	Ayaka HONDA

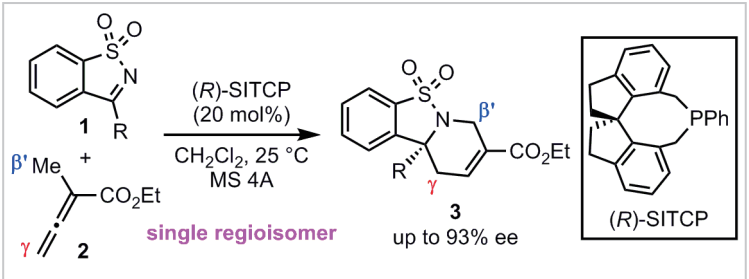
Outlines

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

Organocatalyzed Enantioselective Construction of a Tetrahydropyridine Framework with a Chiral Tetrasubstituted Carbon Stereogenic Center

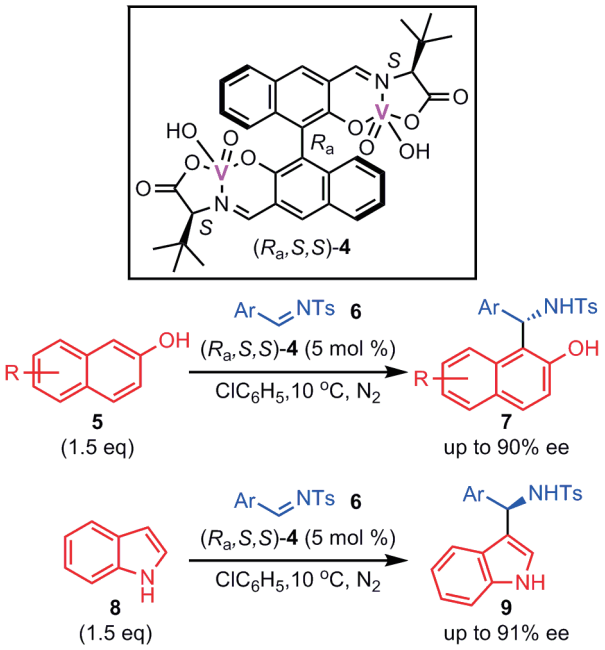
Enantioselective and organocatalytic synthesis of tetrahydropyridines bearing a chiral tetrasubstituted carbon stereogenic center has been developed. The spiro-type monoaryl phosphine catalyst, (*R*)-SITCP, was found to promote the formal [4+2] cycloaddition of saccharin-derived ketimines **1** and α-methyl allenoate **2** to afford the corresponding six-membered *N*-heterocycles **3** in high yields and excellent regioselectivities with up to 93% ee (Scheme 1).



Scheme 1. Enantioselective Synthesis of Chiral Tetrahydropyridines

Vanadium-catalyzed Enantioselective Friedel–Crafts-type Reactions

Chiral vanadium complexes are known to be effective catalysts for enantioselective and chemoselective oxidative reactions such as oxidation of sulfides to sulfoxides and epoxidation of allylic alcohols. However, chiral vanadium catalysts that function as Lewis acids have not been adequately studied so far. We have discovered the first vanadium-catalyzed asymmetric Friedel–Crafts-type (FC-type) reaction of *N*-tosyl imines **6** with 2-naphthols **5** or indole (**8**). Various aryl aldimine substrates **6** bearing either electron-withdrawing or electron-donating groups could be successfully employed with 5 mol % of (R_a,*S*,*S*)-**4**, leading to the corresponding adduct **7** or **9** in high enantioselectivity (Scheme 2).



Scheme 2. V-catalyzed Enantioselective FC-type Reactions

Enantioselective Pd(II)/Pd(IV) Catalysis Using SPRIX Ligand

Novel enantioselective catalysis involving a Pd(II)/Pd(IV) redox couple has been achieved by utilizing a unique chiral ligand "SPRIX" which possesses isoxazoline coordination sites on a rigid spiro backbone. Treatment of homoallyl alcohol substrates with a catalytic amount of Pd–SPRIX and TfOH in the presence of PhI(OAc)$_2$ in a mixture of AcOH–dimethoxyethane gave 3-acetoxy-tetrahydrofuran derivatives in moderate to good yields with high enantioselectivities. Mechanistic studies including a deuterium-labeling experiment revealed that the cyclative acetoxylation proceeded through chelation-assisted *anti*-acetoxypalladation, subsequent oxidation of the resultant Pd(II) complex, and a final S_N2-type attack of the hydroxy functionality on the alkyl–Pd(IV) intermediate.

Green Powder-phase Oxidation Using Apatite Powder

We have developed a green powder-phase oxidation reaction (Nonhalite® method) 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. Halogen-free, high purity epoxy resins are requested for the application to electronic materials. The epoxidation with hydrogen peroxide is one of halogen-free reaction processes. In the powder-phase oxidation reaction, halogen-free glycidyl ethers were obtained at high purity. The gycidyl ethers are easy to be hydrolyzed in the conventional liquid phase conditions with hydrogen peroxide.

Department of Regulatory Bioorganic Chemistry

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Takeo FUKUZUMI (~2013.4)
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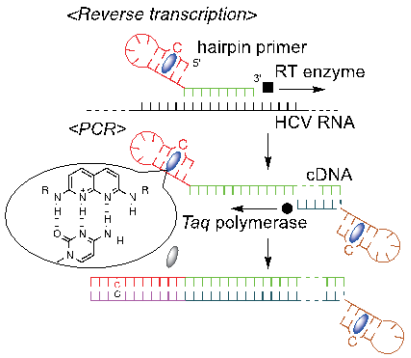
Yasuyuki OKADA, Jun MATSUMOTO
Research Assistance: Maki KIMURA, Yasue HARADA, Ayako SUGAI,
Supporting Staff: Yuriko YAGUCHI

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

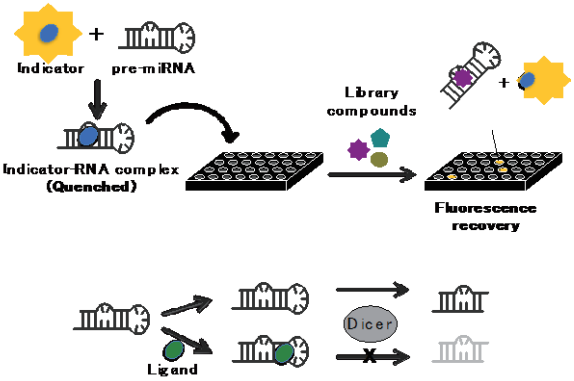
Development of Gene Detection Technology (RT-PCR)



We have reported a hairpin primer PCR (HP-PCR) method using primer having a hairpin tag at the 5'-end and a fluorescent dye 2, 7-diamino-1, 8-naphthyridine derivative (DANP) which bound to the cytosine-bulge (C-bulge) embedded in the hairpin tag. As the PCR proceeds, the hairpin tag in the primer was opened up and disappeared, leading to the decrease of the fluorescence. This HP-PCR provides extremely high allele specificity in allele specific HP-PCR.
The specific primer of a HCV having a hairpin tag at the 5'-end was used as RT and PCR primers. The HCV-RNA template was transcribed by reverse transcriptase with the hairpin primer, and the resulting cDNA was amplified directly by HP-PCR (RT-HP-PCR). Using the RT-HP-PCR, we succeeded in demonstrating the detection of HCV-RNA in one-tube. The RT-HP-PCR selectively detected HCV-RNA extracted from the patient serums containing contaminant materials, and the method could be applicable for the quantitative detection of HCV. **[Original Paper 9]**

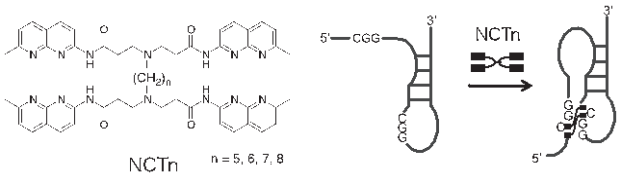
Fluorescent displacement assay for the detection of RNA-ligand interactions

MicroRNA (miRNA) is involved in many biological processes including development, differentiation and carcinogenesis. miRNA is now broadly recognized as an important drug target for the treatment of various diseases. A small molecule that modulates the specific miRNA pathway can be a drug candidate as well as biological tool. We have applied the fluorescent displacement assay to screen a large chemical library for a molecule that binds to a specific miRNA precursor **[Original Paper 6]**. Recently, bis(2-aminoethoxy) thioxanthone (X2SS), one of the fluorescent indicators that we have developed, have shown to be a potential inhibitor of pre-miRNA processing to miRNA by Dicer. The result indicates that X2SS has an advantage as the fluorescent indicator, since a ligand that competes for X2SS binding site of pre-miRNA would be readily used as an inhibitor for pre-miRNA processing. We are also developing novel RNA-binding ligands that can be used as the inhibitors for pre-miRNA processing.

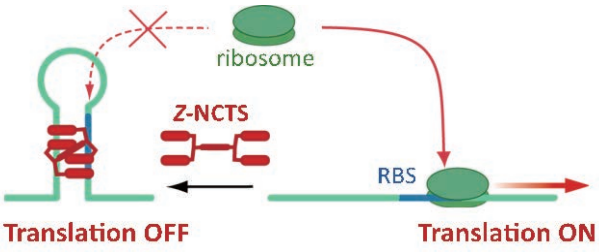


Modulation of RNA structure and functions by RNA-binding small molecules

We have developed the small-molecule ligands that recognize and specifically bind to mismatched base pairs in DNA. Among those ligands, NCTn (Naphthyridine Carbamate Tetramer) have shown to bind to CGG/CGG sequences in a RNA sequence, and induce a pseudoknot structure in the RNA **[Original Paper 2]**.

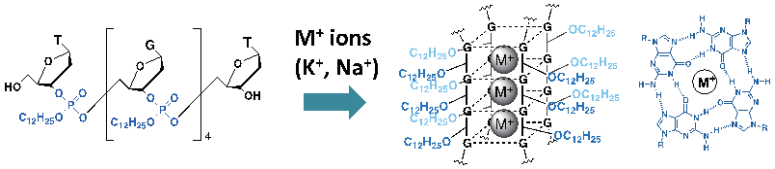


We have also developed the construction of an artificial riboswitch using a rational design of RNA-binding molecules. *Z*-NCTS selectively and significantly stabilized an RNA duplex containing a tandem mismatch sequence of r(XGG)/r(XGG) (X = U, A, and G). The integration of the *Z*-NCTS-binding sequences into the 5′-untranslated region of a luciferase-coding mRNA provided an artificial riboswitch that was responsive to *Z*-NCTS. **[Original Paper 5]**



Hydrophobic G-quadruplex in organic solvents

We have synthesized a hydrophobic G-quadruplex DNA consisting of dodecyl phosphotriester linkages. In the presence of Na^+ or K^+ cations, the hydrophobic DNA of TG_4T sequence forms a tetramolecular G-quadruplex in organic solvents. [**Original Paper 3**]



Department of Organic Fine Chemicals

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Specially Appointed Associate Professor: Kunihiro KAIHATSU
Assistant Professors: Hajime NITTA, Shunro YAMAGUCHI
Yusuke HIGUCHI (2013.9.16-)
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Atsushi KUSUMOTO, Chenyu WANG, Kenji TAKAGI
Takahiro FUKUOKA
Under Graduate Student: Miku OKAZAKI
Special Research Student: Fatma YESIL
Technical Assistants: Haruko FUKUI, Hideaki FURUSAWA, Fujio ITO
Aya TAKENAKA (-2013.8.1)
Supporting Staff: Misuzu TANNO

Outlines

The major goals of this department are to identify promising lead compounds for drug development and to explore their mechanism of action. Our research interests focus on small organic compounds that potentially modulate protein-protein interactions. These compounds are also utilized as tools to elucidate intracellular signaling pathways. We are also working on peptide nucleic acids aiming to develop devices for sequence-specific detection of viral genes. Our research extends further to generate lines of model mouse in which spatio-temporal morphogenetic signal-transduction activities become defective. They provide a novel strategy for understanding the mechano-chemical basis as well as development of diagnosis and therapy for diseases.

Current Research Projects

Client selective stabilization of 14-3-3 protein–protein interaction by a semisynthetic fusicoccane derivative

14-3-3 proteins are ubiquitous eukaryotic adaptor proteins that control many physiological processes through association with their client phosphoproteins (over 200 clients are known). Therefore, selective stabilization of a specific 14-3-3 protein–protein interaction (PPI) may lead a novel phenotypic outcome. FC-THF, a semi-synthetic fusicoccane derivative, selectively stabilized 14-3-3 PPI with mode 3 phosphopeptides, which are clients of 14-3-3 proteins having phosphorylation site at the penultimate position of its C-terminus. TASK-3 is a K^+-channel and has a mode 3 motif for 14-3-3. FC-THF stabilized a

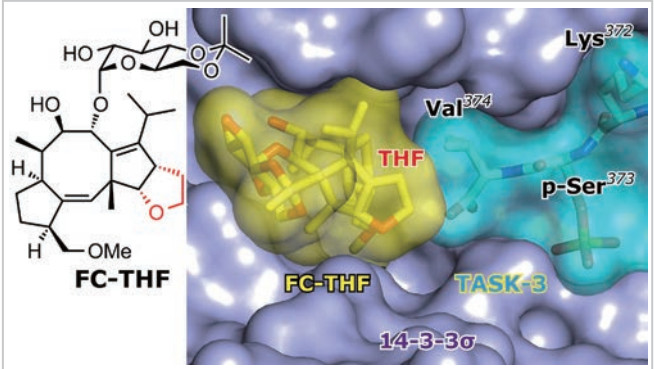
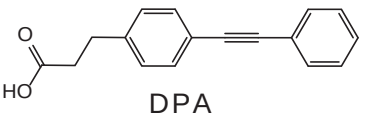


Fig.1 Ternary complex of 14-3-3/TASK-3 peptide/FC-THF

14-3-3 PPI with TASK-3 (Fig.1) and promoted the transport of TASK channels, heterologously expressed in *Xenopus* oocytes, to the cell membrane.

Detection of single base mismatch by intercalator-modified peptide nucleic acid

Detection of single nucleotide polymorphysim is important for the diagnosis of potential risks of diseases. Recently, various types of oligo-nucleotides have been developed for precise discrimination of single base difference in target gene. However, their sequence specificities often lowered in case the mismatch basepairs locates near terminal regions in duplex.



DPA

PNA-DPA Lys-ACCTTCTCTTCC–DPA
Match DNA 5′-TGGAAGAGAAGG-3′
Mismatch DNA 5′-TGGAAGAGCAGG-3′

Fig.2 PNA-DPA, match DNA, and mismatch DNA sequences

We synthesized a series of intercalators and introduced them at the amino terminus of peptide nucleic acid (PNA). As a result, diphenylacetylene-modified PNA (PNA-DPA) stabilized the perfectly matched duplex, while it destabilized the mismatched duplex (Fig.2). Fluorescence analysis and molecular dynamics simulation of the PNA-DPA/DNA duplex indicated that the DPA stabilizes the duplex by capping fashion only as there is no mismatch basepair in four base distances (Fig.3). These results inform us a design of intercalator-modified PNA for precise recognition of single base mismatch in target gene sequence.

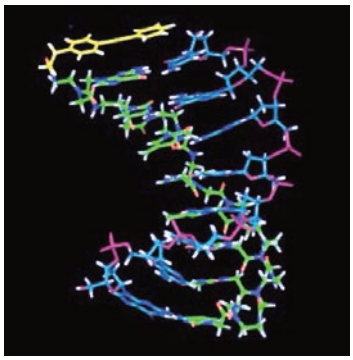


Fig.3 Molecular dynamics simulation of a PNA-DPA/DNA duplex. Yellow: DPA, Green: PNA backbone, Purple: DNA backbone. Blue: Basepairs.

Early embryo as a platform for deciphering endocytic regulation of signal transduction

Endocytic pathway is considered to play essential roles in signal transduction, although its significance in a multi-cellular context remains largely unknown. We show that the endocytic delivery of activated signaling molecules plays essential roles in embryogenesis. In rodent perigastrulation embryos, signaling molecules as well as maternal nutrients must cross a tightly sealed epithelium, visceral endoderm (VE), to reach the embryo proper, implicating importance of endocytic and exocytic functions. We found that the endocytic delivery in VE cells proceeds by microautophagy: large vacuoles engulf incoming pre-vacuolar endosomes without forming a continuous membrane (Fig. 4). This unique membrane dynamics is quite different from the canonical endosome-lysosome traffic that involves the fusion of two distinct membranes.

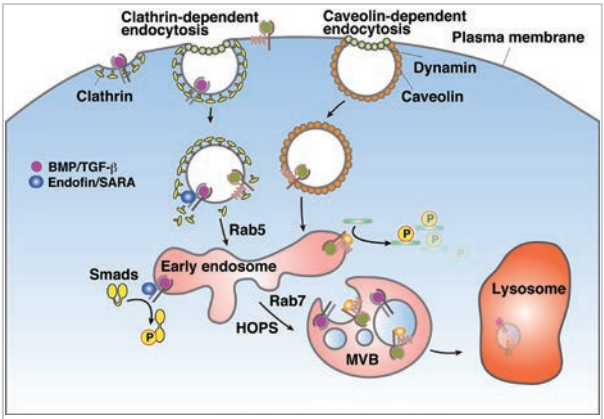


Fig.4 Schematic diagram of endocytosis into mammalian cells and implications in signal transduction

Department of Structural Molecular Biology

Associate Professor: Toshihide OKAJIMA
Assistant Professors: Kenji TATEMATSU, Tadashi NAKAI

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. We have also determined the crystal structures of the protein domains involved in the bacterial two-component signal transduction system (TCS) and elucidated 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

Biogenesis of Quinohemoprotein Amine Dehydrogenase

The structural genes coding for quinohemoprotein amine dehydrogenase (QHNDH) constitute a polycistronic locus together with several nearby genes, which may be termed a '*qhp*' operon (T. Nakai et al. (2014) *Biochemistry 53*, 895–907) (Figure 1). We have already shown that the *qhpD* gene intervening between *qhpA* and *qhpC* coding for α and γ subunits of QHNDH, respectively, and the *qhpE* gene following *qhpB* coding for β subunit, both encode enzymes specifically involved in the posttranslational modification of γ subunit. It is found that *qhpD* and *qhpE* are prerequisite for QHNDH biogenesis. In this study, we further demonstrate that the *qhpF* gene following *qhpE* and the *qhpG* and *qhpR* genes peripherally located in the operon are also essential for the biogenesis forming the active QHNDH.

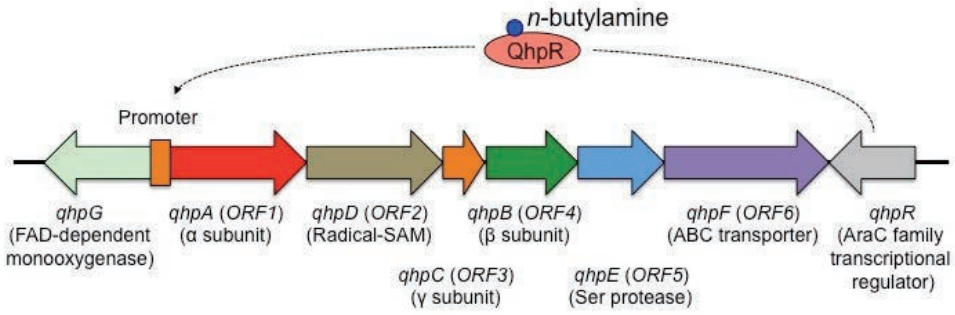


Fig.1 Gene structure of *qhp* operon.

The *qhpF* gene product was predicted to be an efflux ABC transporter, which likely has a function to translocate γ subunit into periplasm coupled with hydrolysis of ATP. The *qhpG* gene encodes an FAD-dependent monooxygenase. QhpG protein plays a role in generation of the quinone cofactor in γ subunit. Transcriptional regulation of the *qhp* operon is done by the *qhpR* gene product, an AraC family transcriptional regulator. The QhpR protein activates expression of the *qhp* operon probably thorough the binding of *n*-butylamine added to the culture medium. BLAST analysis of the *qhp* genes reveals their very wide distribution in not only various Gram-negative but also a few Gram-positive bacteria. On the basis of the previous and present results, we propose overall biogenesis mechanism of QHNDH.

Atomic Resolution Crystal Structure of Copper Amine Oxidase from *Arthrobacter globiformis*

The crystal structure of a Cu amine oxidase from *Arthrobacter globiformis* was determined at 1.08 Å resolution with the use of low-molecular-weight polyethylene glycol (LMW PEG; average M_r = ~200) as a cryoprotectant (T. Murakawa, et al. (2013) *Acta Crystallogr. D. 69*, 2483–2494). This resolution is considerably high for a relatively large protein with a monomer M_r of ~70,000; $AGAO_{PG}$ stands next to the highest resolution crystal structure of a 210-kDa homotrimeric enzyme, endosialidase NF, diffracted to 0.98 Å. After a refinement employing anisotropic displacement parameters and riding hydrogen atoms, an R_{work} and an R_{free} were 0.126 and 0.142, respectively. In the refined structure, several electron densities were assigned as polyethylene glycol molecules not only in the surface area of the protein but also in the active-site cavity. These polyethylene glycol molecules seem to reduce the fluctuation of protein, which would induce the low *B* factor. About 20% of all the possible hydrogen atoms in the whole protein were observed in the $F_o - F_c$ difference map with hydrogen atoms omitted. Visualization of the anisotropic displacement parameters as thermal ellipsoids provided insights into the atomic motions in the protein molecule. Moreover, one of the electron densities assigned as diatomic molecule, most likely to be oxygen molecule, was detected in the region enclosed by two subunits, which has previously been proposed as the probable entry site for molecular oxygen.

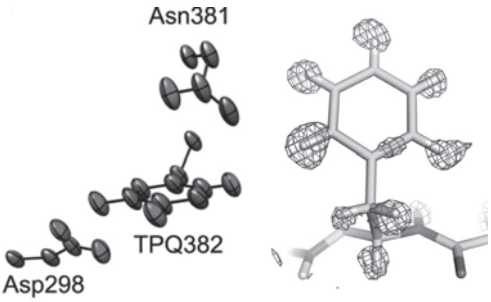


Fig.2 Observed anisotropy of the active site and electron density of hydrogen atoms.

Department of Cell Membrane Biology

Associate Professor: Tsuyoshi NISHI
Postdoctoral Fellows: Shoko NISHI
Graduate Students: Seiji YAMASAKI, Katsuhiko HAYASHI
Supporting Staff: Sumie MATSUOKA

Outlines

Living cells are separated from the outer environment with the lipid bilayer. Transporters and channels are important for transmembrane transport of essential nutrients and ions. Multidrug efflux pumps are widely distributed in living organisms from mammalian to bacteria as a host-defense mechanism in cellular level. These pumps are not only conferring 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.

Especially we are focusing on the transporters that are secreting the lipid mediators such as sphingosine 1-phosphate to develop the transporter oriented drugs.

Current Research Projects

Physiological Role of the Sphingosine 1-phosphate Transporter, SPNS2 in Mice

Sphingosine 1-phosphate (S1P) is one of the most important lipid mediators that is produced by phosphorylation of sphingosine, degratdaive product of ceramide. S1P is essential for cell migration such as lymphocyte, preosteoclast cells and endothelial cells in mammalian. Lymphocytes recognized S1P gradient between blood plasma and secondary lymphoid tissues and migrate into blood stream (Fig. 1). We have been trying to identify the physiologically functional S1P transporter(s) that supply S1P into blood plasma in mammalians. we identified that zebrafish *Spns2* is a physiologically functional S1P transporter and essential for myocardial precursors migration to form normal heart in

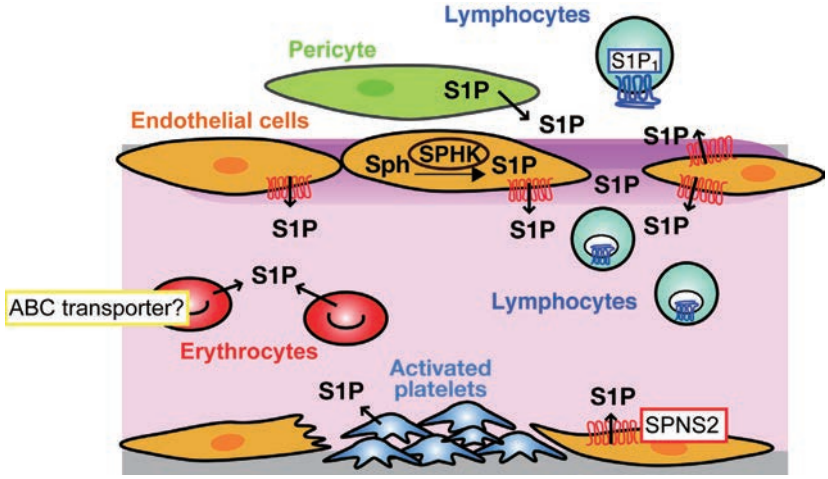


Fig.1 Schematic model of the S1P supply into blood plasma and migration of lymphocytes

zebrafish. Human and mouse *Spns2* 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. SPNS2-deficient mice were born in the expected Mendelian ratios and showed no abnormalities in the cardiovascular system or other organs, suggesting that there are functional differences between zebrafish and mammals 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 that 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.

Construction of the rapid screening methods for S1P transporter inhibitor

S1P transporter is a good candidate for development of immunosuppressive drugs without severe side effect. However, quantification methods of S1P are time consuming or expensive for high throughput screening. We tried to develop the simple assay method using fluorescent-labeled S1P. This fluorescent-labeled S1P was secreted from various culture cells and was not a substrate of SPNS2. However, fluorescent-labeled S1P was secreted from erythrocytes and inhibited by glyburide as well as S1P. We will develop this method for screening of S1P transporter inhibitors.

Department of Biomolecular Science and Engineering

Professor: Takeharu NAGAI
Associate Professor: Tomoki MATSUDA
Assistant Professor: Yoshiyuki ARAI
Specially Appointed Assistant Professor: Masahiro NAKANO
Post Doctoral Fellows: Koldenkova Vadim PEREZ, Dhermendra Kumar TIWARI
Kunito YOSHIDA, Guirong BAI
Graduate Students: Kazushi SUZUKI, Noritaka FUKUDA, Kousui HORIUCHI
Shigenori INAGAKI, Syoji KAWAKAMI
Under Graduate Students: Yohei AOYAGI, Hajime SHINODA, Hiroki TAKAUCHI
Supporting Staff: Kazuyo SAKAI

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 monomeric fluorescence protein

Chromophore-assisted light inactivation (CALI) is a powerful technique for acute perturbation of biomolecules in a spatio-temporally defined manner in living specimen with reactive oxygen species (ROS). Whereas a chemical photosensitizer including fluorescein must be added to specimens exogenously and cannot be restricted to particular cells or sub-cellular compartments, a genetically-encoded photosensitizer, KillerRed, can be controlled in its expression by tissue specific promoters or subcellular localization tags. Despite of this superiority, KillerRed hasn’t yet become a versatile tool because its dimerization tendency prevents fusion with proteins of interest. Here, we report the development of monomeric variant of KillerRed (SuperNova) by direct evolution using random mutagenesis. In contrast to KillerRed, SuperNova in fusion with target proteins shows proper localization. Furthermore, unlike KillerRed, SuperNova expression alone doesn’t perturb mitotic cell division. Supernova retains the ability to generate ROS, and hence promote CALI-based functional analysis of target proteins overcoming the major

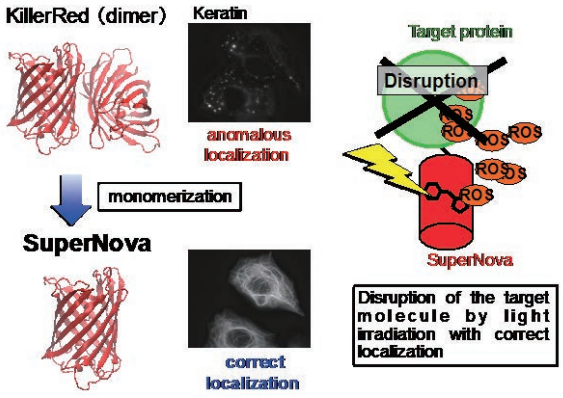


Fig.1 Genetically-encoded photosensitizer SuperNova applicable to CALI

drawbacks of KillerRed.

Development of Genetically encoded caged Ca^{2+}

In living organism, Ca^{2+} is one of the most versatile second messenger to control biological processes. To reveal its spatial and temporal dynamics dynamics, variety of Ca^{2+} indicators which enabled visualization of Ca^{2+} dynamics have been developed. Nowadays, live cell imaging is providing meaningful Information for research in wide range of biological field. However, for deeper understanding of role of Ca^{2+}, a technique to manipulate intracellular Ca^{2+} level have been desired. In previous methods, Ca^{2+} concentration is controlled by light through Ca^{2+} binding chemical compounds with photocleavable moieties. However, most of them must be irradiated with UV light which has possibility to impair cells. Also, the chemical compounds cannot be restricted to particular cells or sub-cellular compartments.

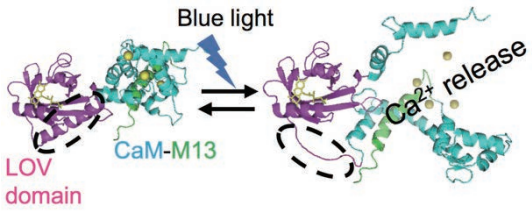


Fig.2 Schematic diagram of PACR conformational change upon blue light illumination

To overcome these problems, we developed genetically-encoded photoactivatable calcium ion-releaser PACR (PhotoActivatable Ca^{2+} Releaser). That is composed of Ca^{2+} binding protein and light-sensitive protein. Binding affinity of PACR for Ca^{2+} was decreased upon blue light irradiation due to unfolding of Ca^{2+} binding domain, which thermally restores its structure during tens of second. Thus reversible and repeatable increasing of Ca^{2+} concentration in cell is possible without cell damage. With the PACR, we succeeded not only to increase Ca^{2+} in nucleus of HeLa cells but also to control behavior of *C. elegans* by blue light irradiation to the touch neuron expressing PACR.

Diffusion of single-stranded DNA molecules in aqueous solution near glass substrate surface observed by total internal reflection fluorescence microscopy

Diffusion of biomolecules in solution is fundamental from the viewpoint of not only biology but also engineering. DNA sequencers are designed to lead the single-stranded DNA (ssDNA) molecules in fluid to a nanoscale pore where the sequence should be read. Since the sequencing technology faces the issue of Brownian motion, diffusion coefficient is a highly valuable information to realize the optimal design of the device. In this article, we report the experimental results of short ssDNA diffusion in aqueous solution in the vicinity of glass substrate surface, observed by total internal reflection fluorescence microscopy (TIRF) technique. Preliminary treatment of the glass substrate by low concentration KOH leads to adsorptive effect on the ssDNA molecules, whereas high concentration treatment leads to less adsorptive but still substantially smaller diffusion coefficient compared to the bulk. The slow down of diffusion without direct adsorption can be useful for the DNA sequencing where Brownian motion is desired to be moderated.

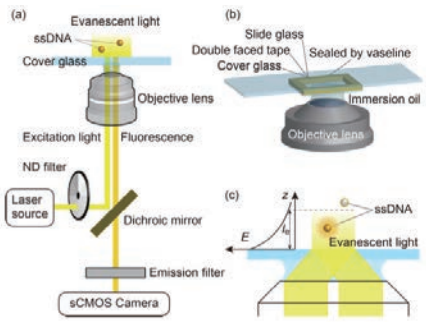


Fig.3 Schematic diagrams of the experimental setup

Division of Next Industry Generation

Outlines

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, Osaka University (professor Yasushi Yagi, director of ISIR) started two JSPS programs of Brain Circulation and Core to core.

The kick off meeting for Core to core program and 2nd imec Handai international symposium for Brain Circulation program were held at imec(Belgium and the Netherlands) which was our strong partner by means of Collaboration Framework Agreement, and our international collaboration idea was proposed at EC(European Commision).

In paralell, Osaka univ. COI STREAM was submitted, then successfully accepted as one of 12 programs in whole Japan. Osaka univ. where ISIR is main player, started the COI activity with 26 companies toward social implemenation as the new industrialization.

Achievements

Kick off meeting of JSPS Core to core program was held.

During two days (June 17 and 18), total 79 participants were very well attended in kick off meeting at imec , Leuven, Belgium. Professor Dr. Luc Van den hove, imec CEO&President, gave the welcome word, professor Kazuhiko Matsumoto explained the outline of Core to core program, and among 4 sessions, 18 papers of nanowire devices, graphene epitaxial growth, graphene devices, nanowire memorystor, bifunctional catalyst, single p-type organic semiconductor with high mobility, chemical treatment on Si solar cell, prediction for human feeling, data mining, quantitative scanning probe, self-assembly of nano-particle, femtsecond dynamics, block polymer, ultra thin chip package etc were reported with very active and positivediscussions.

Greeting by Luc Van den hove, imec President&CEO and Group photo in imec lobby

2nd imec Handai International Symposium was held.

On July 18(Tuesday) 13：30－18:30 at imec Caf-1A

1) In 2 sessions of Organic and transistor devices, More Moore and bio devices, 7 papers given by Dr. Heremans, prof. Suganuma, Dr Gerwin, Dr Marteen, Dr. Gosia, prof. Nakatani, Dr. Liesbet) were given for large area organic devices, Ag nanowire transparent electrodes, non volatile memory for ferroelectric polymer, growth of CNT interconnect, RRAM, Hairpin primer PCR, Micro fluidics etc. Total 35 participants were very well attended.

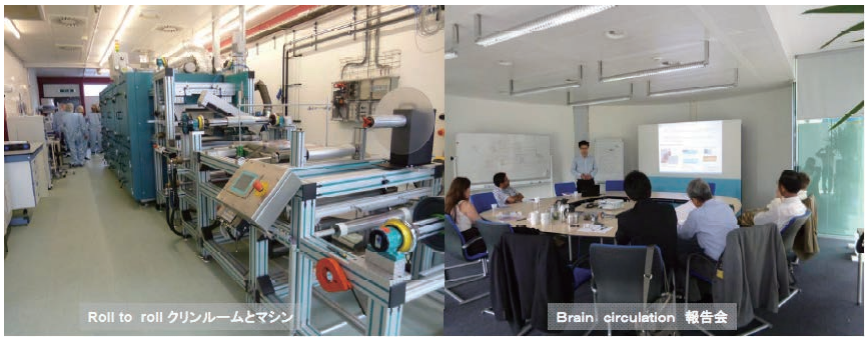
The cite visit lab tour was held for 300/450mm CMOS platform, Nerf bio clean room.

These window tours of most advanced clean room facility and NXW3100EUV were quite significant.

Holst Centre meeting on July 19(Wednesday)

Profs.Matsumto, Hirotsu, Ogura, Mr.Nishimura joined at Holst Centre, Eindhoven, The Netherlands. Bert managing director of imec NL, gave the outline of Holst Centre, among total budget of 45 Meuro, 50% was coming from companies , 40% from Dutch government, and 10% from EC funding, respectively. As for human resource, 180 members(28 nationalities)、40 residents from companies, and 35 PhD students joined.　Holst Centre has joined more than 20 FP7 projects, and has been preparing for Horizon2020 submission. And roll to to roll inside tour, OLED, Miplaza(260m2) window/video tour were given.

According to Brain circulation program, the progress-check meeting was held for Dr. Uemura assistant professor, and Mr. Araki PhD student(D2) together with mentors of Drs. Jan and Rajesh and Dr. Iryna manager. They showed good progress on Ag nanowire fabrication by LIFT(Mr.Araki) and Analyses for contact resistance(Dr.Uemura).



Collaboration program with major worldwide universities was proposed to EC(European Commision)

We explained the activities of two JSPS programs and proposed collaboration scheme of imec, Max Planck, Paris south univ., NTNU, Oxford univ.、Purdue univ（USA）.

Osaka univ. intends to continue to keep in touch with EC towards Horizon 2020.

Department of Intellectual Property Research

Specially Appointed Professor: Hirokazu SHIMIZU
Invited Professor: Akio KOBAYASHI
Specially Appointed Associate Professor: Shigeki KAWAKAMI
Specially Appointed Assistant Professor: Yoshihiro KIMURA

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.

We gained new three external grants from Kiriyama-shogakukai and Small and Medium-sized Enterprise Agency. The Japanese Society of Eucommia / 8th research grant, and the 160th committee on plant biotechnology "industry-university cooperation activity strengthening program, respectively. These empirical studies were carried out.

Current Research Projects

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

To promote the use of intellectual property held by the University, we have developed new methods to explore the possible partners of joint research in the industry by patent-related information survey. We are applying the specific case studies of the new methods for searching the companies with high professional and specialized properties.

University-Industry Collaboration of New Business Fields

We have conducted the following university-industry collaboration projects.
-New element technologies to enable the value adding of natural materials
-Development of manufacturing technology for tableting mold with low sticking characteristics (supplementary research)
-Development of Laser lighting technology

New Element Technologies to Enable the Value Adding of Natural Materials

To develop systems to create intellectual properties from plant biology, we inspected Eucommia farms and research laboratories in China.

We held on a public symposium to promote public relations and public engagement in plant biotechnology.

Supported by the 160th committee of plant biotechnology, we newly carried out several Scientific-experiments lessons for students of the high school or the junior high school. Furthermore, we made it learn about an understanding about a transgenic plant, and the process of new industrial creation.

Specially Appointed Laboratory: Kawai FIRST Project

Specially Appointed Professor: Tomoji KAWAI
Specially Appointed Assis. Professors: Takahito OHSHIRO, Masayuki FURUHASHI, Soh RYUZAKI, Kazumichi YOKOTA,
Specially Appointed Technical Expert: Hiroe KOWADA
Specially Appointed Researchers: 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) single-molecule sequencing of RNA/DNA using tunneling current, (2) single-molecule identification of Amino acid and protein, (3) Control of Translational Velocity for a DNA Passing through a nanopore, (4) Develop On-chip Integrated In-plane Nanopore Devices Toward single-molecule electrical sequencer.

Current Research Project

Single-Molecule Detection for Post-Modification Identification of DNA

Epigenetic nucleotide variants, such as methylated cytidine (mC), methylated adenosine (mA), oxidized guanosine (oxoG) and so on, are recently interesting sequencing targets because their variants is the important index for cell or tissue analysis, which can be potentially used for various kinds of diagnosis of disease including cancer. In this study, we performed electrical measurements of epigenetic mono-and oligo-nucleotide by nanogap-electrode devices. From the statistical analysis of the molecular signal intensity, each of the characteristic conductance values of mono-nucleotide was determined. In addition, we also obtained the molecular signals of oligonucleotide containing mC. From the conductance profiles constructed from each of molecule signals, we successfully detected a methylation of cytidine in the GGTGCAT sequence.

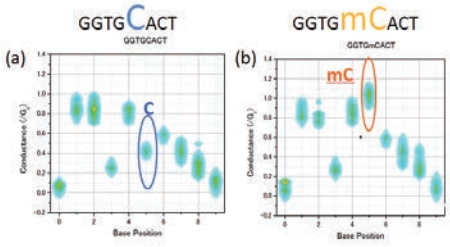


Fig.1 : Conductance profile of (a) no-methylated DNA (GGTGCAT), and (b) methylated DNA (GGTGmCACACT).

Tunnel-Current based single-molecule Amino-acid and Peptide Identification

We have proposed a methodology of single-molecule protein and amino-acid identification by tunnel-current for single-cell proteome analysis. As a proof of concept, we performed electrical measurements of amino-acid molecule by using nano-gap devices. From the signal analysis of the detected molecular signal, we determined characteristic conductance values for twelve kinds of amino acid molecules (W, Y, F, H, P, E, D, I) and phosphorylated tyrosine (pY) (Fig.2). We also

performed electrical measurements of oligopeptide: IEEEIYGEFD, which is a peptide sequence of kinase substrate. Based on the conductance values, we identify the phosphorylation of the tyrosine, which is important index of the kinase activity.

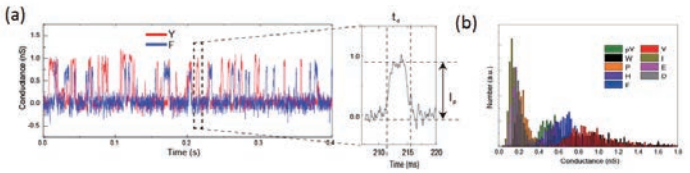


Fig.2 (a) A typical Conductance-Time profiles of Amino acid (Y: tyrosine and F:phenylalanine) molecules by nano-gap electrode devices. (b) Conductance Histogram of Y, I, E, D, W, P, H, F, and pY.

Control of Translational Velocity for a DNA Passing through a Nanopore

In order to develop a method for sequencing by nanopore device, a control of the DNA translocation speed is key issue because the translocation speed (>200 bp/ms) is too fast to detect each of the base-conductance during the translocation, while the tunnel-current detection speed is about 1bp/ms at this present stage. In our laboratory, we proposed a methodology for a control of the DNA translocation by using the flow-speed control of electro-osmotic flow using the nanopore device, which is surrounded by gate-electrode (Fig.3a). In this study, we try to demonstrate a DNA translocation control by using our surrounding gate-electrodes. We first fabricated nanopore surrounded with gate electrode, which can control the extent of charge of the nanopore wall. By using the surrounding-gate device, we clarify the relation of the DNA translocation speed and gate-voltage（Vg）(Fig.4b). We found that the distribution of the translocation speed is shifted to longer, the peak of the speed is shifted to 54 bp/ms. The phenomena would be due to the negative direction flow induced by electro-osmotic flow when applied negative voltage to the sidewall of the nanopore.

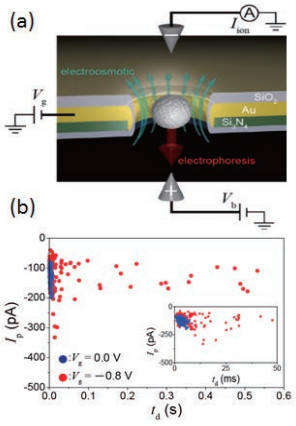


Fig.3 (a) Schematics of Surrounding gate device. (b) The relation plots of translocating time (t_d) verses the ion-current intensity (I_p) for resistive current signals.

Demonstration to Develop On-chip Integrated In-plane Nanopore Devices

For the demonstration of on-chip-integrated nanopore devices, we fabricated electrophoresis electrodes and nanogap-nanopore (in-plane nanopore) structures, which respectively manipulate DNA molecules and detect single-base molecules, on the same chip device and demonstrated its performance (Fig. 4a). In this experiment, we employed 10 μM solution of deoxyguanosine monophosphate (dGMP), and tunneling currents between the nanogap electrodes are measured at a bias voltage of 0.5V simultaneously applied an electrophoresis voltage of 0.5 V.

The signals from single-base molecules are detected as increasing of electric currents seen in Fig 4b (indicated as green regions). The detection frequency increases from 10/s to 23/s by applying an electrophoresis voltage. This result evidences that the on-chip integration of electrophoresis electrodes is effective for high throughput detection of single-molecule DNA detection by nanopore devices.

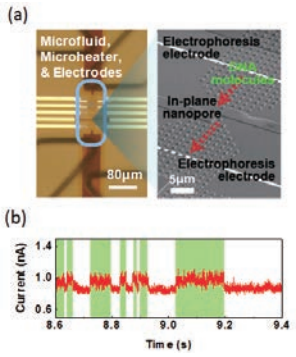


Fig.4 (a) Microscope images for the on chip integrated in plane nanopore devices. (b) Measurements of currents. Green regions are assigned as single-molecule signals.

Laboratory of Microbiology and Infectious Diseases

Associate Professor: Kunihiko NISHINO
Specially Appointed Assistant Professor: Mitsuko NISHINO
Specially Appointed Researcher: Yoshimi MATSUMOTO (Visiting Professor)
Graduate Students: Katsuhiko HAYASHI, Seiji YAMASAKI
Supporting Staff: Aiko FUKUSHIMA

Outlines

Genome annotation identified a considerable number of membrane transporter genes in bacteria. Multidrug-resistant bacteria are now encountered frequently and the rates of multidrug resistance have increased considerably in recent years. We previously identified membrane transporters related with bacterial multidrug resistance and virulence. We are studying on the mechanism of regulation and function of bacterial membrane transporters. 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

Xenobiotic sensing by the RamR efflux regulator in *Salmonella enterica*

One important mechanism that gives rise to multidrug resistance is the active efflux of drugs by membrane transporters. In Gram-negative bacteria, membrane transporters belonging to resistance-nodulation-cell division family such as AcrAB are especially effective in generating this resistance. A number of membrane transporter genes are tightly regulated by transcriptional activators and/or repressors. In several pathogens, the RamA global transcriptional activator participates in multidrug resistance by activating the expression of the AcrAB. Previous study identified, directly upstream of *ramA*, the *ramR* gene coding for a protein of the TetR family of transcriptional repressors (Fig.1). RamR is an important factor of multidrug resistance because various types of mutations in *ramR* or in the *ramR-ramA* intergenic region were identified in multidrug-resistant strains of *S.* Typhimurium, other *S. enterica* serovars, and *K. pneumonia*, which result in increased expression of *ramA* and increased efflux-mediated multidrug resistance.

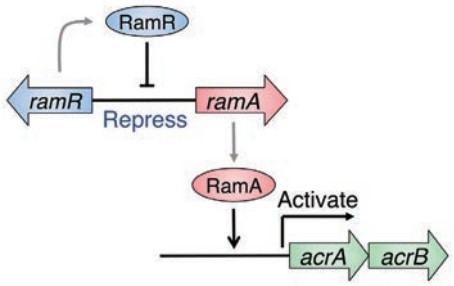


Fig.1 Model for gene regulation by RamR. RamR represses the *ramA* gene, which encodes the activator protein for the *acrAB* drug efflux pump genes. RamR binds to the intergenic region between the *ramR* and *ramA* genes, and RamA binds to the upstream region to *acrAB*.

The regulators usually bind many of the same structurally and chemically diverse drugs that are effluxed by the transporters that they regulate. Therefore, these regulators act as cytosolic multidrug sensors that respond to threatening amounts of drug as they overwhelm the multidrug transporters. Although it is an important regulator of multidrug resistance in several pathogens, the structure of RamR and the drugs to which this regulatory protein binds have not been reported yet. In this financial year of 2013, we reported the crystal structure of RamR in complex with multiple drugs. All of the compounds tested were found to interact with RamR resulting in a decreased DNA-binding affinity, and consecutive increased expression of *ramA*.

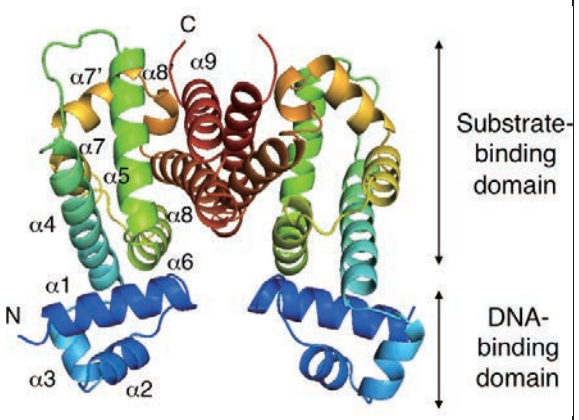


Fig.2 Crystal structure of the RamR dimer. The structure of RamR was initially determined at a resolution of 2.6 Å by multiple wavelength anomalous dispersion using selenomethionine modification. Subsequently, we determined the RamR structure at 2.1 Å by molecular replacement. Approximate overall dimensions of the RamR dimer were 58 × 47 × 44 $Å^3$.

We have succeeded in solving the crystal structure of RamR (Fig.2) in complex with multiple drugs, including berberine, crystal violet, dequalinium, ethidium bromide and rhodamine 6G. All compounds were found to interact with Phe155 of RamR, and each compound was surrounded by different amino acid residues (Fig.3). Binding of these compounds to RamR reduced its DNA-binding affinity which resulted in the increased expression of *ramA*. Our results reveal significant flexibility in the substrate recognition region of RamR, which regulates the bacterial efflux participating in multidrug resistance.

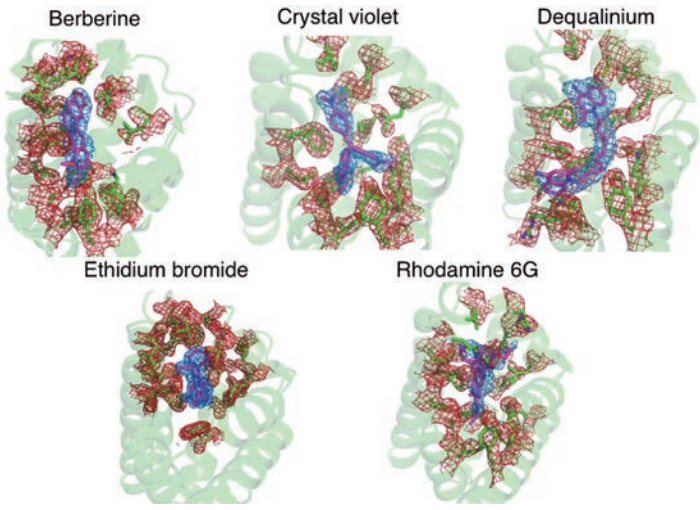


Fig.3 Co-crystal structures of RamR with multiple drugs. we determined the crystal structures of RamR in complex with berberine, crystal violet, dequalinium, ethidium bromide and rhodamine 6G (Fig. 3). Electron density maps of each co-crystal structure are shown in Supplementary Fig. S3. The crystal structures were refined to a resolution of 2.4 Å, 2.2 Å, 2.6 Å, 1.6 Å and 2.5 Å, respectively

In conclusion, we have made an effort to extend our knowledge of transcriptional regulation mediated by RamR, a regulator of multidrug resistance in several Enterobacterial pathogens.

Laboratory of Atomic Scale Materials Processing

Associate Professor:	Takeshi YANAGIDA
Specially Appointed Assitant Professor:	Kazuki NAGASHIMA
Specially Appointed Researcher:	Fuwei ZHUGE
Specially Appointed Researcher:	Yong HE
Specially Appointed Researcher:	Gang MENG
Supporting Staff:	Ayako FUJIWARA (2014.3.1-2014.3.31),
Supporting Staff:	Keiko TSUKADA (2014.3.1-2014.3.31)

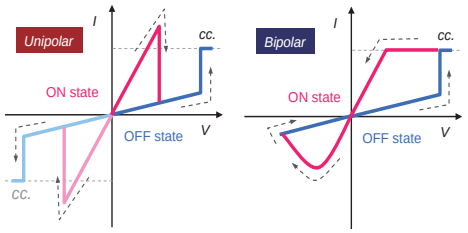
Outlines

This research group investigates the atomic scale materials processing by taking over the principle of nature, in which their 3D hierarchical structures are naturally formed by utilizing extremely small energy and reacting in limited environments. We try to explore the mechanism of such atomic scale materials processing, and to create the original hierarchical nanostructures, the functional properties and the unique nanodevices. Main subjects are (1) Creation and design of one-dimensional functional nanowires via identifying fundamental principles of the atomic scale materials processing, (2) Search for nanoscale physical properties in a spatially confined single nanowire, (3) Developments of green-electronics devices (nonvolatile memory and energy conversion, etc.) and biomolecular analysis devices.

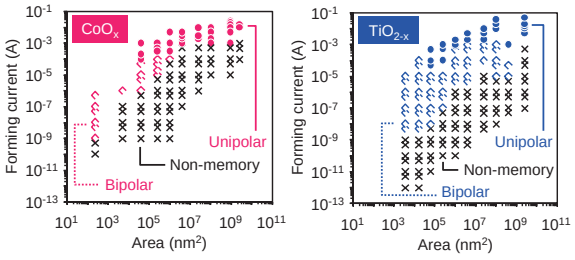
Current Research Projects

Scaling Effect on Unipolar and Bipolar Resistive Switching of Metal Oxides

Resistive switching in metal/oxide/metal structure is attracting much attention as next-generation nonvolatile memory, so-called memristor or ReRAM, due to its excellent memory performance. The resistive switching consists of the electrical polarity independent ‘unipolar switching’ and the electrical polarity dependent ‘bipolar switching’, however, predicting and tailoring such operation mode have been impossible. Here we demonstrate that the operation mode of resistive switching is inherently dependent on the device size and electric field intensity. This trend was commonly seen for various oxide materials including CoO_x, TiO_{2-x} and NiO_x. The clarified scaling rule in this study will help for many researchers to predict and tailor the property of resistive switching memory.



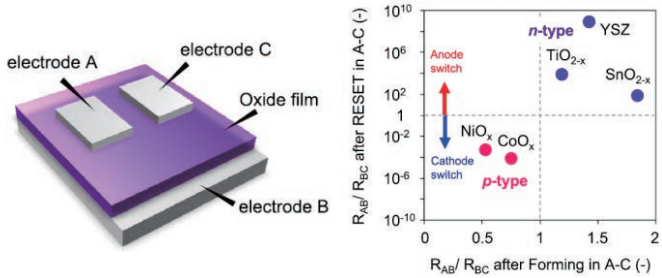
Unipolar switching (left) and bipolar switching (right).



Device size and initial applied current dependence on the operation mode of resistive switching memory.

Carrier Type Dependence on Unipolar Resistive Switching of Metal Oxides

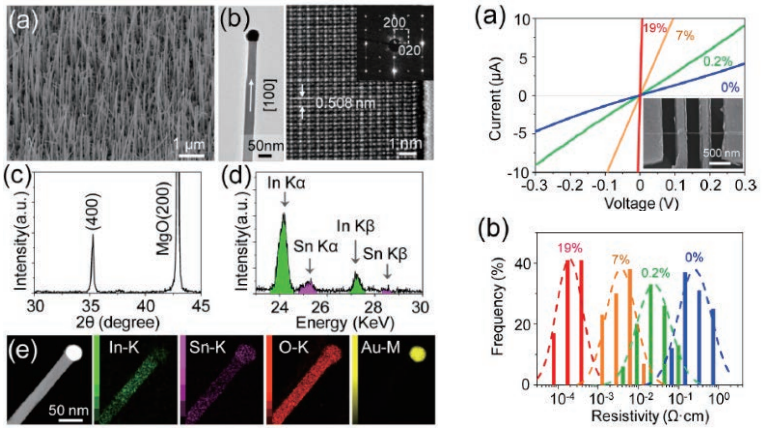
Memory device based on a resistive switching in metal/oxide/metal junction is expected as next-generation nonvolatile memory so-called 'ReRAM' or 'memristor'. However, the underlying switching mechanism especially in electrical polarity independent unipolar switching is controversial. Since the resistive switching is strongly governed by initial electrical breakdown process, extracting the feature of such breakdown process in unipolar switching might help to clarify the switching mechanism. Here we demonstrate the carrier type dependent asymmetry of resistive switching behavior. The resistive switching was seen near anode in n-type oxides while near cathode in p-type oxides. We found that the asymmetry of resistive switching was determined by the electrically induced inhomogeneity of cation/anion vacancies in oxides. These results were consistent with our previous model for bipolar switching based on the co-existence of cation/anion vacancies.



Device configuration for identifying the local resistance of unipolar switching (left) and the carrier type dependent switching location (right)

Synthesis of Highly Conductive Single Crystalline ITO Nanowires

Impurity doping is powerful tool to modulate the material properties. However, an arbitrary control of oxide nanowires has been difficult due to the lack of understanding of the impurity doping process during oxide nanowire growth. In this study, we successfully clarified that the impurity doping of vapor-liquid-solid oxide nanowire growth is dominated via the critical nucleation process of dopant at liquid-solid interface. In addition, we successfully synthesized the highly conductive ITO (Sn doped In_2O_3) nanowires with the resistivity of $2.1 \times 10^{-4}\Omega$cm by arbitrarily controlled doping process. The results found in this study are important not only for tailoring the material properties of oxide nanowires but also for synthesizing a novel nanowires composed of functional complex oxides.



Structural and compositional analysis (left) and conductivity measurement (right) of ITO nanowires.

Department of Cellulose Nanofiber Materials

Associate Professor: Masaya NOGI
Specially Appointed Assistant Professor: Hirotaka KOGA
Postdoctoral Fellow: Thi Thi Nge
Supporting Staff: Ming-chun HSIEH, Miki NAKAMURA, Hitomi YAGYU
Izumi KANAI

Outlines

Cellulose is the most common and abundant bioresources, mainly originating from higher plants. We have successfully extracted cellulose nanofibers with widths of 4-15 nm from wood pulps, and have developed cellulose nanofiber-based materials, such as transparent paper, especially for electronic applications.

Current Research Projects

Conductive Lines on Nanopaper

Metal nanoinks were successfully printed on the surfaces of the nanopaper with densely-packed nanofiber structures. The as-printed conductive line patterns lighted light-emitting diodes (Fig. 1).

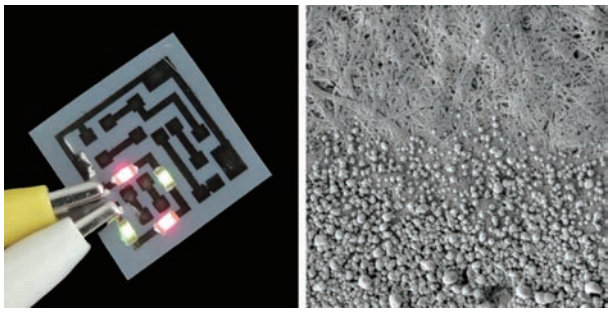


Fig.1 Conductive line patterns printed on a nanopaper

Transparent Conductive Paper

Silver nanowires and carbon nanotubes were uniformly coated on a transparent paper through a papermaking process. The as-prepared paper showed high foldability as well as transparency and conductivity (Fig. 2), opening new doors for transparent paper electronics.

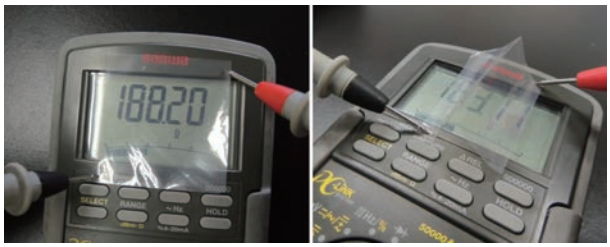


Fig.2 Foldable, transparent and conductive paper

Electrochromic Paper Display

Electrochromic display consisting of PEDOT/PSS-coated transparent paper and ionic liquid-containing pulp paper was successfully prepared (Fig. 3). The all paper-based electrochromic display can be used for various e-paper applications such as e-book, and thus is expected to be next-generation display media.

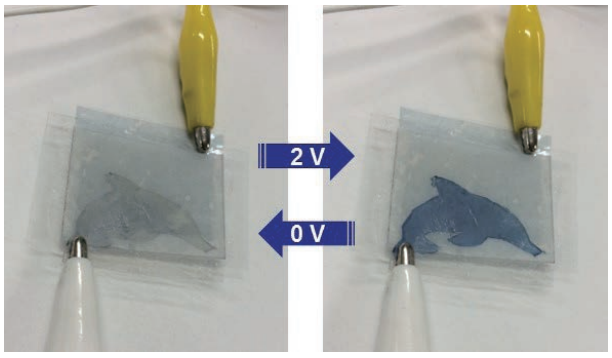


Fig.3 Electrochromic paper display

Department of Cell Membrane Structural Biology

Specially Appointed Professor: Akihito YAMAGUCHI
Specially Appointed Associate Professor: Ryosuke NAKASHIMA
Specially Appointed Assistant Professor: Keisuke SAKURAI
Supporting Staff: Sumie MATSUOKA, Kimie KITAGAWA, Han JINMIN

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.

In 2013, we reported the first inhibitor-bound structures of AcrB and MexB. The pyridopyrimidine derivative (ABI-PP) tightly binds to a narrow pit composed of a phenylalanine cluster located in the distal pocket and sterically hinders the functional rotation. The structure of the hydrophobic trap will contribute to the development of universal inhibitors of MexB and MexY.

Current Research Projects

The inhibitor specificity is determined by the small difference in the amount of space in the hydrophobic narrow pit

This pit is a hydrophobic trap that branches off of the substrate-translocation channel. F178 is located at the edge of this trap in AcrB/MexB and contributes to the tight binding of the ABI-PP molecule through a π-π interaction with the pyrido- pyrimidine ring. The voluminous side chain of W177 located at the corresponding position in MexY prevents inhibitor binding, which may be the reason why ABI-PP does not inhibit MexY. To confirm this hypothesis, we constructed the mutants, MexY W177F, MexB F178W and AcrB F178W. The inhibitory effect of ABI-PP on efflux transporters was measured by examining its effect on cell growth and its ability to prevent the accumulation of doxorubicin in *E. coli* cells. The results were indicating that the AcrB F178W mutant is no longer inhibited by ABI-PP, and in contrast, the MexY W177F mutant is inhibited by ABI-PP. These clearly indicate that the presence of a voluminous side chain at the edge of the hydrophobic trap in MexY reduces the inhibitory activity of ABI-PP.

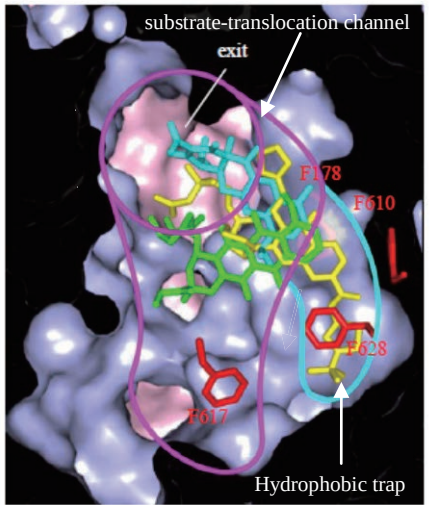


Fig.1 Cutaway view of the distal drug-binding pocket. Bound minocycline (blue) and doxorubicin (green) are superimposed on inhibitor (yellow) binding structure.

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

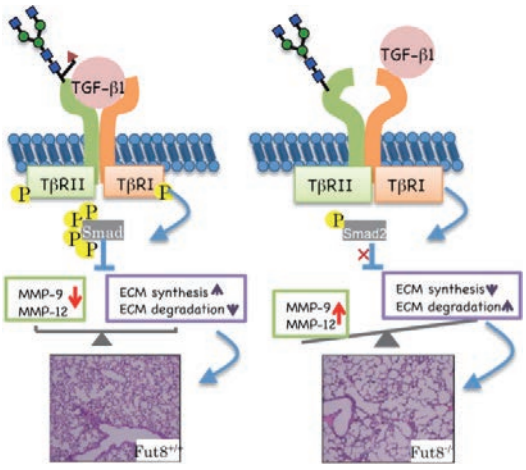
Guest Professor:	Naoyuki TANIGUCHI
Guest Professor:	Kazuaki OHTSUBO
Visiting Academic Staff:	Congxiao GAO, Hiroaki KOREKANE
Technical Assistant:	Junko IIJIMA, Emmanuel Siota PALACPAC
Supporting Staff:	Izumi SUGASE (-2013.8.31)
	Yuko TANAKA (2013.10.1-)

Outlines

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

Current Research Project

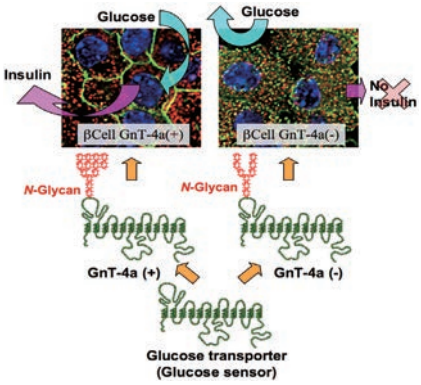
The Role of Glycosylation in Pathology of Pulmonary Emphysema



Cigarette smoking is the major risk factor for chronic obstructive pulmonary disease (COPD), a deadly condition kills more than 3 million people worldwide each year. Yet, despite the irreversible cell damage caused by tobacco smoke, only around one in five lifelong smokers go on to develop COPD, indicating that some people have genetic factors that predispose them to the condition whereas others harbour DNA variants that offer protection. We showed that wiping out a gene called alpha1,6-fucosyltransferase (FUT8), which makes a simple sugar structure known as ‘core fucose’ that helps maintain alveolar structure, led to lung-destructive characteristics in mice. While exposing Fut8 heterozygous mice to cigarette smoke, the mice experienced a rapid influx of inflammatory cells in the lungs and developed emphysema after only three months, which is much shorter than wild type mice. Proteins involved in the so-called Smad pathway, which control the activity of enzymes that break down the extracellular matrix along the lung alveoli wall, help

drive this lung destruction process.
From more than 100 clinical samples, we found that people with lower FUT8 activity had worse lung function on average and experienced more acute exacerbations of COPD than others with elevated FUT8 levels.

Functional Analyses of Protein Glycosylation in Pathogenesis of Diabetes Mellitus



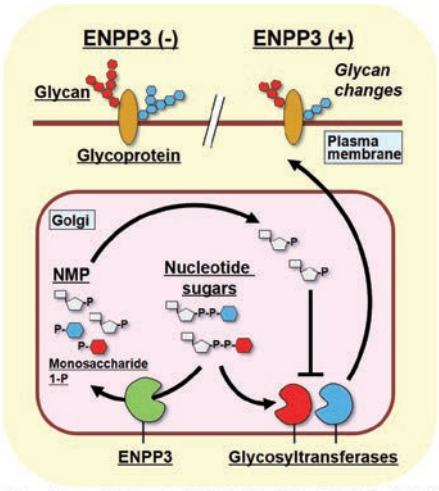
A connection between diet, obesity and diabetes exists in multiple species and is the basis of an escalating human health problem. We reported that elevated concentrations of free fatty acids caused nuclear exclusion and reduced expression of the transcription factors in beta cells. This resulted in a deficit of GnT-4a glycosyltransferase expression in beta cells. Protection from disease was conferred by enforced beta cell-specific GnT-4a protein glycosylation and involved the maintenance of glucose transporter expression and the preservation of glucose transport. We observed that this pathogenic process was active in human islet cells obtained from donors with type 2 diabetes; thus, illuminating a pathway to disease implicated in the diet- and obesity-associated component of type 2 diabetes mellitus.

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 that preferentially binds to glycan.

Identification of ENPP3 as a new regulator for glycan biosynthesis

A brain-specific β1,6-*N*-acetylglucosaminyltransferase GnT-IX has a broad GlcNAc transfer activity towards *N*-linked and *O*-mannosyl glycans. Based on purifying, identifying, and characterizing ectonucleotide pyrophosphatase/phosphodiesterase (ENPP) 3 as an intrinsic inhibitory factor for GnT-IX in Neuro2a cells, we found that the enzyme inhibits GnT-IX via ENPP3-mediated hydrolysis of the nucleotide-sugar donor substrate UDP-GlcNAc, with the resulting generation of UMP, a potent competitive inhibitor of GnT-IX. Such a novel regulatory mechanism of glycan biosynthesis would be responsible for altering the total cellular glycosylation profile and modulating cellular functions.



Korekane H, Park JY (2013) 288: 27912-27926

Activities of Centers

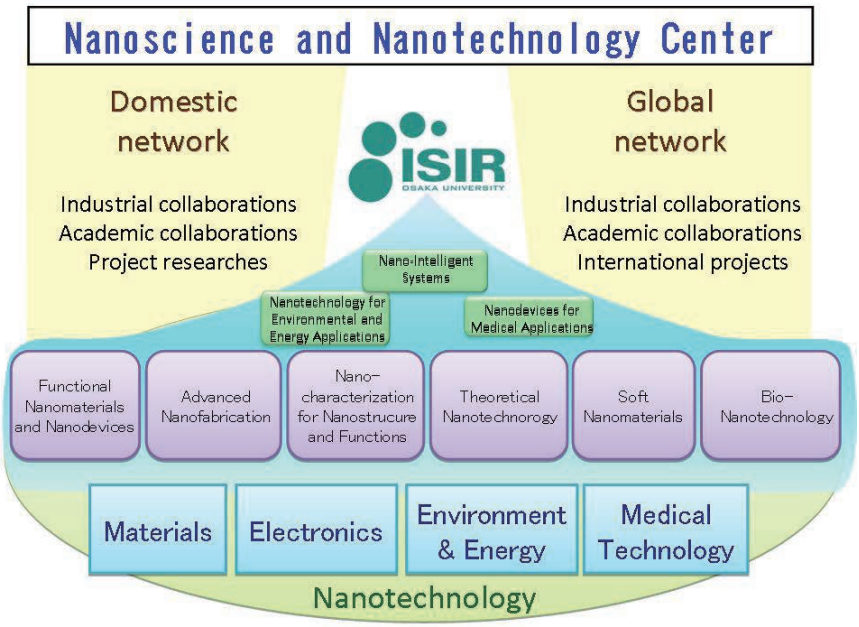
Nanoscience and Nanotechnology Center

Director, Professor: Yoichi YOSHIDA
Supporting Staff: Yuka UMEMOTO

Outlines

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
Associate Professor: Teruo KANKI
Assistant Professors: Azusa HATTORI, Kohei FUJIWARA
Specially Appointed Researcher: Koichi OKADA
Graduate Students: Hidefumi TAKAMI, NGUYEN Thi Van Anh, WEI Tingting, Kenichi KAWATANI, Takashi ICHIMURA, Shouta YAMASAKI, Tatsuya HORI, Tsubasa SASAKI
Under Graduate Students: Koutarou SAKAI, Takurou NAKAMURA
Technical Supporting Staff: Aya IWAKI
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). 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

Simultaneous measurements of transport properties and electronic domain behaviors in VO_2 thin films

VO_2, a typical strongly correlated electron material, shows a first-order metal-insulator transition (MIT) around room temperature. From a nano to microscopic point of view, VO_2 shows mixed electronic phases consisting of metallic and insulating domains around the MIT temperature. In this year, we have investigated the relationship between individual domain behaviors and electronic properties of micro-scaled domains in VO_2 on TiO_2(001) substrates in simultaneous measurements using an optical microscope and a measurements system for electronic transport properties [Original Paper 1]. By the metallic domain configurations from two to one dimensions in Fig.1(a) to (c), electronic transport properties were fully changed as shown in Fig.1 (d). In one dimensional cases, drastic resistive changes could be observed with insulator-to-metal transition of the final domain in the 1D-serial configuration and initial domain in the 1D-parallel configuration. These drastic changes could be observed in

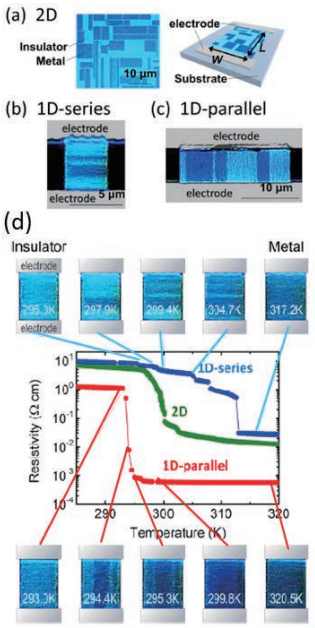


Fig. 1. Optical microscope images of metal and insulator domain configurations in (a) random 2D, (b) 1D series, and (c) 1D parallel connections. (d) temperature dependence of resistivity for 1D series (blue dots), 1D parallel (red dots) and 2D (green dots), and optical microscope images obtained at 293 K to 320 K during heating of the 1D series (upper) and parallel (lower) connections.

VO_2 nano-wires with nano-scale domains of VO_2 thin films on Al_2O_3(0001) substrates [Original Paper 5]. The concept of dimensional control of domain configuration through precise size control of thin films will provide strategies for creation of unique electronic functionalities in materials with coexisting different electronic phases.

Nonvolatile memory effect in electrolyte-gated spinel ferrite thin films

The electric-field control of the electronic properties of functional oxide materials has been intensively studied as a key technology in the next-generation of electronics. In this work, we found that the conductivity and magnetoresistance of a practically useful ferrite compound, $Zn_xFe_{3-x}O_4$, are electrically programmable in a nonvolatile manner, by an electric-field effect with an ionic liquid electrolyte [Fig. 2(a)] [Original Paper 2,3]. The application of a positive/negative gate voltage across the electrolyte increased/decreased the conductivity and magnetoresistance [Fig. 2(b)] of the ferrite channel, and the gate-induced changes remained even after the removal of the gate voltage. From the detailed analysis, redox reactions that reversibly change the oxygen content were suggested to be responsible for the observed nonvolatile electric-field effect. This unique field effect, distinct from the conventional electrostatic carrier doping mechanism, should provide a new route to developing high-performance oxide-based field-effect devices.

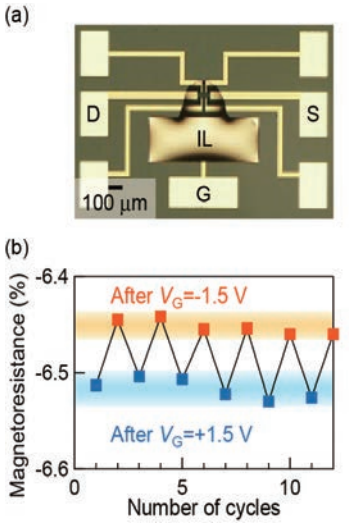


Fig. 2 (a) Device structure. G, D, S, and IL represent gate, drain, and source electrodes and ionic liquid, respectively. (b) Gate-induced nonvolatile switching of magnetoresistance at 300 K

Construction of functional metal oxide 3D nanostructures and investigation typical nano-property

Transition metal oxides possess unique functionalities, and these three-dimensional (3D) nanostructures are indispensable factor to achieve the nanoscale electronic devices. Figure 3(a) shows the epitaxial $(Fe,Zn)_3O_4$ (FZO) nanowall wire fabricated by our original technique: 3D nanotemplate PLD [Original Paper 4,6]. Figures 3(b) and 3(c) show cross-sectional transmission electron microscopy (TEM) image of FZO nanowire and FZO/3D-MgO interface, respectively. The TEM image revealed the existence of an epitaxially matched lateral interface between FZO/3D-MgO. Figure 4(a) shows the accurately wall-width-controlled and well aligned (La, Pr, Ca)MnO_3 (LPCMO) nanobox structures. Figure 4(b) shows the satellite peak intensity on the $Mn2p_{3/2}$ peak change according to temperature for LPCMO nanobox by hard X-ray photoemission spectroscopy. A quick increase on nanobox indicates that insulator-metal transition in nanobox occurs at the higher transition temperature. Thus, nanostructuring the strongly correlated LPCMO is a frontier to deliver promising functional nano-materials.

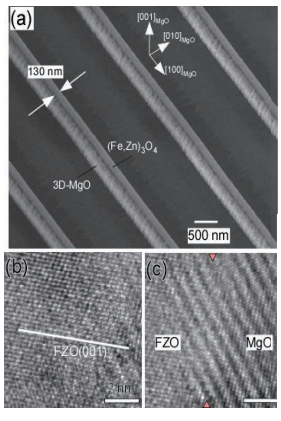


Fig. 3 (a) Typical epitaxial (FZO) nanowall wire, and cross-sectional TEM images of (b) FZO nanowall wire and (c) FZO/3D-MgO interface.

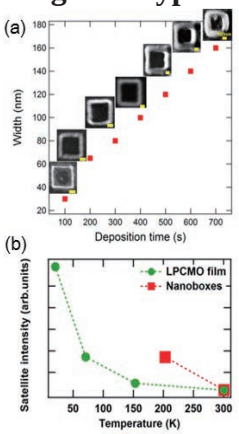


Fig. 4 (a) The LPCMO nanobox structures. (b)The temperature dependence of the satellite peak intensity.

Department of Advanced Nanofabrication

Professor:	Yoichi YOSHIDA
Associate Professor:	Jinfeng YANG
Assistant Professors:	Takafumi KONDOH, Koichi KAN
Specially Appointed Researcher:	Masao GOHDO
Guest Professors:	Atsushi OGATA, Hitoshi KOBAYASHI
Guest Associate Professor:	Hiromi SHIBATA
Graduate Students:	Tomohiro TOIGAWA, Yasushi SASAKI, Taiki IGAHARA, Itta NOZAWA, Liang LI
Under Graduate Students:	Satoshi Nishii, Suguru YAMASO
Supporting Staff:	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

Generation of ultrashort electron beam for attosecond pulse radiolysis

Generation of an ultrashort electron beam was realized by several schemes, e.g., femtosecond photocathode RF gun and magnetic bunch compression with higher-order compensation. Infrared electro-magnetic (EM) -wave emitted by the electron beam was measured by a Michelson interferometer. In the interferometer, a MCT (HgCdTe) detector was used for the analysis of EM-waves with shorter wave length than a case in previous study. The generation schemes realized ultrashort electron beam with an rms bunch length of 1 fs at a bunch charge of 2.1 pC. In the future, such electron bunches will be used for attosecond pulse radiolysis.

Study of the formation process of alkyl radicals in n-dodecane by using UV femtosecond pulse radiolysis

Decomposition process of n-dodecane which is used extraction reagent in a nuclear fuel reprocessing is very important from viewpoint of the radiolysis and the polymer-resist model compound. In order to reveal the relationship between the initial process of radiation chemistry and the formation process of alkyl radicals (R·) in n-dodecane, by expanding the measurable wavelength of the femto second pulse radiolysis to 240 nm, the transient absorption of alkyl radicals were observed. Transient absorption at 240 nm showed the rapid rising with 7 ps and then the slow decay without formation. Previous model for the alkyl radical formation from excited state by geminate ion recombination could not explain these behaviors. This experimental result shows the contribution of the short lived active species like an excited radical cation which was proposed recent year.

Study of the formation process of phenyl dimer radical cation in poly-α-methyl styrene by direct ionization method

In order to understand the basic process of radiation chemistry of the polymer-resist in the semiconductor nanofabrication, as a model compound of the polymer resist, the formation process of dimer radical cation of PAMS was observed by direct ionization methods and the femtosecond pulse radiolysis. For the observation of the dimer radical cation of PAMS by direct ionization, tetrahydrofuran (THF) which cannot transfer the cation was selected. Also a dichloromethane (CH_2Cl_2) was prepared for the scavenger of solvated electrons. Dimer radical cation was observed at 1200 nm by direct ionization of PAMS in solution, formation rate constant was estimated as 2×10^{11} s^{-1}.

Study of the solvation process of the hydrated electron by using the femto second pulse radiolysis

It is well known that hydrated electrons is formed from pre-hydrated electrons, and react with some solute in water. However, the formation behaviors of the hydrated electron and the pre-hydrated electron could not be observed by the electron beam pulse radiolysis because of lack of time resolution. Transient absorption traces of water were measured from 450 nm to 1700 nm by using the femtosecond pulse radiolysis. And then, it was analyzed by a two states model that the hydrated electron was formed from pre-hydrated electron considering the time resolution of the measurement system. From transient traces at every wavelength, dynamics of the hydrated electron and pre-hydrated electron could be obtained. And also transient spectra of the hydrated electron and the pre-hydrated electron were obtained. An absorption peak of the pre-hydrated electron was shifted to the shorter in NIR region, and that of the hydrated electron did not shift almost. It was found solvation process of an excess electron in water that water molecule re-oriented in the state of the pre-hydrated electron and then the hydrated electron was formed by an electronic transition from p-like state to s-like state.

Study of the formation process of pre-solvated electron in alcohols by using the femto second pulse radiolysis

Solvated electrons are formed by re-orientation of surrounding solvent molecule and induce some subsequent reactions in polar solvent like water and alcohols. For more advanced application, it is very important that the whole solvation process of excess electron is understood in alcohols. Transient spectra of the excess electron in ethanol and octanol were observed by the femto second pulse radiolysis method. A spectral jump from NIR to VIS region and a continuously spectral shift in VIS region were observed. It could be explained by the model that the solvation process of electron is progressed by the electronic transition and the re-orientation of solvent molecule. Fast rise and decay of transient absorption which was quenched by an electron scavenger was observed at 1900 nm in octanol might be due to dry electrons. It was possible to obtain important knowledge for solvated electron formation mechanism.

Department of Nanocharacterization for Nanostructures and Functions

Professor: Seiji TAKEDA
Associate Professor: Hideto YOSHIDA
Assistant Professor: Naoto KAMIUCHI (2013.10.1-)
Specially Appointed Researcher: Keju SUN
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Supporting Staff: Noriko TAKASE

Outlines

The analysis of nanostructures in nanomaterials and evaluation of its properties by transmission electron microscopy (TEM) are indispensable for the improvement and development of new functional materials. Especially, the in situ analysis of nanostructure and the estimation of formation process of nanodevices will become more important in the near future. Our group has developed environmental transmission electron microscopy (ETEM), which enables us to observe solid-gas reactions in situ in high resolution. We have studied the morphology of gold nanoparticles (AuNPs) supported on metal oxides under catalytic reaction conditions and the formation process of grown-in defects in carbon nanotubes (CNTs).

Current Research Projects

Stepwise Displacement of Gold nanoparticles in Au/CeO_2 Catalyst under Reaction Conditions

Gold nanoparticles (AuNPs) supported on CeO_2 exhibit high catalytic activity for CO oxidation reaction even below room temperature. The interface between AuNPs and metal oxide support may play an important role for the acceleration of catalytic reaction, whereas the mechanism is not elucidated. In situ observation of Au/CeO_2 catalyst at atomic scale under reaction conditions is necessary in order to explain the reaction mechanism. In this research, the catalyst of Au/CeO_2 prepared by the Deposition-Precipitation (DP) method was investigated by Cs-corrected ETEM observation under CO oxidation reaction conditions (CO 1vol.%/air, room

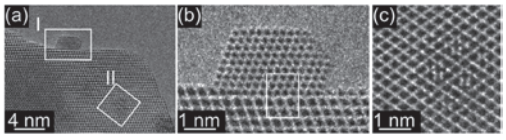

Fig. 1 Cs-corrected ETEM images of AuNPs in Au/CeO_2.

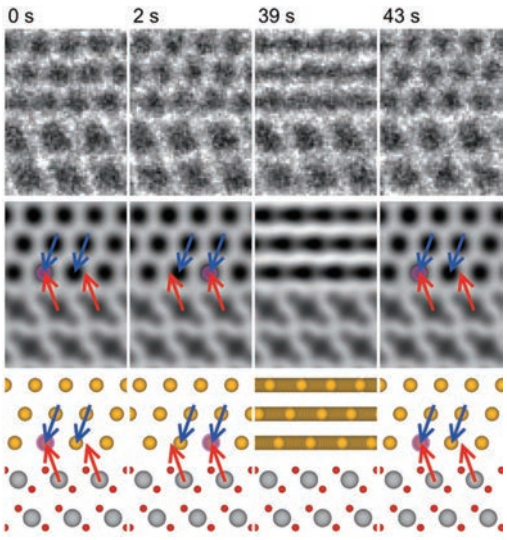

Fig. 2 Displacement of an AuNP under reaction conditions.

temperature). Figure 1 shows ETEM images of Au/CeO_2 catalyst, and the rectangular areas I and II in Fig. 1(a) are shown in Fig. 1(b) and (c), respectively. An AuNP moved by approximately 0.09 nm and slightly rotated with time, as indicated in Figure 2, which corresponds to the white rectangular of Fig. 1(b). The simulated images in the middle row of Fig. 2 agreed well with the ETEM images. In addition, an AuNP in Fig. 1(c) rotated around an anchoring point, (Fig. 3(a)). The results of Fourier transformation revealed the rotation angle (±4°) of the AuNPs (Fig. 3(b)-(d)). This study revealed that AuNPs in Au/CeO_2 catalyst move reversibly and rotate on CeO_2 support surface under reaction conditions at room temperature. The results indicate that AuNPs should be loosely bound to oxygen-terminated CeO_2 and AuNPs are possibly anchored to oxygen-deficient sites of the surface of CeO_2.

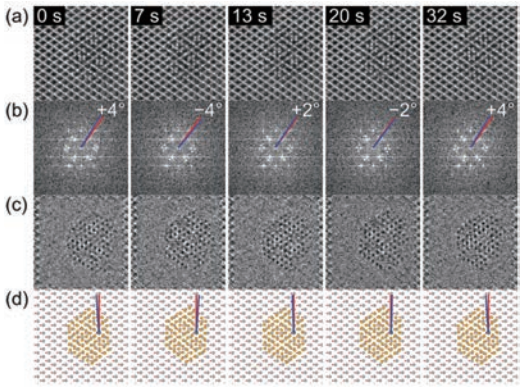

Fig. 3 Rotation of an AuNP under reaction conditions.

In Situ Structural Analysis of Grown-in Defects in Carbon Nanotubes

It is well know that carbon nanotubes (CNTs) have extraordinary electronic and mechanical properties due to their atomic structure. The intrinsic properties of CNTs are affected by the grown-in defects such as vacancies, bending, and irregular interlayer spacing. To establish a growth method of defect-free CNTs is necessary for application of CNTs to future nanodevices. In this research, the origin of grown-in defects in CNTs was elucidated by in situ ETEM observations. CNTs were synthesized at 600°C by the catalytic chemical vapor deposition (CVD) growth with Fe-Mo nanoparticle catalysts (NPCs) under acetylene and hydrogen gas, and the formation process of CNTs was observed in situ at atomic scale. Figure 4 shows the formation of a large-angle bend in a CNTs growing from an NPC. The smooth interface between the CNT and the NPC changed to a concave one, and the bend formed simultaneously. As shown in Fig. 5, the interlayer spacing of CNT consisting of 11 graphitic layers gradually became irregular and large from 0.34 nm to 0.41 nm. The deformation of the NPC at the interface with CNTs was clearly observed during the formation of the irregular interlayer spacing. It was also revealed that the changes in the diameter and number of graphitic layers in CNTs were caused by the large protrusion and shrink deformations of NPCs. This study provides insightful strategies to control the structural variations in CNTs.

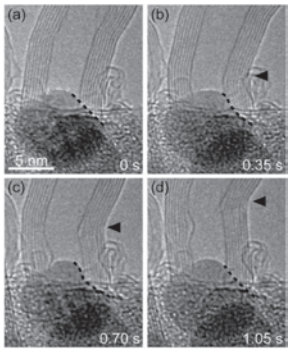

Fig. 4 Formation process of a large-angle bend in a growing CNT.

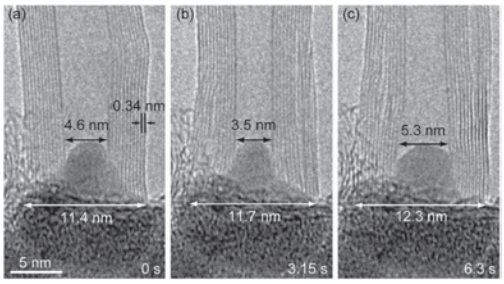

Fig. 5 Formation of irregular interlayer spacing layers in a growing CNT.

Department of Theoretical Nanotechnology

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Guest Professors:	Mitsuhiro MOTOKAWA, Takeo JO
Visiting Professor:	Jaichan LEE (2013.11.11-2013.12.13)
Visiting Researcher:	Ryoji ASAHI (2013.10.1-2014.1.31)
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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

Electronic Structure of Transition Metals and Their Compounds

Transition-metal elements form alloys and compounds with other elements and reveal a wide variety of physical properties. We have focused on several transition-metal oxides and explored their peculiar electronic structure and related properties. The A-sire ordered perovskite oxides $AA'_3B_4O_{12}$ are derivatives of simple perovskite oxides ABO_3, by occupying the A-site with two different A and A' cations and reveal many interesting electronic properties. We have investigated the microscopic mechanism of stable magnetic order in $CaCu_3B_4O_{12}$ (B=Ti, Ge, Zr, Sn) by mean of first-principles electronic structure calculations [Original Paper 1]. The electronic structure of $CaCu_3Fe_4O_{12}$ is also studied to understand measured stable magnetic order and x-ray magnetic circular dichroism spectra [Original Paper 2]. We pursue electronic structure calculations for transition-metal oxides with triangular lattice structure, $PdCoO_2$ and $PdCrO_2$ [Original Paper 3, Original Paper 4].

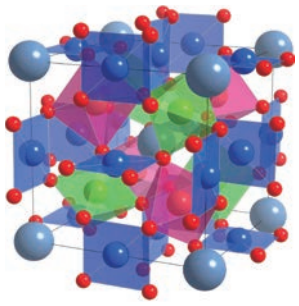

Fig.1 A-site ordered perovskite oxide

Materials Design Utilizing Atom Dynamics

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.

In crystalline Si, hydrogen impurity has an important role in the electronic properties. Experiment shows that the local vibration induced by H is decayed at large rates. This large decay time has been demonstrated by an effect of dynamics of H impurity. Another contribution in this field is elucidation of the elastic softening induced by vacancies. The softening is caused by a rotational motion of vacancy in a strong anharmonic potential.

No definite consensus has been, so far, obtained about the temperature dependence of Young's modulus, which is an important parameter in the Si growth from melt. We have shown the observed temperature dependence by a reasonable model.

Materials Design of Multiferroics and Magnetoelectrics

Among multiferroic system, which shows both magnetism and ferroelectricity, some oxides (such as magnetite) are known to exhibit charge-order-induced ferroelectricity. We have studied charge-ordered manganites and ferrites to clarify the microscopic mechanism of the ferroelectricity [Original Paper 5]. Most of multiferroics shows magnetoelectric effect, by which one can control magnetism by applying electric field. $Ba_2CoGe_2O_7$ shows the particular magnetoelectric effect induced by spin-orbit coupling and asymmetric *pd* hybridization. We performed density functional calculations and clarified the electronic structure of $Ba_2MGe_2O_7$ as replacing Co ion by other transition metal ions (M = V, Cr, Mn, Fe, Ni, Cu) as aiming at materials design of novel magnetoelectrics. We found that partially occupied t_{2g} electron system with M = V, Ni causes polar Jahn-Teller distortion of oxygen tetrahedron and leads to large ferroelectric polarization.

Exploring Materials and Structure Analyses for Cathodes in Secondary Batteries

One problem of the Li-ion batteries is the high material-costs, therefore replacements of Li by Na, as Na-ion batteries, is a preferable way to reduce the costs. To find cathode materials suitable for Na-ion batteries, several types of materials have been studied, and recently pyrite-FeS_2 attracts much interest. Charge/discharge reactions, in which atomic-scale mechanism strongly depends on materials in general, are not so clear especially in intermediate states of reactions. Using first-principles calculations, we investigate discharge reactions in Na/FeS_2 system, which has considered to be governed by the conversion mechanisms. Assuming possible conversion reactions, we theoretically estimate electromotive forces (EMF) characterizing battery performances. To study local-structure changes during the reactions, we calculate x-ray absorption spectra (XAS) of Na/FeS_2 before and after discharges. Calculated EMF and XAS are compared with experimental results, and we discuss probable discharge reaction mechanisms in Na/FeS_2 batteries. EMFs are calculated assuming several stable Na-S crystals as final products of discharge reactions of Na/pyrite-FeS_2. Calculated EFMs (vs Na) for assumed discharge reactions are about 0.9V for the reaction $2Na + FeS_2 \rightarrow Na_2S_2 + Fe$, and about 1.2V for the reaction $4Na + FeS_2 \rightarrow 2Na_2S + Fe$, showing that both the reactions with positive EFMs are possible, and that the dominant reaction is the latter one which produces Na_2S with Fe as a final product.

Department of Soft Nanomaterials

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Assistant Professors: Makoto KARAKAWA, Masashi NITANI
Graduate Students: Jianming HUANG, Seihou JINNAI, Chihiro SATO, Saori TONE, Yi WANG, Shohei SASADA, Aya TASHIRO
Specially Appointed Researcher: Shreyam CHATTERGEE
Supporting Staff: Keiko YAMASAKI
Technical Assistant Staff: Takeo MAKINO (-2013.12.31)

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 organic field-effect transistors (OFETs). It has been known that the introduction of electron-withdrawing groups into pi-conjugated systems increases their n-type character. Electron-withdrawing imide groups are most commonly inserted into pi-conjugated systems to apply to n-type semiconducting materials. However, in terms of increasing the intermolecular interactions in combination with reducing the lowest unoccupied molecular orbital (LUMO) energy level, the discovery of new electron-accepting units applicable to n-type materials is still a matter of significance. With

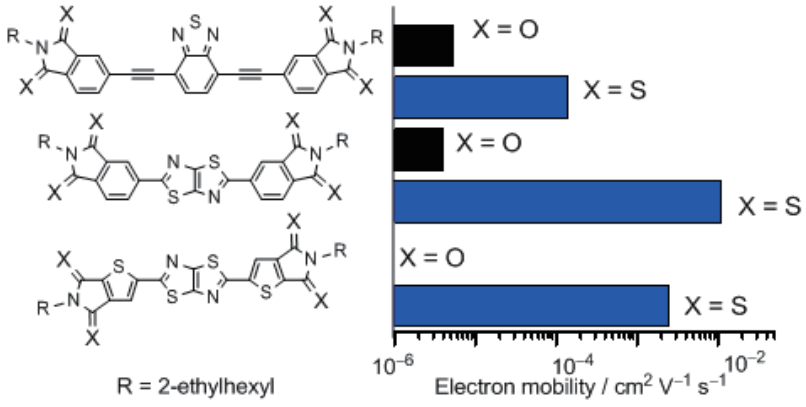

Fig. 1. Electronegative oligomers based on imide- and dithioimide-based compounds.

this point in mind, we focused on dithioimide groups. OFETs based on the dithioimide compounds showed good electron-transporting characteristics. Furthermore, the observed OFET performances were dramatically improved compared to those of the corresponding imide derivatives [Original Paper 1] (Fig. 1).

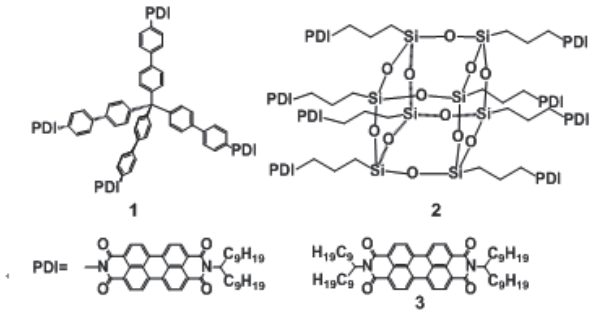

Fig 2. Chemical structures of three-dimensional electron-accepting compounds.

Bulk-heterojunction organic photovoltaics (OPV) based on conjugated polymers and soluble fullerene derivatives have attracted a great deal of attention owing to their solution processability and mechanical flexibility. A well-known soluble fullerene derivative, [6,6]-phenyl C_{61} butyric acid methyl ester ($PC_{61}BM$), is the most promising acceptor material in OPVs,

On the other hand, progress in non-fullerene acceptor materials has been still behid. In this context, n-type semiconductor materials based on linearly conjugated low molecular weight molecules have been developed as acceptor materials in OPVs. However, their PCEs are not satisfactory. To address this situation, we hypothesized a three-dimensional (3-D) arrangement of electron-accepting pi-conjugated molecules that would: form isotropic electron-transporting pathways like fullerene derivatives in the BHJ cell, improve OPV performances. Based on this hypothesis, we synthesized two compounds: one with a tetragonal structure having tetraphenylmethane at the center, and the other with a hexahedron structure having silsesquioxane at the center; and alkylated perylene bis(dicarboximide) (PDI) at the corners. As a result, compound **1** showed similar OPV characteristics as compared to reference planar compound **3** (In both cases, the power conversion efficiencies (PCEs) were 0.12%). Gratifyingly, the hexa-PDI-based compound **2** exhibited the best performance with the highest PCE of 0.18%. [Original Paper 2] (Fig. 2).

We have almost no choice of other acceptors in testing new donor polymers for the device fabrication. This lack of the acceptor materials leads to insufficient fundamental understanding and limits the further improvement of the OPV performances. We have synthesized novel soluble fullerene derivatives, followed by their detailed light absorbance, electrochemical, and photovoltaic properties. We fabricated the OPV devices using newly synthesized *N*-phenyl [60]fulleropyrrolidines with a typical low-band gap polymer (PTB7) as a donor material, and found that these devices exhibited excellent performances of over 7% which is the highest class value of OPVs using C_{60} derivatives as an acceptor material.

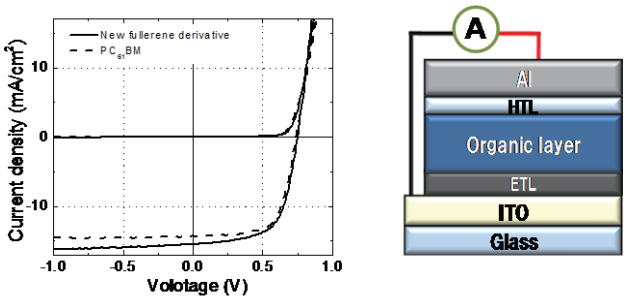

Fig. 3 current density-voltage characteristics of OPV cells using new fulleropyrrolidine and its device structure.

Department of Bio-Nanotechnology

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Associate Professor:	Makusu TSUTSUI
Assistant Professor:	Hiroyuki TANAKA, Kazumichi YOKOTA
Graduate Students:	Sadato HONGO, Akihide ARIMA, Takanori MORIKAWA
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

Discriminations of equi-sized single-particles by a nanopore trapping method

Solid-state nanopores are considered as a promising sensing device for bioanalytical applications. It consists of a nanometer-sized hole formed in a thin membrane made of SiO2 or SiN. Resistive pule technique is one of the nanopore sensing methods that uses a temporal change in the ion current through a nanopore during electrophoretically-driven translocation of a particle or a molecule. In this method, however, analytes are often accelerated to an extremely high speed by the huge electric field inside the nanopore whereby degrading the single-particle sensing capability. We therefore developed a nanopore trapping method that offers an easy

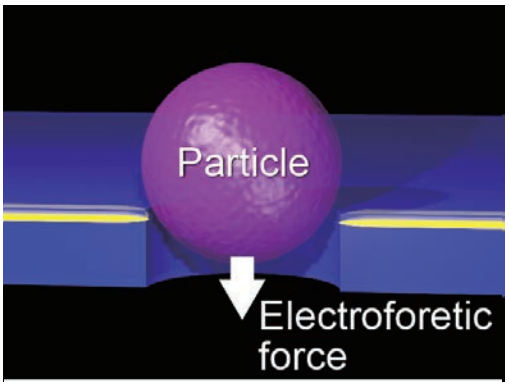


Fig.1 A nanopore trapping method. an oversized particle can be trapped/detrapped at the pore orifice by imposing electrophoretic forces.

way to electrophoretically trap and identify single-particles on a nanopore. The method uses a pore with diameter smaller than the size of analytes of interest. We demonstrate that an oversized particle can be trapped/detrapped at the pore orifice by imposing electrophoretic forces (fig.1). We also found that this method allows discrimination of equi-sized particles by the difference in the surface charge status, the sensing capability of which may expand the application of nanopore sensors.

Thermoelectric transport in atom-sized contacts

Single-molecule junctions are zero-dimensional nanostructure considered as a promising thermoelectric material that can achieve high thermopower by utilizing the steep rise in the electronic density of states at the frontier molecular orbital levels. Conventional ways to measure single-molecule thermoelectric transport properties use scanning probe microscope (SPM) set up to form metal-molecule-metal structures via a break junction approach. However, SPM is not a suitable system to form and hold single-molecule junctions for long enough time to conduct thermopower measurements because of the poor mechanical stability to fix the tip position at room temperatures. Here we utilized lithographically-defined mechanically-controllable break junctions (MCBJs) for single-molecule thermoelectric transport measurements. We integrated a microheater at the vicinity of a Au nano-bridge that can be used to apply a temperature difference over the junction (fig.2). Using the microheater-embedded MCBJs, we performed simultaneous measurements of conductance and thermovoltage of Au atom-sized junctions. We found a conductance-dependent thermopower oscillation, which can be interpreted qualitatively as originating from the one-dimensional band structure of Au atomic wires. This method is now used for evaluating thermoelectric performance of single-molecule junctions.

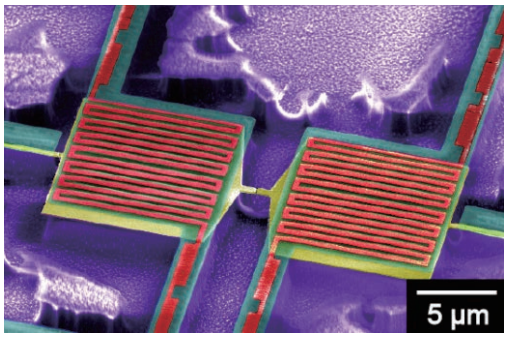


Fig.2 the microheater-embedded MCBJ

Preparation of Ni(111) and Graphene Substrate for SPM

Efficient DNA sequencing of real long DNA by scanning tunneling microscope prefers a millimeter wide and atomically flat conductive substrate. Recently, graphene is considered to be a good substrate for observing adsorbed molecule's electronic state. First, a wide and atomically clean Ni(111) was successfully fabricated on mica substrate (fig.3). Secondly, graphene was synthesized on Ni(111) by chemical vapor deposition of hydrocarbon. SPM image revealed wrinkle like structure which is native to graphene (fig.4), indicating successful synthesis of graphene.

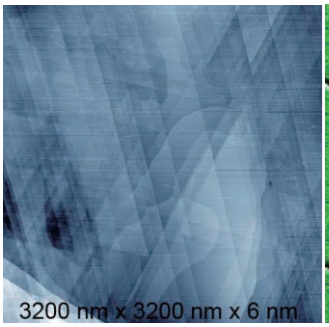


Fig.3 SPM image of Ni(111)

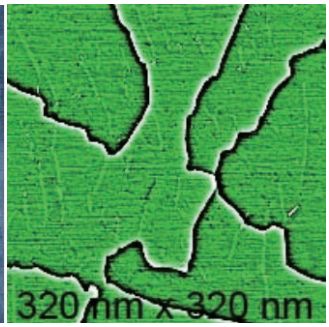


Fig.4 SPMimage of graphene

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 spintronic 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 Project

Basic research of topological insulators for spintronic 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 just a few years ago. In the helically spin-polarized surface state, the current direction and the spin polarization is directly coupled; namely, right- and left-moving electrons carry up and down spins, respectively (this is also called spin-momentum locking). 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 a challenge. It is therefore important to develop suitable device designs for electrically detecting the surface spin currents. Known TI materials 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 developed a highly bulk-insulating TI material $Bi_{2-x}Sb_xTe_{3-y}Se_y$, in which the surface-dominant transport has been achieved for the first time in a bulk single crystal. Using this material, we pursue the idea of detecting spin currents on the surface of a TI. As a step toward this goal, we fabricated a back-gate field-effect device (Fig. 1) using a small exfoliated piece of $Bi_{2-x}Sb_xTe_{3-y}Se_y$, where the type of the carriers can be tuned from n- to p-type.

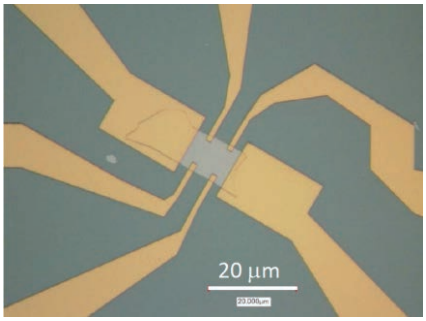


Fig. 1 Optical microscope picture of a back-gate field-effect device made of exfoliated $Bi_{2-x}Sb_xTe_{3-x}Se_x$ single crystal and Pd electrodes fabricated with *e*-beam lithography.

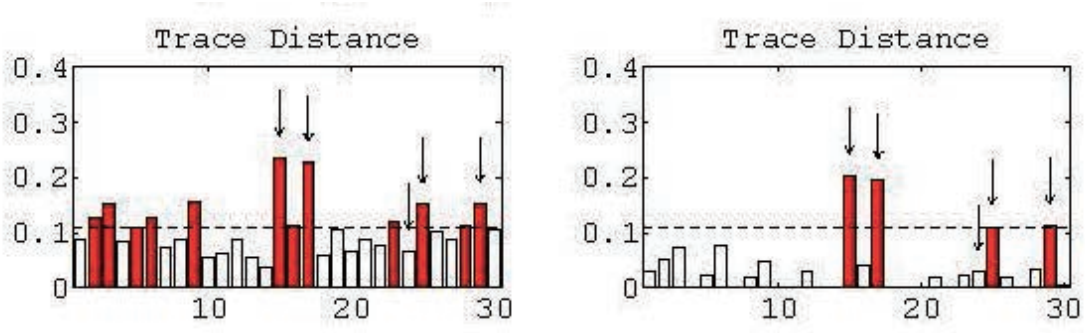
Department of Nano-Intelligent Systems

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. In this year, we worked on the development of a new method based on our latest research outcome in collaboration with Department of Quantum Information Photonics (Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.). During a quantum information experiment over a long period, various outer disturbance and performance degradation of facilities change the experimental conditions and can reduce the reliability of the experiment. We developed a new mathematical method to decompose state density matrices into their steady components and unsteady components and derive accurate estimation results. Moreover, we applied it to real experiments and confirmed its efficacy.

Current Research Projects



Error detection by a conventional method Error detection by proposed method

Our proposed method detects erroneous parts (indicated by arrows) more accurately (indicated by red bars).

Distributions of AUC indices in repeated experiments show that our proposed method has higher reliability.

Department of Nanodevices for Medical Applications

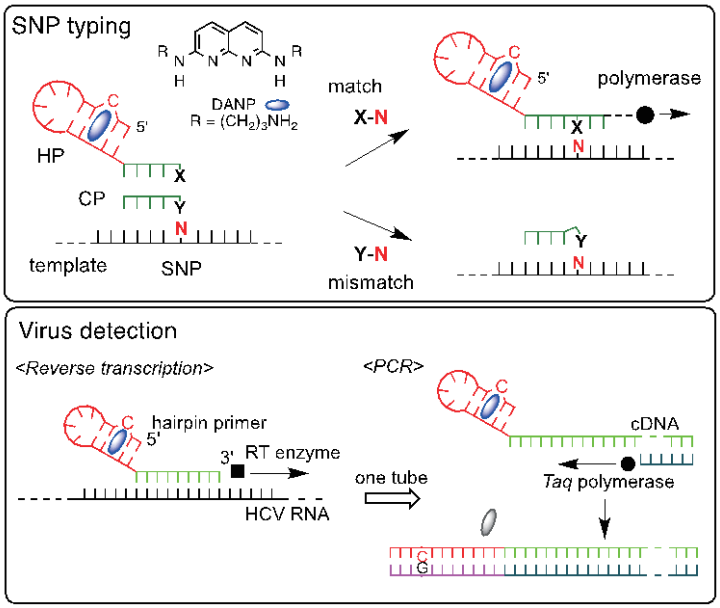
Professor: Kazuhiko NAKATANI

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. 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. In addition, we developed a novel single step virus detection system using the fluorescent molecule with a hairpin primer on the reverse transcription (RT)- polymerase chain reaction (PCR).

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

Department of Nanosystem Design

Guest Professor: Shiro TSUKAMOTO (2013.5.1-9.30)

Outlines

An InAs single quantum dot (QD) embedded in a compound semiconductor GaAs is remarkable as a single photon light source for a quantum cryptography communication. However, a general making method depends on a self-organization and it is difficult to control a position by the nano level. Therefore, during the invitation period of 5 months, I tried to establish a marker forming technique, using the Nanotechnology Open Facilities in Osaka University, for detecting one high quality QD in the specific position. First, we examined mask materials to endure molecular beam epitaxy (MBE) growth, and then, the process way of reducing damage to the GaAs(001) substrate surface about the mask making step to the utmost. At the final stage of these experiments, using a STMBE system (Fig.1) which equipped with a scanning tunneling microscope (STM) inside the MBE growth chamber, we will fabricate the single QD into an artificially formed hole (Fig.2). Therefore, we need to select the mask material that don't react to the materials of Ga, In, As, etc. at the high temperature and moreover the mask shape must not change. Also, because the flatness in the atomic-level is necessary for the MBE growth, the damage of the surface etching by the mask making process and so on must be fastened on the grown-up surface to the minimum.

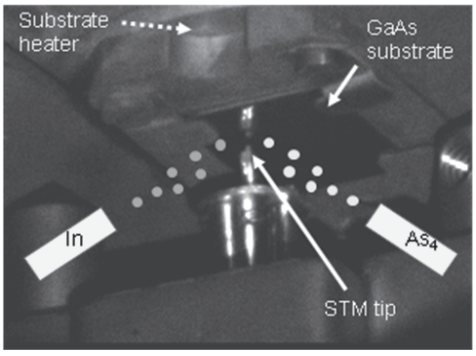


Fig.1 STMBE system

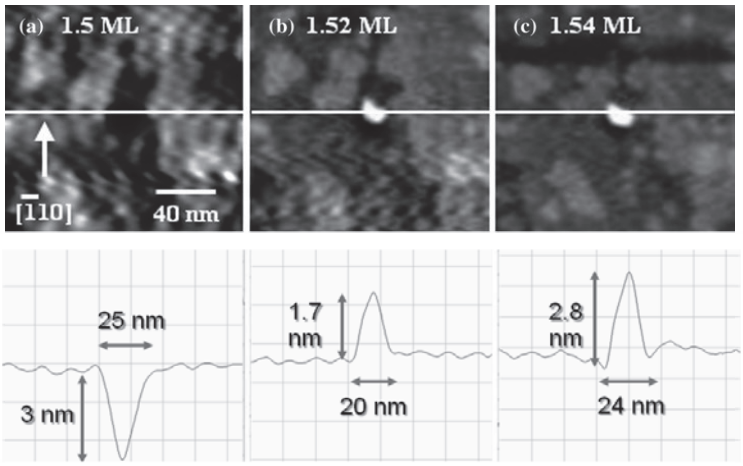


Fig.2 Site-controlled single quantum dot :
deposited InAs amounts and its cross-sectional line profiles

Achievement

First, as the mask material, it chose tungsten (W). W is used as the mask for the selective growth, too. GaAs doesn't grow on the mask or its cluster contains dislocations, resulting in no emitting light where there is a mask. Therefore, one can distinguish from the epitaxial grown InAs QD. The shape of a used photomask and its enlargement as

shown in Fig.3(a), fabricating a W mask in Fig.3(b). Because the wide area scan range by STMBE is only 10μm all sides, the opening must be done below it and it succeeded in the opening making of 4μm as shown in Fig.3(b). Also, it found that GaAs substrate surface was eroded and that about tens-of nm unevenness had been formed when soaking in DMF solution for a long time during a lift-off process. Then, we finally found that the surface unevenness could be suppressed to about 1 nm within 45 min in DMF.

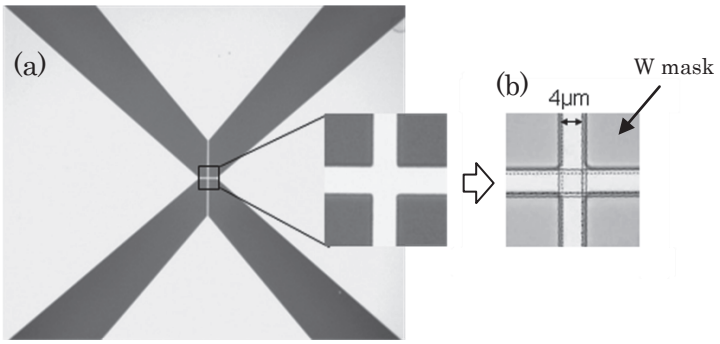


Fig.3 (a) used photomask (b) fabricated W mask pattern

Department of Nanodevice Characterization

Visiting Professor: Ryoji Asahi (2013.10.1-2014.1.31)

Outlines

Extension and application of first-principles calculations for the development of functional materials

Achievements

First-Principles Calculations of Functional Materials

We have pursued the research and development on several functional materials such as photocatalysts, solar batteries, thermoelectrics, ideal-strength alloys, by means of first-principles calculations, to analyze materials properties and to propose new functional materials. Our achievements include not only academic publications but also patent applications and commercial products by closely collaborating with experimental groups, showing the applicability of the calculations. Recently we have explored the algorithm for making possible generalized and stratified materials design. In this study, we apply the first-principles calculations for wider development of functional materials. We organized open seminars entitled “Functional Materials Design 1 – Optical Devices” on the 16th of December, 2013, and “Functional Materials Design 2 – Alloy Materials and Methodological Developments” on the 16th of January, 2014 by Prof. Asahi, stimulating valuable discussion for the perspectives on this research subject.

Department of Nanodevice Characterization

Guillaume CARON (2013.4.1-5.31)

Outlines

In this department, a deformable mirror system, which can change the surface shape according to the scene, has been developed as a new imaging system. A prototype system and an auto calibration method for mirror angles were developed.

Achievements

Deformable mirror system

In the computer vision and robotics research fields, convex and concave mirrors have been utilized according to the purpose. Although complex mirror system in which mirror surface is controlled by actuators exists, such a system tends to be expensive. On the other hand, we have developed a simpler deformable mirror system that small mirror patches are attached to the rubber and the rubber surface can be changed by moving control bar. The surface becomes convex as well as concave. The prototype system has been developed as shown in Fig.1, and we have tested the functions.

Auto calibration method

The angle of each mirror patch cannot be controlled independently in the proposed deformable mirror system. Hence, we have developed the auto calibration method to estimate the mirror angle. The plane with coded dot pattern is captured. By finding the pattern position observed on each mirror patch, the mirror angle can be computed. The mirror shape can be calibrated by recording the relationship between the position of the control bar and the mirror angle.

Figure 1 Deformable mirror system.

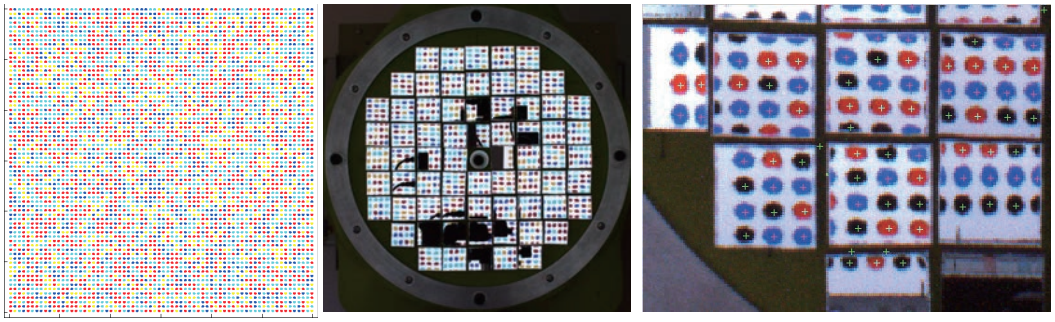


Figure 2 Auto calibration using coded dot pattern.

Department of Nanotechnology Characterization

Guest Professor: Sung Sik KIM (2013.6.21-2013.7.30)

Outlines

In various organic reactions, radical ions are important intermediates owing to their reactivities. Our research group demonstrated that photoexcited radical ions exhibit much higher reactivities. Usually, lifetime of excited radical ions is shorter than 1 ns, thus, application of ultrafast laser spectroscopy is essential to follow their reaction processes. Furthermore, dyad molecules, in which functional molecules are connected by a covalent bond, are useful to realize an efficient reaction. From these points, we have synthesized a series dyad molecules, which is useful to study electron transfer from the excited radical anion.

Achievements

Our research group already investigated the electron transfer from excited radical anion of naphthaldimide (NDI) to pyromellitic diimide (PI), which was connected to NDI through a phenyl linker. Chemical reduction of the dyad molecule of NDI and PI formed radical anion of NDI selectively, which can be excited by a femtosecond laser pulse. Electron transfer from excited radical anion of NDI to PI within a few picoseconds was confirmed by means of transient absorption spectroscopy. For further understanding of the electron transfer process, dependence of electron transfer rate on the free energy change has to be clarified. For this purpose, a series of dyad molecules have been synthesized in this study, i.e., electron donor is excited radical anion of NDI, while the acceptor molecule was perylene diimide, perylene monoimide, phthalimide, and naphtha imide. Because these four acceptor molecules possess lower reduction potential than that of NDI, selective chemical reduction of NDI is possible, which allows one to measure electron transfer from the excited radical anion of NDI. These compounds were successfully synthesized by means of step wise addition of corresponding carboxylic anhydrides to diaminobenzene. By using these compounds, detailed mechanisms of electron transfer from the excited radical anions will be clarified.

Department of Nanodevice Characterization

Guest Associate Professor: Atif Mossad ALI (2013.6.21-7.30)

Outlines

Si wafers for solar cells are produced by slicing silicon ingots. Nearly the same weight of silicon swarf as that of silicon wafers is produced as an industrial waste in this process. We will produce the silicon nanoparticles from silicon swarf by use of the beads milling method and the photochemical etching method. The silicon nanoparticles will be characterized by photoluminescence spectroscopy, transmission electron microscopy etc. which can reveal the relationships between the silicon nanoparticle size and the band-gap energy. The nitric acid oxidation of silicon (NAOS) method will be used to improve the electrical contact among silicon nanoparticles. Metal contaminants on the silicon nanoparticle surfaces will be removed by the defect passivation etch-less (DPEL) cleaning method. These two methods have been developed by Kobayashi's laboratory. Silicon solar cells with the high efficiency will be fabricated by use of silicon nanoparticles with the quantum confinement effect treated using these methods.

Achievements

Silicon nanoparticles were produced from silicon swarf by use of the beads milling method and the photochemical etching method. The diameter of Si nanoparticles was estimated to be 1~20 nm from TEM topographs and peak shapes of the X-ray diffraction spectra. Silicon nanoparticles annealed under hydrogen atmosphere did not change peak shapes of the X-ray diffraction spectra, indicating that amorphous silicon was not included after beads milling and the photochemical etching. The NAOS method for improving electrical contact among silicon nanoparticles and the DPEL method for removing metal contaminants and passivating defect states have been investigated. The process for the silicon solar cells with silicon nanoparticles having wide band-gap has been studied.

Department of Nanodevice Characterization

Visiting Professor: Jaichan Lee (2013.11.11-2013.12.13)

Outlines

Ab-initio study on low-dimensional transition-metal oxides

Achievements

Electronic Structure of Transition-Metal Oxides Revealing Low Dimensionality

Low-dimensional oxides can be realized in the forms of nano-wires, nano-rods, thin films, and superlattices. Among them, oxide superlattices are structures having arbitrary stacking layers and highly expected to show low dimensionality leading to novel physical properties owing to their ultra-thin oxide layer. In this study, electronic transition phenomena such as metal-insulator transitions are investigated by focusing on oxide superlattice systems from first principles. In particular, the target low-dimensional systems are Mott insulators LaTiO3 and LaVO3, band insulator SrTiO3, and strongly correlated metal SrVO3 that have perovskite-type crystal structures. We have studied the electronic mechanisms of their novel material properties associated with the peculiar low-dimensional structure and related electronic structure. We organized an open seminar entitled “Transition metal oxide superlattices” on the 18th of November, 2013 by Prof. Lee, stimulating invaluable discussion for the perspectives on this research subject.

Department of Nanodevice Characterization

Guest Professor: Asuha(CHANG SHAN) (2013.12.24-2014.1.24)

Outlines

In our previous studies, we have fabricated a gate SiO_2 layer of thin-film transistors (TFTs) for liquid-crystal displays by use of the nitric acid oxidation of Si (NAOS) method at 120 ℃. The NAOS SiO_2 layer with a high atomic density effectively blocks the leakage current, and therefore, the gate SiO_2 layer thickness in TFTs is greatly decreased, resulting in a vast decrease in power consumption. The purpose of this research is to apply the NAOS method to the passivation of conventional pn-junction Si solar cells.

Achievements

The structure of the conventional pn-junction Si solar cells is Ag/antireflection coating layer (SiN)/pn-junction Si/Al. For the effective passivation of the surface of the Si solar cells, we formed the NAOS SiO_2 layer between the antireflection coating layer and the pn-junction Si. By the I-V measurement of the new structure Si solar cells under AM1.5 100 mW/cm^2 irradiation, the NAOS reaction condition (e.g. reaction time and temperature) was optimized.

Department of Nanodevice Characterization

Guest Professor: Sefic SUZER (2014.1.27-2.28)

Outlines

It is important to reveal the mechanism of leakage current, origin of defect states, and mechanism of generation and passivation of defect states. This leads to semiconductor devices with better performance achieved by controlling surface states by use of the information obtained from the fundamental research. Semiconductor materials such as silicon will be characterized with X-ray photoelectron spectroscopy (XPS). The surface electronic states and defect states will be examined especially. The defect passivation etch-less (DPEL) cleaning method with HCN aqueous solutions and the nitric acid oxidation of silicon (NAOS) method will be used as a surface passivation method.

Achievements

We decided to use silicon surfaces with ultra-low reflectivity fabricated by the surface structure chemical transfer (SSCT) method as a new model surface to investigate surface electronic states and defect states. For mutual understanding, silicon surfaces with ultra-low reflectivity were fabricated by the SSCT method, minority carrier lifetimes were measured on the silicon surfaces with ultra-low reflectivity, and I-V curves of the silicon solar cells with the ultra-low reflectivity were measured. We discussed analysis methods of silicon surfaces with ultra-low reflectivity by use of XPS under bias at Professor Suzer's group, and made a plan of the specimens for the measurement. The observation of Li ion behaviors in silicon with XPS under bias was also discussed to investigate the mechanism of diffusion of Li ions during charging and discharging Li ion batteries.

Department of Nanotechnology for Industrial Applications

Guest Professor: Dae Won CHO (2014.4.26-6.28)

Outlines

Conjugated polymers and oligomers have been investigated widely because of their importance in nanomaterial application. Their optical and electronic properties largely depend on the redox state. It is known that redox process induces molecular structural change to these materials. Vibration spectroscopy is a powerful tool to investigate molecular structure, and time-resolved spectroscopy can provide information on their reaction dynamics. Thus, in the present project, structural change of the conjugated oligomer upon oxidation was investigated by means of time-resolved resonance Raman spectroscopy during pulse radiolysis.

Achievements

Fig. 1 shows molecular structures of two-dimensional condensed oligofluorenes investigated in the present study. These oligomers possess isotruxene as a core. Absorption and fluorescence spectra of these oligomers exhibited well defined vibrational structures owing to their rigid structure. Peak shift was observed with the size of the oligomer indicating well π-electron delocalization.

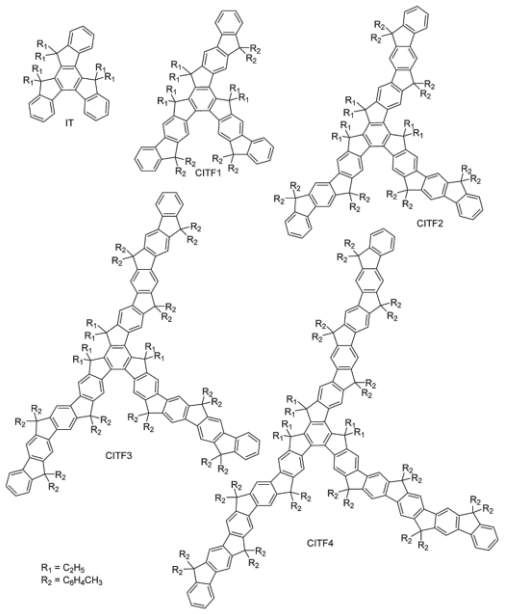


Fig. 1 Two-dimensional condensed oligofluorenes

Absorption spectra of radical cation of these oligofluorenes were obtained by γ-ray radiolysis as well as transient absorption spectroscopy during pulse radiolysis. Radical cations exhibited absorption bands in near IR to UV regions. From the theoretical calculations, it was revealed that the near IR band is due to transition to HOMO, while the visible band is transition from HOMO to LUMO.

Resonance Raman spectra of radical cation species were obtained by synchronization of pulse radiolysis and ns YAG laser. The CC stretch mode of radical cation showed 10 cm^{-1} of downshift when compared with the corresponding neutral molecules, indicating the contribution of the quinoidal character in the oxidized form. This observation was well reproduced by theoretical calculation.

The present study demonstrates that the combination of the pulse radiolysis and time-resolved resonance Raman spectroscopy is a powerful tool to investigate molecular structure of short-lived intermediate.

Department of Beam Materials Science

Guest Professor: Asokendu MOZUMDER (2013.7.2-2013.9.30)

Outlines

An understanding of radiolysis of water is important to evaluate and control the radiation effects in various research fields such as nuclear engineering, radiological science and so on. The radiolysis of water at ambient temperature and under ordinary irradiation conditions has been intensively studied. It is recognized that it begins with energy deposition at femtosecond, followed by the nonhomogeneous formation of short-lived intermediates (electron, free radicals and molecular products) in spurs within picosecond and then the diffusion and reactions of the intermediates within the spurs in nano- and micro-second time scale. However, at high temperatures, many properties such as the diffusion and the reactivity of the intermediates have not been studied well. Early events in the radiolysis of high temperature and supercritical water were investigated.

Achievements

It is well known that the density of supercritical water dramatically varies with pressure, and it has gas-like properties under low pressure condition. Although the ionization yield of water vapor is generally lower than that of liquid, we performed pulse radiolysis experiment and the experimentally estimated picosecond yields of the hydrated electron in supercritical water showed opposite pressure dependence. At room temperature, the hydrated electron mostly originates from ionization process, however, at high temperatures, that from excitation process will also be nonnegligible. In order to explain the peculiar tendency, theoretical considerations of electron thermalization and trapping process as well as contribution of the excitation process to form the hydrated electron are also carried out. Modeling of cross section and oscillator strength distribution of electron beam – water molecule interactions at high temperature is ongoing. An open seminar was held on 19th August, in which Prof. Mozumder gave a lecture entitled “Status of Radiation Chemistry from the Viewpoint of a Theorist: Some Solved and Unsolved Problems”. Summary talk on theoretical aspects of radiation chemical research was introduced, and recent progress in modeling of electron thermalization process was intensively discussed.

Department of Nanotechnology for Industrial Applications

Guest Professor: Zhi-quan Liu (2013.11.8-2014.1.31)

Outlines

Controlling microstructure and optimizing interface in solder, bonding material of electronics field, are very important and crucial for the performance and life-time of micro-electronic devices. With TEM (transmission electron microscope), we have performed the analysis and control of microstructure and interfacial reaction of material in solder and bonding material under electromigration and thermal process. In addition, we also examined the evaluation of morphology of silver nanowires which have been used in printed electronics.

Achievements

Silver nanowire networks based on transparent conductive films (TCFs) have attracted much more attention as ITO alternatives due to the high transparency, conductivity, flexibility, scalability and low-cost in these years, which have been widely applied to various fields such as a touch panel, an organic EL, and an organic solar cell and so on. However, the reliability of silvers nanowire films have not studied yet. In this study, the morphology of silver nanowires has been examined with TEM after heating and exposing to atmosphere. Silver nanowires were FCC single crystalline of the five-folded twin crystal structure growing along the (111) crystal plane. The five-folded twin structure was destroyed by decreasing crystallinity and increasing lattice defects when the nanowires were exposed to over a certain temperature. Hence, the conductivity of silver nanowire TCFs decreased. In addition, silver nanowires exposed to air with moisture, hydrogen sulfide and oxygen, reacted into silver sulfide and silver oxide resulting in the transformation into nanoparticles or short-rods which have been observed with TEM measurement. The present result implies that the stability of silver nanowires strongly depends on the atmosphere even at room temperature. The control of the reliability and detailed elucidation of reaction mechanism of silver nanowires will be paid more attention in the future work.

One of the great achievements done by Prof. Liu at ISIR was his comprehensive lecture for students and staffs on the principle, feature, application, and measurement and analysis of TEM. Various materials such as solders, joints, and nanomaterials have been demonstrated as TEM samples followed by deep discussion on the applicability of TEM technique in our materials field.

Department of Nano-Technology Industrial Application

Visiting Professor: Ralescu Anca Luminita (2014. 2 .3 – 2014. 4.30)

Outlines

In recent years, techniques of artificial intelligence (AI), machine learning (ML) and statistics (S) are applied to the field of nano-technology. An example is a method to solve a Schrödinger equation by using non-linear regression. However, no generic and clear guide on effective use of these techniques has been provided in the nano-technology. This is because of the difficulty to transform models developed in biology, chemistry and physics into a united representation. Accordingly, the AI/ML/S techniques are rather used in ad-hoc manner. In this study, first, we review the applications of these techniques in the nano-technology, and second, evaluate the effectiveness of the techniques in the nano-technology including molecular design.

Nanofabrication Shop

Director, Professor: Hidekazu TANAKA
Technical Staff: 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 and develops micro-nano devices for researchers who want to apply those devices for their own experiments.

Current Research Projects

On demand fabrication requests

The nanofabrication shop performs the development of a new device from beginning, or does a part of the device-fabrication process such as etching and the film formation. We received 94 fabrication requests from 10 laboratories in 2013. Fig. 1 shows the transit of requests since 2005. Since a major client left, requests number decreased significantly.

As new requests, we made micro water-droplet arrays in 2013. Though the array had been developed three years ago, they were utilized in the drug screening assay and the enzyme-linked immunosorbent assay in earnest. Fig. 2 shows culture of bacteria in the droplet array.

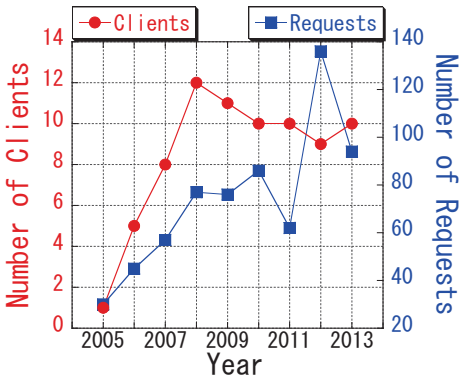


Fig.1 The transit of requests since 2005.

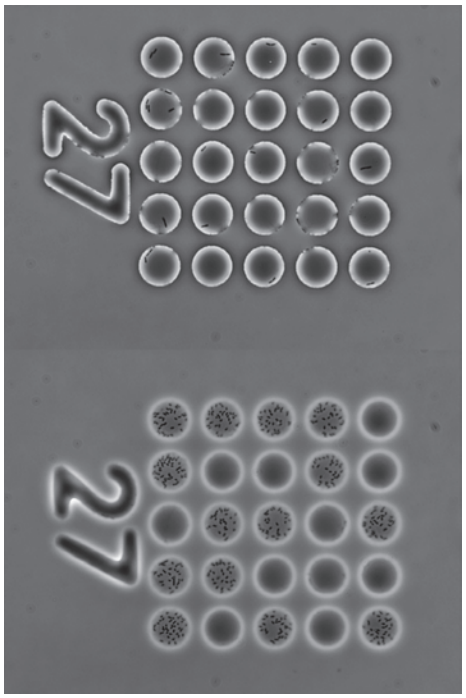


Fig.2 Culture of bacteria in water droplets whose diameters are 15μm. Top photo shows initial stage, while bottom photo shows after 22 hours culture.

Participation in “nanotech 2014”

We made an oral presentation which introduced our activity at the international nanotechnology exhibition and conference “nanotech 2014” which was held on 29th to 31th of January in 2014. We also showed a panel and fabricated materials.

Advanced Nanotechnology Instrument Laboratory

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

Outlines

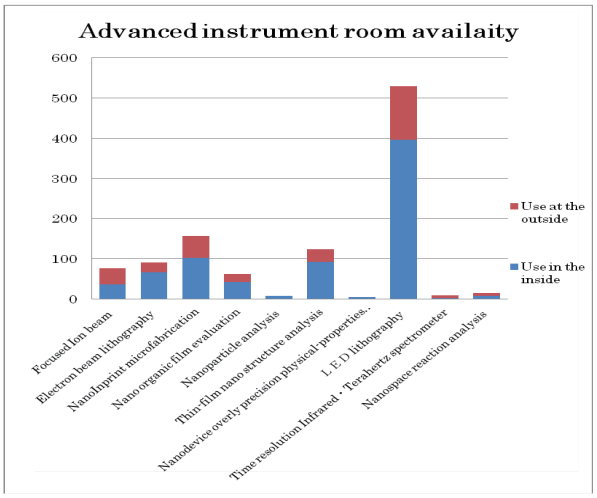
Advanced Nanotechnology Instrument Laboratory has founded in the new Nanoscience and Nanotechnology center since 2009 in order to develop cutting edge researches on the nanoscience and nanotechnology. The fine nano-fabrication system based on electron beam lithography is installed at present to construct 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 use situation of the each equipment in the Advanced Instrument Laboratory is shown in the right figure.

The number of total use is 1078 increased by 144 from last year.

Users from outside of ISIR increase, because the equipments are shared with Nanotechnology Open Facilities from last year.



Nanotechnology Open Facilities

Director, Professor:	Yoichi YOSHIDA
Professor:	Hidekazu TANAKA
	Masateru TANIGUCHI
	Hidehiro YASUDA (-2014.2.15)
Specially Appointed Professor:	Hirotarou MORI
Assistant Professor:	Keita KOBAYASHI (2014.2.16-)
Specially Appointed Assistant Professor:	Akira KITAJIMA
	Kimihiro NORIZAWA (2013.4.1-)
Specially Appointed Researcher:	Miki KASHIWAKURA
	Kouji HIGUCHI
	Nguyen Tuan DANG (-2013.9.30)
	Takashi TANIGUCHI
	Cong Que DINH (2013.4.1-2013.9.30)
	(2013.11.1-)
Supporting Staff:	Kyoko SHIMOMITSU
	Keiko ENMI (2013.4.1-)
	Rieko UEMURA (-2014.3.31)

Outlines

Nanotechnology Open Facilities (NOF) was founded in mission of Nanotechnology Platform Program, supported by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. The purpose to start up is to establish platforms for supporting nanotechnology research and development, especially, for researchers outside of Osaka University. NOF started from July 2012, and our efforts resulted in supporting 128 research themes in 2013.

The mission of Nanotechnology Platform Program 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. NOF has supported lots of researchers inside / outside of Osaka University through three platforms, “Nanofabrication”, “Molecule & Material Synthesis” and “Advanced Characterization”.

Focuses of NOF are shown below.

(1) Innovation by integrated and speedy nanotechnology support consisting of “Fabrication (top-down and bottom-up)” and “Observation and Measurement”.

(2) Creation of advanced interdisciplinary nanotechnology through integrated research and development of inorganic and organic materials, metals, semiconductor materials, and biomaterials.

(3) Fostering of scientists in the field of advanced interdisciplinary nanotechnology.

Current Research Projects

Bring-up Nanotechnology Open Facilities

The 128 research themes (except for technical consulting and non-publish the fruits) have been supported in the program in 2013. Considering they have been applied for by researchers in the universities, companies, and national institutes, we are able to see that NOF activates clearly nanotechnology field. NOF has been founded to support nanotechnology researchers through nanofabrication, molecule & material synthesis, advanced characterization. These supports are divided into following five ways, (a) Technical consulting, (b) Equipments utilization without assistance, (c) Technical substitution, (d) Collaborative research with NOF staff and (e) Using equipments with NOF operators.

Break-through toward Multi-platform Nanotechnology R&D

NOF 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 NOF.

Fusion between Top-down and Bottom-up Nanotechnologies

For top-down and bottom-up nanotechnologies, lots of useful equipments such as electron beam lithography, photolithography, focused ion beam / chemical vapor deposition, pulse laser deposition, etcher and so on, are in operations. 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: Nobuo KATO
Associate Professor: Takeyuki SUZUKI
Assistant Professor: Da-Yang ZHOU, Kaori ASANO
Specially Appointed Assistant Professor: Mitsuko NISHINO
Technical Staff: Takanori TANAKA, Tsuyoshi MATSUZAKI, Hitoshi HANEOKA, Yosuke MURAKAMI
Technical assistant Staff: Takeshi ISHIBASHI, Tsunayoshi TAKEHARA
Support Staff: Etsuko TANI

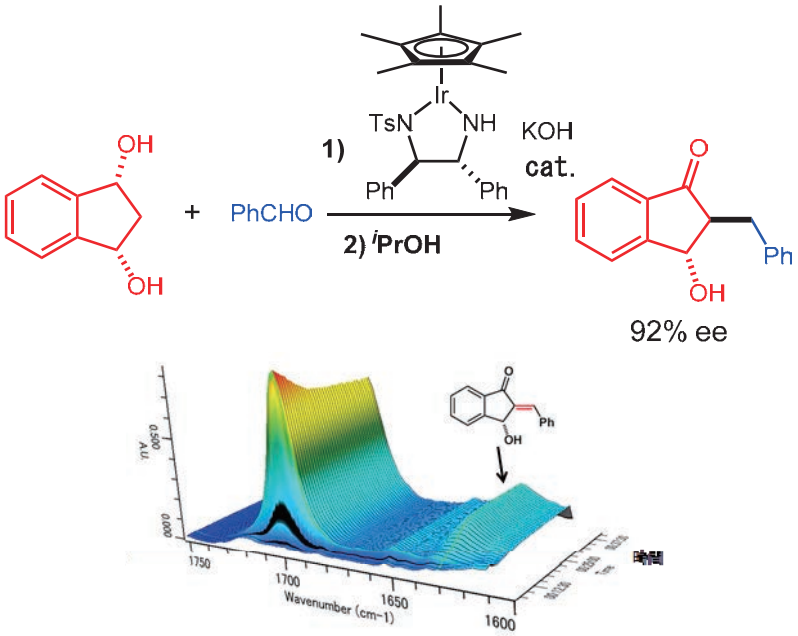
Outlines

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. We have developed the catalytic tandem asymmetric reaction based on desymmetrization of *meso* diols. Furthermore, we observed the enone intermediate using React-IR.



Catalytic tandem asymmetric reaction using chiral Ir complex

Research Laboratory for Quantum Beam Science

Professor, Director:	Tetsuro MAJIMA
Associate Professor:	Yoshihide HONDA
Assistant Professor:	Sachiko TOJO
Technical Staff:	Kazuya FURUKAWA
Supporting Staff:	Tamotsu YAMAMOTO, Akira TOKUCHI, Kumiko KUBO, Shoji SUEMINE
(Concurrent members)	
Professors	Goro ISOYAMA, Yoichi YOSHIDA, Takahiro KOZAWA
Associate Professors:	Ryuko KATO, Mamoru FUJITSUKA, Kiyohiko KAWAI, Jinfeng YANG, Yusa MUROYA,
Assistant Professors:	Kazuo KOBAYASHI, Keigo KAWASE, Takafumi KONDO, Takashi TACHIKAWA, Akinori IRIZAWA, Hiroki YAMAMOTO, Koichi KAN

Specially Appointed Assistant Professors: Jungkweon CHOI

Outline

The Research Laboratory for Quantum Beam Science (RLQBS) has 3 electron linacs, i.e. an L-band linac, a 150 MeV S-band linac, an RF-Gun S-band linac, and 3 ^{60}Co γ-ray sources as the representative facilities for joint use. These are opened to the 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 the above 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, RF-Gun S-band linac, ^{60}Co γ-ray sources)

The results of operation for 3 linacs: total score 5,349 hours, 410 days, 38 themes.

L-band linac: the linac was operated for 275 days, 3,141 hours (Fig.1). In an injection section, the replacements of cathode, motor and its driver adjusting pulse width were carried out. In addition the test operation of a new grid pulser of 27 MHz which makes a current twice, has started. The improvement of subharmonic buncher has been tried by replacing vacuum tube with solid state switch. Some of troubles were solved by replacing the parts. The reason of unstable operation due to overheat of charging capacitor would be understood soon. To get more stable operation, an improved solid state switch is in trial operation. The equipment of inverter module for cooling fan in the primary flow system was made to get better stability and to save energy. Also its logical connection of the controller in the secondary flow system was rearranged so as to be

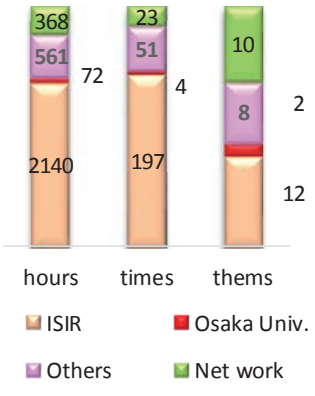


Fig.1 Operation of L-band linac

robust against troubles, and some of the damaged flow switches were replaced. A new notebook computer was prepared for the user to smooth operation and experiments. It was installed linac operation program and can use in each experimental section.

RF-gun S-band linac: the linac was operated 142 days, 1,635 hours. There arose no serious problem in this year. Using this linac, generation of from femtosecond to atosecond pulse beam, development of diagnostic method of such ultrashort electron beam, development of pulse radiolysis system in the range of femtosecond in addition to study of reaction mechanism in such ultrashort time range initiating chemical reaction.

Cobalt-60 facility: This facility was used in 81 days, 3,637 hours, for 18 subjects, users are not only in ISIR staffs but also by the member of other faculties, as shown in Fig.2.

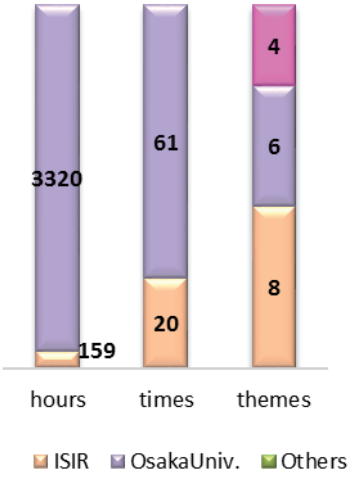


Fig.2 Operation of the cobalt-60 facility

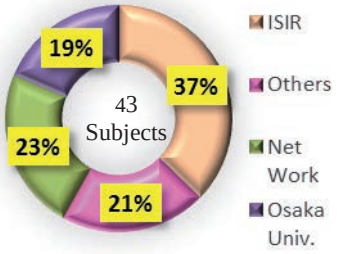


Fig.3 Accepted subjects.

Management (Joint use & Radiation safety management)

Accepted subjects relating from the joint-users are 43 in total (Fig.3). Specially programmed academic meetings were held two times (Dec. 12th, 2013/ Jan. 9th -10th, 2014) and the annual debrief session was held on March 7 in 2014. Visitors our laboratory are more than 371. About radiation safety management, radiation pursuer training was held for new registrant in May 15th 2014. Researchers including students were registered as the radiation pursuer. Special self-inspection was made twice a year for radiation facilities according to an ordinance.

Improvement of Nanosecond Pulse Radiolysis System

Nanosecond pulse radiolysis system has been improved to investigate the radiation chemical reactions of various samples including films. The transient absorption spectra of the aromatic monomer radical cation and the dimer radical cation were observed in the 290 – 1600 nm regions during the single-shot pulse radiolysis of the aromatic compound in a 2-mm cell ($2 \times 10 \times 40$ mm^3).

Application of positron to decontamination materials

Temperature dependence of the cavity size of crown ether was studied by positron annihilation spectroscopy (PAS), followed by the evaluation of captured strontium in crown ether by changing temperature in extraction phase. The capture efficiency was greatly increased in some case, but there was no sufficient reproducibility. The elucidation of extraction mechanism is under way. The study of capture process of cesium in zeolite was started with PAS. The PAS related parameters such as lifetimes of positron showed different behavior in different type of zeolite such as kaolinite and vermiculite, suggesting a possibility of positron as a diagnostic tool of cesium.

Center for Collaborative Research Education and Training

Director:	Professor Yoichi YOSHIDA
Head of Educational Affaires Board:	Professor Seiji TAKEDA
Board Members:	Professor Takashi Washio
	Associate Professor Kouji SEGAWA
	Associate Professor Sinobu TAKIZAWA
Head of International Affaires Board:	Professor Yoishi ANDO
Board Members:	Professor Tetsuro MAJIMA
	Associate Professor Teruo KANKI
	Assistant Professor Koichi MORIYAMA

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

Outlines

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 seven 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

AU-SOC lab.

Institute of Organic Chemistry, RWTH Aachen University-Germany (AU), and ISIR have established a cooperative research laboratory on synthetic organic chemistry (SOC) between both institutions. Its studies focus on efficient transformation of organic molecules.

1. Organocatalytic enantioselective catalysis
2. Transition metal catalyzed reactions
3. Development of domino reactions

BU-SOC lab.

Faculty of Chemistry, Bielefeld University-Germany (BU), and ISIR have established a cooperative research laboratory on synthetic organic chemistry (SOC) between both institutions. Its studies focus on combination of biocatalysis and molecular catalysis.

1. Hybridization of biocatalysis and enantioselective organocatalysis
2. Immobilization of enantioselective catalysis
3. Exploring a novel C-C bond-forming reactions

Nano-Macro Materials, Devices and System Research Alliance

Outlines

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 Research Institute for Electronic Science (Hokkaido University), Institute of Multidisciplinary Research for Advanced Materials (Tohoku University), Chemical Resources Laboratory (Tokyo Institute of Technology), the Institute of Scientific and Industrial Research (Osaka University), and Institute for Materials Chemistry and Engineering (Kyushu University). This Alliance consists of four research groups for (G1) Next-generation electronics, (G2) Energy materials and devices, (G3) Medical materials, devices, and system, and (G4) Environmentally benign materials and devices. 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 FY2013 from ISIR were Prof. H. Tanaka (Vice Chair), Prof. Y. Yagi, and Prof. T. Oguchi. Our members of this Alliance were as follows.

(G1) Next-generation electronics research group
Prof. K. Matsumoto (Group Leader), Prof. Y. Aso, Prof. Y. Ando, Prof. T. Oguchi, Prof. H. Tanaka, Assoc. Prof. T. Yanagida, Prof. T. Washio

(G2) Energy materials and devices research group
Prof. H. Kobayashi (Group Leader), Prof. K. Suganuma, Assoc. Prof. T. Suzuki, Prof. S. Takeda, Prof. K. Tanimura, Assoc. Prof. Y. Honda, Prof. M. Numao

(G3) Medical materials, devices, and system research group
Prof. K. Nakatani (Group Leader), Assoc. Prof. T. Okajima, Prof. N. Kato, Assoc. Prof. Y. Kitamura, Prof. M. Taniguchi, Prof. T. Nagai, Assoc. Prof. T. Nishi, Assoc. Prof. K. Nishino, Prof. Y. Yagi, Specially Appointed Prof. A. Yamaguchi

(G4) Environmentally benign materials and devices research group
Prof. Y. Yoshida (Group Leader), Prof. G. Isoyama, Prof. T. Kozawa, Prof. H. Sasai, Prof. T. Majima

Next Generation Electronics Research Group

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

Outlines

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

Outlines

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)

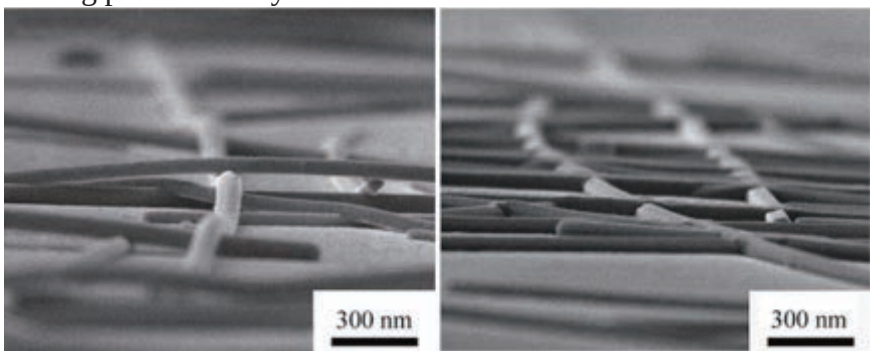
A method to effectively produce Si nanoparticles has been developed by use of the photochemical etching method. The characteristics of the *pn*-junction solar cells with the fabricated Si nanoparticles were improved by the nitric acid oxidation method. (Kobayashi)

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

Outlines

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.

Activities of Facilities

Workshop

Director Professor: Yoshio ASO
Technical Staff:
Machine Shop: Masayoshi OHNISHI, Yuki MATSUSHITA, Michiaki KAKUICHI
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.

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, and a 5-axis machine was introduced in 2013, so that we can answer to advanced and difficult requests from researchers.

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

By the increase employee, we were able to do our best work request number.

We participated in the event of the technical Division, and achieved the local contribution in cooperation with the ISIR.

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: 203 jobs (193 jobs in the previous year).
Glassworks: 113 jobs (132 jobs).

Laboratory for Radio-isotope Experiments

Professor: Goro ISOYAMA

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

Outlines

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

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

This laboratory is utilized for experimental researches of surface structure analysis and electrode formation, for the measurements of electronic and other properties of various materials and also for the fabrication of photonic, electronic and molecular devices. Guidance to the users to the equipments and systems as well as the daily maintenance and repair of them were conducted. In the year of 2012, the equipment and systems were used about 50 times from 4 laboratories and facilities.

Library

Professor:	Yoshio ASO
Librarian:	Takako WADA
Temporary Staff:	Yasuko ONO

Outlines

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, 2014)

	Number of books	Journals	Newspapers
Japanese	5,096	185 titles	4 titles
Foreign	19,479	538 titles	1 title

Open Laboratory

Professor: Hiroaki SASAI
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 Projects

On 2013, the following 12 researchers used Open Laboratory.

Prof. Yusuke MORI	Graduate School of Engineering
Prof. Keisuke MORISHIMA	Graduate School of Engineering
Prof. Yoji SHIBUTANI	Graduate School of Engineering
Prof. Kohji MINOSHIMA	Graduate School of Engineering
Assoc. Prof. Kaori HIRAHARA	Graduate School of Engineering
Prof. Kazuyuki YOSHIZAKI	Graduate School of Engineering
Prof. Kazuyoshi ITOH	Office for University-Industry Collaboration
Prof. Yoshimitsu YAMASAKI	Graduate School of Medicine
Prof. Hikaru KOBAYASHI	Institute of Scientific and Industrial Research
Prof. Kazuhiko MATSUMOTO	Institute of Scientific and Industrial Research
Prof. Hidekazu TANAKA	Nanotechnology Open Facilities
Prof. Masateru TANIGUCHI	Nanotechnology Open Facilities

Office of Information Network

Professor, Director:	Yoichi YOSHIDA
Professor:	Takashi WASHIO
Professor:	Katsumi TANIMURA
Professor:	Hiroaki SASAI
Professor:	Tamio OGUCHI
Associate Professor:	Kouji KOZAKI
Associate Professor:	Shohei SHIMIZU
Technical Staff:	Senjin AIHARA

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 network 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 on-line abstract submitting system. Total number of conferences was 6.

And we have offered poster printing services for ISIR researchers. Total number of poster printing was 453.

And we issued ISIR CARD (access control card).

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

And we introduced LabVIEW (Graphical programing software) and provided a campus license for Osaka University researchers and students.

Network Planning and Design
ODINS Wireless LAN

Academia Industry Relations Office

Director Professor:	Hikaru KOBAYASHI
Professors:	Kazuhiko MATSUMOTO, Takahiro KOZAWA Hiroaki SASAI, Masateru TANIGUCHI
Specially Appointed Professors:	Hirokazu SHIMIZU, Mototsugu OGURA

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 industry-university cooperation events. 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

Promotion of Industry-University Cooperation

1) SANKEN Techno Salon

Meeting	Date	Number of Participants
1st	May 17, 2013	72
2nd	Aug.2, 2013	75
3rd	Nov.8, 2013	66
4th	Feb.7, 2014	94

2) Introduction of new technologies through the web site

3) Publication of a booklet for introduction of ISIR's research activities

4) Publicity of ISIR's technologies at exhibitions etc.: 2 exhibitions and 3 lecture-meetings

Use of Company Research Park

Use: 17 companies (20 rooms) [new use: 3 companies]

Coordination of Joint Research etc.

2 joint researches were established.

Support for External Funding

2 fund programs were obtained.

Support for New Industry Creation Study Groups

2 study groups

Public Relations Office

Director, Professor:	Yoichi YOSHIDA
Professors:	Masayuki NUMAO, Goro ISOYAMA (2013.10.1-), Tetsuro MAJIMA (2013.10.1-), Masateru TANIGUCHI, Takahiro KOZAWA (-2013. 9.30), Nobuo KATO (-2013.9.30)
Associate Professors:	Shohei SHIMIZU (2013.5.1-), Tomoki MATSUDA, Jinfeng YANG, Hideto YOSHIDA, Toshihiro OKAMOTO (-2013.4.30) Koichi SUDOH (-2013.9.30), Shin'ichiro TANAKA (-2013.9.30), Koun SHIRAI (-2013.9.30)
Specially Appointed Associate Professor:	Shijo NAGAO (2013.10.1-)
Assistant Professors:	Kenichi FUKUI (2013.10.1-), Hiroki YAMAMOTO, Yusuke HIGUCHI (2013.10.1-), Kazuhiro TAKENAKA (-2013.9.30)
Staffs:	Noriko MATSUMOTO, Atsumi ITO (2013.11.18-)
Technical Staff:	Yuka OKUMURA

Outlines

The Public Relations Office was opened in 2006 to provide various information on SANKEN for the public widely, and was strengthened in 2012 by the merge with the Public Relation Committee.

The major activities are:

1) Building of the strategy on the public information
2) Information gathering
3) Support of the issue of the annual report and other reports
4) Web authoring and maintenance
5) Support of the press release
6) Receiving of field tour
7) Others

Especially, the monthly press meeting had been started in 2013 in the collaboration with other offices of SANKEN.

Technical Division

Head: Takanori TANAKA

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 Public Relations Office, 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 , 2014）

Director : Toshio SANDA

General Affairs Division

Staffs: Tadashi NAKAGAWA
Sumiaki YAMAGUCHI
Natsuko HORII
Tomomi HIGASHIO
Kazuko HANAMI
Kazumi HAYASHI

Supporting Staffs: Junko HANASHIMA
Mitsuru NISHISAKO
Noriko SASAKAWA

Research Cooperation Division

Staffs: Hiromi NISHIKAWA
Osamu NISHIMURA
Takeshi SHIODA
Tamaki UEBAYASHI
Misa TOKUMOTO
Yuichi TANAKA
Ayaka IMAMURA
Yukiyo KANDA
Mayu ESAKA
Aiko SATO
Misato KUBO
Mina TANIZAWA
Masako MORITA

Supporting Staffs: Miyuki TSUTSUI
Yukako MORI
Kumiko TERADA
Kazune OTANI
Kuniko NISHIMOTO
Yasuhiro UCHIDA

List of Achievements

Department of Quantum System Electronics

Original Papers

[1]Growth and Characterization of GaN Nanostructures toward Electron Field Emitter Application, S. Haseagwa, J. U. Seo, M. Uenaka, M. Kimura, H. Asahi: Jpn. J. Appl. Phys., 52 (2013) 110103-1-110103-9.

[2]Structure Analysis of Composition Modulation in Epitaxially-Grown III–V Semiconductor Alloys, M. Ishimaru, S. Hasegawa, H. Asahi, K. Sato, T. J. Konno: Jpn. J. Appl. Phys., 52 (2013) 110120-1-110120-5.

[3]Magnetoresistance Generated by Combination of Spin-Orbit Interaction and Applied Magnetic Field in Bipolar Conductors, M. Sakai, D. Kodama, Y. Okano, T. Sakuraba, Z. Honda, A. Kitajima, A. Oshima, K. Higuchi, S. Hasegawa, O. Nakamura: Jpn. J. Appl. Phys., 52 (2013) 093001-1-093001-8.

[4]Enhancement of Hydrogen Uptake for Y and Gd Films by Thin Ni Surface Overlayers, H. Hirama, M. Hayakawa, T. Okoshi, M. Sakai, K. Higuchi, A. Kitajima, A. Oshima, S. Hasegawa: J. Crystal Growth, 378 (2013) 356-360.

[5]Influence of Hydrogen Incorporation on Texture and Grain Size in YH2 Films, T. Okoshi, M. Hayakawa, H. Hirama, M. Sakai, K. Higuchi, A. Kitajima, A. Oshima, S. Hasegawa: J. Crystal Growth, 378 (2013) 388-392.

[6]Crystal Growth of Magnetic Dihydride GdxY1−xH2 for Generation of Spin Current, T. Sakuraba, H. Hirama, M. Sakai, Z. Honda, M. Hayakawa, T. Okoshi, A. Kitajima, A. Oshima, K. Higuchi, S. Hasegawa: J. Crystal Growth, 378 (2013) 351-355.

[7]Mechanism of Selective Area Growth of InP on Si(001) Substrates Using SiO2 Mask by Gas-Source Molecular Beam Epitaxy, S. Hasegawa, T. Shimoi, H. Asahi: J. Crystal Growth, 378 (2013) 47-49.

[8]Growth Parameter Dependence of Structural, Electrical and Magnetic Properties in GaGdN Layers Grown on GaN(0001), S. Sano, S. Hasegawa, Y. Mitsuno, K. Higashi, M. Ishimaru, T. Sakurai, H. Ohta, H. Asahi: J. Crystal Growth, 378 (2013) 314-318.

[9]Photoluminescence Properties in GaGdN Grown on GaN(0001) by PA-MBE, K. Higashi, S. Hasegawa, S. Sano, Y.K. Zhou, H. Asahi: J. Crystal Growth, 378 (2013) 310-313.

[10]Growth and Characterization of GaDyN/GaN Double Barrier Structures, M. Sano, Y. K. Zhou, S. Emura, S. Hasegawa, H. Asahi: J. Crystal Growth, 378 (2013) 137-140.

[11]Suppression of Vacancy Aggregation by Silicon-Doping in Low-Temperature-Grown Ga1-xCrxN, A. Yabuuchi, M. Maekawa, A. Kawasuso, Y.-K. Zhou, S. Hasegawa, H. Asahi: Appl. Phys. Lett., 102 (2013) 142406-1-142406-4.

[12]Antiferromagnetic Exchange Interactions in $Ni_2Mn_{1.4}In_{0.6}$ Ferromagnetic Heusler Alloy, K. R. Priolkar, P. A. Bhobe, D. N. Lobo, S. W. D'Souza, S. R. Barman, A. Chakrabarti, S. Emura: Phys. Rev. B, 87 (2013) 144412-1-6.

[13]Stabilization of Temperature Dependence of Band Gap by Introducing Nitrogen Ion into GaInNP Alloy, S. Emura, S. Nonoguchi, K. M. Kim: AIP Conf. Proc., 1566 (2013) 387-389.

[14]Nitorgen Ion Role on Photoluminescence Variation Observed in III-N-V Semiconductors, S. Nonoguchi, S. Emura, M. Kondow: AIP Conf. Proc., 1566 (2013) 91-92.

[15]Induced Dielectric Polarization Effects on Valence Band Alignment in Multi-Quantum Well

Structures in Wurtzite Semiconductors, S. Emura, K. Sato: JPS Conf. Proc., 1 (2014) 012032-1-6.

[16]Temperature Dependence of Resonant Peaks from Quantum Disk of GaN, M. Almokhtar, M. Kimura, S. Emura, H. Asahi: JPS Conf. Proc., 1 (2014) 012090-1-6.

International Conferences

[1]Effects of Ion-Bombardment Damage on Mechanical Properties of c-BN Thin-Films Formed by a Magnetically-Enhanced Plasma Ion Plating Method (poster), M. Noma, K. Eriguchi, S. Hasegawa, M.Yamashita, Y. Takao, N. Terayama, K. Ono: The 6th Int. Symp. Adv. Plasma Sci. and its Application for Nitrides and Nanomaterials / 7th Int. Conf. on Plasma Nano-Technol. & Sci.

[2]Impacts of Plasma Process Parameters on Mechanical Properties of c-BN Thin Films (oral), M. Noma, K. Eriguchi, S. Hasegawa, M. Yamashita, Y. Takao, N. Terayama, K. Ono: The 8th Int. Conf. Reactive Plasmas / 31st Symp. Plasma Processing.

[3]Structural and Mechanical Characterization of BN Films Grown on Si(001) by Magnetically-Enhanced Plasma Ion Plating (poster), S. Hasegawa, M. Noma, K. Eriguchi: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[4]Room Temperature Injection and Detection of Spin Accumulation in Lateral Four Terminal Co/GaN Schottky Barrier Devices (poster), S. Hasegawa, H. Yamaguchi, A. Beppu, H. Ichihara: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[5]MBE Growth of Fe Nitride on GaN(0001) and Its Electrical and Magnetic Characterization (poster), S. Hasegawa, M. Yoneoka, H. Yamaguchi: The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[6]Electrical and Magnetic Characterization of Fe Nitride Grown on GaN(0001) (poster), S. Hasegawa, M. Yoneoka, H. Yamaguchi: 12th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures.

[7]Structural and Defect Characterization of Gd-Doped GaN Films (oral), A. Yabuuchi, N. Oshima, B. E. O'Rourke, R. Suzuki, K. Ito, A. Kawasuso, M. Maekawa, S. Sano, K. Higashi, Y.-K. Zhou, S. Hasegawa: 13th International Workshop on Slow Positron Beam Techniques and Applications.

[8]Hall Effect and Magnetoresistance in GdxY1-xH2 ($x \fallingdotseq 0.4$) (poster), T. Sakuraba, M. Sakai, T. Arai, Y. Tanaka, H. Hirama, Z. Honda, A. Kitajima, K. Higuchi, A. Oshima, S. Hasegawa: The 12th Asia Pacific Physics Conference (APPC12).

[9]Optical Assessment of Carrier Effective Mass in GdxY1-xH2 ($0 \leqq x \leqq 1$) (poster), S. Haruyama, M. Sakai, T. Sakuraba, H. Hirama, Z. Honda, A. Kitajima, K. Higuchi, A. Oshima, S. Hasegwa: The 12th Asia Pacific Physics Conference (APPC12).

[10]Impact of Plasma Power on the Electrical Properties of InN Thin Films Grown by RF-MBE (oral), T. Araki, K. Shigyo, J. Sakaguchi, K. Wang, Y. Nanishi, A. Uedono, Y. K. Zhou, S. Hasegawa, T. Fujishima, E. Matioli, T. Palacios: The 55th Electronic Materials Conference.

[11]The Growth and Their Novel Properties of GaN-Based Ferromagnetic Semiconductor Quantum Structures (invited), Y. K. Zhou, S. Hasegawa, H. Asahi: Advanced Materials-2013 (WCAM2013), Track 2: Optical, Electronic and Magnetic Materials.

[12]Induced Dielectric Polarization Effects on Valence Band Alignment in Multi -Quantum Well Structures in Wurtzite Semiconductors , S. Emura, K. Sato: The 12th Asia Pacific Physics Conference (APPC12).

[13]Temperature Dependence of Resonant Peaks from Quantum Disk of GaN , M. Almokhtar, M. Kimura, S. Emura, H. Asahi: The 12th Asia Pacific Physics Conference (APPC12).

[14]Luminescence Spectra from InGaN/GaN Multi Quantum Disks on GaN Nanorods , D. Krishnamurthy, S. Shanthi, S. Emura, H. Asahi: The 12th Asia Pacific Physics Conference (APPC12).

[15]Applications of Multiple-Scattering Theory to XANES Spectra in Rare-Earth-Doped GaN , A. Koide, D. Abe, K. Niki, S. Emura, T. Fujikawa: The 12th Asia Pacific Physics Conference (APPC12).

[16]Luminescence from Gd-Vacancy Complex in AlGaN/GaGdN Multi-Quantum Wells , M. Almokhtar, S. Emura, A. Kiode, T. Fujikawa, Y.-K. Zhou, H. Asahi: 2013 JSAP-MRS Joint Symposia.

Patents

[1]K20100168 Spintronics Apparatus And Logical Operation Element, K20100168

Publications in Domestic Meetings

The Japan Society of Applied Physics Meeting	12 papers
Physics and Applications of Spin-related Phenomena in Semiconductors	1 papers

Academic Degrees

Bachelor Degree for Engineering S. Yamauchi	Growth and Characterization of Fe Nitrides on GaN(0001) by Molecular Beam Epitaxy
Master Degree for Engineering S. Sano	Formation of Magnetic/Nonmagnetic Semiconductor Superlattices and Their Magnetic Characterization
Master Degree for Engineering H. Yamaguchi	Room Temperature Spin Injection through a Co/GaN Schottky Barrier
Master Degree for Science T. Mori	Molecular Beam Epitaxy Growth and Characterization of InGaN on GaN(0001) Films on GaN(0001)

Cooperative Research

S.Hasegawa	NISSIN ELECTRIC Co.,Ltd.	¥1,800,000

Department of Semiconductor Electronics

Original Papers

[1]Gold-Linked Electrochemical Immunoassay on Single-Walled Carbon Nanotube for Highly Sensitive Detection of Human Chorionic Gonadotropin Hormone, N. X. Viet, M. Chikae, Y. Ukita, K. Maehashi, K. Matsumoto, E. Tamiya, P. H. Viet, Y. Takamura: Biosens. Bioelectron., 44 (2013) 592-597.

[2]pH Sensor Based on Chemical-Vapor-Deposition-Synthesized Graphene Transistor Array, N. B. M. Zaifuddin, S. Okamoto, T. Ikuta, Y. Ohno, K. Maehashi, M. Miyake, P. Greenwood, K. B. K. Teo, K. Matsumoto: Jpn. J. Appl. Phys., 52 (2013) 06GK04.

[3]Position-Controlled Direct Graphene Synthesis on Silicon Oxide Surfaces Using Laser Irradiation, K. Koshida, K. Gumi, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: Appl. Phys. Express, 6 (2013) 105101.

[4]Silicon-Nitride-Passivated Bottom-Up Single-Electron Transistors, G. Hackenberger, Y. Azuma, S. Kano, D. Tanaka, M. Sakamoto, T. Teranishi, Y. Ohno, K. Maehashi, K. Matsumoto, Y. Majima: Jpn. J.

Appl. Phys., 52 (2013) 110101.

[5]Direct Electrical Detection of DNA Hybridization Based on Electrolyte-Gated Graphene Field-Effect Transistor, Y. Ohno, S. Okamoto, K. Maehashi, K. Matsumoto: Jpn. J. Appl. Phys., 52 (2013) 110107.

[6]Floating-Bridge Structure of Graphene with Ionic-Liquid Gate, Y. Yamashiro, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto: Phys. Status Solidi (c), 10 (2013) 1604-1607.

[7]Selective Ion Sensors Based on Ionophore-Modified Graphene Field-Effect Transistors, K. Maehashi, Y. Sofue, S. Okamoto, Y. Ohno, K. Inoue, K. Matsumoto: Sens. Actuators, B, 187 (2013) 45-49.

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[3]Room Temperature Single Charge Memory Using All Surrounded Carbon Nanotube Channel (oral), K. Matsumoto, T. Kamimura: 14th International Conference on the Science and Application of Nanotubes.

[4]Nano carbon devices & applications (invited), K. Matsumoto, T. Kamimura, K. Maehashi, Y. Ohno: NT13 Satellite Symposia.

[5]Advances in Graphene Device & Bio-Sensor Applications (invited), K. Matsumoto, K. Maehashi, Y. Ohno, K. Inoue: The 20th International Workshop on Active-Matrix Flatpanel Displays and Devices.

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Publications in Domestic Meetings

The Japan Society of Applied Physics Meeting	11 papers

Academic Degrees

Bachelor Degree for Engineering Y. Ishibashi	Direct Graphene Synthesis Using Laser Irradiation with Co catalyst
Bachelor Degree for Engineering M. Okano	Control of Receptor Densities on Graphene
Master Degree for Science T. Ikuta	Direct Graphene Synthesis and Device Fabrication Using Transfer-Free Processes
Master Degree for Science K. Koshida	Graphene Synthesis and its Device Application on Insulating Substrates by Laser Annealing Method
Master Degree for Science Nursakinah B. Mohd Zaifuddin	Biosensor Applications Based on CVD-Synthesized Graphene
Doctor Degree for Science Y. Yamashiro	Study on Physical Properties and Its Application Relating to the Band Gap Generation in Bilayer Graphene with Ionic Liquid

Grant-in-Aid for Scientific Research

K. Matsumoto	Molecular Architectonics: Orchestration of Single Molecules for Novel Functions	¥5,850,000
K. Maehashi	Electric-Field-Induced Band Gap of Graphene in Ionic Liquid and Fabrication of Nanodevices	¥4,550,000

Entrusted Research

K. Matsumoto	Japan Science and Technology Agency	Quantum Nano Devices by Control of Quantum Nano Interface	¥20,085,000
K. Matsumoto	Japan Science and Technology Agency	Develop Super Japanese by Human Power Activation/Enhancement of Industrial Competitiveness/Rich Society	¥142,000,000

Contribution to Research

K. Matsumoto	AIXTRON SE	¥300,000

Cooperative Research

K. Matsumoto	TOSHIBA Co.	¥2,400,000

Other Research Fund

K. Matsumoto	Japan Society for the Promotion of Science	¥16,376,000

Department of Advanced Electron Devices

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Publications in Domestic Meetings

Japan Society of Applied Physics Meeting		1 paper
Mechanical Engineering Congress		1 paper

Grant-in-Aid for Scientific Research

T.Okamoto	Development of v-shaped organic semiconducting materials with high performance and thermal durability	¥8,450,000
T.Uemura	Devepolment of carrier transport mechanisum elucidation of organic semiconductor contributing to molecular fluctuation and high performance transistor	¥5,200,000

Entrusted Research

K.Sudoh	Japan Science and technology agency	Development of MEMS/FIB-based technique for measurement of the mechanical properites of single-layer graphen	¥260,000
K.Sudoh	Japan Science and technology agency	Development of flash heating nano-particles which realize temperature increase upto 100C for 0.1 second	¥650,000

Contribution to Research

K.Sudoh	Fuji Electric Co., Ltd.	¥490,000
T.Okamoto	JNC Corp.	¥9,500,000

Cooperative Research

K.Sudoh	Konan Gakuen	¥0,000

Department of Intelligent Media

Original Papers

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[4]K20120133 Light Absorption Object Estimation Device and its Method, K20120133

[5]K20090358 Omnidirectional Imaging System, K20090358

[6]K20090153 Accurate PSF Estimation Method based on Blur Model and its Application to Coding, K20090153

[7]K20080447 Compound Ominidirectional Camera, K20080447

Contributions to International Conferences and Journals

Y. Yagi	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (General Chair)
Y. Yagi	2013 IEEE Int. Conf. on Robotics and Automation (ICRA 2013) (Associate Editor)
Y. Yagi	The 26th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2013) (Program Committee Member)
Y. Yagi	Int. Journal of Automation and Computing (Editorial Board Member)
Y. Yagi	2013 IEEE Int. Conf. on Robotics and Biomimetics (IEEE-ROBIO 2013) (Program Committee Member)
Y. Yagi	2014 IEEE Int. Conf. on Robotics and Automation (ICRA 2014) (Associate Editor)
Y. Yagi	The 2014 Int. Conf. on Informatics, Electronics & Vision (ICIEV 2014) (Advisory Board Member)
Y. Yagi	The 8th Int. Workshop on Robust Computer Vision (IWRCV 2014) (Program Chair)
Y. Yagi	2014 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS 2014) (Associate Editor)
Y. Yagi	The 13th European Conf. on Computer Vision (ECCV 2014) (Reviewer)
Y. Mukaigawa	The 6th Pacific-Rim Symposium on Image and Video Technology (PSIVT 2013) (Area Chair)
Y. Mukaigawa	The 26th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2013) (Program Committee Member)
Y. Mukaigawa	Int. Journal of Computer Vision (Editorial Board Member)
Y. Mukaigawa	2013 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS 2013) (Associate Editor)
Y. Mukaigawa	The 14th IEEE Int. Conf. on Computer Vision (ICCV 2013) (Reviewer)
Y. Mukaigawa	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Program Committee Member)

Y. Mukaigawa	The 26th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2014) (Reviewer)
Y. Mukaigawa	The 22nd Int. Conf. on Pattern Recognition (ICPR 2014) (Technical Program Committee Member)
Y. Makihara	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Program Committee Member)
Y. Makihara	The 10th IEEE Conf. on Automatic Face and Gesture Recognition (FG 2013) (Program Committee Member)
Y. Makihara	The 26th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2013) (Program Committee Member)
Y. Makihara	The 14th IEEE Int. Conf. on Computer Vision (ICCV 2013) (Reviewer)
Y. Makihara	The 6th Pacific-Rim Symposium on Image and Video Technology (PSIVT 2013) (Reviewer)
Y. Makihara	The 2013 Pacific-Rim Conf. on Multimedia (PCM 2013) (Program Committee Member)
Y. Makihara	The 26th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2014) (Reviewer)
Y. Makihara	The 13th European Conf. on Computer Vision (ECCV 2014) (Reviewer)
Y. Makihara	The 22nd Int. Conf. on Pattern Recognition (ICPR 2014) (Technical Program Committee Member)
I. Mitsugami	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Publicity Chair)
I. Mitsugami	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Program Committee Member)
I. Mitsugami	The 22nd Int. Conf. on Pattern Recognition (ICPR 2014) (Technical Program Committee Member)
I. Mitsugami	The 2014 Int. Conf. on Informatics, Electronics and Vision (ICIEV 2014) (International Program Committee Member)
D. Muramatsu	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Program Committee Member)
M. Nakazawa	The 2nd IAPR Asian Conf. on Pattern Recognition (ACPR 2013) (Program Committee Member)
M. Nakazawa	Int. Joint Workshop on Advanced Sensing / Visual Attention and Interaction (ASVAI 2013) (Web and Finance Chair)

Publications in Domestic Meetings

The 16th Meeting on Image Recognition and Understanding (MIRU 2013)	19 papers
IPSJ SIG CVIM: Computer Vision and Image Media	10 papers
The 3rd Symposium on Biometrics, Recognition and Authentication	4 papers
IEICE Technical Committee on Biometrics	2 papers
IEICE Technical Committee on Pattern Recognition and Media Understanding	1 paper
The 2013 IEICE General Conf.	2 papers
The 19th Symposium on Sensing via Image Information	1 paper
Japanese Society on Normal-pressure Hydrocephalus	1 paper
Annual Workshop on Mathematics and Computer Science	1 paper

Academic Degrees

Master Degree for Information Science T. Ogawa	Gait Change Analysis with and without Physical Constraints Considering Kinematics and Balance
Master Degree for Information Science K. Tanaka	Descattering Transmissive Observation using Parallel and Coaxial High Frequency Illumination
Master Degree for Information Science R. Matsumoto	Extinction Coefficient Distribution Estimation based on Depth-sensitive Measurement of Single Scattering at

Grant-in-Aid for Scientific Research

Y. Yagi	Wearable ambient surveillance by lensless omnidirectional sensor and its application to schoolchild crime prevention	¥36,790,000
Y. Mukaigawa	Safe visualization of 3D structure in human body by computational photography	¥54,600,000
Y. Makihara	High-accuracy gait recognition by fluctuation analysis	¥4,160,000
Y. Makihara	Proposal of Cross-modal Biometrics	¥1,170,000
I. Mitsugami	Development of 3D shape reconstruction method for glossy surface	¥1,040,000
D. Muramatsu	Development of multi-modal biometric person authentication method using writing style	¥1,430,000

Entrusted Research

Y. Yagi	Japan Science and Technology Agency	Behavior Understanding based on Intention-Gait Model	¥43,518,000
Y. Yagi	Ministry of Education, Culture, Sports, Science and Technology	Human sensing system for criminal investigation	¥25,847,000
Y. Yagi	Ministry of Education, Culture, Sports, Science and Technology	Omnipresent Vision System by Heterogeneous Cameras	¥3,500,000

Contribution to Research

Y. Yagi	Fujitsu Laboratory Ltd., Media Processing Systems Laboratories, Director, Shoji Suzuki	¥500,000
I. Mitsugami	Artificial Intelligence Research Promotion Foundation, Administrative Director, Hiroyasu Naito	¥500,000

Cooperative Research

Y. Yagi	Olympus Co, Ltd.	¥1,800,000
Y. Yagi	Osaka Prefecture Univ.,Wakayama Univ.,Toshiba Co.	¥0,000

Department of Reasoning for Intelligence

Original Papers

[1]Derivation of a Mathematical Expression for Predicting the Time to Cardiac Events in Patients with Heart Failure: a Retrospective Clinical Study, A. Yoshida, M. Asakura, H. Asanuma, A. Ishii, T. Hasegawa, T. Minamino, S. Takashima, H. Kanzaki, T. Washio, M. Kitakaze: Hypertension Research, 36 (5) (2013) 450-456.

[2]Active Learning for Noisy Oracle via Density Power Divergence, Y. Sogawa, T. Ueno, Y. Kawahara, T. Washio: Neural Networks, 46 (2013) 133-143.

[3]Anomaly Detection in Reconstructed Quantumn States Using a Machine Learning Technique, S. Hara, T. Ono, R. Okamoto, T. Washio, S. Takeuchi: Phys. Rev. A, 89 (2014) 022104.

[4]ParceLiNGAM: A Causal Ordering Method Robust against Latent Confounders, T. Tashiro, S. Shimizu, A. Hyvarinen, T. Washio: Neural Computation, 26 (2014) 57-83.

[5]LiNearN: A New Approach to Nearest Neighbour Density Estimator, Jonathan R. Wells, Kai Ming Ting, Takashi Washio: Pattern Recognition, 47(2014) pp.2702-2720.

[6]Efficient Network-Guided Multi-Locus Association Mapping with Graph Cuts, C-A. Azencott, D. Grimm, M. Sugiyama, Y. Kawahara, K. M. Borgwardt: Bioinformatics, 29 (13) (2013) i171-i179.

International Conferences

[1]Estimation of Causal Structures in Longitudinal Data Using Non-Gaussianity, K. Kadowaki, S. Shimizu, T. Washio: Proc. of 2013 IEEE International Workshop on Machine Learning for Signal

Processing, 13 (2013) 1-6.

[2]A Novel Structural AR Modeling Approach for a Continuous Time Linear Markov System, M. Demeshko, T. Washio, Y. Kawahara: Proc. of The IEEE International Conference on Data Mining (ICDM) Workshop 2013, (2013) 104-113.

[3]Efficiently Rewriting Large Multimedia Application Execution Traces with Few Event Sequences, T. Washio: Proc. of the 19th ACM SIGKDD Iternational Conference on Knowledge Discovery and Data Mining, (2013) 1348-1356.

[4]Low-Dimensional Parallel Coordinates Collection for High-Dimensional Data Visualization, H. Suematsu, Z. Yunzhu, T. Itoh, R. Fujimaki, S. Morinaga, Y. Kawahara: Proc. of the 17th International Conference on Information Visualization, (2013) 59-65.

[5]Structured Convex Optimization under Submodular Constraints, K. Nagano, Y. Kawahara: Proc. of the 29th Annual Conference on Uncertainty in Artificial Intelligence, (2013) 459-468.

[6]Structural Analysis of IBR-2 Based on Continuous Time Canonicality (oral), M. Demeshko, T. Washio, Y. Pepyolyshev: ANS National Meeting; 2013 ANS Winter Meeting Technical Sessions.

[7]Estimation of Causal Direction in the Presence of Latent Confounders Using a Bayesian LiNGAM Mixture Model (invited), N. Tanaka, S. Shimizu, T. Washio （Invited）: Workshop on Causality: Perspectives from Different Disciplines.

[8]Issues for Modeling from Big Data (invited), T. Washio: Workshop on Computation: Theory and Practice.

[9]Rare Flood Scenario Analysis Using Observed Rain Fall Data (oral), T. Washio, Y. Iba: JSST 2013; International Conference on Simulation Technology.

[10]Finding Structured Dictionary Representation by Network-Flow Optimization (oral), A. Kanemura, J. Yuan, Y. Kawahara: Workshop on Data Discretization and Segmentation for Knowledge Discovery.

[11]Parametric Submodular Optimization in Machine Learning (invited), Y. Kawahara: Trends in Machine Learning.

Review Papers
Modeling From Big Data, T. Washio, ISCIE Journal 'Systems, Control and Information', The Institute of Systems, Control and Information Engineers, 58[1] (2014), 3-8.

Submodularity in Machine Learning and Combinatorial Algorithms, Y. Kawahara, Communications of the Operations Research Society of Japan, The Operations Research Society of Japan, 58 (2013), 267-274.

Machine Learning with structural Information: Structured Regularization and Submodularity, Y. Kawahara, IPSJ Magazine "Joho Shori", Information Processing Society of Japan, 52 (7), 734-740.

Books
[1]Modeling from Big Data T. Washio, “Big Data Management”, NTS Inc., 2[4] (57-67) 2014.

Patents
[1]K20070226 Method, Instrument and Program for Multi-dimensional Data Analysis, JP2007-301025

[2]K20110229 Discriminant model learning device, method and program, US 20130204810 A1

[3]K20110230 Optimized query generating device and method, and discriminant model learning method, US 20130204811 A1

[4]K20110251 Device, method, and program for visualization of multi-dimensional data, WO 2013114509 A1

[5]K20120339 Interactive variable selection device, interactive variable selection method, and interactive variable selection program, 2013-114509

Contributions to International Conferences and Journals

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)
T. Washio	ECML/PKDD'13: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Guest Editorial Board)
T. Washio	SDM2013 : SIAM International Conference on Data Mining (Senior Program Committee)
T. Washio	ACM SIGKDD'13: The 19th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. Washio	The 22nd International Conference on Information and Knowledge Management (CIKM 2013) (Program Committee)
T. Washio	ICDM 2013 IEEE International Conference on Data Mining (Workshop Co-Chair)
T. Washio	ECML/PKDD'13: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Program Committee)
T. Washio	NIPS2013: Neural Information Processing Systems 2013 (Reviewer)
T. Washio	SDM2014 : SIAM International Conference on Data Mining (Senior Program Committee)
T. Washio	The 18th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2014) (Publicity Chair)
T. Washio	The 18th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2014) (Program Committee)
T. Washio	Society for Industrial and Applied Mathematics (Program Director)
T. Washio	DS-2014: the Seventeenth International Conference on Discovery Science (Program Committee)
T. Washio	JSAI International Symposia on AI(JSAI-isAI 2014) (Advisory Committee)
T. Washio	ACM SIGKDD'14: The 20th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. Washio	ICDM 2014: IEEE International Conference on Data Mining (Program Committee)
T. Washio	ECML/PKDD 2014: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases 2014 (Program Committee)
T. Washio	The Second IEEE ICDM (IEEE International Conference on Data Mining) Workshop on Causal Discovery (CD 2014) (Organizing Committee)

Publications in Domestic Meetings

The 27th Annual Conference of the Japanese Society for Artificial Intelligence	3 papers
The Institute of Electrical Engineers of Japan	1 paper
Operations Research Society of Japan	1 paper
The 16th Information-based Induction Sciences Workshop	1 paper
Incomplete Data Analysis and Causal Inference	1 paper

Academic Degrees

Bachelor Degree for Engineering T. Kamon	Anommaly detection in crowd scenes by using Structured Regularization
Bachelor Degree for Engineering	Causal structure reasoning for non-stationary time series by using non-Gaussianity

K. Otsuki
Bachelor Degree for Engineering — Portfolio selection using componentwise kernel learning
S. Okada
Master Degree for Engineering — Anommaly detection in process by using Grouped Regularization
I. Umemura
Master Degree for Engineering — Group regularized PCA using submodularity
K. Sugimoto

Grant-in-Aid for Scientific Research

T. Washio	Development and application of Statistical Estimation and Simulation Principles in a Super High Dimensional Data Space	¥10,140,000
T. Washio	Learning Probabilistic Simulation Models of Event and Scenario Occurences under Rare and Special Conditions	¥1,560,000
Y. Kawahara	Hardware-friendly machine learning by regularized learning with integer parameters based on discrete convexity	¥650,000
S. Shimizu	Causal structure learning from multiple high-dimensional datasets and its application to life sciences	¥910,000
A. Kanemura	Robust signal processing that captures local structures by probabilistic models on dense patches	¥650,000

Entrusted Research

T. Washio	National Cerebral and Cardiovascular Center	Clinical study over multiple facilities on a numerical model of chronic heart failure and its validity	¥500,000
T. Washio	Fujitsu Laboratories LTD.	Study on Technical Basis for Data Analysis	¥2,000,000
Y. Kawahara	Japan Science and Technology Agency	Knowledge discovery from super-high dimensional data based on combinatorial computation	¥10,166,000

Cooperative Research

T. Washio	Japan Science and Technology Agency	¥1,140,000
Y. Kawahara	NEC Co.	¥1,575,000
Y. Kawahara	Honda R&D Co.,Ltd.	¥2,640,000

Other Research Fund

Y. Kawahara	JSPS/NUS Joint Project	¥2,450,000

Department of Knowledge Systems

Original Papers

[1]Characterizing Functions Based on Phase- and Evolution-Oriented Models, Y. Kitamura, R. Mizoguchi: Applied Ontology, 8 (2) (2013) 73-94.

[2]Ontological Characterization of Functions: Perspectives for Capturing Functions and Modeling Guidelines, Y. Kitamura, R. Mizoguchi: Artificial Intelligence for Engineering Design, Analysis and Manufacturing, 27 (3) (2013) 259-269.

[3]Protein Experimental Information Management System (PREIMS) Based on Ontology: Development and Applications, J. Sato, K. Kozaki, S. Handa, T. Ikeda, R. Saka, K. Tomizuka, Y. Nishiyama, T. Okumura, S. Hirai, T. Ohno, M. Ohta, S. Date, H. Nakamura: IPSJ Transactions on Bioinformatics, 6 (2013) 9-17.

International Conferences

[1]CHARM Pad: Ontology-Based Tool for Learning Systematic Knowledge about Nursing, M. Sasajima,

S. Nishimura, Y. Kitamura, A. Hirao, K. Hattori, A. Nakamura, H. Takahashi, Y. Takaoka, R. Mizoguchi: Proc. of the Second International Conference, DUXU 2013, held as Part of HCI International 2013, Part IV, LNCS, 8015 (2013) 560-567.

[2]Goal-Oriented Ontological Framework CHARM (poster), S. Nishimura, G. Nishijima, Y. Kitamura, M. Sasajima, T. Takeda, Y. Matsumura, R. Mizoguchi: Proc. of the 7th International Conference on Health Informatics, (2014) 211-221.

[3]Publishing a Disease Ontologies as Linked Data, K. Kozaki, Y. Yamagata, T. Imai, K. Ohe, R. Mizoguchi: Semantic Technology - Third Joint International Conference, JIST 2013; Revised Selected Papers, Lecture Notes in Computer Science, 8388 (2013) .

[4]Ontology Exploration Tool for Social, Economic and Environmental Development, K. Kozaki, T. Kumazawa, O. Saito, R. Mizoguchi: Proc. of 7th IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST 2013), (2013) .

[5]Ontological Model of Abnormal States and Its Application in the Medical Domain, Y. Yamagata, H. Kou, K. Kozaki, R. Mizoguchi, T. Imai, K. Ohe: Proc. of the 4th International Conference on Biomedical Ontology (ICBO 2013), (2013) 28-33.

[6]Multistep Expansion Based Concept Search for Intelligent Exploration of Ontologies, K. Kozaki, O. Saito, R. Mizoguchi: Proc. of International Workshop on Intelligent Exploration of Semantic Data (IESD 2013), (2013) .

[7]An Ontology-Based Tablet Tool for Learning Procedural Knowledge about Nursing with Rationale (poster), Y. Kitamura, S. Nishimura, M. Sasajima, A. Nakamura, H. Takahashi, A. Hirao, K. Hattori, Y. Takaoka, R. Mizoguchi,: The 3rd Joint International Semantic Technology (JIST) Conference.

[8]A Browsing System for Causal Chains in a Disease Ontology Published as Linked Data (poster), K. Kozaki, Y. Yamagata, T. Imai, K. Ohe, R. Mizoguchi: The 3rd Joint International Semantic Technology (JIST) Conference.

[9]A Basic Consideration on Ontology Refine Method Using Similarity among Is-a Hierarchies (oral), T. Masuda, K. Kozaki: The First Workshop on Practical Application of Ontology for Semantic Data Engineering.

[10]Ontology Engineering for Big Data (invited), K. Kozaki: Ontology and Semantic Web for Big Data (ONSD2013) Workshop in the 2013 International Computer Science and Engineering Conference （ICSEC2013), Bangkok, Thailand, Sep. 5, 2013.

Review Papers

Co-Design and Development of Goal-Oriented Guidelines for Nursing Care, M. Sasajima, S. Nishimura, Y. Kitamura, M Riichiro, Journal of JSAI, Ohmsha, 28[6] (2013), 899-905.

Ontological Engineering for Navigation Interface of Mobile Services, Y. Kitamura, M. Sasajima, M Riichiro, J. of Human Interface Society, Taiseisha, 15[3] (2013), 19-24.

Books

[1]Task-Oriented User Modeling Method and its Application to Service Navigation on the Web, M. Sasajima, Y. Kitamura, R. Mizoguchi , “Social Media Mining and Social Network Analysis : Emerging Research”, Guangdong Xu, Lin Li (eds.), IGI-Global, (127-139) 2013.

[2] Y. Zeng, K. Y. Kim, V. Raskin, B. C.M. Fung, Y. Kitamura (Eds.), Special issue: modeling, extraction, and transformation of semantics in computer aided engineering systems, Advanced Engineering

Informatics, Elsevier, 27[1](2013), 1-92

[3] H. Takeda, Y. Qu, R. Mizoguchi, Y. Kitamura (Eds.) , Semantic Technology - Second Joint International Conference, JIST 2012, Nara, Japan, December 2-4, 2012, Proceedings, Lecture Notes in Computer Science, Springer,7774 (2013)

Contributions to International Conferences and Journals

Y. KITAMURA	JSME Journal of Advanced Mechanical Design, Systems, and Manufacturing (Editor)
Y. KITAMURA	International Journal of Advanced Engineering Informatics (Editorial board member)
Y. KITAMURA	The 6th International Conference on Design Computing and Cognition (Advisory Board member)
Y. KITAMURA	The 3nd Joint International Semantic Technology Conference (JIST2013) (PC member)
Y. KITAMURA	The 19th International Conference on Engineering Design (ICED 13) (PC member)
K. KOZAKI	The 3nd Joint International Semantic Technology Conference (JIST2013) (Poster and Demo Chair)
K. KOZAKI	The 3nd Joint International Semantic Technology Conference (JIST2013) (PC member)
K. KOZAKI	Journal of Information Processing (Editorial board)
K. KOZAKI	SEED Inauguration Workshop (Organaizing Committtee)
K. KOZAKI	The International Workshop on Intelligent Exploration of Semantic Data (IESD2013) (Organaizing Committtee)
K. KOZAKI	The First Workshop on Practical Application of Ontology for Semantic Data Engineering (PAOS2013) (Organaizing Committtee)
K. KOZAKI	Linked Data in Practice Workshop (PC member)

Publications in Domestic Meetings

The Japanese Society for Artificial Intelligence	10 papers
Japan Association for Medical Informatics	2 paper
The Japan Academy of Nursing Science	1 paper
Japan Society for Science Education	1 paper

Academic Degrees

Bachelor Degree for Engineering K. Tada	A Consideration on a Method for Expansion of a Biomimetic Ontology using Technical Documents and Linked Open Data
Bachelor Degree for Engineering Y. Hirohata	Trial Development of a Knowledge Base of Ways of Function Achievment in Organisms
Master Degree for Engineering Y. Fukui	Development of a Nursing Action Ontology based on Informal Instructions for Nurses

Grant-in-Aid for Scientific Research

Y. Kitamura	Development of a common modeling framework for functional whole and an integrated modeling tool	¥4,160,000
K. Kozaki	Intelligent Exploration of Semantic Data through Domains based on Multi-dimension Viewpoint Management of Ontologies	¥4,420,000
K. Kozaki	Formalizations of Probability, Causality and Risk in Applied Ontology	¥300,000
M. Sasajima	Hierarchical modeling of the nursing care manual and development of its browser	¥5,070,000
Y. Kitamura	Development of a biomimetic database	¥4,940,000
K. Kozaki	Development of a biomimetic database	¥1,950,000

Y. Kitamura	Development of the next-generation knowledge systems using ontological engineering	¥845,000
K. Kozaki	Development of the next-generation knowledge systems using ontological engineering	¥845,000
K. Kozaki	Development of a Basic Technology for Information Integration of Mouse/Rat Phenotypes	¥260,000
K. Kozaki	Development of an ontology of information literacy and classification of goals based on international comparison	¥260,000

Entrusted Research

K. Kozaki	The University of Tokyo	Development of Ontology-based Knowledge Processing Mechanism	¥9,000,000
K. Kozaki	The University of Tokyo	Research on Development of a Medical Knowledge Database for Medical Information Systems; Design of a Semantic Relational Model	¥4,500,000

Contribution to Research

K. Kozaki	Samsung R&D Institute Japan	¥750,000

Department of Architecture for Intelligence

Original Papers

[1]Discovering Emotion-Inducing Music Features Using EEG Signals, R. Cabredo, R. Legaspi, P.S. Inventado, M. Numao: Journal of Advanced Computational Intelligence and Intelligent Informatics, 17 (3) (2013) 362-370.

International Conferences

[1]Helping Students Manage Personalized Learning Scenarios, P.S. Inventado, R. Legaspi, M. Numao: Proc. of the The 6th International Conference on Educational Data Mining (EDM 2013), (2013) 244-247.

[2]Identification of Effective Learning Behaviors, P.S. Inventado, R. Legaspi, C. Rafael, K. Moriyama, K. Fukui, S. Kurihara, M. Numao: Artificial Intelligence in Education, LNCS 7926 (2013) 670-673.

[3]An Architecture for Identifying and Using Effective Learning Behavior to Help Students Manage Learning, P.S. Inventado, R. Legaspi, K. Moriyama, K. Fukui, M. Numao: Proc. of Formative Feedback in Interactive Learning Environments, (2013) .

[4]Modeling Affect in Self-Directed Learning Scenarios, P.S. Inventado, R. Legaspi, K. Moriyama, K. Fukui, M. Numao: Proc. 4th International Workshop on Empathic Computing (IWEC'13), (2013) .

[5]Personalization Approach in Health Information Retrieval System, I. Puspitasari, K. Fukui, K. Moriyama, M. Numao: Proc. of 4th International Workshop on Empathic Computing (IWEC'13), (2013) .

[6]An Analysis of Player Affect in Survival Horror Game Using Physiological Signals and Player Self-Reports, V. Vachiratamporn, R. Legaspi, P. S. Inventado, K. Fukui, K. Moriyama, M. Numao: Proc. of 4th International Workshop on Empathic Computing (IWEC'13), (2013) .

[7]Generation of Rhythm for Melody in a Constructive Adaptive User Interface, N. Otani, R. Kamimura, Y. Yamano, M. Numao: Proc. of 4th International Workshop on Empathic Computing (IWEC'13), (2013) .

[8]APP: Aperiodic and Periodic Model for Long-Term Human Mobility Prediction Using Ambient Simple Sensors, D. Sodkomkham, R. Legaspi, K. Fukui, K. Moriyama, S. Kurihara, M. Numao: Proc. of 4th International Workshop on Mining Ubiquitous and Social Environments (MUSE), (2013) .

[9]Distributed Inference to Support Inter-Subjective Empathic Computing, M. Numao: Proc. of Workshop

on Computation: Theory and Practice (WCTP-2013), (2013) .

[10]Health Information Search Personalization with Semantic Network User Model, I. Puspitasari, K. Fukui, K. Moriyama, M. Numao: Proc. of Workshop on Computation: Theory and Practice (WCTP-2013), (2013) .

[11]Building Incremental Affect Models to Help Students Annotate and Analyze Their Behavior in Self-Directed Learning Scenarios, P. S. Inventado, R. Legaspi, K. Fukui, K. Moriyama, M. Numao: Proc. of Workshop on Computation: Theory and Practice (WCTP-2013), (2013) .

[12]Towards the Design of Affective Survival Horror Games: an Investigation on Player Affect, V. Vachiratamporn, R. Legaspi, K. Moriyama, M. Numao: Proc. 2013 Humaine Association Conference on Affective Computing and Intelligent Interaction (ACII-2013), (2013) 576-581.

[13]Intelligent Analysis For Evaluating Physical Degradation Using Acoustic Emission, K. Fukui, K. Sato, T. Hashida, J. Mizusaki, M. Numao: ECS Transactions, 57 (2013) 571-580.

[14]Evolutionary Distance Metric Learning Approach to Semi-Supervised Clustering with Neighbor Relations, K. Fukui, S. Ono, T. Megano, M. Numao: Proc. of 25th IEEE International Conference on Tools with Artificial Intelligence (ICTAI-13), (2013) 398-403.

[15]Towards Building Incremental Affect Models in Self-Directed Learning Scenarios, P. S. Inventado, R. Legaspi, K. Fukui, K. Moriyama, M. Numao: Proc. of the 21st International Conference on Computers in Education (ICCE 2013), (2013) 170-172.

[16]Context-Aware Application Prediction and Recommendation in Mobile Devices, S. Kurihara, K. Moriyama, M. Numao: Proc. of 2013 IEEE/WIC/ACM International Joint Conferences on Web Intelligence and Intelligent Agent Technologies (WI/IAT 2013), (2013) 494-500.

[17]Proposition of the Context-Aware Application Prediction Mechanism for Mobile Devices, S. Kurihara, K. Moriyama, M. Numao: Proc. of 2013 IEEE/WIC/ACM International Joint Conferences on Web Intelligence and Intelligent Agent Technologies (WI/IAT 2013), (2013) 118-121.

[18]Distributed Inference to Support Inter-Subjective Interpretation of Behavior (invited), M. Numao: The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[19]Distributed Inference to Support Inter-Subjective Formalization (invited), M. Numao: Spring workshop on Mining and Learning.

[20]Long-Term Human Mobility Prediction Using Simple Sensors (poster), D. Sodkomkham: Spring workshop on Mining and Learning.

Review Papers

AI Methods for Solid State Cell Development, K. Sato, K. Fukui, S. Takafuji, T. Hashida, J. Mizusaki, Journal of Japanese Society for Artificial Intelligence, The Japanese Society for Artificial Intelligence, 28[4] (2013), 529-534.

Fundamental Technologies for Reliability Diagnosis and Knowledge Management of Fuel Cells utilizing Data Mining and Ontology Engineering, K. Fukui, S. Takafuji, K. Sato, M. Numao, R. Mizoguchi, Journal of Japanese Society for Artificial Intelligence, The Japanese Society for Artificial Intelligence, 28[4] (2013), 535-542.

Forming "Personal Values": Constructive Approach by Using Artificial Agents, K. Moriyama, Manufacturing & Technology, Association for Manufacturing & Technology Promotion, 65[4] (2013), 84-86.

The Fifth Generation Computer Systems Project from the View Point of Machine Learning and Its Future, M. Numao, Journal of Japanese Society for Artificial Intelligence, The Japanese Society for Artificial Intelligence, 29[2] (2014), 142-148.

Literature Introduction: Machine Learning that Matters, K. Fukui, Journal of Japanese Society for Artificial Intelligence, The Japanese Society for Artificial Intelligence, 29[2] (2014), 217-219.

What is Intelligence? — from the Viewpoint of Interdisciplinary Research, M. Numao, Manufacturing & Technology, Association for Manufacturing & Technology Promotion, 65[4] (2014), 72-74.

Grant-in-Aid for Scientific Research

M. Numao	Constructing Empathic Computing Mechanism	¥4,680,000
M. Numao	Distributed Inference to Support Inter-Subjective Formalization and Its Application to Sensor Network	¥1,300,000
K. Fukui	Co-occurring Cluster Mining and its Envitionmental Contribution	¥1,300,000

Entrusted Research

K. Fukui	Japan Science and Technology Agency	Evaluation Method for Next Generation Engergy Device based on Artificial Intelligence	¥130,000

Contribution to Research

M. Numao	Daikin Industries, Ltd.	¥300,000
K. Fukui	Kayamori Foundation of Information Science Advancement	¥1,000,000

Department of Quantum Information Optics (Alliance Laboratory of ISIR, Osaka Univ. and RIES, Hokkaido Univ.)

Original Papers

[1]An Entanglement-Enhanced Microscope, T.Ono, R.Okamoto, S.Takeuchi: Nature Communications, 4 (2406) (2013) 3426.

[2]Investigation of the Performance of an Ultralow-Dark-Count Superconducting Nanowire Single-Photon Detector, S.Subashchandran, R.Okamoto, L.Zhang, A.Tanaka, M.Okano, L.Kang, J.Chen, P.Wu, S.Takeuchi: Jpn. J. Appl. Phys., 52 (10) (2013) 102801.

[3]Dispersion Cancellation in High-Resolution Two-Photon Interference, M.Okano, R.Okamoto, A.Tanaka, S.Ishida, N.Nishizawa, S.Takeuchi: Phys. Rev. A, 88 (2013) 43845.

[4]Observation of 1.2-GHz Linewidth of Zero-Photon-Line in Photoluminescense Spectra of Nitrogen Vacancy Centers in Nanodiamonds Using a Fabry-Perot Interferometer, H.Q.Zhao, M.Fujiwara, M.Okano, S.Takeuchi: Opt. Exp., 21 (24) (2013) 29679.

[5]Anomaly Detection in Reconstructed Quantum States Using a Machine-Learning Technique, S.Hara, T.Ono, R.Okamoto, T.Washio, S.Takeuchi: Phys. Rev. A, 89 (2) (2014) 022104.

[6]Recent Progress in Single-Photon and Entangled-Photon Generation and Applications, S.Takeuchi: Jpn. J. Appl. Phys., 53 (2014) 30101.

[7]Quantum Information Science Using Photons, S.Takeuchi: AAPPS Bulletin, 24 (1) (2014) 19.

International Conferences

[1]Photonic Quantum Circuits and Single Photon Sources (invited), S. Takeuchi: The 11th US-Japan Joint

Seminar on Quantum Electronics and Laser Spectroscopy "Ultimate Quantum Systems of Light and Matter-Control and Applications".

[2]Experimental Demonstration of Adaptive Quantum State Estimation (oral), S. Takeuchi, R. Okamoto, M. Iefuji, S. Oyama, K. Yamagata, H. Imai, A. Fujiwara: CLEO/EUROPE-IQEC 2013.

[3]Nano Optical Fibers for Photonic Quantum Information (invited), S. Takeuchi: Optical Nanofiber Applications: From Quantum to Bio Technologies ONNA 2013.

[4]Dispersion-Tolerant Quantum Optical Coherence Tomography by Broadband Parametric Fluorescence (poster), M. Okano, R. Okamoto, A. Tanaka, S. Ishida, N. Nishizawa, S. Takeuchi: The 21st International Conference on Laser Spectroscopy (ICOLS2013).

[5]Experimental Demonstration of Adaptive Quantum State Estimation (invited), S. Takeuchi, R. Okamoto, M. Iefuji, S. Oyama, K. Yamagata, H. Imai, A. Fujiwara: 20th Central European Workshop on Quantum Optics.

[6]Coupling Diamond Nitrogen Vacancy Centers to Tapered Fibers: Toward Generation of Indistinguishable Single Photons (oral), M. Fujiwara, T. Schroder, H. Q. Zhao, T. Noda, S. Kamioka, O. Benson, S. Takeuchi: CLEO-PR & OECC/PS 2013.

[7]Broadband Frequency Correlated Photon Pairs Using a Chirped-QPM Device (poster), A. Tanaka, R. Okamoto, H. H. Lim, S. Subashchandran, M. Okano, L. Zhang, L. Kang, J. Chen, P. Wu, T. Hirohata, S. Kurimura, S.Takeuchi: CLEO-PR & OECC/PS 2013.

[8]High-Resolution Quantum Optical Coherence Tomography by Broadband Parametric Fluorescence (poster), M. Okano, R. Okamoto, A. Tanaka, S. Ishida, N. Nishizawa, S. Takeuchi: CLEO-PR & OECC/PS 2013.

[9]Adaptive Quantum State Estimation of Mixed States Using Photons (poster), S. Oyama, M. Iefuji, R. Okamoto, K. Yamagata, A. Fujiwara, S. Takeuchi: CLEO-PR & OECC/PS 2013.

[10]Sum-Frequency-Photon Generation from an Entangled Photon Pair (poster), Y. Eto, M. Okano, A. Tanaka, S. Subashchandran, R. Okamoto, H. H. Lim, S. Kurimura, S. Takeuchi: CLEO-PR & OECC/PS 2013.

[11]Photoluminescence Measurement of Zero-Phonon Line from NV Center in Diamond Nanocrystals at Cryogenic Temperatures (poster), H. Takashima, H. Q. Zhao, M. Okano, M. Fujiwara, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[12]Direct Observation of 150 THz-Frequency Correlation of Photon Pairs Generated from Chirped Quasi-Phase Matched Crystal (poster), A. Tanaka, R. Okamoto, H. H. Lim, S. Subashchandran, M. Okano, Y. Eto, L. Zhang, L. Chen, P. Wu, T. Hirohata, S. Kurimura, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[13]Toward the Realization of Monocycle Entangled Photons (invited), S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[14]High-Resolution Quantum Optical Coherence Tomography by Broadband Entangled Photon Pairs (invited), M. Okano, R. Okamoto, A. Tanaka, S. Ishida, N. Nishizawa, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[15]Coupling Diamond Nitrogen Vacancy Centers with Optical Tapered Fibers for Single Photon Sources (poster), M. Fujiwara, H Q. Zhao, M. Okano, T. Noda, S. Takeuchi: New science and technologies using

entangled photons (NSTEP).

[16]Adaptive Quantum State Estimation of Mixed States Using Photons (poster), S. Oyama, M. Iefuji, R. Okamoto, K. Yamagata, A. Fujiwara, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[17]The Effect of Diamond Nanocrystal Structures on the Coupling of Single Nitrogen Vacancy Centers with Tapered Nanofibers (poster), M. Almokhtar, M. Fujiwara, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[18]Sum-Frequency-Photon Generation from an Entangled Photon Pair (poster), Y. Eto, M. Okano, A. Tanaka, R. Okamoto, H. H. Lim, S. Kurimura, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[19]Experimental Demonstration of an Entanglement-Enhanced Microscope (poster), T. Ono, R. Okamoto, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[20]Fabrication of Nanostructured Tapered Fibers for Highly Efficient Single Photon Sources (poster), S. Kamioka, M. Fujiwara, S. Takeuchi: New science and technologies using entangled photons (NSTEP).

[21]Application of Quantum Metrology Using Photons (invited), T. Ono, R. Okamoto, S. Takeuchi: 22nd International Laser Physics Workshop.

[22]Quantum Measurements and Sensings (invited), S. Takeuchi: SPIE Optics + Photonics.

[23]Coupling Diamond Nitrogen Vacancy Centers with Ultrathin Optical Tapered Fibers at Cryogenic Temperatures toward Efficient Indistinguishable Single Photon Sources (oral), M. Fujiwara, H. Q. Zhao, M. Okano, T. Noda, K. Ikeda, H. Sumiya, S. Takeuchi: International Conference on Diamond and Carbon Materials.

[24]Photonic Quantum Circuits and Quantum Metrologies (invited), S. Takeuchi: OSA'S97th Annual meeting Frontiers in Optics 2013.

[25]Photonic Quantum Circuits and Quantum Metrologies (invited), S. Takeuchi: Quantum Science Symposium Asia-2013.

[26]A Quantum Shutter Closing N Slits (poster), R. Okamoto, S. Takeuchi: THE 14th RIES-HOKUDAI INTERNATIONAL SYMPOSIUM「mou」.

[27]Adaptive Quantum State Estimation for Single Quantum Bit (poster), S. Oyama, R. Okamoto, K. Yamagata, A. Fujiwara, S. Takeuchi: THE 14th RIES-HOKUDAI INTERNATIONAL SYMPOSIUM「mou」.

[28]High-Resolution Quantum Optical Coherence Tomography by Broadband Entangled Photon Pairs (poster), M. Okano, R. Okamoto, A. Tanaka, S. Ishida, N. Nishizawa, S. Takeuchi: The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project.

[29]Experimental Demonstration of An Entanglement-Enhanced Microscope (poster), T. Ono, R. Okamoto, S. Takeuchi: The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project.

[30]An Entanglement-Enhanced Microscope (invited), S. Takeuchi: Photonics West (SPIE).

Review Papers

Optical Phase Measurement Using Entangled Photons, R.Okamoto, S.Takeuchi, KOGAKU, Japanese Journal of Optics, 42[10] (2013), 500-505.

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)
S.Takeuchi	CLEO-PR, Quantum optics, Quantum information (Technical Program Committee)
S.Takeuchi	Asian Conference on Quantum Information Science (Program Committee)

Publications in Domestic Meetings

The 28th Quantum Information Technology Symposium	3 papers
The 2013 JSAP-MRS Joint Symposia	1 paper
JSP 2013 Fall meetings	7 papers
The 29th Quantum Information Technology Symposium	2 papers
H25 RIES Research Meeting	1 paper
3th Quantum Theory & Technology un-official meeting	1 paper
Opt Osaka 2014 in Tokyo	1 paper
New Horizon in Quantum Information Science	3 papers
69th Annual Meeting of the Physical Society of Japan	2 papers

Academic Degrees

Doctor Degree for Science A.Tanaka	Coherent Manipulation of Photonic Quantum States towards Mono-Cycle Entangled Photon Pairs and Quantum Phase Gate
Master Degree for Science Y.Eto	Study on sum frequency photon generation using photon pair having ultra-short time correlation
Master Degree for Science S.Kamioka	Realization of cavity embedded optical nano fiber fabricated by nanomachining
Master Degree for Science S.Ooyama	Adaptive quantum state estimation for single photon quantum bit

Grant-in-Aid for Scientific Research

S.Takeuchi	Realization of an efficient quantum memory for single photons using a diamond color center as a λ-type atom	¥10,790,000
S.Takeuchi	Realization of quantum cybernetics using photonic quantum circuits	¥18,330,000
R.Okamoto	Realization of boson sampling using photon	¥13,650,000
R.Okamoto	Realization of single photon absorption spectroscopy using quantum light	¥2,600,000

Entrusted Research

S.Takeuhi	Japan Science and Technology Agency (JST)	Toward the realization of monocycle entangled photons for novel nonlinear quantum optics	¥37,500,000
S.Takeuhi	Japan Society for the Promotion of Science	Realization of entanglement microscope and supersensitive phase measurement	¥11,881,000

Department of Quantum Functional Materials

Original Papers

[1]Tunability of the k-space Location of the Dirac Cones in the Topological Crystalline Insulator $Pb_{1-x}Sn_xTe$, Y. Tanaka, T. Sato, K. Nakayama, S. Souma, T. Takahashi, Z. Ren, M. Novak, K. Segawa, Y. Ando: Phys. Rev. B, 87 (15) (2013) 155105/1-5.

[2]Fermiology of the Strongly Spin-Orbit Coupled Superconductor $Sn_{1-x}In_xTe$: Implications for Topological Superconductivity, T. Sato, Y. Tanaka, K. Nakayama, S. Souma, T. Takahashi, S. Sasaki, Z. Ren, A. A. Taskin, K. Segawa, Y. Ando: Phys. Rev. Lett., 110 (20) (2013) 206804/1-5.

[3]Anomalous Dressing of Dirac Fermions in the Topological Surface State of Bi_2Se_3, Bi_2Te_3, and Cu-Doped Bi_2Se_3, T. Kondo, Y. Nakashima, Y. Ota, Y. Ishida, W. Malaeb, K. Okazaki, and S. Shin, M. Kriener, S. Sasaki, K. Segawa, Y. Ando: Phys. Rev. Lett., 110 (21) (2013) 217601/1-5.

[4]Experimental Studies of the Topological Superconductor $Cu_xBi_2Se_3$, Y. Ando, K. Segawa, S. Sasaki, M. Kriener: J. Phys.: Conf. Ser., 449 (2013) 012033/1-5.

[5]Topological Insulator Materials, Y. Ando: J. Phys. Soc. Jpn (Invited review paper), 82 (10) (2013) 102001/1-32.

[6]Unusual Nature of Fully Gapped Superconductivity in In-Doped SnTe, M. Novak, S. Sasaki, M. Kriener, K. Segawa, Yoichi Ando: Phys. Rev. B (Rapid Communications), 88 (14) (2013) 140502(R)/1-5.

[7]Two Types of Dirac-Cone Surface States on the (111) Surface of the Topological Crystalline Insulator SnTe, Y. Tanaka, T. Shoman, K. Nakayama, S Souma, T. Sato, T. Takahashi, M. Novak, K. Segawa, Y. Ando: Phys. Rev. B, 88 (23) (2013) 235126/1-5.

[8]Relationship between Fermi Surface Warping and Out-of-Plane Spin Polarization in Topological Insulators: A View from Spin-and Angle-Resolved Photoemission, M. Nomura, S. Souma, A. Takayama, T. Sato, T. Takahashi, K. Eto, K. Segawa, Y. Ando: Phys. Rev. B, 89 (4) (2014) 045134/1-6.

[9]Topological Surface Transport in Epitaxial SnTe Thin Films Grown on Bi_2Te_3, A. A. Taskin, F. Yang, S. Sasaki, K. Segawa, Y. Ando: Phys. Rev. B (Rapid Communications), 89 (12) (2014) 121302(R)/1-5.

International Conferences

[1]Experimental Studies of 3D Topological Insulators (invited), K. Segawa: CIFAR Quantum Materials Program Meeting.

[2]Searching for Possible Topological Superconductors with Time-Reversal Invariance (invited), Y. Ando: Gordon Research Conference on Superconductivity.

[3]Possible Topological Superconductivity in Doped Topological Insulators (invited), Y. Ando: Majoranas in Solid State Workshop.

[4]Transport Studies of Epitaxial Thin Films of Topological Crystalline Insulators (invited), A. A. Taskin: 7th ISSP International Symposium on "Emergent Quantum Phases in Condensed Matter".

[5]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: 2013 Swiss Workshop on Material with Novel Electronic Properties.

[6]Possible Bulk Topological Superconductors with Time-Reversal invariance (invited), Y. Ando: Conference on Majorana Physics in Condensed Matter, Ettore Majorana Foundation and Center for Scientific Culture.

[7]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: International Workshop on Superconductivity Research and Advanced by New Materials and Spectroscopies.

[8]Experimental Efforts to Realize Time-Reversal Invariant Topological Superconductors (invited), S. Sasaki, A. A. Taskin, K. Segawa, Y. Ando: International Symposium on Quantum Fluids and Solids (QFS2013).

[9]Transport Studies of Epitaxial Films of Topological Insulators and Topological Crystalline Insulators (invited), A. A. Taskin: The 16th International Conference on "Narrow Gap System".

[10]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Symposium on Frontiers of Solid State Physics.

[11]Ionic-Liquid Gating Experiment on Topological Insulators (poster), K. Segawa, Z. Ren, S. Sasaki, T. Tsuda, S. Kuwabata, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[12]Conductance Spectroscopy on Superconducting Topological Insulator Families (invited), S. Sasaki, A. A. Taskin, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[13]The Gating of Topological Insulator Thin Films and Exfoliated Crystals (poster), F. Yang, A. A. Taskin, M. Kishi, K. Eto, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[14]Phase Diagram of $Sn_{1-x}In_xTe$ -a Topological Superconductor Candidate (poster), M. Novak, S. Sasaki, M. Kriener, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[15]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Colloquium, Max-Planck Institute for Solid State Research.

[16]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: FIRST-QS2C Workshop on Emergent Phenomena of Correlated Materials.

[17]Transport Studies of Topological Insulators (invited), Y. Ando: International Symposium on Nanoscale Transport and Technology (ISNTT2013).

[18]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Colloquium, Department of Physics, University of California Santa Barbara.

[19]Spin Pumping into the Surface State of Topological Insulators (invited), Y. Ando: Workshop on Topological Matter, Superconductivity and Majorana.

[20]Transport Studies of Topological Insulators (plenary), Y. Ando: Trends in Nano Technology (TNT Japan 2014).

[21]Materials Efforts for Topological Insulators and Superconductors (invited), Y. Ando: FIRST International Symposium on Topological Quantum Technology.

[22]Superconducting doped topological insulators (invited), S. Sasaki: The 5th Science Research Center for Topological Matter Winter Workshop.

[23]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Quantum Matter and Materials Colloquium, University of Cologne.

[24]New Topological Materials: Topological Crystalline Insulators and Topological Superconductors (invited), Y. Ando: 18th International Winterschool on New Developments in Solid State Physics.

[25]Superconducting Topological Insulators (invited), Y. Ando: Theo Murphy International Scientific Meeting, Emergence of New Exotic States at Interfaces with Superconductors.

Review Papers

Condensed Matter Physics and New Materials -Examples of Superconductors and Topological Insulators-, Y. Ando, Mathematical Sciences, SAIENSU-SHA Co., Ltd., [605] (2013), 26-31.

A door to establishing the existence of topological superconductor: Soft point-contact spectroscopy, S. Sasaki, Forum of Superconductivity Science and Technology News, The Society of Non-Traditional Technology, 138 (2013), 17-20.

Contributions to International Conferences and Journals

Y. Ando	Europhysics Letters (EPL) (Co-Editor)
Y. Ando	Advanced Materials Interfaces (International Advisory Board)
Y. Ando	International Conference on Topological Quantum Phenomena (TQP2014) (Chair, Program Committee)
Y. Ando	Materials and Mechanisms of Superconductivity Conference (M2S 2015) (International Advisory Board)
Y. Ando	7th International Conference "Science and Engineering of Novel Superconductors" of the Forum on New Materials (International Advisory Board)

Publications in Domestic Meetings

13rd Intensive-Interactive Meeting "Novel Quantum Phenomena in Topological Electron Fluids"	1 paper
New Developments in Dirac fermions in condensed matter systems	1 paper
19th Meeting of the Magnetics Society of Japan "Berry phase and topological insulators"	1 paper
Meeting 2013 for G1 working group of five-institute alliance	1 paper
Fall Meeting of the Physical Society of Japan 2013	11 papers
4th Annual Meeting of Topological Quantum Phenomena in Condensed Matter with Broken Symmetries	7 papers
69th Annual Meeting of the Physical Society of Japan	7 papers

Academic Degrees

Master Degree for Science M. Kishi	Study of top-gated devices based on topological insulator
Master Degree for Science T. Toba	Crystal growth of the Pb-based homologous compounds forming multilayer heterostructure of topological/ordinary insulators

Grant-in-Aid for Scientific Research

Y. Ando	Creation of Innovative Devices Based on Topological Insulators	¥11,050,000
Y. Ando	Explorations of Novel Quantum Phenomena in Topological Insulators and Superconductors	¥136,760,000
K. Segawa	Precise Control of Physical Properties of Topological Insulators/Superconductors with Electrochemical Technique	¥1,950,000
S. Sasaki	Elucidation of the Symmetry of Superconducting Gap of Topological Superconductor $Cu_xBi_2Se_3$ and Other Novel Materials	¥1,690,000
A. Taskin	MBE Growth of Topological Insulators	¥1,170,000
K. Segawa	Novel Phenomena in the Electron Fluids with Broken Inversion Symmetry	¥9,100,000

Contribution to Research

S. Sasaki	Inamori Foundation, Kazuo Inamori	¥1,000,000

Department of Semiconductor Materials and Processes

Original Papers

[1]Surface Structure Chemical Transfer Method for Formation of Ultralow Reflectivity Si Surfaces, M. Takahashi, T. Fukushima, Y. Seino, W.-B. Kim, K. Imamura, H. Kobayashi: J. Electrochem. Soc., 160 (2013) H443-H445.

[2]Improvement of Minority Carrier Lifetime by HCN Treatments, T. Matsumoto, W. Kai, T. Fukushima, M. Takahashi, A. Ishibashi, H. Kobayashi: ECS J. Solid State Sci. Technol., 2 (2013) Q127-Q130.

[3]Ultra-Low Reflectivity Polycrystalline Si Surfaces Formed by Surface Structure Chemical Transfer Method, K. Imamura, F.C. Franco, Jr., T. Matsumoto, H. Kobayashi: Appl. Phys. Lett., 103 (2013) 013110-1-4.

[4]Passivation of a-Si:H-Based Structures in KCN and HCN Solutions and Its Application on p-i-n Solar Cell, E. Pinčík, H. Kobayashi, M. Takahashi, R. Brunner, S. Jurecka: J. Chinese Adv. Mater. Soc., 1 (2013) 151-165.

[5]Hydrogen Effect on Nanostructural Features of Nanocrystalline Silicon Thin Films Deposited at 200˚C by PECVD, A. M. Ali, H. Kobayashi: J. Non-Cryst. Solids, 385 (2014) 17-13.

[6]Metal Removal and Defect Passivation Performed on Si Wafers for Solar Cell Use by HCN Treatments, K. Kimura, M. Takahashi, H. Kobayashi: ECS J. Solid State Sci. Technol., 3 (2014) Q11-Q15.

[7]Si Nanoparticles Fabricated from Si Swarf by Photochemical Method, T. Matsumoto, M. Maeda, J. Furukawa, W.-.B. Kim, H. Kobayashi: J. Nanopart. Res., 16 (2014) 124190.

International Conferences

[1]High Effciency Crystalline Si Solar Cells with a Nanocrystalline Si Layer Formed by Surface Structure Chemical Transfer Method (invited), H. Kobayashi: IIV International Workshop on Semiconductor Surface Passivation.

[2]New Chemical Methods for Improvement of Conversion Efficiencies of Crystalline Si Solar Cell (invited), M. Takahashi, H. Kobayashi: 4th International Symposium on Advanced Ceramics and Technology for Sustainable Energy Applications toward a Low Carbon Society.

[3]Nitric Acid Oxidation of Si (NAOS) Method for Application to Thin Film Transistors (TFT), Eternal Memory "Digital Rosetta Stone", and Si Solar Cells (invited), T. Matsumoto, M. Maeda, T. Akai, S. Imai, H. Kobayashi: 8th Solid State Surfaces and Interfaces.

[4]Chemical Methods to Improve Conversion Efficiencies of Crystalline Si Solar Cells (invited), H. Kobayashi: 8th Solid State Surfaces and Interfaces.

[5]Characterization of Nanocrystalline Si Layer with Ultra-Low Reflectivity (poster), W. Xie, M. Takahashi, H. Kobayashi: The 17th SANKEN International Symposium and the 2nd International Symposium of Nano-Macro Matrials, Devices, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[6]Light-Trapping in Ultra-Low Reflectivity Si Solar Cells Fabricated by Use of Surface Structure Chemical Transfer (SSCT) Method (poster), T. Nonaka, K. Imamura, D.Irishika, H. Kobayashi: The 17th SANKEN International Symposium and the 2nd International Symposium of Nano-Macro Matrials, Devices, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[7]Ultra-Low Reflectivity Nanocrystalline Si Solar Cells Fabricated by Surface Structure Chemical Transfer Method (poster), K. Imamura, D. Irishika, T. Nonaka, H. Kobayashi: The 17th SANKEN International Symposium and the 2nd International Symposium of Nano-Macro Matrials, Devices, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[8]Blue and Green Luminescent Si Nanoparticles Fabricated from Si Swarf (poster), M. Maeda, T. Matsumoto, H. Kobayashi: The 17th SANKEN International Symposium and the 2nd International Symposium of Nano-Macro Matrials, Devices, and System Research Alliance Project, Suita, Osaka,

Japan, January 21-22, 2014.

Review Papers
Application of the DPEL and NAOS methods to TFT, H. Kobayashi, Display, Techno Times Co. Ltd., 65 (2013), 30-36.

Improvement of efficiency of crystalline silison solar cells, H. Kobayashi, Manufacturing and technology, Manufacturing technology promotion organization, 19 (2013), 95-98.

Improvement of conversion efficiency of crystalline Si solar cells by new chemical methods, H. Kobayashi, Clean energy, Japan industrial publishing Co. Ltd., 23[2] (2014), 40-46.

Books
[1]Light trapping technique on silicon surface by wet etching and application to crystalline silicon solar cells(R. Ebata) H. Kobayashi, Y. Kobayashi, K. Imamura, “Light controle technique and the application”, Technical information institute Co. Ltd., (175-182) .

Patents
[1] Luminescent materials with silicon nanoparticles and their manufacturing method, JP2014-38421

[2] Hydrogen generation apparatus, hydrogen generation method, silicon nanoparticles for hydrogen generation, and manufacturing method of same, JP2013-184481

[3] Fabrication of microhole on silicon wafer, semiconductor apparattus, and manufacturing method of same, JP2014-38423

[4] Surface treatment of silicon surfaces, maufacturing methid of semiconductor apparattus, transfer memberane, manufacturing method of same, solar cell and manufacturing method of same, JP2013-188124

[5] Manufacturing method of silicon nanoparticles and luminescent materials and manufacturing method of same, JP2013-188227

[6] Surface treatment method of silicon wafer, manufacturing method of semiconductor apparatus and semiconductor apparatus, transfer memberane, manufacturing methid of same, solar cell, and manufacturing methid of same, PCT/JP2014/056888

[7]K20060220 Manufacturing method of insulator film and semiconductor apparatus, JP5224570

[8]K050001B1 Manufacturing method of paste for solar cell and solar cell, JP5241758

[9]K20060181 Thin film semiconductor apparatus and their manufacturing method, K20060181

[10]K20110201 Cleaning apparatus for semiconductor and cleaning method, JP2013-131550 JP2011-278566

[11]K20090216 Removing surfacew cotaminants and manufacturing method of semiconductor apparatus, JP2010-133471 WO2011/114890

[12]K20100090 Solar cells and their manufacture, JP2012-49156 JP2010-186803

[13]K20110326 Manufacturing method of oxide film, semiconductor apparatus, manufacturing method of same, and manufacturing apparatus of semiconductor apparatus, JP5278804

[14]K20100081 Manufacturing method of semiconductor apparatus and semiconductor apparatus, JP5256444 JP2010-251787 JP2010-140069

[15] Manufacturing method of semiconductor apparatus and semiconductor apparatus, JP2012-530453

[16] Manufacturing method of semiconductor apparatus and semiconductor apparatus, TW100125054

[17] Manufacturing method of semiconductor apparatus and semiconductor apparatus, JP2012-525285

[18] Solar cells and their manufacturing method of same, and manufacturing apparatus, WO2011/099494 PCT/JP2010/62420

[19] Semiconductor apparattus, manufacturing method of same, and transfer memberane, TW20132481

[20] Semiconductor apparattus, manufacturing method of same, and transfer memberane, WO2013/02746

Contributions to International Conferences and Journals

H. Kobayashi	8th Solid State Surfaces and Interfaces (Scientific Committee)
T. Matsumoto	8th Solid State Surfaces and Interfaces (Scientific Committee)
K. Imamura	8th Solid State Surfaces and Interfaces (Scientific Committee)
H. Kobayashi	VIII International Workshop on Semiconductor Surface Passivation (Scientific Committee)
H. Kobayashi	Applied Surface Science (Editor)

Publications in Domestic Meetings

Japan Applied Surface Science Meeting	10 papers
Surface and Interface Spectroscopy	2 papers
Japan Physics Meeting	1 paper

Academic Degrees

Master Degree for Science T. Akaia	Fabrication of Silicon Microholes by the Surface Structure Chemical Transfer Method and the Mechanism
Master Degree for Science D. Irishika	Fabrication of Silicon Surfaces with Ultra-Low Reflectivity by the Surface Structure Chemical Transfer Method and Application to Solar Cells
Master Degree for Science K. Kimura	Improvement of Minor Carrier Lifetime and Hydrogen Generation from Si Nanoparticles with Water
Master Degree for Science B. Xie	Nano Structure on Silicon Surfaces Fabricated with Ultra-Low Reflectivity by the Surface Structure Chemical Transfer Method
Master Degree for Science R. Hirose	Silicon Surface Passivation by the Nitric Acid Oxidation of Si Method and Fabrication of Solar Cells with High Efficiency

Grant-in-Aid for Scientific Research

H. Kobayashi	Fabrication of Si nanoparticles from Si swarf and application of Si nanoparticles to silicon solar cells	¥3,250,000
T. Matsumoto	Surface science of highly-doped Si surface for devices in the next generation	¥2,600,000

Entrusted Research

H. Kobayashi	Ministry of Education, Culture, Sports, Science and Technology	Fabrication of silicon surface with ultra-low reflectivity and crystalline silicon solar cells with higher efficiency	¥2,250,000
H. Kobayashi	Japan Science and Technology Agency	Fabrication of silicon surface with ultra-low reflectivity with the	¥72,150,000

	interface control method and development of crystalline silicon solar cells with ultra-high efficiency	

Contribution to Research

H. Kobayashi	Canon marketing Japan Inc., Masami Kawasaki	¥18,300,000

Cooperative Research

H. Kobayashi	IDEC Corp.	¥15,584,000
H. kobayashi	Nisshin Kasei Co. Ltd.	¥0,000

Department of Metallic Materials Process

Original Papers

[1]Pore Formation and Compressive Deformation in Porous TiAl-Nb Alloys Containing Directional Pores, F. Yang, M. Tane, J. P. Lin, Y. H. Song, H. Nakajima: Materials & Design, 49 (2013) 755-760.

[2]Effect of Solidification Condition and Alloy Composition on Formation and Shape of Pores in Directionally Solidified Ni-Al Alloys, T. Ide, M. Tane, H. Nakajima: Metallurgical and Materials Transactions A, 44 (9) (2013) 4257-4265.

[3]Elastic Properties of an Mg-Zn-Y Alloy Single Crystal with a Long-Period Stacking Ordered Structure, M. Tane, Y. Nagai, H. Kimizuka, K. Hagihara, Y. Kawamura: Acta Materialia, 61 (17) (2013) 6338-6351.

[4]Elastic Properties of Single-Crystalline ω Phase in Titanium, M. Tane, Y. Okuda, Y. Todaka, H. Ogi, A. Nagakubo: Acta Materialia, 61 (20) (2013) 7543–7554.

[5]Formation Mechanism of a Plateau Stress Region during Dynamic Compression of Porous Iron: Interaction between Oriented Cylindrical Pores and Deformation Twins, M. Tane, F. Zhao, Y. H. Song, H. Nakajima: Materials Science & Engineering A, 591 (2014) 150–158.

International Conferences

[1]Mechanism of Low Young's Modulus in Ti-Nb-Ta-Zr and Ti-Nb-Ta-Zr-O Alloys (invited), M. Tane, T. Nakano, M. Niinomi, H. Nakajima: The 8th Pacific Rim International Conference on Advanced Materials and Processing (Pricm 8).

[2]Low Young's Modulus in Ti-Nb-Based Alloys with Low Body-Centered Cubic Phase Stability (invited), M. Tane, T. Nakano, M. Niinomi, H. Nakajima: 8th International Conference on Processing and Manufacturing of Advanced Materials (THERMEC' 2013).

Publications in Domestic Meetings

2013 Fall Meeting, The Japan Institute of Metals and Materials	2 papers
2014 Spring Meeting, The Japan Institute of Metals and Materials	2 papers
The 166th ISIJ Meeting, The Iron and Steel Institute of Japan	1 paper
Young Researcher Meeting, The Japan Titanium Society	1 paper
Young Researcher Meeting, The Japan Institute of Light Metals	2 papers

Academic Degrees

Master Degree for Engineering Y. Nagai	Elastic Properties of Mg-Zn-Y Alloys with 18R-Type Long-Period Stacking Ordered Structure
Master Degree for Engineering Y. Okuda	Effect of ω Phase Transformation on Elastic Properties of Biomedical Ti Alloys

Grant-in-Aid for Scientific Research

M.Tane	Clarification of elastic properties in single-crystalline LPSO phases	¥4,160,000

Contribution to Research

M.Tane	The Light Metal Educational Foundation, Inc. the Board of Directors, M.Imazu	Chairman of	¥1,500,000

Cooperative Research

M.Tane	Toray Industries,Inc.	¥500,000
M.Tane	Lotus AlloyCo.,Ltd.	¥1,037,000

Department of Advanced Interconnection Materials

Original Papers

[1]Microstructural Stability of Ag Sinter Joining in Thermal Cycling, S. Sakamoto, T. Sugahara, K. Suganuma: J. Mater. Sci.: Mater. Electron., 22 (4) (2013) 1332-13402013.

[2]High-Strength Si Wafer Bonding by Self-Regulated Eutectic Reaction with Pure Zn, S.W. Park, T. Sugahara, S. Nagao, K. Suganuma: Scripta Materialia, 68 (2013) 591–594.

[3]Least Lead Addition to Mitigate Tin Whisker for Ambient Storage, J.-L. Jo, K.-S. Kim, T. Sugahara, S. Nagao, K. Hamasaki, M. Tsujimoto, K. Suganuma: J. Mater. Sci.: Mater. Electron., 24 (8) (2013) 3108-3115.

[4]Thermal Stress Driven Sn Whisker Growth: in Air and in Vacuum, J.-L. Jo, S. Nagao, T. Sugahara, M. Tsujimoto, K. Suganuma: J. Mater. Sci.: Mater. Electron., 24 (10) (2013) 3897-3904.

[5]Cu Salt Ink Formulation for Printed Electronics Using Photonic Sintering, T. Araki, T. Sugahara, J. Jiu, S. Nagao, M. Nogi, H. Koga, H. Uchida, K. Shinozaki, K. Suganuma: Langmuir, 29 (2013) 11192–11197.

[6]High Thermal Stability of Optical Transparency in Cellulose Nanofiber Paper, M. Nogi, C. Kim, T. Sugahara, T. Inui, T. Takahashi, K. Suganuma: Appl. Phys. Lett., 102 (2013) 181911.

[7]High-Intensity Pulse Light Sintering Silver Nanowire Transparent Films on Polymer Substrates: the Effect the Thermal Properties of Substrates on the Performance of Silver Films, J. Jiu, T. Sugahara, M. Nogi, T. Araki, H. Uchida, K. Shinozaki, K. Suganuma: Nanoscale, 5 (2013) 11820-11828.

[8]Mitigation of Sn Whisker Growth by Small Bi Additions, J.-L. Jo, S. Nagao, K. Hamasaki, M. Tsujimoto, T. Sugahara, K. Suganuma: J. Mater. Sci.: Mater. Electron., 43 (1) (2014) 1-8.

[9]Retarding Intermetallic Compounds Growth of Zn High-Temperature Solder and Cu Substrate by Trace Element Addition, S. W. Park, S. Nagao, T. Sugahara, K.-S. Kim, K. Suganuma: J. Mater. Sci.: Mater. Electron., 24 (12) (2013) 4704-4712.

[10]Mechanical Stabilities of Ultrasonic Al Ribbon Bonding on Electroless Nickel Immersion Gold Finished Cu Substrates, S. Park, S. Nagao, T. Sugahara, K. Suganuma: Jpn. J. Appl. Phys., 53 (4S) (2014) 04EB02.

[11]Facile Synthesis of Very-Long Silver Nanowires for Transparent Electrodes, J. Jiu, T. Araki, J. Wang, M. Nogi, T. Sugahara, N. Shijo, H. Koga, K. Suganuma, E. Nakazawa, M. Hara, H. Uchida, K. Shinozaki: J. Mater. Chem. A, 18 (2014) 6326-6330.

[12]Effect of Electromigration on Mechanical Shock Behavior in Solder Joints of Surface Mounted Chip Components, Y. Kim, S. Nagao, T. Sugahara, K. Suganuma, M. Ueshima, H.-J. Albrecht, K. Wilke, J. Strogies: Jpn. J. Appl. Phys., 53 (4S) (2014) 04EP06.

[13]Ultra-Fast Photonic Curing of Electrically Conductive Adhesives Fabricated from Vinyl Ester Resin and Silver Micro-Flakes for Printed Electronics, H.-W. Cui, J.-T. Jiu, S. Nagao, T. Sugahara, K. Suganuma, H. Uchidab, K. A. Schroder: RSC Adv., 4 (2014) 15914-15922.

[14]Electrically Conductive Bacterial Cellulose Composite Membranes Produced by the Incorporation of Graphite Nanoplatelets in Pristine Bacterial Cellulose Membranes., T. Zhou, D. Chen, J. Jiu, T. T. Nge, T. Sugahara, S. Nagao, H. Koga, M. Nogi, K. Suganuma, X. Wang, X. Liu, P. Cheng, T. Wang, D. Xiong: Expr. Polym. Lett., 7 (9) (2013) 756-766.

[15]Giant Stretchability and Reversibility of Tightly Wound Helical Carbon Nanotubes, J. Wu, J. He, G. M. Odegard, S. Nagao, Q. Zheng, Z. Zhang: J. Am. Chem. Soc., 135 (37) (2013) 13775–13785.

[16]Nanohinge-Induced Plasticity of Helical Carbon Nanotubes, J. Wu, S. Nagao, J. He, Z. Zhang: Small, 9 (21) (2013) 3561–3566.

[17]Size-Dependent Mechanical Behavior of Nanoscale Polymer Particles through Coarse-Grained Molecular Dynamics Simulation, J. Zhao, S. Nagao, G. M. Odegard, Z. Zhang, H. Kristiansen, J. He: Nanoscale Res. Lett., 8 (1) (2013) 541.

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International Conferences

[1]Electromigration Effect on Mechanical Shock Behavior of Sn-Ag-Bi-In + Co Solder Joints for Surface-Mounted Chip Components (oral), Y. Kim, S. Nagao, T. Sugahara, K. Suganuma: SSDM (Solid State Devices and Materials) 2013.

[2]Heavy Ribbon Wire Bonding for Advanced Power Module Packages (oral), S. Park, S. Nagao, T. Sugahara, K. Suganuma: SSDM (Solid State Devices and Materials) 2014.

[3]Sintering Properties of CIGS Absorption Layer Based on Nanoparticle-Ink (poster), J. Jiu, T. Sugahara, T. Takahashi, M. Singh, K. Suganuma: 2013 JSAP-MRS Joint Symposia.

[4]Solution Phase Synthesis of CuInGaSe2 Nanoparticles for Solar Cell Applications (poster), M. Singh, J. Jiu, T. Sugahara, K. Suganuma: 2014 JSAP-MRS Joint Symposia.

[5]Formation of CIGS Nano-Ink and Application in Solar Cell (poster), T. Takahashi, J. Jiu, T. Sugahara, M. Singh, K. Suganuma: 2015 JSAP-MRS Joint Symposia.

[6]Synthesis of Ultra-Long Silver Nanowires and Application to Transparent Electrode (oral), T. Araki, J. Jiu, M. Nogi, T. Sugahara, K. Suganuma: ICFPE(International conference on Flexible and Printed Electronics) 2013.

[7]Photo-Sintering of Ag Nanowires for Wiring on Transparent Films (invited), K. Suganuma: ICFPE(International conference on Flexible and Printed Electronics) 2013.

[8]Silver Nanowires Transparent Conductive Films: Fabrication Using Different Sintering Techniques (oral), J. Jiu, T. Sugahara, M. Nogi, S. Nagao, K. Suganuma: 13th IEEE International Conference on Nanotechnology.

[9]Thermo-Mechanical Stress-Driven Ag Direct Bonding (oral), C. Oh, S. Nagao, K. Suganuma: 8th PRICM8 (Pacific Rim International Congress on Advanced Materials and Processing).

[10]Thermomechanical Reliability of Ag Flake Paste for Die-Attached Power Devices in Thermal Cycling (poster), S. Sakamoto, S. Nagao, K. Suganuma: 62nd ECTC 2013.

[11]Oxidation Resistance and Joining Properties of Cr-Doped Zn Bonding for SiC Die-Attachment (poster), S.-W. Park, T. Sugahara, S. Nagao, K. Suganuma: 63rd ECTC 2013.

[12]Partial Transient Liquid Phase Bonding for Hightemperature Power Electronics Using Sn/Zn/Sn Sandwich Structure Solder (oral), S.-W. Park, S. Nagao, T. Sugahara, Y. Katoh, H. Ishino, K. Sugiura, K. Suganuma: CIPS 2014 8th Meeting & Exhibition.

[13]High Temperature Compatibility of Interface between Al Ribbon and Au Finished DBC Substrate (oral), S.-W. Park, S. Nagao, K. Suganuma: CIPS 2014 9th Meeting & Exhibition.

[14]Microstructure Refinement in Sn-Ag-Bi-In Solder by Adding SiC Nanoparticles to Reduce Electromigration under High Electric Current (oral), Y. Kim, S. Nagao, T. Sugahara, K. Suganuma, M. Ueshima, H.-J. Albrecht, K. Wilke, J. Stogies: TMS 2014 143rd Annual Meeting & Exhibition.

[15]Pressure-Less Si Wafer Bonding Using Sputtered Ag Thin Films (oral), C. Oh, S. Nagao, K. Suganuma: TMS 2014 143rd Annual Meeting & Exhibition.

Review Papers
Printed Electronics for tomorrow, Display, Techno Times, Co. Ltd., 9[1] (2013), 10-15.

Printed Electronics: 1. Materials technology, Plastic Age, PLASTICS AGE CO., LTD, 58[1] (2013), 70-74.

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Books
[1]Functional Adhesives K. Suganuma, “Q&A for advanced addhesisves”, Industrial Technology Service Center, (176-182) 2013.

[2]Introduction to Lead-free Soldering K. Suganuma, “Introduction to Lead-free soldering”, Osaka University Press, (144) 2013.

[3]Introduction to Conductive Adhesives K. Suganuma, “Introduction to conductive addhesives”, Kagaku Gijyutsu Shuppan, 2014.

[4]Introduction to Printed Electronics K. Suganuma, “Briefs in Electrical and Computer Engineering”, Springer, 74 (124) 2013.

Patents
[1]K20130056 Joining structure production, joining structure, and apparatus for joining structure production, 2013-169168

[2]K20120401 Production method of insulater materials, passive devices, circuit board, and insulator sheet, 2013-145390

[3]K20130186 Production method of setting resin and the setting resin compound material, 2013-217195

[4]K20130029 Production method of metal nanowires and the metal nanowires, 2013-110243

[5]K20120384 Anisotropic conductive films and the anisotropoically conductive interconnections, 2013-076840

[6]K20130064 Fabrication of chalcopyrite nanoparticles, 2013-150685

[7]K20130283 Joinning structure and joining structure production method, 2014-018163

[8]K20130094 Compound materials for metal patterning, and metal pattern fabrication, 2013-144585

[9]G20120076WO Conductive adhesive and electronic device using same, PCT/JP2013/052348

[10]G20120091WO Fabrication method of transparent and electrically conductive patterns, PCT/JP2013/056497

[11]G20120096WO Transparent conductive ink, and method for producing transparent conductive pattern, PCT/JP2013/062387

[12]G20120097WO Transparent conductive substrate fabrication method, transparent conductive substrate and electrostatic capacitance-type touch panel, PCT/JP2013/062388

[13]G20130011WO Joining method, PCT/JP2013/002963

[14]KP2013033 Transparent conductive pattern fabrication method, 2014-503564

[15]KP2013040 Transparent conductive ink, and method for producing transparent conductive pattern,

[16]K20090043 Fabrication method of silver nanoparticles coated by TiO2, 2009-280895

[17]K20060484 Conductive paste, 2008-007582

[18]G20060015EP Silver β-Ketocarboxylate, metal silver materials involving same, and their application, 6767197.4000000004

[19]G20060044KR Surface treatment for whisker mitigation, 10-2008-7010538

[20]KB2009001 Metal silver forming material, and metal silver fabrication, 2009-142264

[21]K20080371 Conductive material fabrication, conductive materials obtained, electronic and photoemission devices involving same, K20080371

[22]K20070208 Semiconductor device and semiconductor device assembling method (2), K20070208

[23]K20090402 Stretchable wiring and substrate material using polyurethane, K20090402

[24]K20060435 Zn/Sn multilayer solder, soldering using same, and soldered joining, K20060435

[25]K20080084 Solder material fabrication and solder joining, K20080084

[26]K20090060 Conductive material fabrication, conductive materials obtained, electronic and photoemission devices involving same, K20090060

[27]K20070207 Semiconductor device and semiconductor device assembling method (1), K20070207

Grant-in-Aid for Scientific Research

K.Suganuma	Heterophase interface science in power semiconductor in extreme environment	¥40,040,000
T.Sugahara	Stretchable thermoelectric device by printing	¥3,510,000

Entrusted Research

K.Suganuma	Next-generation printed electronics (NEDO)	¥4,910,000
K.Suganuma	NEC corporation	¥525,000
K.Suganuma	ITEC corporation (JST A-STEP)	¥2,525,000
K.Suganuma	E-thermogentec corporation	¥1,890,000
K.Suganuma	Japan society for the promotion of science	¥19,790,000

Contribution to Research

K.Suganuma	Senju metal industry Co., Litd.	¥2,000,000
K.Suganuma	Daicel corporation	¥500,000
K.Suganuma	Cemedain Co., Ltd.	¥580,000
K.Suganuma	Showa Denko K.K.	¥1,000,000
K.Suganuma	Toray Research Center, Inc.	¥300,000
K.Suganuma	Uyemura & Co. Ltd.	¥1,000,000
K.Suganuma	Senju metal industry Co., Litd.	¥4,000,000
K.Suganuma	Printed Electronics Association	¥2,000,000
S.Nagao	Murakami Co., Ltd.	¥60,000
S.Nagao	Murakami Co., Ltd.	¥120,000

Cooperative Research

K.Suganuma	Fujitsu Ten Limited	¥780,000
K.Suganuma	KGK Co., Ltd.	¥0,000
K.Suganuma	Showa Denko K.K.	¥13,200,000
K.Suganuma	DENSO Corporation	¥4,675,000
K.Suganuma	Soler Cell Research Center	¥23,100,000
K.Suganuma	Nissin coporation	¥1,500,000
K.Suganuma	Asset-Wits Co., Ltd.	¥200,000
K.Suganuma	Cemedain Co., Ltd.	¥420,000
K.Suganuma	Uyemura & Co. Ltd.	¥420,000
K.Suganuma	Nippon Shokubai Co., Ltd.	¥30,450,000
K.Suganuma	Pi-Crystal Inc.	¥210,000
K.Suganuma	Toppan Forms Co., Ltd.	¥3,150,000
K.Suganuma	KGK Co., Ltd.	¥126,000
K.Suganuma	Toray Research Center, Inc.	¥0,000
K.Suganuma	Toray Research Center, Inc.	¥0,000
K.Suganuma	Senju metal industry Co., Litd.	¥0,000
K.Suganuma	imec	¥0,000

Department of Excited Solid-State Dynamics

Original Papers

[1]Structural Dynamics of Laser-Irradiated Gold Nanofilms, S. L. Daraszewicz, Y. Giret, N. Naruse, Y. Murooka, J. Yang, D. M. Duffy, A. L. Shluger, K. Tanimura: Phys. Rev. B, 88 (2013) 184101.

[2]Determination of Transient Atomic Structure of Laser-Excited Materials from Timeresolved Diffraction Data, Y. Giret, N. Naruse, S. L. Daraszewicz, Y. Murooka, J. Yang, D. M. Duffy, A. L. Shluger, K. Tanimura: Appl. Phys. Lett., 103 (2013) 253107.

[3]An investigation of electron-phonon coupling via phonon dispersion measurements in graphite using angle-resolved photoelectron spectroscopy, S. Tanaka, M. Matsunami, S. Kimura: Scientific Reports, 3 (2013) 3031.

[4]Nanoscale-Resolved Near-Infrared Photoabsorption Spectroscopy and Imaging of Individual Gallium

Antimonide Quantum Dots, N. Naruse, Y. Nakamura, Y. Mera, M. Ichikawa, K. Maeda: Journal of Vacuum Science and Technology B, 32 (2014) 11803.

International Conferences

[1]Transformation from Graphite to sp^3-Bonded Carbon Phases Induced by Femtosecond-Laser Excitation (invited), K. Tanimura: 2013 JSAP-MRS Joint Symposia Symposium B.

[2]Time-, Energy-, and Momentum-Resolved Distributions of Photoinjected Hot Electrons in Si and GaAs (invited), K. Tanimura: International workshop on “Modeling the physical properties of clustering crystal”.

[3]Imaging Energy-and Momentum-Resolved Distributions of Photoinjected Hot Electrons in GaAs (invited), J. Kanasaki: 8th International Conference on Ultrafast Surface Dynamics.

[4]Ultrafast Electron Dynamics in Photo-Excited GaAs Studied by Time- and Angle-Resolved Two-Photon Photoemission Spectroscopy (oral), J. Kanasaki: 2013 JSAP-MRS Joint Symposia Symposium B.

[5]Ultrafast Relaxation of Highly Excited Hot Electrons in Semiconductors (poster), J. Kanasaki: 8th International Conference on Ultrafast Surface Dynamics.

[6]Direct Observation of the Electron-Phonon Scattering in Graphite by Using the Angle-Resolved Photoelectron Spectroscopy (oral), S. Tanaka, M. Matsunami, S. Kimura: The 12th Asia Pacific Physics Conference（APPC12）.

[7]Electron-Phonon Coupling Investigation via Phonon Dispersion Measurement in Graphite by Angle-Resolved Photoelectron Spectroscopy (invited), S. Tanaka, M. Matsunami, S. Kimura: Advanced Spectroscopy of Correlated Materials (A satellite meeting of SCES2013).

[8]New Aspects of the Angle-Resolved Photoelectron Spectroscopy: Detection of the Phonon-Dispersion and Quantitative Analysis of the Polarization-Dependence on Graphite (poster), S. Tanaka: The 18th Hiroshima International Symposium on Synchrotron Radiation.

Review Papers

Development of Ultrafast Relativistic-Electron Diffraction, Yoshie Murooka, Nobuyasu Naruse, Jinfeng Yang and Katsumi Tanimura, KENBIKYO, The Japanese Society of Microscopy, 48 (2013), .

Grant-in-Aid for Scientific Research

K.Tanimura	Innovation of structural materials science: Femtosecond time-resolved atomic imaging	¥141,700,000
S.Tanaka	Primary processes of electron-phonon interaction in Carbon-nanomaterials	¥2,340,000
J.Kanasaki	Ultrafast dynamics of valence holes in semiconductors studied buy femtosecond time-resolved photoelectron spectroscopy	¥910,000

Department of Accelerator Science

Original Papers

[1]The High-Power Operation of a Terahertz Free-Electron Laser Based on a Normal Conducting RF Linac Using Beam Conditioning, K. Kawase, R. Kato, A. Irizawa, M. Fujimoto, S. Kashiwagi, S. Yamamoto, F. Kamitsukasa, H. Osumi, M. Yaguchi, A. Tokuchi, S. Suemine, G. Isoyama: Nuclear Instruments and Methods in Physics Research Section A, 726 (2013) 96-103.

[2]1 ms Pulse Beam Generation and Acceleration by Photocathode Radio Frequency Gun and Super-Conducting Accelerator, M. Kuriki, H. Iijima, S. Hosoda, K. Watanabe, H. Hayano, J. Urakawa, G.

Isoyama, R. Kato, K. Kawase, A. Kuramoto, S. Kashiwagi, K. Sakaue: Japanese Journal of Applied Physics, 52 (5) (2013) 056401-7.

[3]Photoemission Spectroscopy and the Unusually Robust One Dimensional Physics of Lithium Purple Bronze, J. Dudy, J. D. Denlinger, J. W. Allen, F. Wang, J. He, D. Hitchcock, A. Sekiyama, S. Suga: J. Phys.: Condens. Matter, 25 (1) (2013) 014007-1-11.

[4]Diffrent Evolution of Intrinsic Gap in Strongly Correlated SmB6 and YbB12, J. Yamaguchi, A. Sekiyama, M. Y. Kimura, H. Sugiyama, Y. Tomida, G. Funabashi, S. Komori, T. Balashov, W. Wulfhekel, T. Ito, S. Kimura, A. Higashiya, K. Tamasaku, M. Yabashi, T. Ishikawa, S. Yeo, S.-I. Lee, F. Iga, T. Takabatake, S. Suga: New Journal of Physics, 15 (2013) 043042-1-11.

[5]Hard X-ray Photoemission Spectroscopy of the Intrinsic Correlated Electronic Structure of CrO2, M. Sperlich, C. König, G. Güntherodt, A. Sekiyama, G. Funabashi, M. Tsunekawa, S. Imada, A.Shigemoto, A. Higashiya, M. Yabashi, K. Tamasaku, T. Ishikawa, V. Renken, T. Allmers, M. Donath, S. Suga: Phys. Rev. B, 87 (2013) 235138-1-5.

[6]Direct k-space Mapping of the Electronic Structure in an Oxide-Oxide Interface, G. Berner, M. Sing, H. Fujiwara, A. Yasui, Y. Saitoh, A. Yamasaki, Y. Nishitani, A. Sekiyama, N. Pavlenko, T. Kopp, C. Richter, J. Mannhart, S. Suga, R. Claessen: Phys. Rev. Lett., 110 (2013) 247601-1-7.

[7]Ce Electronic States in Nd0.45-xCexSr0.55MnO3 Probed by Photoemission and X-ray Absorption Spectroscopy, T. Shirai, S. Imada, A. Higashiya, A. Sekiyama, S. Suga, T. Muro, Y. Tanaka, K. Tamasaku, M. Yabashi, T. Ishikawa, S. Miyasaka, Y. Tokura: J. Phys.: Condens. Matter, 25 (41) (2013) 415601.

[8]Spin-Polarized Angle-Resolved Photoelectron Spectroscopy of the So-Predicted Kondo Topological Insulator SmB6, S. Suga, K. Sakamoto, T. Okuda, K. Miyamoto, K. Kuroda, A. Sekiyama, J. Yamaguchi, H. Fujiwara, A. Irizawa, T. Ito, S. Kimura, T. Balashov, W. Wulfhekel, S. Yeo, F. Iga, S. Imada: J. Phys. Soc. Jpn., 83 (1) (2014) 014705-1-6.

[9]Bulk Nature of Layered Perovskite Iridates beyond the Mott Scenario: An Approach from a Bulk-Sensitive Photoemission Study, A. Yamasaki, S. Tachibana, H. Fujiwara, A. Higashiya, A. Irizawa, O. Kirilmaz, F. Pfaff, P. Scheiderer, J. Gabel, M. Sing, T. Muro, M. Yabashi, K. Tamasaku, H. Sato, H. Namatame, M. Taniguchi, A. Hloskovskyy, H. Yoshida, H. Okabe, M. Isobe, J. Akimitsu, W. Drube, R. Claessen, T. Ishikawa, S. Imada, A. Sekiyama, S. Suga: Phys. Rev. B, 89 (2014) 121111(R)-1-5.

[10]Isoscalar Giant Resonance Strengths in 32S and Possible Excitation of Superdeformed and 28Si + α Cluster Bandheads, M. Itoh, S. Kishi, H. Sakaguchi, H. Akimune, M. Fujiwara, U. Garg, K. Hara, H. Hashimoto, J. Hoffman, T. Kawabata, K. Kawase, T. Murakami, K. Nakanishi, B. K. Nayak, S. Terashima, M. Uchida, Y. Yasuda, M. Yosoi: Phys. Rev. C, 88 (2013) 064313-1-6.

International Conferences

[1]Potential of Terahertz Free Electron Laser (THz-FEL) for User-Experiments (poster), A. Irizawa, R. Kato, K. Kawase, M. Fujimoto, H. Ohsumi, M. Yaguchi, S. Suga, G. Isoyama: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[2]THz-FEL Generation via 27 MHz Macropulse Electron Beam (poster), K. Kawase, S. Suemine, R. Kato, A. Irizawa, M. Fujimoto, H. Ohsumi, M. Yaguchi, S. Funakashi, R. Tsutsumi, K. Furukawa, K. Kubo, A. Tokuchi, G. Isoyama: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[3]Spectral Evolution of High Power Terahertz FEL (poster), R. Kato, K. Kawase, A. Irizawa, M.

Fujimoto, H. Ohsumi, M. Yaguchi, S. Funakoshi, R. Tsutsumi, S. Suemine, G. Isoyama, S. Kashiwagi, S. Yamamoto: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[4]Measurement of the FEL Micro Pulse Using Autocorrelation Method (poster), H. Ohsumi, R. Kato, K. Kawase, A. Irizawa, M. Fujimoto, M. Yaguchi, S. Funakoshi, R. Tsutsumi, G. Isoyama: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

Books

[1]Photoelectron Spectroscopy: Bulk and Surface Electronic Structures, S. Suga, A. Sekiyama, Springer Series in Optical Sciences, 176 (1-378) 2013.

Patents

[1]K20120247 Imaging system and imaging method, 2013-030165

Publications in Domestic Meetings

The Particle Accelerator Society of Japan	7 papers
Topical Meeting for FEL & High Power Radiation	4 papers
The Japanese Society for Synchrotron Radiation Research	3 papers
The Physics Society of Japan	2 papers

Academic Degrees

Master Degree for Science	Measurement of the FEL micropulse using autocorrelation method
H. Ohsumi	

Grant-in-Aid for Scientific Research

G.Isoyama	Development of a high intensity and high efficiency coherent light source using a novel method	¥1,170,000
G.Isoyama	Development of a new operating range of the free-electron laser	¥2,730,000
S.Suga	Unified spectroscopy of strongly correlated electron systems from 10 meV to 10 keV	¥1,040,000

Entrusted Research

G.Isoyama	KEK	Technology development and training of young scientists for renewal of the L-band electron linac at ISIR, Osaka Universit	¥2,000,000

Department of Beam Materials Science

Original Papers

[1]Structural and Mechanistic Insights into the Electron-Flow through Protein for Cytochrome c-tethering Copper Nitrite Reductase, A. Tsuda, R. Ishikawa, H. Koteishi, K. Tange, Y. Fukuda, K. Kobayashi, T. Inoue, M. Nojiri: J. Biochem., 154 (2013) 51-60.

[2]Electron Transfer Reactions of Candidate Tumor Suppressor 101F6 Protein, a Cytochrome b561 Homologue, with Ascorbate and Monodehydroascorbate Radical, M. Recuenco, Md. Rahman, F. Takeuchi, K. Kobayashi, M. Tsubaki: Biochemistry, 52 (2013) 3660-3668.

[3]Chemical Gradient of Contact Hole Latent Image Created in Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa and T. Hirayama: Jpn. J. Appl. Phys., 52 (2013) 046502.

[4]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., 84 (2013) 30–34.

[5]Relationship between Defects and Stochastic Effect in Chemically Amplified Resists Used for Extreme

Ultraviolet Lithography, T. Kozawa, J. J. Santillan, T. Itani: Jpn. J. Appl. Phys., 52 (2013) 076502.

[6]Acid Diffusion Length in Line-and-Space Resist Patterns Fabricated by Extreme Ultraviolet Lithography, T. Kozawa, J. J. Santillan, T. Itani: Jpn. J. Appl. Phys., 52 (2013) 076501.

[7]Theoretical Relationship between Quencher Diffusion Constant and Image Quality in Chemically Amplified Resists Used for Extreme Ultraviolet Lithography, T. Kozawa: Jpn. J. Appl. Phys., 52 (2013) 076504.

[8]Radiation-Induced Synthesis of Metal Nanoparticles in Ethers THF and PGMEA, H. Yamamoto, T. Kozawa, S. Tagawa, M. Naito, J.-L. Marignier, M. Mostafavi, J. Belloni: Radiat. Phys. Chem., 91 (2013) 148–155.

[9]Deprotonation of Poly(4-hydroxystyrene) Intermediates: Pulse Radiolysis Study of Extreme Ultraviolet and Electron Beam Resist, K. Okamoto, R. Matsuda, H. Yamamoto, T. Kozawa, S. Tagawa, R. Fujiyoshi, T. Sumiyoshi: Jpn. J. Appl. Phys., 52 (2013) 06GC04-1-06GC04-5.

[10]Stochastic Effect on Contact Hole Imaging of Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, T. Hirayama: Jpn. J. Appl. Phys., 52 (2013) 086501.

[11]Formation of Nanoscale Reaction Field Using Combination of Top-Down and Bottom-Up Nanofabricaiton, H. Yamamoto, A. Ohnuma, B. Ohtani, T. Kozawa: Microelectronic Engineering, 110 (2013) 369–373.

[12]Controlled Array of Silver Nanoparticles on Nanopatterns, H. Yamamoto, A. Ohnuma, B. Ohtani, T. Kozawa: J. Photopolym. Sci. Technol., 26 (2013) 495-499.

[13]Effect of Initial Dispersion of Protected Units on Line Edge Roughness of Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa: J. Photopolym. Sci. Technol., 26 (2013) 643-648.

[14]Acid Diffusion Length in Contact Hole Imaging of Chemically Amplified Extreme Ultraviolet Resists, T. Kozawa, T. Hirayama: Jpn. J. Appl. Phys., 53 (2014) 016503.

[15]Stochastic Effects in 11nm Imaging of Extreme Ultraviolet Lithography with Chemically Amplified Resists, T. Kozawa, J. J. Santillan, T. Itani: Jpn. J. Appl. Phys., 53 (2014) 036503.

[16]On the temperature dependence of the rate constant of the bimolecular reaction of two hydrated electrons, S. L. Butarbutar, Y. Muroya, L. M. Kohan, S. Sanguanmith, J. Meesungnoen, J.-P. Jay-Gerin: Atom Indonesia, 39 (2) (2013) 51-56.

International Conferences

[1]Mechanistic Insight into the Nitration of [2Fe-2S] Cluster of SoxR Studied Pulse Radiolysis (poster), Mayu Fujikawa, Kazuo Kobayashi, Takahiro Kozawa: Redox Modulation of Health and Disease (Erlangen-Nurnberg, Germany, July 20-22).

[2]Activation Mechanism in the [2Fe-2S] Oxidative-Stress Sensor SoxR (poster), Kazuo Kobayashi, Mayu Fujikawa, Takahiro Kozawa: 16th International Conferenca on BioInorganic Chemistry (Grenoble, France, July .22-26).

[3]Mechanism of Transcription Activation by SoxR Protein upon Redox Changes of the [2Fe-2S] Cluster Probed with Fluorescent Base (poster), Mayu Fujikawa, Kazuo Kobayashi, and Takahiro Kozawa: 16th International Conferenca on BioInorganic Chemistry (Grenoble, France, July .22-26).

[4]Nanochemistry in Chemically Amplified Resists Used for Extreme Ultraviolet Lithography (Invited)

(oral), T. Kozawa, J. J. Santillan, and T. Itani: The 57th International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication (Nashville, Tennessee, USA, May 28-31, 2013).

[5]Stochastic Effects in Chemically Amplified Resists for Extreme Ultraviolet Lithography (oral), T. Kozawa, J. J. Santillan, and T. Itani: 2013 International Workshop on EUV Lithography (Maui, Hawaii, USA, June 10-14, 2013).

[6]Effect of Initial Dispersion of Protected Units on Line Edge Roughness of Chemically Amplified Extreme Ultraviolet Resists (oral), Takahiro Kozawa: 30th International Conference of Photopolymer Science and Tecnology Conference (Chiba, Japan, June 25-28, 2013).

[7]Stochastic Effects in Chemically Amplified Resists (oral), T. Kozawa: 11th Fraunhofer IISB Lithography Simulation Workshop.

[8]Stochastic Effects in Resist Processes of Extreme Ultraviolet Lithography (oral), T. Kozawa, J. J. Santillan, T. Itani: 2013 International Symposium on Extreme Ultraviolet Lithography.

[9]Effects of Effective Reaction Radius for Neutralization on Performance of Chemically Amplified Resists (oral), T. Kozawa, J. J. Santillan, T. Itani: 26th International Microprocesses and Nanotechnology Conference.

[10]Mechanistic Studies on the Formation of Dinitrosyl Iron Complex of the [2Fe-2S] Cluster of SoxR Protein (poster), M. Fujikawa, K. Kobayashi, T. Kozawa: 1st International Picobiology Institute Symposium.

[11]Stochastic Effects in Fabrication of 11 nm Line-and-Space Patterns Using Extreme Ultraviolet Lithography (oral), T. Kozawa, J. J. Santillan, T. Itani: SPIE Advanced Lithography.

[12]Radiolysis of Water at High Temperature and Pressure Conditions (poster), Y. Muroya, Y. Katsumura, M. Lin, J.-P. Jay-Gerin, T. Kozawa: 3rd Asian Congress of Radiation Research.

[13]Radiolysis of Water at High Temperature and Pressure Conditions (oral), Y. Muroya, Y. Katsumura, M. Lin, J.-P. Jay-Gerin, T. Kozawa: Symposium on Water Chemistry and Corrosion in Nuclear Power Plants in Asia.

[14]Process Dependence of Line Width Roughness in Electron Beam Resists (poster), T. Yamazaki, H. Yamamoto, T. Kozawa: The 57th International Conference on Electron, Ion, and Photon Beam Technology and nanofabrication.

[15]Radiation-Induced Synthesis of Metal Nanoparticles in Ethers THF and PGMEA (poster), H. Yamamoto, T. Kozawa, S. Tagawa, J.-L. Marignier, M. Mostafavi, J. Belloni: The 57th International Conference on Electron, Ion, and Photon Beam Technology and nanofabrication.

[16]Controlled Arrangement of Nanoparticles Capped with Protecting Ligand on Au Nanopatterns (poster), H. Yamamoto, A. Ohnuma, B. Ohtani, T. Kozawa: The 39th International Conference on Micro and Nano Engineering.

[17]Acid Generation Mechanism in Solid Poly(4-hydroxystyrene) upon Exposure to Electron Beam (poster), H. Yamamoto, K. Okamoto, T. Kozawa: 26th International Microprocesses and Nanotechnology Conference.

[18]Study on Formation Mechanism of Line Width Roughness (LWR) in Electron Beam Resists (poster), T. Yamazaki, H. Yamamoto, T. Kozawa: 26th International Microprocesses and Nanotechnology Conference.

[19]Study on Resist Performance of Chemically Amplified Molecular Resist based on Noria Derivative and Calixarene Derivative (poster), H. Yamamoto, H. Kudo, T. Kozawa: SPIE Advanced Lithography.

[20]Characterization of Chemically Amplified Resists for Electron Beam Lithography (poster), T. Yamazaki, H. Yamamoto, T. Kozawa, W.-C. Wang: SPIE Advanced Lithography.

[21]Evaluation of Novel Hydrophilic Derivatives for Chemically Amplified EUV Resists (poster), H. Tanagi, H. Tanaka, S. Hayakawa, K. Furukawa, H. Yamamoto, T. Kozawa: SPIE Advanced Lithography.

[22]Development of Novel Protecting Derivatives for Chemically Amplified Extreme Ultraviolet Resist (poster), H. Tanaka, H. Tanagi, S. Hayakawa, K. Furukawa, H. Yamamoto, T. Kozawa: SPIE Advanced Lithography.

Patents

[1]K20080228 Chemical components of supporting films for evaluation of EUV absorption coefficient of thin films and measurement method, K20080228

Contributions to International Conferences and Journals

T. Kozawa	2013 International Symposium on Extreme Ultraviolet Lithography (Steering Committee)
T. Kozawa	2013 International Workshop on EUVL (Technical Steering Committee)
T. Kozawa	26th International Microprocesses and Nanotechnology Conference (Program Chair, Organaizing Committee)
H. Yamamoto	26th International Microprocesses and Nanotechnology Conference (Program Committee)

Publications in Domestic Meetings

Nano-Macro Materials, Devices and System Research Alliance Meeting 2013	1 paper
The 56th Japan Radiation Chemistry Meeting	5 papers
Annual Meeting of Atomic Energy Society of Japan Division of Water Chemistry	1 paper
The 1st Meeting of Nano-Macro Materials, Devices and System Research Alliancefor Junior Researcher	1 paper
Meeting 2013 for G4 working group of five-institute alliance	1 paper
The 4th Singl Nano Patterning Meeting	1 paper
The 61st JSAP Spring Meeting 2014	1 paper
The 94th Japan Chemical Society Meeting	3 papers
The 40th Symposium on Biomolecular Science	1 paper
1st NGL Workshop	1 paper
The 50th Japan Radioisotope Association Meeting	1 paper

Academic Degrees

Master Degree for Science	Characterization of Chemically Amplified Electron Beam Resist	
T.Yamazaki		

Grant-in-Aid for Scientific Research

T. Kozawa	Study on nano chemistry induce in nanofabrication materials using combination of quantum beams	¥15,080,000
Y. Muroya	Reaction mechanism of a bimolecular self reaction of hydrated electrons in water	¥2,340,000
K. Kobayashi	Structual change of DNA bound to transcription factor response to environmental change	¥1,300,000
H. Yamamoto	Creation and Control of Metal Nano-structure Using Combination of Top-down and Bottom-up Nanofabrication	¥1,430,000
Y. Muroya	Study on radiolysis of high temperature water for fundamentals of water chemistry	¥520,000

Entrusted Research

T. Kozawa	EUVL Infrastructure	Development of EUV mask	¥4,199,000

	Development Center, Inc. (EIDEC)	inspection and resist materials/Development of EUV resist materials	

Contribution to Research

T. Kozawa	Nissan Chemical Industries,Ltd	¥1,000,000
T. Kozawa	AZ Electronic Materials Manufacturing (Japan) KK	¥1,000,000
T. Kozawa	DAIHACHI CHEMICAL INDUSTRY CO.,LTD.	¥300,000
T. Kozawa	MITSUBISHI GAS CHEMICAL COMPANY, INC.	¥1,000,000

Cooperative Research

T. Kozawa	Nissan Chemical Industries,Ltd	¥0,000
T. Kozawa	Taiwan Semiconductor Manufacturing Conductor (TSMC)	¥3,864,000
T. Kozawa	Tokyo Ohka Kogyo.Co.,Ltd	¥500,000
T. Kozawa	MITSUBISHI GAS CHEMICAL COMPANY, INC.	¥500,000
T. Kozawa	NuFlare Technology Inc.	¥7,200,000
T. Kozawa	AZ Electronic Materials Manufacturing (Japan) KK	¥0,000
Y. Muroya	Central Research Institute of Electric Power Industry	¥1,000,000

Department of Molecular Excitation Chemistry

Original Papers

[1]Interaction of G-quadruplex with RecA Protein, A. Tanaka, J. Choi, Seog K. Kim, and T. Majima: J. Phys. Chem. B, 117 (22) (2013) 6711-6717.

[2]Photochemistry of Singlet Oxygen Sensor Green, S. Kim, M. Fujitsuka, and T. Majima: J. Phys. Chem. B, 117 (45) (2013) 13985-13992.

[3]Single-Molecule Fluorescence Detection of Effective Adsorption Sites at the Metal Oxide–Solution Interface, T. Tachikawa, T. Ohsaka, Z. Bian, and T. Majima: J. Phys. Chem. C, 117 (21) (2013) 11219-11228.

[4]Enhancement of quinoidal character of smaller [n]cycloparaphenylenes probed by Raman spectroscopy, M. Fujitsuka, T. Iwamoto, E. Kayahara, S. Yamago, and T. Majima: ChemPhysChem., 14 (8) (2013) 1570-1572.

[5]Detection of Single-Nucleotide Variations by Monitoring the Blinking of Fluorescence Induced by Charge Transfer in DNA, K. Kawai, T. Majima, and A. Maruyama: ChemBioChem, 14 (12) (2013) 1430-1433.

[6]Water Photooxidation on Transparent Al2O3/WO3 Thin Films: Role of Alumina Overlayer, W. Kim, T. Tachikawa, D. Monllor-Satoca, H. Kim, T. Majima, and W. Choi: Energy Environ. Sci, 6 (12) (2013) 3732-3739.

[7]Photoinduced Electron Transfer in Supramolecular Donor-Acceptor Dyad of Zn Corrphycene, M. Fujitsuka, H. Shimakoshi, Y. Tei, K. Noda, S. Tojo, Y. Hisaeda, T. Majima: Phys. Chem. Chem. Phys., 15 (15) (2013) 5677-5683.

[8]Visible Light Photocatalytic Activities of Nitrogen and Platinum-Doped TiO_2: Synergistic Effects of Co-Dopants, W. Kim, T. Tachikawa, H. Kim, N. Lakshminarasimhan, P. Murugan, H. Park, T. Majima, W. Choi: Appl. Catal. B Environmental, 147 (2013) 642-650.

[9]Synthesis and Charge Transferability of DNA Possessing a Naphthalimide Photosensitizer at an Extrahelical Position, T. Takada, Y. Kawano, A. Ashida, M. Nakamura, K. Kawai, T. Majima, K. Yamana: Tetrahedron Lett., 54 (35) (2013) 4796-4799.

[10]Spectroscopic Analysis on Interaction of the Axially Pyridinio-Bonded Tricationic Phosphrousporphyrins with Human Serum Albumin, J. Matsumoto, T. Kubo, T. Shinbara, N. Matsuda, T. Shiragami, M. Fujitsuka, T. Majima, M. Yasuda: Bull. Chem. Soc. Jpn., 86 (11) (2013) 1240-1247.

[11]Efficient Electron Transfer in i-motif DNA with a Tetraplex Structure, J. Choi, A. Tanaka, D. W. Cho, M. Fujitsuka, T. Majima: Angew. Chem. Int. Ed, 52 (2013) 12937-12941.

[12]A Nanocomposite Superstructure of Metal Oxides with Effective Charge Transfer Interfaces, Z. Bian, T. Tachikawa, P. Zhang, M. Fujitsuka, T. Majima: Nature Commun., (2013) .

[13]Synthesis and Physical Properties of a Ball-Like Three-Dimensional π-Conjugated Molecule, E. Kayahara, T. Iwamoto, H. Takaya, T. Suzuki, M. Fujitsuka, T. Majima, N. Yasuda, N. Matsuyama, S. Seki, S. Yamago: Nature Commun., 4 (2013) 3694/1–3694/7.

[14]Au/TiO_2 Superstructure-Based Plasmonic Photocatalysts Exhibiting Efficient Charge Separation and Unprecedented Activity, Z. Bian, T. Tachikawa, P. Zhang, M. Fujitsuka, T. Majima: J. Am. Chem. Soc., 136 (1) (2014) 458-465.

[15]Radical Cation of Star-Shaped Condensed Oligofluorenes Having Isotruxene as a Core: Importance of Rigid Planar Structure on Charge Delocalization, M. Fujitsuka, D. W. Cho, S. Tojo, J. Choi, H.-H. Huang, J.-S. Yang, T. Majima: The Journal of Physical Chemistry A, 118 (12) (2014) 2307−2315.

[16]Regulation of Photodynamic Interactions in 1,8-Naphthalimide-linker-Phenothiazine Dyads by Cyclodextrins, D. W. Cho, M. Fujitsuka, A. Sugimoto, U. C. Yoon, Dae Won Cho, T. Majima: Physical Chemistry Chemical Physics, 16 (12) (2014) 5779−5784.

[17]Efficient Charge Separation and Photooxidation on Cobalt Phosphate-Deposited TiO2 Mesocrystal Superstructures, T. Tachikawa, P. Zhang, Z. Bian, T. Majima: J. Mater. Chem. A., (2014) .

[18]Dynamics in the Heme Geometry of Myoglobin Induced by the One-electron Reduction, J. Choi, S. Tojo, M. Fujitsuka, T. Majima: Int. J. Radiat. Biol., (2014) .

International Conferences

[1]Basics in Scholarly Publishing: Getting Started (invited), T. Majima: ACS on Campus, Tokyo, 2013.

[2]Basics in Scholarly Publishing: Getting Started (invited), T. Majima: ACS on Campus, Kyoto, 2013.

[3]Radiation Chemistry and Its Application (plenary), T. Majima: The 8th Workshop on Electron Beam Applicaitons, Korean Atomic Energy Research Institute (KAERI).

[4]Single-Molecule, Single-Particle Fluorescence Imaging of TiO_2 Photocatalytic Reactions (plenary), T. Majima: International Symposium on Advanced Mesostructured Catalysts and Photocatalysts (ISAM-Cat).

[5]Single-Molecule Fluorescence Imaging of TiO_2 Photocatalytic Reactions (oral), T. Majima: 1st Conference (Kick-Off conference) of SANKEN Core to Core Program.

[6]Recent Approach in Pulse Radiolysis towards Material and Biological Science (invited), T. Majima: Seminar at KAERI.

[7]Photooxidation of DNA Damage (invited), T. Majima: 6th Asian Oceanian Conference of Photobiology.

[8]Single Molecule Fluorescence Imaging of Interfacial Electron Transfer (invited), T. Majima: International Symposium “Spectroscopy in the Research on Solar Cell and Artificial/Natural

Photosynthesis".

[9]Efficient Interparticle Charge Transfer in Meso-TiO_2 Crystals (invited), T. Majima: 9th Korea-Japan Symposium on Frontier Photoscience 2005 (KJFP2005).

[10]Single Molecule Fluorescence Imaging of TiO_2 Photocatalytic Reactions (plenary), T. Majima: Fourth Asian Spectroscopy Conference (ASC2013) at the School of Physical & Mathematical Sciences.

[11]Superstructure of TiO_2 Crystalline Nanoparticles with Effective Charge Transfer Pathways (plenary), T. Majima: The International Symposium on Eco-materials Processing and Design (ISEPD).

[12]Hole and Excess Electron Transfer in DNA (invited), T. Majima: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[13]Recent Development of Photoresponsible Materials Chemistry such as Photocatalysts (invited), T. Majima: Symposium on Photoresponsible Materials Chemistry.

[14]Charge Transfer in DNA (invited), T. Majima: KAERI-Osaka University Joint Workshop on Beam Science.

[15]Superstructure of TiO_2 Crystalline Nanoparticles with Effective Charge Transfer Pathways in Nanotechnology for Solar Fuels Production (invited), T. Majima: 247th ACS National Meeting.

[16]Single-Molecule, Single-Particle Approaches for Exploring the Structure and Kinetics of Nanocatalysts in Single Molecules at Interfaces: Experiments and Simultions (invited), T. Majima: 247th ACS National Meeting.

[17]Photochemistry (invited), T. Majima: Chemistry Asia Symposium.

[18]Detection of Single-Nucleotide Variations by Monitoring the Blinking Triggered by Charge Separation in DNA (oral), K. Kawai, T. Majima, A. Maruyama: The 40th International Symposium on Nucleic Acids Chemistry.

Review Papers

Hole Transfer Kinetics of DNA, K. Kawai, T. Majima, Acc. Chem. Res., American Chemical Society, 4[{11] (2013), 2616-2625.

Charge Transfer in DNA, M. Fujitsuka, T. Majima, Pure Appl. Chem., IUPAC, 85[7] (2013), 1367-1377.

Direct Observation of Excess Electron Transfer Dynamics in DNA, M. Fujitsuka, T. Majima, EPA Newslett., EPA, 85[2] (2013), 43-48.

Metal oxides meso-crystals with high charge transport property and high photocatalytic activity, T. Tachikawa, T. Majima, Material Stage, Technical Information Institute Co.,LTD, 13[10] (2014), 61-63.

Recent develpment of excess electron transfer in DNA, M. Fujitsuka, T. Majima, Chemistry and Chemical Industry, The Chemical Society of Japan, 67[1] (2014), 45.

Books

[1]Single-molecule reactive oxygen species detection in photocatalytic reactions(A. Greer, J. F. Liebman) T. Tachikawa, T.Majima, "The Chemistry of Peroxides", John Wiley & Sons, Inc., 3 2013.

Patents

[1] G20130068WO Metal oxides mesocrystals and their synthetic method, PCT/JP2013/082345

Contributions to International Conferences and Journals

T. Majima	Korean Japan Symosium on Photoscinece (Chair person)
T. Majima	Asian Symposium on Photochemistry (Chair person)
T. Majima	Asian Pacific Symposium on Radiation Chemistry (Chair person)
T. Majima	25th IUPAC Photochemistry (Chair person)
T. Majima	Urumqi Symposium on Recent Advances and Applications in Nanoengineering and Nanosystems (Chair person)
T. Majima	Langmuir, American Chemical Society (Senior Editor)
T. Majima	ACS Applied Materials & Interfaces, American Chemical Society (Editorial Advisory Board)
T. Majima	ChemPlusChem, union of 16 European Chemical Societies, Wiley VHC (Editorial Board)
T. Majima	Rapid Communication in Photoscienece, Korean Society of Photoscience (International Editorial Board)
T. Majima	Photochemistry and Photobiology, Wiley VHC (Associate Editor)

Publications in Domestic Meetings

The 35th Japan Photomedicine and Photobiology Meeting	1 paper
Japan Photochemistry Meeting 2013	1 papers
The 94th Japan Chemical Society Meeting	4 paper

Academic Degrees

Master Degree for Science A. Tanaka	Interaction between guanine quadruplex and RecA protein
Master Degree for Science T. Koshimo	DNA environmental change based on the lifetime of fluorescent molecule in the triplet excited state

Grant-in-Aid for Scientific Research

T.Majima	Single molecule chemistry of nanocatalysts for light-energy exchange system	¥71,370,000
T.Majima	Study on the structural characteristics of titanium oxide photocatalyst by time- and spacial-resolved spectroscopy	¥1,200,000
M.Fujitsuka	Dynamics of excited state reactive intermediatesof supramolecules and polymers	¥11,180,000
K.Kawai	Development of single-molecule level analysis techniques for RNA editing and chemical modifications	¥4,810,000
T.Tachikawa	Development of metal oxides mesocrystals photocatalysts for solar energy utilization	¥2,080,000
J.Choi	Investigation of the conformational dynamics of non-B DBA in vivo	¥1,560,000

Entrusted Research

T.Majima	Japan Science and technology Agency	Study on unstable reactive species of CPP	¥14,820,000
K.Kawai	Japan Science and technology Agency	Development of molecule technology based on fluorescence blinking	¥19,643,000
T.Tachikawa	Japan Science and technology Agency	Development of high efficient light energy conversion system using high ordered spacial control of nanoparticles	¥7,592,000

Contribution to Research

T.Tachikawa	Asahi grass company	¥1,000,000

Department of Synthetic Organic Chemistry

Original Papers

[1]*o*-(Hydroxyalkyl)phenyl P-Chirogenic Phosphines as Functional Chiral Lewis Bases, E. Rémond, J. Bayardon, S. Takizawa, Y. Rousselin, H. Sasai, S. Jugé: Org. Lett., 15 (2013) 1870-1873.

[2]Enantioselective Multicatalytic Synthesis of α-Benzyl-β-hydroxyindan-1-ones, T. Suzuki, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: Synthesis, 45 (2013) 2134-21362013.

[3]DFT Study of a 5-endo-trig-Type Cyclization of 3-Alkenoic Acids by Using Pd–Spiro-bis(isoxazoline) as Catalyst: Importance of the Rigid Spiro Framework for Both Selectivity and Reactivity, R. K. Gabr, T. Hatakeyama, K. Takenaka, S. Takizawa, Y. Okada, M. Nakamura, H. Sasai: Chem. Eur. J, 19 (2013) 9518-9525.

[4]Carbonylation of Propargyl Carbamates with Palladium(II) Bisoxazoline Catalysts: Efficient Synthesis of 5-Methoxy-3(2H)-Furanones, T. Kusakabe, T. Takahashi, R. Shen, A. Ikeda, Y. D. Dhage, Y. Kanno, Y. Inouye, H. Sasai, T. Mochida, K. Kao: Angew. Chem. Int. Ed, 52 (2013) 7845-78492013.

[5]Pd(II)–SDP-Catalyzed Enantioselective 5-exo-dig Cyclization of γ-Alkynoic Acids: Application to the Synthesis of Functionalized Dihydrofuran-2(3H)-ones Containing a Chiral Quaternary Carbon Center, V. Sridharan, L. Fan, S. Takizawa, T. Suzuki, H. Sasai: Org. Biomol. Chem., 11 (2013) 5936-59432013.

[6]P-Chirogenic Organocatalysts: Application to the aza-Morita–Baylis–Hillman (aza-MBH) Reaction of Ketimines, S. Takizawa, E. Rémond, F. A. Arteaga, Y. Yoshida, V. Sridharan, J. Bayardon, S. Jugé, H. Sasai: Chem. Commun., 49 (2013) 8392-8394.

[7]Organocatalyzed Formal [2 + 2] Cycloaddition of Ketimines with Allenoates: Facile Access to Azetidines with a Chiral Tetrasubstituted Carbon Stereogenic Center, S. Takizawa , F. A. Arteaga , Y. Yoshida , M. Suzuki, H. Sasai: Org. Lett., 15 (2013) 4142-4145.

[8]Chiral Bifunctional Organocatalysts Bearing a 1,3-Propanediamine Unit for the aza-MBH Reaction, S. Hirata, K. Tanaka, K. Matsui, F. A. Arteaga, Y. Yoshida, S. Takizawa, H. Sasai: Tetrahedron: Asymmetry, 24 (2013) 1189-1192.

[9]Bone Cements Based on Ground b-Tricalcium Phosphate with Sufficient Compressive Strengths and Short Hardening Time, K. Sakamoto, T. Nomoto, S. Yamaguchi, I. Fujihara, K. Satoh, J. Ichihara, T. Kimura, Y. Tsunawaki: Journal of the Ceramic Society of Japan, 121 (2013) 714-722.

[10]Enantioselective Pd(II)-Pd(IV) Catalysis Utilizing SPRIX Ligand: Efficient Construction of Chiral 3-Oxy-Tetrahydrofurans, K. Takenaka, Y. D. Dhage, H. Sasai: Chem. Commun., 49 (2013) 11224-11226.

[11]Enantioselective Oxidative-Coupling of Polycyclic Phenols, S. Takizawa, J. Kodera, Y. Yoshida, M. Sako, S. Breukers, D. Enders, H. Sasai: Tetrahedron, 70 (2014) 1786-1793.

International Conferences

[1]Umpolung Reactivity of Pd Enolate: Cyclative Diacetoxylation of Alkynyl Cyclohexadienones Catalyzed by Pd-SPRIX (oral), K. Takenaka, S. C. Mohanta, S. Takizawa, H. Sasai: 245th ACS National Meeting.

[2]Enantioselective Cyclization of 4-Alkenoic Acids via an Oxidative Allylic C–H Esterification (poster), M. Akita, Y. Tanigaki, K. Takenaka, S. Takizawa, H. Sasai: 245th ACS National Meeting.

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[14]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The 16th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis.

[15]Enantioselective Organocatalyzed Formal [n+2] Cycloaddition of Ketimines (poster), F. A. Arteaga, S. Takizawa, Y. Yoshida, M. Suzuki, H. Sasai: The 16th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis.

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Conference on Cutting-Edge Organic Chemistry in Asia (ICCEOCA-8) and The 4th New Phase International Conference on S Cutting-Edge Organic Chemistry in Asia (NICCEOCA-4).

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[19]Enantioselective Organocatalyzed Formal [n+2] Cycloaddition of Ketimines with Allenoates (poster), F. A. Arteaga, S. Takizawa, Y. Yoshida, M. Suzuki, H. Sasai: The 8th International Symposium on Integrated Synthesis (ISIS-8).

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[21]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyarto, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The 8th International Symposium on Integrated Synthesis (ISIS-8).

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[24]Enantioselective Synthesis of α-Methylidene-γ-Butyrolactones: Intramolecular Rauhut-Currier Reaction Promoted by Acid/Base Organocatalysts (poster), T. M.-N. Nguyen, A. Grossmann, S. Takizawa, M. Suzuki, D. Enders, H. Sasai: First Osaka University-EPFL International Symposium.

[25]Facile Synthesis of Tetrasubstituted Olefins Bearing Four Different Functional Units (poster), K. Kishi, S. Takizawa, F. A. Arteaga, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[26]Enantioselective Pd(II)/Pd(IV) Catalysis Utilizing SPRIX Ligand: Effective Construction of Chiral Acetoxylated Tetrahydrofurans (poster), Y. D. Dhage, K. Takenaka, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[27]Enantioselective Palladium(II) Catalyzed Cyclization-Cycloaddition Cascade Reactions of Alkenyl Oximes (poster), M. A. Abozeid, S. Takizawa, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

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[29]Umpolung Reactivity of Pd Enolate: Cyclative Diacetoxylation of Alkynyl Cyclohexadienones Catalyzed by Pd-SPRIX (poster), S. C. Mohanta, K. Takenaka, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[30]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Y. Ishizaka, K. Ghozati, Ismiyarto, D.-Y. Zhou, K. Asano, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[31]Catalytic Enantioselective Synthesis of Spiro Compounds and Their Applications to Asymmetric Catalysis (poster), L. Fan, Y. Takeuchi, S. Takizawa, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[32]Chiral Trisimidazole-Catalyzed Friedel-Crafts (FC)-type Reaction (poster), S. Hirata, S. Takizawa, K. Murai, H. Fujioka, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[33]Development of Artificial Enzyme as Luminescence Probe (poster), T. M.-N. Nguyen, Y. Nagata, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[34]Palladium-Catalyzed Direct C5 Arylation of Isoxazoles (poster), M. Shigenobu, K. Takenaka, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

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[37]Enantioselective Organocatalyzed Formal [n+2] Cycloaddition Using Ketimines and Allenoates (poster), F. A. Arteaga, S. Takizawa, Y. Yoshida, M. Suzuki, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[38]Development of Chiral Catalyst Based on Functionalization of 1,2,3-Triazoles (poster), Y. Yoshida, S. Takizawa, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

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Patents

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[2]K20130248 Method for producing epoxy compounds with solid catalysts, 2013-239919

[3]G20120072WO Method for producing epoxy compounds, PCT/JP2013/062354

[4]G20120073WO Manifacture of alicyclic diepoxides by epoxidizing alicyclic olefins in the prsence of solid carries and solid catalysts, PCT/JP2013/062355

[5]G20120074WO Method for producing epoxy compounds, PCT/JP2013/062356

[6]G20120075WO Method for producing epoxy compounds, PCT/JP2013/062357

[7]G20130016WO Preparation of alicyclic N-oxyl compounds, PCT/JP2013/067699

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[9]K20080101 New Heterocyclic Aromatic Polymer, JP2010-043071

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[11]K20090300 Cysteine based oxygen absorbent, K20090300

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Grant-in-Aid for Scientific Research

H. Sasai	Integrated Synthesis Based on the Creation of Multifunctional Organocatalysts	¥3,380,000
S. Takizawa	Synthesis of Chiral Multifunctional Compounds Promoted by Acdi-Base Organocatalysts	¥4,810,000
S. Takizawa	Development of Environmentally Benign Asymmetric Catalysts using Spiro Chirality	¥1,690,000
J. Ichihara	Reaction Mechanism of Halogen-free Epoxidation Reaction with Environmentally Friendly Powder Reaction	¥1,560,000

Entrusted Research

H. Sasai	Japan Science and Technology Agency	Control of Chirality by Immobilized Ligands Based on Metal-bridging Polymer	¥10,790,000
H. Sasai	Japan Science and Technology Agency	Practical Transformation Based on Catalytic Asymmetric Domino Reactions	¥20,519,000
J. Ichihara	Ministry of Education, Culture, Sports, Science and Technology in Japan	Production of Halogen-free Epoxides for Electronic Devices Using the Compact "Nonhalite" System	¥1,620,000

Contribution to Research

H. Sasai	Nagase ChemteX Corporation	¥1,000,000
H. Sasai	Nissan Chemical Industries, Ltd.	¥400,000

Cooperative Research

J. Ichihara	Okawara MFG.CO., LTD.	¥315,000

Other Research Fund

H. Sasai	National Institute of Natural Sciences, Institute for Molecular Science	¥1,700,000

Department of Regulatory Bioorganic Chemistry

Original Papers

[1]Ligand-Induced Electron Spin-Assembly on a DNA Tile, H. Atsumi, S. Nakazawa, C. Dohno, K. Sato,

T. Takui, K. Nakatani: Chem. Commun., 49 (2013) 6355-6458.

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[6]Fluorescent Indicator Displacement Assay of Ligands Targeting 10 microRNA Precursors, A. Murata, Y. Harada, T. Fukuzumi, K. Nakatani: Bioorg. Med. Chem., 21 (2013) 7101-7106.

[7]Facile Electrochemical Biosensor Based on a New Bifunctional Probe for Label-Free Detection of CGG Trinucleotide Repeat, H. He, J. P. Xia, X. Q. Peng, G. Chang, X. H. Zhang, Y. F. Wang, K. Nakatani, Z. W. Lou, S. F. Wang: Biosensors and Bioelectronics, 49 (2013) 282-289.

[8]High Speed DNA Denaturation Using Microheating Devices, M. Furuhashi, Y. Okamoto, D. Onoshima,T. Ohshiro, S. Ryuzaki, K. Yokota, M. Tsutsui, M. Taniguchi, K. Nakatani, T. Kawai: Appl. Phys. Lett., 103 (2013) 023112.

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International Conferences

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[2]Synthesis and Application of New Modified DNA Having Cytosine-bulge Binding Fluorescence Molecule , : Technologies for Medical Diagonosis and Therapy (G3 Meeting).

[3]Inhibition of Hairpin RNA Processing by Dicer Using RNA-Binding Small Molecules , : Technologies for Medical Diagonosis and Therapy (G3 Meeting).

[4]A Synthetic Riboswitch Based on a Rationally Designed Ligand- RNA pair , : Technologies for Medical Diagonosis and Therapy (G3 Meeting).

[5]Sequence-Dependent Binding of the Amphiphilic DNA to Lipid Bilayer Membrane , : ISNAC2013.

[6]An Artificial Riboswitch Driven by a Synthetic RNA-Binding Ligand , : ISNAC2013.

[7]Physical Properties of 2D-DNA-Nanostructures on Lipid Bilayer Membrane , : ISNAC2013.

[8]Synthesis of the Restrained Naphthyridine Dimer and the Exploration for Binding RNA by in vitro Selection , : ISNAC2013.

[9]New PCR Monitoring System Using DNA Primer Having Cytosine-Bulge and Covalent Binding Fluorescence Molecule , : The 17th SANKEN International Symposium 2014 Joined with The 2nd

International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project.

[10]Development of Potential Small-Molecule Inhibitors of pre-miRNA Processing , : The 1st Osaka University - EPFL International Symposium.

[11]Synthesis of RNA Bulge Binding Small Molecule and Application to Inhibitor of Dicer Cleavage Reaction , : The 1st Osaka University - EPFL International Symposium.

[12]Synthesis and Evaluation of an Amphiphilic DNA That Binds to a Hydrophobic Inner Core of Lipid Membranes (oral), : Imaging and Sensing Biomolecular Function and Assembly.

[13]Design and Synthesis of Novel Small-Molecule Ligand for Targeting Nucleotide Bulges (oral), : Imaging and Sensing Biomolecular Function and Assembly.

[14]Regulation of RNA Secondary Structure and Function (invited), : Imaging and Sensing Biomolecular Function and Assembly.

[15]Biochemical Functions Emerging from DNA Containing Hydrophobic Regions (invited), : Imaging and Sensing Biomolecular Function and Assembly.

[16]Toward Regulation of RNA Structure and Function by Small Molecules (invited), Toward Regulation of RNA Structure and Function by Small Molecules: A3RONA 2013.

[17]Small Molecule Interaction to RNA (invited), Small Molecule Interaction to RNA: The 16th Japan-Korea Seminor on Organic Chemistry.

[18]Small Organic Molecules Regulating RNA Structure and Function (invited), Small Organic Molecules Regulating RNA Structure and Function: First Osaka University-EPFL International Symposium.

[19]Small Organic Molecules Regulating RNA Structure and Function #2 (invited), Small Organic Molecules Regulating RNA Structure and Function #2: Asian Chemical Biology Initiative, Manila Meeting.

Review Papers
The Chemistry of PCR Primers: Concept and Application, F. Takei, K. Nakatani, Israel Journal of Chemistry, John Wiley & Sons, Inc., 53 (2013), 401-416.

microRNA (miRNA): an emerging drug target, A. Murata, K. Nakatani, T. Nagano (Editor), Experimental Medicine, YODOSHA, 32(2) (2014), 160-165.

In vitro selection of RNA aptamers for a small-molecule dye, A. Murata, S. Sato, A. Ogawa (Editor), Methods in Molecular Biology, Springer, 1111 (2014), 17-38.

Patents
[1]G20120087WO Method for detecting single nucleotide polymorphism in nucleic acid, PCT/JP2013/056423

[2]KP2013018 Method for detecting single nucleotide polymorphism in nucleic acid, 2013-532002

[3]KP2013018 Method for detecting single nucleotide polymorphism in nucleic acid, 2013-532002

[4]G20070017EPGB DNA fragment used in the form attached to 5'-terminus of primer for use in amplification reaction of nucleic acid, and use thereof, G20070017EPGB

Contributions to International Conferences and Journals

K. NAKATANI	The International Conference on Cutting-Edge Organic Chemistry in Asia (Organizing Committee)
K. NAKATANI	Bulletin of the Chemical Society of Japan (Associate Editor)

Publications in Domestic Meetings

The 94th CSJ Annual Meeting 2014	8 papers
8th Annual Meeting of Japanese Society for Chemical Biology	3 papers
The 62nd Symposium on Macromolecules	1 paper
15th RNA meeting	1 paper

Academic Degrees

Master degree for Science Y. Di	Synthesis of RNA binding molecules and exploration of their aptamer
Master degree for Science K. Matsuzaki	Studies on hydrophobic DNA that binds to a hydrophobic inner core of lipid membranes
Master degree for Science S. Matsumoto	Ligand-inducible formation of RNA pseudoknot and its applicatoin for regulation of gene expression

Grant-in-Aid for Scientific Research

K. Nakatani	Riboswitch reengineering using a synthetic 8-substituted purine library	¥16,250,000
K. Nakatani	RNA loop-loop interaction modulated by small molecules	¥4,030,000
F. Takei	The high sensitive virus detection system using hairpin primer PCR method	¥6,240,000
A. Murata	Gene regulation by small molecule-modulated miRNA pathway	¥2,210,000
T. Fukuzumi	Design and synthesis of small molecules that target miR-29a precursor.	¥2,340,000
H. Aikawa	Developments of new modification reactions of peptide and development of new amide isosteres	¥2,210,000

Entrusted Research

K. Nakatani	National Institute of Biomedical Innovation	Development of Research Basis for accelerating the Drug Discovery targeting Functional ncRNA	¥60,000,000
C. Dohno	Japan Science and Technology Agency, PREST	Biochemical functions emerging from DNA containing hydrophobic regions	¥10,530,000

Cooperative Research

K. Nakatani	NITTO KASEI co.,ltd.	¥840,000
K. Nakatani	FURUKAWA ELECTRIC ADVANCED ENGINEERING CO.,LTD.	¥0,000

Department of Organic Fine Chemicals

Original Papers

[1]A semisynthetic fusicoccane stabilizes a protein-protein interaction and enhances the expression of K+ channels at the cell surface, C. Anders, Y. Higuchi, K. Koschinsky, M. Bartel, B. Schumacher, P. Thiel, H. Nitta, R. Preisig-Müller, G. Schlichthörl, V. Renigunta, J. Ohkanda, J. Daut, N, Kato, C. Ottmann: Chem. Biol., 20 (4) (2013) 583-593.

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[3]Sequence-specific and visual identification of influenza virus gene by azobenzene-tethered bis-peptide

nucleic acid, K. Kaihatsu, S. Sawada, S. Nakamura, T. Nakaya, T. Yasunaga, N. Kato: PLoS ONE, 8 (5) (2013) e64017 (5 pages).

[4]Antimicrobial N-(2-chlorobenzyl)-substituted hydroxamate is an inhibitor of 1-deoxy-D-xylulose 5-phosphate synthase, D. Hayashi, N. Kato, T. Kuzuyama, Y. Sato, J. Ohkanda: Chem. Commun., 49 (49) (2013) 5535-5537.

[5]Peptidomimetic modification improves cell permeation of bivalent farnesyltransferase inhibitors, S. Machida, M. Tsubamoto, N. Kato, K. Harada, J. Ohkanda: Bioorg. Med. Chem., 21 (14) (2013) 4004-4010.

[6]Rapid idenfitication of swine-origin influenza A virus by peptide nucleic acid-chromatography, K. Kaihatsu, S. Sawada, N. Kato: J. Antivirals & Antiretrovirals, 5 (4) (2013) 77-79.

[7]Bone cements based on ground b-tricalcium phosphate with sufficient compressive strengths and short hardening time, K. Sakamoto, T. Monoto, S. Yamaguchi, I. Fujihara, K. Satoh, J. Ichihara, T. Kimura, Y. Tsunawaki: J. Ceramic Soc. Jpn., 121 (8) (2013) 714-722.

[8]Stabilization of physical RAF/14-3-3 interaction by cotylenin A as treatment strategy for RAS mutant cancers, M. Molzan, S. Kasper, L. Röglin, M. Skwarczynska, T. Sassa, T. Inoue, F. Breitenbuecher, J. Ohkanda, N. Kato, M. Schuler, C. Ottmann: ACS Chem. Biol., 8 (9) (2013) 1869-1875.

[9]The role of individual domains and the significance of shedding of ATP6AP2/(pro)renin receptor in vacuolar H(+)-ATPase biogenesis, K. Kinouchi, A. Ichihara, M. Sano, G.-H. Sun-Wada, Y. Wada, H. Ochi, T. Fukuda, K. Bokuda, H. Kurosawa, N. Yoshida, S. Takeda, K. Fukuda, H. Itoh: PLoS ONE, 8 (11) (2013) e78603 (12 pages).

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International Conferences

[1]Rab7-Dependent Microautophagy in the Visceral Endoderm is Essential for Mouse Early Development , Y. Wada: Experimental Biology 2013.

[2]Microautophagic Assembly of Large Vacuoles in Mammalian Embryonic Tissues , Y. Wada, G.-H. Sun-Wada, N. Kawamura: COLD SPRING HARBOR ASIA CONFERENCES: Membrane Protein Structure and Function.

[3]Unique Endocytic Pathway in Early Mouse Embryos and Its Implication in Signal Regulation (oral), Y. Wada, G.-H. Sun-Wada, N. Kawamura: The 61st NIBB Conference: Cellular Community in Mammalian Embryogenesis.

[4]Diagnosis of Influenza A/H1N1pdm Virus Genome by Hairpin-Type Peptide Nucleic Acid Chromatography (invited), K. Kaihatsu: Option for the control of Influenza VIII.

[5]Microautophagic Delivery to Lysosomes Regulates Patterning of BMP Signals in Mouse Gastrulae , Y. Wada: Mouse Molecular Genetics 2013.

[6]Sequence-Specific Detection of a Single Base Pair Mismatches by Tolane-Modified Peptide Nucleic Acid , M. Okazaki, T. Hayashi, K. Kaihatsu, S. Sawada, N. Kato: The 40th International Symposium on

Nucleic Acids Chemistry.

[7]Effect of Pseudo-Pyrimidine Bases on Peptide Nucleic Acid Duplex Formation Stability , K. Takagi, K. Kaihatsu, Z. Yiting, N. Kato: The 40th International Symposium on Nucleic Acids Chemistry.

[8]Identification of Influenza Virus by Anti-Viral Gene Peptide Nucleic Acid (invited), K. Kaihatsu: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[9]Design and Synthesis of Fusicoccin-J-based Chemical Probes for Elucidation of Structural Effects on Binding to 14-3-3/Phospholigand Complexes , A. Kusumoto, N. Kato, J. Ohkanda: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[10]Effect of 5, 6-Substituted Pyrimidine Bases on Peptide Nucleic Acid Duplex Formation Stability , K. Takagi, K. Kaihatsu, Z. Yiting, N. Kato: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[11]Recognition of Single Base Mismatch within Single Strand DNA by Intercalator-Modified Peptide Nucleic Acids , M. Okazaki, T. Hayashi, K. Kaihatsu, S. Sawada, N. Kato: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

Review Papers

Vacuoles in mammals: A subcellular structure indispensable for early embryogenesis, Y. Wada, BioArchitecture, Landes Bioscience, 3[1] (2013), 13-19.

Microautophagy in the visceral endoderm is essential for mouse early development, Y. Wada, G.-H. Sun-Wada, N. Kawamura, Autophagy, Landes Bioscience, 9[2] (2013), 252-254.

Positive and negative regulation of developmental signaling by the endocytic pathway, Y. Wada, G.-H. Sun-Wada, Curr Opin Genet Dev, Elsevier, 23[4] (2013), 391-398.

Vacuolar-type proton pump ATPases: Acidification and pathological relationships, G.-H. Sun-Wada, Y. Wada, Histol. Histopathol., Jiménez-Godoy, S.A., 28[7] (2013), 805-815.

Diagnostic method for influenza virus gene by peptide nucleic acid, K. Kaihatsu, N. Kato, Ｃｈｅｍｉｃａｌ Industry, Chemical Industry, 64[8] (2013), 25-29.

MVam2-dependent endocytic pathway regulates BMP signaling during mouse early development, G.-H. Sun-Wada, Y. Wada, Seikagaku, The Japanese Biochemical Society, 85[9] (2013), 806-809.

Books

[1]Antivirals(H. Etoh, I. Tomita, J. Shinmura, M. Isemura, Y. Hara, H. Yukigoshi, M. Yamoto-Maeda,) K. Kaihatsu, “New edition: Tea Functions”, Japan Tea Central Association, 2 (173-179) 2013.

Patents

[1]K20120388 Method and apparatus for preparation of organic compounds with solid phase oxidation reaction, JP2013-073584

[2]K20130248 Method for producing epoxy compounds, JP2013-239919

[3]G20120072WO Method for producing epoxy compounds with solid catalyst, WO 2013175935 A1

[4]G20120073WO Manufacture of alicyclic diepoxides by epoxidizing alicyclic olefins in the presence of solid carriers and solid catalysts, WO 2013175936 A1

[5]G20120074WO Method for producing epoxy compounds, WO 2013175937 A1

[6]G20120075WO Method for producing epoxy compounds, WO 2013175938 A1

[7]KB2009001 Material for forming metal silver, method for producing metal silver, P5167522

[8]KP2009014 Mixture for solid-phase oxidation reaction, P5376505

[9]KP2011033 Antibacterial agents, P5279054

[10]K20120417 Non-envelope virus inhibitors, JP2013-070031

Contributions to International Conferences and Journals

K. Kaihatsu Journal of Antivirals & Antiretrovirals (Editorial Boad)

Publications in Domestic Meetings

The 94th CSJ Annual Meeting	7 papers
55th Symposium on the Chemistry of Natural Products	1 paper
Annual Meeting of Japan Society for Biosci. Biotechnol. Agrochem. 2014	1 paper
The Society for Chemistry and Micro-nano Systems	1 paper
Bio-optics Symposium	1 paper
Others	3 papers

Academic Degrees

Docter Degree for Science Y. Haranosono	Studies on Migration-inhibition Activity of a 3,12-Unsubstituted Fusicoccin Derivative
Master Degree for Science R. Ishida	Synthesis and Functional Evaluation of 13-Substututed Fusicoccin Derivatives
Master Degree for Science Y. Inoue	Synthetic Studies on Inhibitors for Efflux Transporters Aiming to Devise an Effective Treatment for Infectious Diseases Caused by Multi-drug Resistant Bacteria
Master Degree for Science C. Wang	Exploration of Intracellular Ligands Involved in the Interaction between 14-3-3 and Fusicoccin-based Antitumor Agent
Master Degree for Science A. Kusumoto	Structural Effects on Molecular Recognition of Fusicoccin-based Fluorescent Probes for 14-3-3 Protein Bound Phospholigands
Bachelor Degree for Science M. Okazaki	Recognition of Single Base Mismatch in DNA by Intercalator-modified Peptide Nucleic Acid

Grant-in-Aid for Scientific Research

Y. Wada	Extracellular signaling during early embryogenesis in mouse	¥10,140,000
Y. Wada	A novel endocytic pathway constituting of microautophagy	¥1,690,000
K. Kaihatsu	Highly sensitive detection method for a single-base mismatch of virus gene by chemically modfied peptide nucleic acid	¥8,060,000
K. Kaihatsu	Development of on-chip device for respiratory virus detection and its application	¥1,300,000
K. Kaihatsu	Development of 3-way junction nucleic acid for the inhibition of influenza virus	¥360,000

Entrusted Research

N. Kato	JST	Design and synthesis of universal	¥16,364,000

		inhibitors for bacterial efflux pumps	

Cooperative Research

K. Kaihatsu	Protectea Co. Ltd.,		¥492,000

Department of Structural Molecular Biology

Original Papers

[1]High-Resolution Crystal Structure of Copper Amine Oxidase from *Arthrobacter globiformis*: Assignment of Bound Diatomic Molecules as O_2, T. Murakawa, H. Hayashi, T. Sunami, K. Kurihara, T. Tamada, R. Kuroki, M. Suzuki, K. Tanizawa, T. Okajima: Acta Crystallogr. D., 69 (12) (2013) 2483-2494.

[2]Identification of Genes Essential for the Biogenesis of Quinohemoprotein Amine Dehydrogenase, T. Nakai, T. Deguchi, I. Frébort, K. Tanizawa, T. Okajima: Biochemistry, 53 (5) (2014) 895–907.

[3]High-Throughput de novo Screening of Receptor Agonists with an Automated Single-Cell Analysis and Isolation System, N. Yoshimoto, K.Tatematsu, M. Iijima, T. Niimi, A. D. Maturana, I. Fujii, A. Kondo, K. Tanizawa, S. Kuroda: Scientific Reports, 4 (2014) 424.

International Conferences

[1]Development of Novel Antibiotics Effective for Multiple Drug Resistant Bacteria (poster), T. Okajima, M. Igarashi, R. Utsumi, K. Tanizawa: Technologies for Medical Diagonosis and Therapy (G3 Alliance Meeting).

[2]Novel Antibacterial Compounds Specifically Targeting Bacterial Signal Transduction System (poster), T. Okajima, M. Igarashi, R. Utsumi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

Review Papers

An Unusual Protease Essential for Biogenesis of Quinohemoprotein Amine Dehydrogenase, T. Nakai, Manufacturing and Technology, Association for Manufacturing Technology, 64[4] (2012), 37-39.

Patents

[1]Screening Method for Receptor Tyrosine Kinase-binding Ligands, K20060364

[2]Cell Picking System and Screening Method for Mammalian Cells, K20080472

Publications in Domestic Meetings

The 86th Annual Meeting of the Japanese Biochemical Society	1 paper
Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry	1 paper
Meeting of Enzyme and Coenzyme Researchs	1 paper

Grant-in-Aid for Scientific Research

T.Okajima	Creation of Novel Bioactive Cyclic Peptide Using Fe-S Cluster Containing Peptide Crosslink Enzyme	¥1,430,000
T.Nakai	Biogenesis Processs of Quinohemoprotein Amine Dehydrogenase Accompanying Multi-step Posttranslational Modification	¥1,300,000

Entrusted Research

K.Tatematsu	National Agriculture and Food Research Organization	Construction and Improvement in Productivity of the Next Generation Bio-Nano Capsule	¥4,600,000

Cooperative Research

T.Okajima	Okayama Univ., Kinki Univ., Insitute of Microbial Chemistry, YuiMedic Inc.	¥0,000

Department of Cell Membrane Biology

International Conferences

[1]Physiological role of S1P transporters in S1P signaling (invited), T. Nishi: FASEB Science Research Conferences, Lysophospholipid and other Related Mediators - From Bench to Clinic.

Review Papers

Functional roles of sphingosine-1-phosphate (S1P) transporter in mammals., T. Nishi, N. Kobayash, Y. Hisano, A. Kawahara, A. Yamaguchi, Biochim. Biophys. Acta, Elsevia, 1841 (2014), 759-765.

Books

[1]Functional and physiological roles of sphingosine 1-phosphate transporters(T. Hla., S. Spiegel, W. Moolenaar, J. Chun) A. Kawahara, T. Nishi, "Lysophospholipid Receptors: Signaling and Biochemistry", John Wiley & Sons, Inc., (185-200) 2013.

Publications in Domestic Meetings

The 134th Annual Meeting of the Pharmaceutical Society of Japan	1 paper

Academic Degrees

Master Degree for Pharmaceutical Sciences K. Hayashi	Structure and functional analysis of multidrug efflux transporters in gram-negative bacteria	

Grant-in-Aid for Scientific Research

T.Nishi	Development of the conveniebt method for detecting the lipiddynamics by using click reaction	¥2,340,000

Contribution to Research

T.Nishi	The Cell Science Research Foundation	¥1,200,000

Department of Biomolecular Science and Engineering

Original Papers

[1]Improved Orange and Red Ca^{2+} Indicators and Photophysical Considerations for Optogenetic Applications, J. Wu, L. Liu, T. Matsuda, Y. Zhao, A. Rebane, M. Drobizhev, Y. F. Chang, S. Araki, Y. Arai, K. March, T. E. Hughes, K. Sagou, T. Miyata, T. Nagai, W. H. Li, R. E. Campbell: ACS Chem Neurosci., 4 (6) (2013) 963-972.

[2]Rab6a Releases LIS1 from a Dynein Idling Complex and Activates Dynein for Retrograde Movement, M. Yamada, K. Kumamoto, S. Mikuni, Y. Arai, M. Kinjo, T. Nagai, Y. Tsukasaki, T. M. Watanabe, M. Fukui, M. Jin, S. Toba, S. Hirotsune: Nat Commun., 4:2033 (2013) 1-10.

[3]Saturated Excitation of Fluorescent Proteins for Subdiffraction-Limited Imaging of Living Cells in Three Dimensions, M. Yamanaka, K. Saito, N. I. Smith, S. Kawata, T. Nagai, K. Fujita: Interface Focus., 3 (5) (2013) 20130007.

[4]Flexible and Dynamic Nucleosome Fiber in Living Mammalian Cells, T. Nozaki, K. Kaizu, C. G. Pack, S. Tamura, T. Tani, S. Hihara, T. Nagai, K. Takahashi, K. Maeshima: Nucleus., 4 (5) (2013) 349-356.

[5]SuperNova, a Monomeric Photosensitizing Fluorescent Protein for Chromophore-Assisted Light Inactivation, K. Takemoto, T. Matsuda, N. Sakai, D. Fu, M. Noda, S. Uchiyama, I. Kotera, Y. Arai, M. Horiuchi, K. Fukui, T. Ayabe, F. Inagaki, H. Suzuki, T. Nagai: Sci Rep., 3:2629 (2013) 1-7.

[6]Extraction of Recombinant Protein from Escherichia coli by Using a Novel Cell Autolysis Activity of VanX., T. Kamioka, S. Sohya, N. Wu, T. Maki, T. Matsuda, T. Ikegami, H. Nakamura, Y. Kuroda: Anal Biochem., 439 (2) (2013) 212-217.

[7]Importin Alpha Subtypes Determine Differential Transcription Factor Localization in Embryonic Stem

Cells Maintenance, N. Yasuhara, R. Yamagishi, Y. Arai, R. Mehmood, C. Kimoto, T. Fujita, K. Touma, A. Kaneko, Y. Kamikawa, T. Moriyama, T. Yanagida, H. Kaneko, Y. Yoneda: Dev Cell., 26 (2) (2013) 123-135.

International Conferences

[1]Revolutionary Bioimaging with Super-Duper Luminescent Proteins (invited), T. Nagai: Lecture at Department of Pharmacology, University of Oxford.

[2]Superstrong Luminescent Protein for High Speed Imaging at Single Cell and Whole Body Level (invited), T. Nagai: JSAP-OSA Joint Symposia 2013, the 74th JSAP Autumn Meeting 2013.

[3]Genetically-Encoded Functional Probes Applicable in Conjunction with Photo-Manipulation Technologies (invited), T. Nagai: Optogenetics2013.

[4]Photo-Manipulation of Intracellular Ca^{2+} by a Genetically-Encoded Caged Ca^{2+} (poster), T. Nagai: ECS Workshop 2013　4th ECS WORKSHOP　“Ca2+ and cell death”.

[5]Beyond the Diffraction Limit with an Advanced Photoswiching Fluorescent Protein (invited), T. Matsuda, D. T. Tiwari, Y.Arai, T. Nagai: International Symposium on Morphological Science XXIII ISMS 2013.

[6]Photo-Manipulation of Intracellular Ca^{2+} by Genetically Encoded Caged Ca^{2+} (poster), T. Matsuda: Joined GDRE CNRS /European Calcium Society workshops.

[7]Realtime Fluorescence and Chemiluminescence Imaging with Optogenetic Activation (poster), Y. Arai, Y.-F. Chang, T. Nagai: Technologies for Medical Diagnostic and Therapy Symposium.

[8]Genetically-Encoded Functional Probes Applicable in Conjunction with Photo-Manipulation Technologies (invited), T. Nagai: 7th International Symposium　on Nanomedicine　(ISNM2013).

[9]Realtime Fluorescnece and Chemiluminescence Imaging with Optogenetic Activation in Living Cells (invited), Y. Arai: International Workshop on Quantitative Biology 2013.

[10]Manipulation and Visualization of Biological Function with Genetically Encoded Molecular Spies. (invited), T. Nagai: 2013 ASCB Annual Meeting.

[11]Kohinoor, a Photo-Switichable Fluorescent Protein for Superresolution Imaging (poster), Y. Arai: First Osaka University-EPFL International Symposium.

[12]Monitoring Temperature inside a Single Cell with a Novel Genetically Encoded Fluorescent Temperature Indicator (poster), M. Nakano: First Osaka University-EPFL International Symposium.

[13]Monitoring Temperature inside a Single Cell with a Novel Genetically Encoded Fluorescent Temperature Indicator (poster), M. Nakano: The 17th SANKEN International Symposium 2014.

[14]Monitoring Cytosolic Mg^{2+} with a Novel Genetically Encoded Fluorescent Indicator Using a Non-FRET-Based Ratiometric Imaging Approach (poster), V. P. Koldenkova, T. Matsuda, S. Kawakami, T. Nagai: The 17th SANKEN International Symposium 2014.

Review Papers

Visualbiology　- From the Story of Fluorescent Ca2+ Sensor Development -, T. Nagai, Manufacturing & Technology, Seisangijutu-Shinkoukyokai, 65[2] (2013), 54-56.

Smart fluorescent proteins: innovation for barrier-free superresolution imaging in living cells., Tiwari

D.K., and Nagai T., Dev Growth Differ., Wiley Online Library, 55[4] (2013), 491-507.

Genetically encoded Ca^{2+} indicators: properties and evaluation., Koldenkova V.P. and Nagai T., Biochim Biophys Acta., Elsevier, 1833[7] (2013), 1787‐1797.

Extensive use of FRET in biological imaging., Arai Y, Nagai T., Microscopy (Oxf)., Oxford Journals, 62[4] (2013), 419-428.

Development and application of a Brighter Chemiluminescent Protein for Bioimaging., T. Nagai, K. Saito, N. Hatsugai., MICROSCOPY, The Japanese Society of Microscopy., 48[3] (2014), 213-215.

Fluorescence switching imaging, T. Matsuda, Seibutsu-kogaku Kaisi, The Society for Biotechnology, Japan, 91[10] (2013), 585.

Patents

[1]K20130133 Fluorescent protein, 2013-191058

[2]K20130265 Method for chemical substance detection, 2014-015110

[3]K20130228 Absorption microscope, 2013-233447

[4]G20130052WO Optical microscope and auto-focusing device for optical microscope, PCT/JP2013/081259

[5]K20130270 Method for cAMP detection, 2014-065145

[6]K20130272 Method for cAMP detection, 2014-065146

Contributions to International Conferences and Journals

Y. Arai	International Workshop on Quantitative Biology 2013 (Organizing Committee)
T. Nagai	17th SANKEN International Symposium (Organizing Committee)
T. Nagai	Biophysics (Editorial bord)
T. Nagai	Microscope (Editorial bord)
T. Matsuda	17th SANKEN International Symposium (Organizing Committee)

Publications in Domestic Meetings

Seminar of Institute for Protein Research, Osaka University	1 paper
The 3rd Report Meeting of Network Joint Research for Advanced Materials and Devices	1 paper
2012 Report Meeting of Nano-Macro Materials, Devices, and System Research Alliance Project	1 paper
The Lecture to Commemorating Kihara Memorial Foundation Academic Award	1 paper
The 69th Annual Meeting of the Japanese Society of Microscopy	1 paper
Core member meeting of the Japanese Society for Quantitative Biology	1 paper
Joint Symposium of Opto-Science and Technology CREST/PREST Project	1 paper
The 65th Annual Meeting of the Japan Society for Cell Biology	1 paper
Lecture at Uenomiya High School	1 paper
2013 interim Report Meeting of Funding Program for World-Leading Innovative R&D on Science and Technology	1 paper
The 10th Annual Meeting of JST PREST Project "Innovative use of light and materials/Life"	1 paper
The 5th Annual Meeting of the Grant-in-Aid for Scientific Research on Innovative Areas "Spying minority in biological phenomena"	1 paper
The 22th Annual Meeting of the Bioimaging Society	1 paper
The 45th Autumn Meeting of SCEJ	1 paper
Open symposium of Science Council of Japan	1 paper

The 65th Annual Meeting of the Society of Biotechnology of Japan	1 paper
The 55th Annual Meeting of the Japanese Association for Oral Biolog	1 paper
The 51st Annual Meeting of the Biophysical Society of Japan	3 papers
Academic Lecture of Onga･Nakama Pharmacetical association	1 paper
The 69th academic lecture of SANKEN	2 papers
The 6th Annual Meeting of the Japanese Society for Quantitative Biology	1 paper
Symposium "Saibou wo TSUKURU AYATSURU"	1 paper
MBSJ2013	2 papers
MBSJ2013 Public Presentation	1 paper
The 26th Report Meeting of the Technical Division of ISIR, Osaka University	1 paper
The 1st Joint Symposium of the Grant-in-Aid for Scientific Research on Innovative Areas "Spying minority in biological phenomena" and "Plant Environmental Sensing"	1 paper
The 39th JBEG Meeting	1 paper
Research Meeting of Quantum Electronics, JSAP	1 paper
The 5th Annual Meeting of Membrane transport protein Society for researches	1 paper
2014 Training programs of Japan Patent Office	1 paper
2014 The 2nd Annual Meeting of Next-Generation BioNano Society for researches	1 paper
Meet the Mentors 2.0	1 paper
Bioscience Symposium of Department of Biological Sciences	1 paper
The 6th Annual Meeting of the Grant-in-Aid for Scientific Research on Innovative Areas "Spying minority in biological phenomena"	3 papers
2013 Report Meeting of JST PREST Project "Innovative use of light and materials/Life"	1 paper
2013 Year-end Report Meeting of Funding Program for World-Leading Innovative R&D on Science and Technology	1 paper
A public program for the general public of University of Shizuoka	1 paper
Symposium for Young Scientists of Dissimilar Field @ KANSAI	1 paper

Academic Degrees

Master Degree for Engineering K. Horiuchi	Time-independent response to countable number of chemotactic molecules in Dictyostelium discoideum cells.
Bachelor Degree for Engineering Y. Aoyagi	Improvement of the brightness of NanoLuc and the application to Virus-Like-Particle.
Bachelor Degree for Engineering H. Shinoda	Development of chemiluminescent protein-based IP3 sensor.
Bachelor Degree for Engineering H. Takauchi	Improvement of photoswitchable protein "Dreiklang"

Grant-in-Aid for Scientific Research

T. Nagai	Spying minority in biological phenomena -Toward bridging dynamics between individual and ensemble processes-	¥15,080,000
T. Nagai	Development of molecular probes and photonic tools for bio-manipulation	¥64,090,000
Y. Arai	Developlment of optical sectioning microscopy for chemiluminescent imaging	¥2,730,000
M. Nakano	Visualization of heat production inside a single cell with genetically-encoded fluorescent temperature indicator	¥1,950,000

Entrusted Research

T. Nagai	Japan Science and Technology Agency	Invention of high performance bright luminescent proteins used as a nanolight source	¥16,380,000
T. Nagai	Japan Science and Technology Agency	Development of multi-modal chemiluminescent imaging system	¥12,415,000

T. Nagai	New Energy and Industrial Technology Development Organization	Development of absorption-enhanced microscopy based on novel principle and its application for bioscience	¥8,671,000
T. Matsuda	Japan Science and Technology Agency	Analysis of Dynamics of Drug Efflux Transporter and Drug	¥14,140,000

Contribution to Research

T. Nagai	The Naito Foundation	¥3,000,000
T. Nagai	The Uehara Memorial Foundation	¥5,000,000
T. Matsuda	Protein Research Foundation	¥800,000

Cooperative Research

T. Nagai	Nikon Instech Co.,Ltd.	¥7,040,000
T. Nagai	OPTO-LINE, Inc.	¥0,000
T. Nagai	Nikon Co.,Ltd.	¥8,270,000
T. Nagai	Panasonic Corporation	¥1,200,000
T. Nagai	Olympus Corporation	¥0,000
T. Nagai	RIKEN	¥0,000
T. Nagai	Hamamatsu Photonics K.K.	¥0,000
T. Nagai	RIKEN	¥0,000

Other Research Fund

T. Nagai	Japan Society for the Promotion of Science	¥1,500,000

Specially Appointed Laboratory

Original Papers

[1]Tracking Single-Particle Dynamics via Combined Optical and Electrical Sensing, N. Yukimoto, M. Tsutsui, Y. He, H. Shintaku, S. Tanaka, S. Kawano, T. Kawai, M. Taniguchi: Scientific Reports, 3 (2013) 1855(1-7).

[2]DNA Manipulation and Separation in Sublithographic-Scale Nanowire Array, T. Yasui, S. Rahong, K. Motoyama, T. Yanagida, Q. Wu, N. Kaji, M. Kanai, K. Doi, K. Nagashima, M. Tokeshi, M. Taniguchi, S. Kawano, T. Kawai, Y. Baba: ACS NANO, 7 (4) (2013) 3029-3035.

[3]Non-Equilibrium Ionic Response of Biased MCBJ Electrodes, K. Doi, M. Tsutsui, T. Ohshiro, C.-C. Chien, M. Zwolak, M. Taniguchi, T. Kawai, S. Kawano, M. Di Ventra: J. Phys. Chem.C, 118 (7) (2014) 3758-3765.

International Conferences

[1]Single Molecule DNA and RNA Sequencing by Gating Nanopore Systems (invited), T. Kawai: 4th Asian Conference on Coordination Chemistry (ACCC4).

[2]Convergence of NT with IT and Bio for Green and Life Innovation (invited), T. Kawai: KU-KIST Converging Science and Technology Symposium.

[3]Integrated Nanogap Electrodes System for the Single Molecule DNA and RNA Sequencing (invited), T. Kawai: International Symposium on Single Biomolecule Analysis 2013 (ISBA2013).

[4]Single-Molecule Tunnel-Current Identification of DNA/RNA Oligonucleotides Toward Genome Sequencing (invited), T. Ohshiro, M. Taniguchi, T. Kawai: EMN Fall Meeting 2013.

[5]A Structural Analysis Method for Nanomaterials Using a Nanopore (oral), S. Ryuzaki, M. Taniguchi, T. Kawai: A structural analysis method for nanomaterials using a nanopore.

[6]Single-Molecule Tunnel-Current Based Identification of DNA/RNA Nucleotides toward Electrical Genome Sequencing (poster), T. Ohshiro, M. Taniguchi, T. Kawai: The 17th Sanken International

Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[7]Development of Single-Molecule Tunnel-Current Based Electrical Identification of DNA/RNA Nucleotides (oral), T. Ohshiro, M. Taniguchi, T. Kawai: Trends in Nanotechnology (TNT) Japan 2014.

[8]Single-Molecule Tunnel-Current Based Identification of DNA/RNA Nucleotides by Using Nano-Gap Electrode (poster), T. Ohshiro, M. Taniguchi, T. Kawai: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

Patents

[1] K20130221 biomolecule sequencing apparatus, method, and program, 2014-011430

[2] K20120294 sample introduction method, 2013-099363

[3] K20130208 sample method of crushing, extraction method of biomolecules, and lysate containing nanowires, 2013-268424

[4] K20130059 single molecular identification method, apparatus, and program, 2013-197443

[5] K20120307 identification method of substance, 2013-047373

[6] K20130265 chemical detection method, 2014-015110

[7] K20120352 chemical detection method, 2013-141711

[8] K20130040 biomolecule sequencing apparatus, method, and program, 2013-193498

[9] K20130055 biomolecules thermal denaturation apparatus and method of manufacturing the same, 2013-175637

[10] K20120351 biological separation and extraction device and a method for manufacturing of the molecule, as well as the separation and extraction method of biomolecules, 2013-044739

[11] K20130206 biomolecule sequencing equipment for electrode, biomolecule sequencing apparatus, method, and program, 2014-031084

[12] G20120069WO control method and apparatus of the moving speed of the material, as well as, these use, PCT / JP2013 / 051913

[13] a method for determining the nucleotide sequence of G20120080WO polynucleotides, and an apparatus for determining the nucleotide sequence of a polynucleotide, PCT / JP2013 / 059645

[14] G20120083WO one particle analyzer and analysis method, PCT / JP2013 / 056690

[15] G20130020WO way analysis of a sample, PCT / JP2013 / 071059

[16] G20130035US control of mass transfer rate of the method and the control device, 13/975610

[17] G20130051WO nucleic acid production method of the extraction device and nuclear devices, as well as nucleic acid extraction methods and nucleic acid sequence analysis method, PCT / JP2013 / 078203

[18] KP2013025 method for determining the nucleotide sequence of a polynucleotide, and an apparatus

for determining the nucleotide sequence of a polynucleotide, 2013-541893

[19] K20070368 organic field-effect transistor and method of manufacturing the same, 2008-223369

[20] G20050101TW ambipolar organic field-effect thin layer transistor and method of manufacturing the same, 95,110,388

[21] G20090020EP Organic Field Effect Transistor and its Production Method, 9252087.3000000007

[22] KP2010036 noise generator, and stochastic resonators, 2010-532890

Publications in Domestic Meetings

1st symposium on Development of molecular robots equipped with sensors and intelligence: sponsored by Grant-in-Aid for Scientific Research on Innovative Areas)	1 paper
The 60th Japan Polymer Society	1 paper
The 73rd JSAP Autumn Meeting, 2012	5 papers
62st Annual Meeting of the Japan Society for Analytical Chemistry	1 paper
The 60th JSAP Spring Meeting, 2013	2 papers
The Chemical Society of Japan, The 94rd Annual Meeting	1 paper

Grant-in-Aid for Scientific Research

T.Kawai	High-speed detection of epigenetical property of long-stranded DNA with Nanochannel electrode device	¥19,630,000
T.Kawai	Emergent chemistry of nano-scale molecular systems	¥3,900,000
M.Furuhashi	Development of Optical device for Single-Partical Detection	¥2,730,000
S.Ryusaki	Development of Single-Molecule Structual Analysis by UsingNanopore Device	¥3,380,000
K.Yokota	Development of Graphene Nanopore-device	¥1,040,000

Laboratory of Microbiology and Infectious Diseases

Original Papers

[1]Cooperation of the Multidrug Efflux Pump and Lipopolysaccharides in the Intrinsic Antibiotic Resistance of Salmonella enterica serovar Typhimurium, S. Yamasaki, S. Nagasawa, A. Fukushima, M. Hayashi-Nishino, K. Nishino: J. Antimicrob. Chemother., 68 (5) (2013) 1066-1070.

[2]The Crystal Structure of Multidrug-Resistance Regulator RamR with Multiple Drugs, S. Yamasaki, E. Nikaido, R. Nakashima, K. Sakurai, D. Fujiwara, I. Fujii, K. Nishino: Nat. Commun., 4 (2013) 2078.

[3]Structural Basis for the Inhibition of Bacterial Multidrug Exporters, R. Nakashima, K. Sakurai, S. Yamasaki, K. Hayashi, C. Nagata, K. Hoshino, Y. Onodera, K. Nishino, A. Yamaguchi: Nature, 500 (7460) (2013) 102-106.

[4]Design of a Large-Scale Femtoliter Droplet Array for Single-Cell Analysis of Drug-Tolerant and Drug-Resistant Bacteria, R. Iino, Y. Matsumoto, K. Nishino, A. Yamaguchi, H. Noji: Front. Microbiol., 4 (2013) 300.

[5]Streptococcus pneumoniae Invades Erythrocytes and Utilizes Them to Evade Human Innate Immunity, M. Yamaguchi, Y. Terao, Y. Mori-Yamaguchi, H. Domon, Y. Sakaue, T. Yagi, K. Nishino, A. Yamaguchi, V. Nizet, S. Kawabata: PLoS One, 8 (10) (2013) e77282.

International Conferences

[1]Regulation of the AcrAB Multidrug Efflux Pump in Salmonella enterica serovar Typhimurium (invited), K. Nishino: Symposium Salmonella and Salmonellosis I3S 2013.

[2]Regulation of the AcrAB Multidrug Efflux Pump in Salmonella enterica serovar Typhimurium (oral), S. Yamasaki, S. Baucheron, E. Giraud, E. Nikaido, S. Yamasaki, K. Hayashi, R. Nakashima, K. Sakurai, A.: Symposium on Antimicrobial Resistance in Animals and the Environment.

[3]Inhibitor-Bound Structures of Bacterial Major Multidrug Efflux Transporters, AcrB and MexB (poster), K. Hayashi, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: Symposium on Antimicrobial Resistance in Animals and the Environment.

[4]Peristaltic Drug Export Mechanism of the Multidrug Exporter AcrB (poster), S. Yamasaki, K. Nishino, R. Nakashima, K. Sakurai, A. Yamaguchi: Symposium on Antimicrobial Resistance in Animals and the Environment.

[5]Bile-Mediated Activation of the acrAB and tolC Efflux Genes Occurs Mainly Through Transcriptional Derepression of ramA in Salmonella typhimurium (poster), S. Baucheron, K. Nishino, S. Canepa, M.C. Maurel, F. Coste, I. Monchaux, A. Cloeckaert, E. Giraud: Symposium on Antimicrobial Resistance in Animals and the Environment.

[6]Function and Regulation of Bacterial Multidrug Efflux Pumps (oral), K. Nishino: Joint Meeting of ISIR and BioTechnology Institute at University of Minnesota.

[7]The New Rapid Method to Determine Antibiotic Susceptibility via Microscopy Using a Novel Microfluidic Device (poster), Y. Matsumoto, S. Sakakihara, R. Iino, K. Nishino: Interscience Conference on Antimicrobial Agents and Chemotherapy 2013.

[8]The Crystal Structure of Multidrug Resistance Regulator RamR with Multiple Drugs (poster), K. Nishino: Technologies for Medical Diagnostic and Therapy Symposium 2nd Committee Meeting for G3.

[9]The Crystal Structure of Multidrug Resistance Regulator RamR with Multiple Drugs (poster), S. Yamasaki, E. Nikaido, R. Nakashima, K. Sakurai, D. Fujiwara, I. Fujii, K. Nishino: The 14th RIES-Hokudai International Symposium "網"[mou].

[10]The Crystal Structure of Multidrug Resistance Regulator RamR with Multiple Drugs (poster), S. Yamasaki, E. Nikaido, R. Nakashima, K. Sakurai, D. Fujiwara, I. Fujii, K. Nishino: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[11]Structural Basis of Bacterial Major Multidrug Efflux Transporter Inhibition (poster), K. Hayashi, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[12]Structures of the Multidrug Exporter AcrB Reveal a Proximal Multisite Drug-Binding Pocket (poster), S. Yamasaki, K. Nishino, R. Nakashima, K. Sakurai, A. Yamaguchi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[13]Simple and Rapid Determination of Antibiotic Susceptibility Using Microfluidic Device and a Microscope (poster), Y. Matsumoto, S. Sakakihara, R. Iino, K. Nishino: The 28th International Congress of Chemotherapy and Infection.

Review Papers

Alternative Explanation for Indole-Induced Antibiotic Tolerance in Salmonella, J.M. Bkair, A. Cloeckaert, K. Nishino, L.J. Piddock, Proc. Natl. Acad. Sci. USA., National Academy of Sciences of the United States of America, 110[48] (2013), E4569.

Patents

[1]KP2011033 Antibacterial Agent, 2011-524865

Contributions to International Conferences and Journals

K. NISHINO	Frontiers in Micirobiology (Antimicrobials, Resistance and Chemotherapy) (Associate Editor)
K. NISHINO	African Journal of Microbiology Research (Ad-Hoc Reviewer)
K. NISHINO	Journal of Antimicrobial Chemotherapy (Ad-Hoc Reviewer)
K. NISHINO	Microbial Drug Resistance (Ad-Hoc Reviewer)
K. NISHINO	PLoS One (Ad-Hoc Reviewer)
K. NISHINO	Journal of Biochemistry (Ad-Hoc Reviewer)
K. NISHINO	University of Hong Kong, PhD Thesis, External Examinar (External Examiner)
K. NISHINO	Ghent University Research Professor, Evaluation Referee (Evaluation Referee)
K. NISHINO	Evaluation of the BMBF programme “Centres for Innovation Competence in the New Federal States: Create Excellence – Foster Talent” (Germany) (Evaluation Referee)
S. YAMASAKI	Journal of Antimicrobial Chemotherapy (Ad-Hoc Reviewer)

Publications in Domestic Meetings

Institute for Fermentation, 7th Report Meeting	1 paper
Super Science High School, Super Science Lecture	1 paper
86th Annual Meeting of Japanese Biochemical Society	2 papers
51st Annural Meeting of the Biophysical Society of Japan	2 papers
42nd Research Meeting of Society for Bacterial Drug Resistance	2 papers
61st Annual Meeting of Western Japan Branch of the Japanese Society of Chemotherapy	2 papers
Academic lecture meeting of the Institute of Scientific and Industrial Research, Osaka University	2 papers
66th Annual Meeting of Kansai Branch of the Japanese Society for Bacteriology	2 papers
35th Symposium on the interaction of biomembranes and pharmaceutical medicine	2 papers
The 36th Annual Meeting of the Molecular Biology Society of Japan	1 paper
6th Regular Press Conference, Institute of Scientific and Industrial Research	1 paper
CREST/PRESTO Joint Research Meeting	1 paper
FIRST EXPO 2014	1 paper
The 2nd Science Forum, Aichi Gakuin University, School of Pharmacy	1 paper
87th Annual Meeting of the Japanese Society for Bacteriology	5 papers
The 134th Annual Meeting of the Pharmaceutical Society of Japan	3 papers
The 8th Annual Meeting of the Japan Transporter Research Association	1 paper
60th Annual Meeting of Eastern Japan Branch of the Japanese Society of Chemotherapy	1 paper
The 25th Annual Meeting of Japanese Society for Clinical Microbiology	2 papers
New Technology Presentation Meetings	1 paper

Grant-in-Aid for Scientific Research

K. Nishino	Roles of Drug Efflux Pumps in Bacterial Multidrug Resistance・Virulence and Development of Novel Therapeutic Strategies	¥47,190,000

Entrusted Research

K. Nishino	Ministry of Education, Culture, Sports, Science and Technology	Mechanism of Bacterial Homeostasis Modulated by Transportes and Development of Novel Therapeutics	¥4,840,000
Y. Matsumoto	Japan Science and Technology Agency	Development of a Simple and Quick Method to Meaure Antimicrobial Susceptibilities Using a New Device	¥650,000
Y. Matsumoto	Fluidware Technologies Inc.	Development of a Simple and Quick Method to Meaure	¥4,100,000

	Antimicrobial Susceptibilities Using a Micro-Device	

Contribution to Research

K. Nishino	Senri Life Science Foundation, Chirman of the board of directors, Dr. Tadamitsu Kishimoto	¥2,000,000
K. Nishino	K. Nishino (Kanae Foundation for the Promotion of Medical Science)	¥800,000

Cooperative Research

K. Nishino	Shionogi & Co., Ltd.	¥840,000
K. Nishino	Daiichi-Sankyo	¥0,000
Y. Matsumoto	Keirex Technology Inc.	¥0,000
K. Nishino	Aixin Yan (University of Hong Kong)	¥150,000
K. Nishino	Chikara Furusawa (RIKEN)	¥50,000
K. Nishino	Ayano Satoh (Okayama University)	¥100,000
K. Nishino	Junichi Yamagishi (Nihon Pharmaceutical University)	¥100,000
K. Nishino	Yuji Morita (Aichi Gakuin University)	¥100,000
K. Nishino	Fine	¥5,000,000
K. Nishino	Corinna Kehrenberg (Tierärztliche Hochschule Hannover)	¥0,000
K. Nishino	Masaya Yamaguchi, Yutaka Terao, Shigetada Kawabata（Osaka Univ.）	¥0,000
K. Nishino	Axel Cloeckaert (INRA, France)	¥0,000
K. Nishino	Filip Van Immerseel (Ghent University)	¥0,000
K. Nishino	Mikio Tanabe (Martin Luther University of Halle-Wittenberg)	¥0,000

Laboratory of Atomic Scale Materials Processing

Original Papers

[1]DNA Manipulation and Separation in Sublithographic-Scale Nanowire Array, T. Yasui, S. Rahong, K. Motoyama, T. Yanagida, Q. Wu, N. Kaji, M. Kanai, K. Doi, K. Nagashima, M. Tokeshi, M. Taniguchi, S. Kawano, T. Kawai, Y. Baba: ACS Nano, 7 (2013) 3029-3035.

[2]Scaling Effect on Unipolar and Bipolar Resistive Switching of Metal Oxides, T. Yanagida, K. Nagashima, K. Oka, M. Kanai, A. Klamchuen, B. H. Park, T. Kawai: Sci. Rep., 3 (2013) 1657.

[3]Impact of Preferential Indium Nucleation on Electrical Conductivity of VLS Grown Indium-Tin-Oixde Nanowires, G. Meng, T. Yanagida, K. Nagashima, H. Yoshida, M. Kanai, A. Klamchuen, F. W. Zhuge, Y. He, S. Rahong, X. Fang, S. Takeda, T. Kawai: J. Am. Chem. Soc., 135 (2013) 7033-7038.

[4]Advanced Photoassisted Atomic Switches Produced Using ITO Nanowire Electrodes and Molten Photoconductive Organic Semiconductors, A. Klamchuen, H. Tanaka, D. Tanaka, H. Toyama, G. Meng, S. Rahong, K. Nagashima, M. Kanai, T. Yanagida, T. Kawai, T. Ogawa: Adv. Mater., 25 (2013) 5893-5897.

[5]Carrier Type Dependence on Spatial Asymmetry of Unipolar Resistive Switching of Metal Oxides, K. Nagashima, T. Yanagida, M. Kanai, U. Celano, S. Rahong, G. Meng, F. W. Zhuge, Y. He, B. H. Park, T. Kawai: Appl. Phys. Lett., 103 (2013) 173506.

International Conferences

[1]Material Design Rule for Nanoscale Memristive Switching (oral), K. Nagashima, T. Yanagida, M. Kanai, A. Klamchuen, S. Rahong, G. Meng, M. Horprathum, F. W. Zhuge, Y. He, B. H. Park, T. Kawai: The 12th International Symposium on Sputtering & Plasma Processes.

[2]Single Crystalline NiO Nanowires Grown via VLS Mechanism and Their Properties on Resistive Switching Memory (poster), K. Nagashima, T. Yanagida, M. Kanai, G. Meng, S. Rahong, F. W. Zhuge, Y. He, T. Kawai: Material Research Society Fall Meeting 2013.

[3]Impact of Preferential Indium Nucleation on Electrical Conductivity of VLS Grown Indium-Tin-Oxide Nanowires (poster), G. Meng, T. Yanagida, K. Nagashima, H. Yoshida, M. Kanai, F. W. Zhuge, Y. He, A. Klamchuen, S. Rahong, S. Takeda, T. Kawai: Material Research Society Fall Meeting 2013.

[4]Rational Concept for Designing Metal Oxide Nanowires (poster), F. W. Zhuge, K. Nagashima, A. Klamchuen, T. Yanagida, H. Yoshida, M. Kanai, S. Rahong, G. Meng, Y. He, M. Suzuki, S. Kai, S. Takeda, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[5]Impact of Preferential Indium Nucleation on Electrical Conductivity of VLS Grown Indium-Tin-Oxide Nanowires (poster), G. Meng, T. Yanagida, K. Nagashima, H. Yoshida, M. Kanai, F. W. Zhuge, Y. He, A. Klamchuen, S. Rahong, S. Takeda, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[6]Crucial Role of Material Flux on Growth Temperature for Vapor-Liquid-Solid Oxide Nanowire Growth (poster), K. Nagashima, T. Yanagida, H. Yoshida, M. Kanai, G. Meng, F. W. Zhuge, S. Rahong, Y. He, S. Takeda, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[7]Carrier Type Dependence on Spatial Asymmetry of Unipolar Resistive Switching of Metal Oxides (poster), K. Nagashima, T. Yanagida, M. Kanai, U. Celano, S. Rahong, G. Meng, F. W. Zhuge, Y. He, B. H. Park, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[8]Flux Induced Crystal Phase Variation in Vapor-Liquid-Solid Growth of Multi-Component Metal Oxide Nanowires (poster), G. Meng, T. Yanagida, K. Nagashima, H. Yoshida, M. Kanai, F. W. Zhuge, Y. He, A. Klamchuen, S. Rahong, S. Takeda, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[9]Fundamental Design Rule for Nanowire Alignment on Water Favorable Pattern (poster), Y. He, T. Yanagida, K. Nagashima, M. Kanai, G. Meng, F. W. Zhuge, S. Rahong, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[10]Enhancement of Thermoelectric Properties via Inhomogeneous Radial Dopant Profile in Boron Doped Si Nanowires (poster), F. W. Zhuge, T. Yanagida, N. Fukata, K. Uchida, M. Kanai, K. Nagashima, G. Meng, Y. He, S. Rahong, T. Kawai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

Patents

[1]K20130208 Disruption of Biomolecule using Nanowires, 2013-268424

[2]K20120351 Device for Separation and Extraction of Biomolecules: Device Structure and Fabrication Process, 2013-044739

[3]G20130051WO Device for Extracting Nucleic Acid: Device Fabrication, Extraction Technique and Analysis Method, PCT/JP2013/078203

Publications in Domestic Meetings

The Japan Society of Applied Physics		13 papers
Nature Industry Award -Introduction from Young Researchers-		1 paper

Grant-in-Aid for Scientific Research

T. Yanagida	Green Innovation by Oxide Nanowire Based Nanodevices	¥69,905,000
K. Nagashima	Synthesis of Redox Based Switching Nanodevice Using Oxide Nanowire	¥1,560,000

Entrusted Research

T. Yanagida	Core Research for Evolutional Science and Technology	Ultra Low-Power, Muti-Functional, and High-Sensitivity Sensor Platform Realized by Nano Electric Channel and Thermal Management	¥500,000

Contribution to Research

T. Yanagida	The Murata Science Foundation	¥1,500,000
T. Yanagida	Support Center for Advanced Telecommunications Technology Research, Foundation	¥500,000

Cooperative Research

T. Yanagida	Panasonic Co. Ltd.	¥3,500,000
T. Yanagida	Panasonic Co. Ltd.	¥4,252,000

Laboratory of Cellulose Nanofiber Materials

Original Papers

[1]Foldable nanopaper antennas for origami electronics, M. Nogi, N. Komoda, K. Otsuka, K. Suganuma: Nanoscale, 5 (10) (2013) 4395-4399.

[2]High Thermal Stability of Optical Transparency in Cellulose Nanofiber Paper, M. Nogi, C. Kim, T. Sugahara, T. Inui, T. Takahashi, K. Suganuma: Appl. Phys. Lett., 102 (18) (2013) 181911.

[3]Electrically Conductive Lines on Cellulose Nanopaper for Flexible Electrical Devices, M.-C. Hsieh, C. Kim, M. Nogi, K. Suganuma: Nanoscale, 5 (19) (2013) 9289-9295.

[4]Electrical Functionality of Inkjet-Printed Silver Nanoparticle Conductive Tracks on Nanostructured Paper Compared with Those on Plastic Substrates, T. T. Nge, M. Nogi, K. Suganuma: J. Mater. Chem. C, 1 (34) (2013) 5235-5243.

[5]Cu Salt Ink Formulation for Printed Electronics Using Photonic Sintering, T. Araki, T. Sugahara, J. Jiu, S. Nagao, M. Nogi, H. Koga, H. Uchida, K. Shinozaki, K. Suganuma: Langmuir, 29 (35) (2013) 11192-11197.

[6]High-Intensity Pulse Light Sintering Silver Nanowire Transparent Films on Polymer Substrates: the Effect the Thermal Properties of Substrates on the Performance of Silver Films, J. Jiu, T. Sugahara, M. Nogi, T. Araki, K. Suganuma, H. Uchida, K. Shinozaki: Nanoscale, 5 (23) (2013) 11820-11828.

[7]Low Haze Transparent Electrodes and Highly Conducting Air Dried Films with Ultra-Long Silver Nanowires Synthesized by One-Step Polyol Method, T. Araki, J. Jiu, M. Nogi, H. Koga, S. Nagao, T. Sugahara, K. Suganuma: Nano Res., 7 (2) (2014) 236-245.

[8]Transparent Nanopaper-Based Flexible Organic Thin-Film Transistor Array, Y. Fujisaki, H. Koga, Y. Nakajima, M. Nakata, H. Tsuji, T. Yamamoto, T. Kurita, M. Nogi, N. Shimidzu: Adv. Funct. Mater., 24 (12) (2014) 1657-1663.

[9]Uniformly Connected Conductive Networks on Cellulose Nanofiber Paper for Transparent Paper Electronics, H. Koga, M. Nogi, N. Komoda, T. T. Nge, T. Sugahara, K. Suganuma: NPG Asia Mater., 6

(2014) e93.

[10]Transparent, Conductive and Printable Composites Consisting of TEMPO-Oxidized Nanocellulose and Carbon Nanotube, H. Koga, T. Saito, T. Kitaoka, M. Nogi, K. Suganuma, A. Isogai: Biomacromolecules, 14 (4) (2013) 1160-1165.

[11]Direct Synthesis of Gold Nanocatalysts on TEMPO-Oxidized Pulp Paper Containing Aldehyde Groups, A. Azetsu, H. Koga, L.-Y. Yuan, T. Kitaoka: BioResources, 8 (3) (2013) 3706-3717.

[12]Electrically Conductive Bacterial Cellulose Composite Membranes Produced by the Incorporation of Graphite Nanoplatelets in Pristine Bacterial Cellulose Membranes, T. Zhou, D. Chen, J. Jiu, T. T. Nge, T. Sugahara, S. Nagao, H. Koga, M. Nogi, K. Suganuma, X. Wang, X. Liu, P. Cheng, T. Wang, D. Xiong: Express Polymer Letters, 7 (9) (2013) 756-766.

International Conferences

[1]Applications of Nanopaper in Printed Electronics (invited), M. Nogi: PE Asia 2013, Tokyo, Japan, July 10, 2013.

[2]Synthesis of Ultra-Long Silver Nanowires and Application to Transparent Electrode (poster), T. Araki, J. Jiu, M. Nogi, T. Sugahara, K. Suganuma: ICFPE 2013, Jeju, Korea, Sep 11-13, 2013.

[3]Electrical Functionality and Reliability of Silver Tracks and Thin Film on Nanostructured Paper (poster), T. T. Nge, M. Nogi, K. Suganuma: ICFPE 2013, Jeju, Korea, Sep 11-13, 2013.

[4]Photo-Sintering of Ag Nanowires for Wiring on Transparent Films (invited), K. Suganuma, J. Jiu, T. Sugahara, M. Nogi, H. Koga, T. Araki, H. Uchida, K. Shinozaki: ICFPE 2013, Jeju, Korea, Sep 11-13, 2013.

[5]Transparent Nanopaper for Origami Electronics (invited), M. Nogi, H. Koga, K. Suganuma: ICFPE 2013, Jeju, Korea, Sep 11-13, 2013.

[6]Printed Electronics on Nanopaper (invited), M. Nogi: ICBP 2013, Seoul, Korea, Sep 25-28, 2013.

[7]The Potential Application of Nanostructured Paper in Future Printed Electronics (oral), T. T. Nge, M. Nogi, K. Suganuma: The 4th International Conference on Science and Engineering, ICSE 2013, Yangon, Myanmar, Dec. 9-10, 2013.

[8]Distortion in Lattice Spacing of Silver Nanowires by Heat Treatments (poster), Y. Yoshida, J. Jiu, M. Nogi, S. Nagao, K. Suganuma: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[9]Electrically Conductive Arrays Fabricated on Cellulose Nanofiber Paper Substrates for Flexible Circuits (poster), M. Hsieh, M. Nogi, K. Suganuma: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[10]Photo-Reduced Graphene Oxide/Cellulose Paper Electrode for Flexible Supercapacitor (poster), H. Tonomura, H. Koga, Y. Nishina, M. Nogi, K. Suganuma: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[11]Ultrathin Transparent Nanopaper (poster), T. Wu, M. Nogi, I. Kanai, H. Yagyu, K. Suganuma: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials,

Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[12]Optical Transparency of Cellulose Nanopaper Derived from Various Cellulose Sources (poster), M. Hsieh, I. Kanai, M. Nogi, K. Suganuma: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[13]Nanocellulose as an Emerging Bionanometerial for Catalytic and Electronic Applications (invited), H. Koga: 6th Annual Industrial Biotechnology (IBIO-2013), Nanjing, China, April 25-27, 2013.

[14]Transparent Conductive Paper Prepared by a Papermaking Process (invited), H. Koga: 5th International Workshop on Flexible & Printable Electronics (IWFPE 2013), Jeonju, Korea, November 20-22, 2013.

Review Papers

Functionalization and Applications of Cellulose Fiber Materials, H. Koga, M. Nogi, K. Suganuma, Convertech, Converting Technical Institute, 482 (2013), 106-109.

Reinvention of Paper for Printed Electronics, M. Nogi, H. Koga, K. Suganuma, Display, Techno Times Co.,Ltd., 19[5] (2013), 20-27.

Highly Sensitive and Foldable Nanopaper Antenna, M. Nogi, N. Komoda, H. Koga, K. Suganuma, Japanese Journal of Paper Technology, Tech times, 56[6] (2013), 29-34.

Trapsparent Paper for Printed Electronics, M. Nogi, H. Koga, K. Suganuma, Fiber, THE TEXTILE MACHINERY SOCIETY OF JAPAN, 66[6] (2013), 32-36.

CelluloseNnanofibers for Printed Electronics, M. Nogi, Bioindustry, CMC Publishing Co., Ltd., 30[9] (2013), 52-61.

Flexible Conductive Lines Printed on Nanopaper, M. Nogi, Material Stage, Technical Information Institute Co., Ltd., 12 (2013), 13-15.

Origami Electronics by Using Nanopaper, M. Nogi, Engineering materials, NIKKAN KOGYO SHIMBUN,LTD., 62[1] (2014), 28-29.

Printed Electronics by Using Cellulose Nanofibers, M. Nogi, EKISHO, The Japanese Liquid Crystal Society, 18[1] (2014), 17.

Books

[1]Preparation and Applications of Strechable Condoctors Consisting of Silver Flake and Polyurethane M. Nogi, “Technologies for dispersion and interface control for the development of composite materials”, Technical Information Institute Co., Ltd., 2013.

[2]Highly Sensitive Printed Silver Nanowire Antenna M. Nogi, “Coating technologies of thin film coating and trouble on drying”, Technical Information Institute Co., Ltd., (754-760) 2013.

[3]Printed Electronics by Using Cellulose Nanofibers M. Nogi, H. Koga, K. Suganuma, “Development of Hierarchically and Dimensionally Desired Cellulose Functional Materials”, CMC Publishing Co., Ltd., 2013.

[4]Nanofibrillar Carbon from Chitin Nanofibers M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[5]Acetylation of Bacterial Cellulose Nanofibers for Property Enhancement of Optically Transparent Composites M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[6]High Optical Transparency of Nanofiber Composites against a Wide Refractive Index Range of Polymer Matrix M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[7]Optically Transparent Nanopaper M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[8]Bendable Transparent Nanofiber Composites with an Ultralow Coefficient of Thermal Expansion M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[9]Printed Antennas and Solar Cells on Nanopaper M. Nogi, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[10]Carbon Nanotube/Nanocellulose Composite for Printed and Flexible Electronics H. Koga, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[11]Crystalline Cellulose Nanofibrils Conjugated with Metal Nanocatalysts H. Koga, “Production and Applications of Cellulose Nanomaterials”, TAPPI Press, 2013.

[12]Printed Silver Nanowire Antenna M. Nogi, N. Komoda, K. Suganuma, “Technical seeds for finding of new research themes”, Technical Information Institute Co., Ltd., 2013.

[13]Silver Nanowires for Foldable Conductive Lines, Transparent Conductive Films and Antennas M. Nogi, K. Suganuma, “Leader for research and development”, Technical Information Institute Co., Ltd., 2013.

[14]Improvement of Optical Transparency of Cellulose Nanofiber Materials M. Nogi, “Preparation and applications of optical materials”, Technical Information Institute Co., Ltd., 2014.

Patents

[1]K20120401 Preparation method of insulator, passive element, substrate for circuits, insulative sheet, JP2013-145390

[2]K20130029 Production of metal nanowires, JP2013-110243

[3]K20130094 Materials and patterning techniques of metal lines, JP2013-144585

[4]G20120091WO Patterning of transparent conductive lines, PCT/JP2013/056497

[5]KP2013033 Patterning of transparent conductive lines, JP2014-503564

[6]K20090402 Strechable conductive lines and substrates using polyurethane, K20090402

Publications in Domestic Meetings

25th annual meeting of The Society of Fiber Science and Technology	1 paper
20th annual meeting of the Cellulose Society of Japan	3 papers
28th meeting of Japan Institute of Electronics Packaging	1 paper
64th meeting of the Japan Wood Research Society	1 paper
79th meeting of The Society of Chemical Engineers	1 paper

Grant-in-Aid for Scientific Research

M. Nogi	Environmentally-Friendly and Low-Temperature Printed Electronics by Using Bionanofibers	¥55,900,000

Entrusted Research

H. Koga	Japan Science and Technology Agency	Transparent, Flexible and Conductive Paper Prepared by a Papermaking Process	¥1,700,000

Contribution to Research

M. Nogi	Sekisui Chemical Grant Program for Research on Manufacturing Based on Innovations Inspired by Nature	¥1,500,000
M. Nogi	Hitachi Metals · Materials Science Foundation	¥800,000
M. Nogi	The Sumitomo Foundation Grant for Basic Science Research Projects	¥2,000,000
M. Nogi	The Iwatani Naoji Foundation	¥2,000,000
H. Koga	Shorai Foundation for Science and Technology	¥1,000,000

Cooperative Research

M. Nogi	ALBION Co. Ltd.	¥1,000,000

Beam Application Frontier Research Laboratory

Original Papers

[1]β-Lactam Selectivity of Multidrug Transporters AcrB and AcrD Resides in the Proximal Binding Pocket, N. Kobayashi, N. Tamura, H. W. van Veen, A. Yamaguchi, S. Murakami: J. Biol. Chem., Epub ahead of print .

[2]Design of a Large-Scale Femtoliter Droplet Array for Single-Cell Analysis of Drug-Tolerant and Drug Resistant Bacteria, R. Iino, Y. Matsumoto, K. Nishino, A. Yamaguchi, H. Noji,: Front. Microbiol., 4 (300) (2013) 1-6.

[3]Cooperation of the Multidrug Efflux Pump and Lipopolysaccharides in the Intrinsic Antibiotic Resistance of Salmonella enterica serovar Typhimurium, S. Yamasaki, S. Nagasawa, A. Fukushima, M. Hayashi-Nishino, K. Nishino: J. Antimicrob Chemother., 68 (5) (2013) 1066-1070.

[4]Autoimmune Disorder Phenotypes in Hvcn1-Deficient Mice, M. Sasaki, A. Tojo, Y. Okochi, N. Miyawaki, D. Kamimura, A. Yamaguchi, M. Murakami, Y. Okamura: Biochem. J., 450 (2) (2013) 295-301.

[5]Streptococcus Pneumoniae Invades Erythrocytes and Utilizes Them to Evade Human Innate Immunity, M. Yamaguchi, Y. Terao, Y. Mori-Yamaguchi, H. Domon, Y. Sakaue, T. Yagi, K. Nishino, A. Yamaguchi, V. Nizet, S. Kawabata: PLoS One, 8 (10) (2013) e77282, 1-11.

[6]Structural Basis for the Inhibition of Bacterial Multidrug Exporters, R. Nakashima, K. Sakurai, S. Yamasaki, K. Hayashi, C. Nagata, K. Hoshino, Y. Onodera, K. Nishino, A. Yamaguchi: Nature, 500 (7460) (2013) 120-6.

[7]The Crystal Structure of Multidrug-Resistance Regulator RamR with Multiple Drugs, S. Yamasaki, E. Nikaido, R. Nakashima, K. Sakurai, D. Fujiwara, I. Fujii, K. Nishino: Nat Commun., 4 (2078) (2013) 1-7.

International Conferences

[1]Structural Basis of Bacterial Major Multidrug Efflux Transporter Inhibition (poster), K. Hayashi, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[2]Structures of the Multidrug Exporter AcrB Reveal a Proximal Multisite Drug-binding Pocket (poster), S. Yamasaki, K. Nishino, R. Nakashima, K. Sakurai, A. Yamaguchi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[3]Inhibitor-Bound Structures of Bacterial Major Multidrug Efflux Transporters, AcrB and MexB (poster), K. Hayashi, R. Nakashima, K. Sakurai, S. Yamasaki, K. Nishino, A. Yamaguchi: 5th Symposium on Antimicrobial Resistance in Animals and the Environment.

[4]Peristaltic Drug Export Mechanism of the Multidrug Exporter AcrB (poster), S. Yamasaki, K. Nishino, R. Nakashima, K. Sakurai, A. Yamaguchi: 5th Symposium on Antimicrobial Resistance in Animals and the Environment.

Review Papers

Structural Basis for the Inhibition of Bacterial Multidrug Exporters, A. Yamaguchi, R. Nakashima, K. Sakurai, EXPERIMENTAL MEDICINE, YODOSHA, 31[14] (2013), 2272-2276.

Publications in Domestic Meetings

The 87th Annual Meeting of Japanese Society for Bacteriology	2 papers
The 39th Annual Meeting of Japan Bioenergetics Group	1 paper
The 35th Symposium on Biomembrane-Drug Interaction	2 papers
The 66th Annual Meeting of Japanese Society for Bacteriology, Kansai Branch	1 paper
The 69th ISIR academic mreeting	2 papers
The 51st Annual Meeting of the Biophysical Society of Japan	2 papers
The 86th Annual Meeting of the Japanese Biochemical Society	2 papers
The 8th Annual Meeting of the Japan Transporter Research Association	1 paper

Grant-in-Aid for Scientific Research

R. Nakashima	Crystallographic Study of Multidrug Efflux Proteins Coupled with Outer Membrane Cannel TolC	¥4,680,000

Entrusted Research

A. Yamaguchi	JST Strategic Basic Research Programs, CREST（H24.10.1～H27.3.31)	Studies on the Structural Basis of Multidrug Efflux Transport and the Development of Multidrug Transporter Inhibitors	¥95,935,000

Cooperative Research

A. Yamaguchi	Fine Co., Ltd	¥0,000

Other Research Fund

R. Nakashima	Japan Society for the Promotion of Science	¥2,500,000

Department of Disease Glycomics

Original Papers

[1]Accumulation of Free Neu5Ac-Containing Complex-Type N-Glycans in Human Pancreatic Cancers, M. Yabu, H. Korekane, H. Takahashi, H. Ohigashi, O. Ishikawa, Y. Miyamoto: Glycoconj J., 30 (3) (2013) 247-256.

[2]N-Glycosylation Modulates the Membrane Sub-Domain Distribution and Activity of Glucose Transporter 2 in Pancreatic Beta Cells, K. Ohtsubo, S. Takamatsu, C. Gao , H. Korekane, T. M. Kurosawa, N. Taniguchi: Biochem. Biophys. Res. Commun., 434 (2) (2013) 346-351.

[3]Loss of Branched O-Mannosyl Glycans in Astrocytes Accelerates Remyelination, K. Kanekiyo, K. Inamori, S. Kitazume, K. Sato, J. Maeda, M. Higuchi, Y. Kizuka, H. Korekane, I. Matsuo, K. Honke, N. Taniguchi: J. Neurosci., 33 (24) (2013) 10037-10047.

[4]Occurrence of Free Deaminoneuraminic Acid (KDN)-Containing Complex-Type N-Glycans in Human Prostate Cancers, M. Yabu, H. Korekane, K. Hatano, Y. Kaneda, N. Nonomura, C. Sato, K. Kitajima,Y. Miyamoto: Glycobiology, 23 (6) (2013) 634-642.

[5]Flagellin/Toll-Like Receptor 5 Response was Specifically Attenuated by Keratan Sulfate Disaccharide via Decreased EGFR Phosphorylation in Normal Human Bronchial Epithelial Cells, K. Shirato, C. Gao, F.

Ota, T. Angata, H. Shogomori, K. Ohtsubo, K. Yoshida, B. Lepenies, N. Taniguchi: Biochem. Biophys. Res. Commun., 435 (3) (2013) 460-465.

[6]Structural Characterization of Pyridylaminated Oligosaccharides Derived from Neutral Glycosphingolipids by High-Sensitivity Capillary Electrophoresis-Mass Spectrometry, E. Ito, K. Nakajima, H. Waki, K. Miseki, T. Shimada, T. A. Sato, K. Kakehi, M. Suzuki, N. Taniguchi, A. Suzuki: Anal. Chem., 85 (16) (2013) 7859-7865.

[7]Loss of Siglec-14 Reduces the Risk of Chronic Obstructive Pulmonary Disease Exacerbation, T. Angata, T. Ishii, T. Motegi, R. Oka, R. E. Taylor, P. C. Soto, Y. C. Chang, I. Secundino, C. X. Gao, K. Ohtsubo, S. Kitazume, V. Nizet, A. Varki, A. Gemma, K. Kida, N. Taniguchi: Cell Mol. Life Sci., 70 (17) (2013) 3199-3210.

[8]Mass Isotopomer Analysis of Metabolically Labeled Nucleotide Sugars and N- And o-Glycans for Tracing Nucleotide Sugar Metabolisms, K. Nakajima , E. Ito, K. Ohtsubo, K. Shirato, R. Takamiya, S. Kitazume, T. Angata, N. Taniguchi: Mol. Cell Proteomics, 12 (9) (2013) 2468-2480.

[9]Identification of Ectonucleotide Pyrophosphatase/Phosphodiesterase 3 (ENPP3) as a Regulator of N-Acetylglucosaminyltransferase GnT-IX (GnT-Vb), H. Korekane, J. Y. Park, A. Matsumoto, K. Nakajima, S. Takamatsu, K. Ohtsubo, Y. Miyamoto, S. Hanashima, K. Kanekiyo, S. Kitazume, Y. Yamaguchi, I. Matsuo, N. Taniguchi: J. Biol. Chem., 288 (39) (2013) 27912-27926.

[10]Difucosylation of Chitooligosaccharides by Eukaryote and Prokaryote α1,6-Fucosyltransferases, H. Ihara, S. Hanashima, H. Tsukamoto, Y. Yamaguchi , N. Taniguchi, Y. Ikeda: Biochim. Biophys. Acta., 1830 (10) (2013) 4482-4490.

[11]Suppression of Heregulin β Signaling by Single N-Glycan Deletion Mutant of Soluble ErbB3 Protein, M. Takahashi, Y. Hasegawa, Y. Ikeda, Y. Wada, M. Tajiri, S. Ariki, R. Takamiya, C. Nishitani, M. Araki, Y. Yamaguchi, N. Taniguchi, Y. Kuroki: J. Biol. Chem., 288 (46) (2013) 32910-32921.

[12]Metabolically Programmed Quality Control System for Dolichol-Linked Oligosaccharides, Y. Harada, K. Nakajima, Y. Masahara-Negishi, H. H. Freeze, T. Angata, N. Taniguchi, T. Suzuki: Proc. Natl. Acad. Sci. USA, 110 (48) (2013) 19366-19371.

[13]A Single Dose of LPS into Mice with Emphysema Mimics Human COPD Exacerbation as Assessed by Micro-CT, S. Kobayashi, R. Fujinawa, F. Ota, S. Kobayashi, T. Angata, M. Ueno, T. Maeno, S. Kitazume, K. Yoshida, T. Ishii, C. Gao, K. Ohtsubo, Y. Yamaguchi, T. Betsuyaku, K. Kida, N. Taniguchi: Am. J. Respir. Cell Mol. Biol., 49 (6) (2013) 971-977.

[14]A Circadian Clock Gene, Rev-erbα, Modulates the Inflammatory Function of Macrophages through the Negative Regulation of Ccl2 Expression, S. Sato, T. Sakurai, J. Ogasawara, M. Takahashi, T. Izawa, K. Imaizumi, N. Taniguchi, H. Ohno, T. Kizaki: J Immunol., 192 (1) (2014) 407-417.

[15]The Chondroitin Sulfate Proteoglycan Tenascin-R Regulates Glutamate Uptake by Adult Brain Astrocytes, H. Okuda, K. Tatsumi, S. Morita, Y. Shibukawa, H. Korekane, N. Horii-Hayashi, Y. Wada, N. Taniguchi, A. Wanaka: J. Biol. Chem., 289 (5) (2014) 2620-2631.

[16]Transglutaminase 2 Accelerates Neuroinflammation in Amyotrophic Lateral Sclerosis through Interaction with Misfolded Superoxide Dismutase 1, M. Oono, A. Okado-Matsumoto, A. Shodai, A. Ido, Y. Ohta, K. Abe, T. Ayaki, H. Ito, R. Takahashi, N. Taniguchi, M. Urushitani: J. Neurochem., 128 (3) (2014) 403-418.

[17]A Cascading Reaction Sequence Involving Ligand-Directed Azaelectrocyclization and Autooxidation-Induced Fluorescence Recovery Enables Visualization of Target Proteins on the Surfaces

of Live Cells, K. Tanaka, M. Kitadani, A. Tsutsui, A. R. Pradipta, R. Imamaki, S. Kitazume, N. Taniguchi, K. Fukase: Org. Biomol. Chem., 12 (9) (2014) 1412-1418.

[18]The Absence of Core Fucose Upregulates GnT-III and Wnt Target Genes: a Possible Mechanism for an Adaptive Response in Terms of Glycan Ffunction, A. Kurimoto, S. Kitazume, Y. Kizuka, K. Nakajima, R. Oka, R. Fujinawa, H. Korekane, Y. Yamaguchi, Y. Wada, N. Taniguchi: J. Biol. Chem., in press (2014) .

[19]Epigenetic Regulation of a Brain-Specific Glycosyltransferase N-Acetylglucosaminyltransferase-IX (GnT-IX) by Specific Chromatin Modifiers, Y. Kizuka, S. Kitazume, K. Okahara, A. Villagra, EM. Sotomayor, N. Taniguchi: J. Biol. Chem., in press (2014) .

[20]Precise Structural Analysis of O-Linked Oligosaccharides in Human Serum, M. Yabu, H. Korekane, Y. Miyamoto: Glycobiology, in press (2014) .

International Conferences

[1]Glycosyltransferases Involved in N-Glycan Branching: from Bioloogical Functions to Disease Implication (invited), N.Taniguchi: COS-Lecture.

[2]Glycosyltransferases Involved in N-Glycan Branching: from Biological Functions to Disease Implication (invited), N.Taniguchi: Workshop on Cancer Research biological and molecular basis.

[3]The Complex Interplay of “Yin and Yang” in Branched N-Glycans: from Bisecting GlcNAc to Core Fucose (plenary), N.Taniguchi: GLYCO22.

[4]Lowered Level of Core Fucosylation is a Possible Non-Invasive Predictive Marker for Chronic Obstructive Pulmonary Disease (COPD) (oral), C.Gao: GLYCO22.

[5]Global Network on Systems Glycobiology (oral), N.Taniguchi: The 3rd Austria/Japan Seminar Comparative and Developmental Glycobiology.

[6]A Study on the Role of Hyaluronan Oligosaccharide in Cancer and Aging (poster), J.Iijima: The 3rd Austria/Japan Seminar Comparative and Developmental Glycobiology.

[7]Identification of Ectonucleotide Pyrophosphatase/Phosphodiesterase 3 (ENPP3) as a New Modifier of Glycan Biosynthesis (poster), H.Korekane: HUPO 12th World Congress.

[8]Flagellin/Toll-Like Receptor 5 Response was Specifically Attenuated by Keratan Sulfate Disaccharide via Decreased EGFR Phosphorylation in Normal Human Bronchial Epithelial Cells (poster), C.Gao: Joint Meeting of the Society for Glycobiology and American Society for Matrix Biology.

[9]Systems Glycobiology for Understating the Disease Onset, Biomarker and Therapeutics (plenary), N.Taniguchi: 17th KAST International Symposium.

[10]The Establishment of the Joint Research Center for Systems Chemical Biology (poster), N.Taniguchi: 4th Meeting for Max Planck Centers, München.

[11]Systems Glycobiology Approach for Understating the Disease Onset, Biomarker and Therapeutics (poster), N.Taniguchi: IUBMB 10th International Symposium on Cell Surface Macromolecules.

[12]Glycomics or Glycoproteomics as Essential Tools for Cancer Biomarker Discovery (poster), N.Taniguchi: US-Japan Joint Meeting on Biomarkers for Early Cancer Detection.

Books

[1]Soluble Amyloid Precursor Protein 770 is a Novel Biomarker Candidate for Acute Coronary Syndrome S.Kitazume, A.Yoshihisa, T.Yamaki, M.Oikawa, Y.Tachida, K.Ogawa, R.Imamaki, Y.Takeishi, N.Yamamoto, N.Taniguchi., “Proteomics Clin Appl.”, WILEY, 7[9-10] (595-719) 2013.

[2]N-Acetylglucosaminyltransferase (GnT) Assays Using Fluorescent Oligosaccharide Acceptor Substrates: GnT-III, IV, V, and IX (GnT-Vb)(Inka Brockhausen) S.Takamatsu, H.Korekane, K.Ohtsubo, S.Oguri, JY.Park, A.Matsumoto, N.Taniguchi., “Methods Mol Biol.”, Springer, 1022 (283-298) 2013.

Contributions to International Conferences and Journals

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 (9/30/13 まで) (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 (Editorial Academy)
N. TANIGUCHI	Glycoconjugate Journal (Mini Review Editor)
N. TANIGUCHI	Proteomics/ Proteomics-Clinical Applications (Senior Editor)
N. TANIGUCHI	GlycoT (Scientific Advisory Board)
N. TANIGUCHI	Cellular and Molecular Lide Sciences (Editorial Board)
N. TANIGUCHI	Journal of Proteome Research (Editorial Advisory Board)
N. TANIGUCHI	Clinical Proteomics (Editorial Board)
N. TANIGUCHI	Antioxidants and Redox Signaling (Editorial Board)
N. TANIGUCHI	Society for Glycobiology (President-elect)
N. TANIGUCHI	2013 Annual meeting of the Society for Glycobiology (Award Committee Chair)
N. TANIGUCHI	HUPO 12th Annual World Congress (Chair)

Publications in Domestic Meetings

The 101th Annual Meeting of the Japanese Urological Association	1 paper
The 13th Keiji Heart Seminar	1 paper
The 86th Annual Meeting of the Japanese Biochemical Society	2 papers
The 32nd Annual Meeting of the Japanese Society of Carbonydrate Research	1 paper

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]Manipulation of Metal-Insulator Transition Characteristics in Aspect Ratio-Controlled VO2 Micro-Scale Thin Films on TiO2 (001) Substrates, H. Ueda, T. Kanki and H. Tanaka: Appl. Phys. Lett., 102 (2013) 153106-1-3.

[2]Nonvolatile Transport States in Ferrite Thin Films Induced by a Field Effect Involving Redox Processes, K. Fujiwara, T. Ichimura, H. Tanaka: Advanced Materials Interfaces, published online DOI: 10.1002/admi.201300108.

[3]Unstrained Epitaxial Zn-Substituted Fe3O4 Films for Ferromagnetic Field-Effect Transistors, T. Ichimura, K. Fujiwara, T. Kushizaki, T. Kanki, H. Tanaka: Jpn. J. Appl. Phys., 52 (2013) 015001-1-3.

[4]Colossal Magnetoresistive (La,Pr,Ca)MnO3 Nanobox Array Structures Constructed by the Three-Dimensional Nanotemplate Pulsed Laser Deposition Technique, T. V. A. Nguyen, A. N. Hattori, Y.

Fujiwara, S. Ueda, H. Tanaka: Appl. Phys. Lett., 103 (2013) 223105-1-4.

[5]Multistep Metal Insulator Transition in VO2 Nanowires on Al2O3 (0001) Substrates, H. Takami, T. Kanki, H. Tanaka: Appl. Phys. Lett., 104 (2014) 023104-1-4.

[6]Fabrication of Three-Dimensional Epitaxial (Fe,Zn)3O4 Nanowall Wire Structures and Their Transport Properties, A. N. Hattori, Y. Fujiwara, K. Fujiwara, Y. Murakami, D. Shindo, H. Tanaka: Appl. Phys. Exp., 7 (2014) 045201-1-4.

[7]Metal-Insulator Transition Driven by Low Power Joule Heating in Free-Standing VO2/TiO2 Microstructures, S. Yamasaki, T. Kanki, N. Mancla, L. Pellegrino, D. Marre, H. Tanaka: Appl. Phys. Exp., 7 (2014) 023201-1-4.

[8]Electrical Switching to Probe Complex Phases in a Frustrated Manganite, S. Asthana, K. Fujiwara, H. Tanaka: Solid State Commun., 187 (2014) 64-67.

[9]MoS2 Nanocube Structures as Catalysts for Electrochemical H2 Evolution from Acidic Aqueous Solutions, A. W. Maijenburg, M. Regis, A. N. Hattori, H. Tanaka, K.-S. Choi, J. E. ten Elshof: ACS Appl. Mater. Interfaces, 6 (2014) 2003-2010.

[10]Revealing Magnetic Domain Structure in Functional Fe2.5Zn0.5O4 Wires by Transmission Electron Microscopy, Y. Murakami, A. Ohta, A. N. Hattori, T. Kanki, S. Aizawa, T. Tanigaki, H. S. Park, H. Tanaka, D. Shindo: Acta. Mater., 64 (2014) 144-153.

[11]Ni and p-Cu2O Nanocubes with a Small Size Distribution by Templated Electrodeposition, and Their Characterization by Photocurrent Measurement, A. W. Maijenburg, A. N. Hattori, M. De Respinis, C. M. McShane, K.-S. Choi, B. Dam, H. Tanaka, J. E. ten Elshof: ACS Appl. Mater. Interfaces, 5 (2013) 10938-10945.

[12]Programmable Mechanical Resonances in MEMS by Localized Joule Heating of Phase Change Materials, N. Manca, L. Pellegrino, T. Kanki, S. Yamasaki, H. Tanaka, A. S. Siri, D. Marre: Advanced Materials, 25 (2013) 6430-6435.

[13]Nonvolatile Transport States in Ferrite Thin Films Induced by a Field Effect Involving Redox Processes, K. Fujiwara, T. Ichimura, H. Tanaka: Adv. Mater. Int., published online (2014) DOI: 10.1002/admi.201300108.

[14]5d Iridium Oxide as a Material for Spin-Current Detection, K. Fujiwara, Y. Fukuma, J. Matsuno, H. Idzuchi, Y. Niimi, Y. Otani, H. Takagi: Nat. Commun., 4 (2013) 2893-1-6.

[15]Observation of Rebirth of Metallic Paths during Resistance Switching of Metal Nanowire, K. Horiba, K. Fujiwara, N. Nagamura, S. Toyoda, H. Kumigashira, M. Oshima: Appl. Phys. Lett., 103 (2013) 193114-1-3.

[16]Enhancement of Photoluminescence Efficiency from GaN(0001) by Surface Treatments, A. N. Hattori, K. Hattori, Y. Moriwaki, A. Yamamoto, S. Sadakuni, J. Murata, K. Arima, Y. Sano, K. Yamauchi, H. Daimon, K. Endo: Jpn. J. Appl. Phys., 53 (2014) 021001-1-5.

[17]Coherent Metallic Screening in Core-Level Photoelectron Spectra for Strongly Correlated Oxides of La1-xBaxMnO3 and V1-xWxO2, S. Ueda, H. Takami, T. Kanki, H. Tanaka: Phys. Rev. B, 89 (2014) 035141-1-8.

International Conferences

[1]3D Nanostructures for correlated oxide electronics (invited), H. Tanaka, T. Kanki, A. Hattori, K.

Fujiwara: The 74th Autumn Meeting, 2013/2013 JSAP-MRS Joint Symposia.

[2]Correlated Nano-Oxides for Electronic Phase Change Electronics (invited), H. Tanaka: 224th ECS Meeting incuding electrochemical energy summit 2013 / featuring the Energy-Water Nexus Symposium.

[3]Nano-Confinement Steep Metal-Insulator Transition Driven by Temperature and Magnetic Field in Extremely Small (La,Pr,Ca)MnO3 Epitaxial Nanowall Prepared by 3D Nano-Template PLD (oral), H. Tanaka: 2013 Materials Research Society Fall Meeting& Exhibit.

[4]Colossal Magnetoresistive (La,Pr,Ca)MnO3 Nanobox Array Structures Constructed by 3D Nanotemplate PLD Technique (oral), H. Tanaka: 2013 Materials Research Society Fall Meeting& Exhibit.

[5]Artificial Construction of Correlated Oxide Nanostructures for Electronic Phase Change Electronics (invited), H. Tanaka: International Conference on Nano Science and Technology (ICONSAT-2014).

[6]Manupilation of Metal-Insulator Transition Characteristics Through Control of Size and Aspect Ratio of VO2 Thin Films (oral), T. Kanki, H. Tanaka: 2013 JSAP-MRS Joint Symposia.

[7]Design of Metal-Insulator Transition Characteristics in Size- and Aspect Ratio-Controlled Oxide Thin Films (invited), T. Kanki, H. Tanaka: 2013 EMN(Energy Materials Nanotechnology) meeting.

[8]Design of Electronic Transport Property through Electronic Phase Manipulation in Correlated Electron Materials (invited), T. Kanki, H. Tanaka: 3rd International Conference on Nanotek & Expo.

[9]Electric-Field Control of Transport Properties in VO2 Nanowires with Side Gates via Air Gap (oral), T. Kanki, T. Sasaki, H. Tanaka: 2013 Materials Research Society Fall Meeting& Exhibit.

[10]A New Strategy to Realize the Three-Dimensional Functional Metal Oxide Nanostructured Electronics (oral), A. N. Hattori, H. Tanaka: 224th ECS Meeting incuding electrochemical energy summit 2013 / featuring the Energy-Water Nexus Symposium.

[11]ZnO Luminescent Nanobox by 3D-Nanotemplate PLD (invited), A. N. Hattori: SPIE Phononics West(Oxide-based Materials and Devices International Conference (Conference OE108)).

[12]Control of Magnetotransport Properties of Zinc Ferrite Thin Films via Reversible Electrochemical Reactions (oral), K. Fujiwara, T. Ichimura, T. Hori, H. Tanaka: 2013 Materials Research Society Fall Meeting& Exhibit.

[13]Current Switching Effect in the Insulating Charge-Ordered States of Layered Ferrite Thin Films (poster), K. Fujiwara, T. Hori, H. Tanaka: 2013 Materials Research Society Fall Meeting& Exhibit.

[14]In-Plane Oblique Pulsed-Laser Deposition for Growth of Metal Oxide Nanostructures with Laterally Modulated Profiles (oral), K. Fujiwara, T. Kushizaki, Y. Fujiwara, K. Okada, A. N. Hattori, H. Tanaka: 26th International Microprocesses and Nanotechnology Conference.

[15]Electric-Field-Induced Phase Transition in Charge-Ordered LuFe2O4 Thin Films (invited), K. Fujiwara, T. Hori, H. Tanaka: 21th International Conference on Composites/Nano Engineering.

[16]Modulation of Conductive Property in VO2 Nano-Wires through an Air Gap-Mediated Electric Field (poster), T.Sasaki, H. Ueda, T. Kanki, H. Tanaka: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[17]Metal-Insulator Transition Driven by Low Power Joule Heating in Free-Standing VO2/TiO2 Microstructures (poster), S. Yamasaki, T. Kanki, N. Mancola, L. Pellegrino, D. Marre, H. Tanaka: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[18]Investigation of Effective Carrier Characteristics in Strongly Correlated (La,Pr,Ca)MnO3 Films by the THz Time Domain Spectroscopy (poster), T. V. A. Nguyen, A. N. Hattori, M. Nagai, T. Nakamura, K. Fujiwara, M. Ashida, H. Tanaka: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[19]Redox-Control of Conductive Property in VO2 Nano-Wires by an Electric Field via an Air Nano-Gap (poster), T. Sasaki, T. Kanki, H. Tanaka: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[20]Low Power-Driven Metal-Insulator Transition in Free-Standing VO2 Microstructures and Its Mechanism Elucidation (poster), S. Yamasaki, T. Kanki, N. Mancola, L. Pellegrino, D. Marre, H. Tanaka: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[21]Conductive Properties through the Metal Insulator ITansition in the Strongly Correlated (La,Pr,Ca)MnO3 Film Investigated by the THz Time Domain Spectroscopy (poster), T. V. A. Nguyen, A. N. Hattori, M. Nagai, T. Nakamura, K. Fujiwara, M. Ashida, H. Tanaka: International Symposium on Terahertz Nanoscience（TeraNano4）.

Review Papers
3D Ultra-Small Functional Oxide Nanoelectronics Devices Constructed Artificially Directed Nanostructures, H. Tanaka, A. N. Hattori, K. Okada, Function & Materials, CMC, 34 (2014), 25-33.

Books
[1]PLD, Lithography(F. Matsui) A. N. Hattori, “Modern Surface Science Series6”, Kyoritsu, 1 (162-163) 2013.

Patents
[1]KP2010036 Noize Gnenarater、Stochastic Resonanc device

[2]K02001/EP Tunneling　Magnetoresistance Device, Semiconductor Junction Device, Magnetic Memory, and Semiconductor Light-Emitting Device, EP1489664B1

Contributions to International Conferences and Journals
H. TANAKA　CIMTEC 2014(13th International Ceramics Congress) (Organaizing Committtee)

Publications in Domestic Meetings

SEMI FORUM JAPAN 2013	1 paper
Polymer Hybrid Materials Research Center 2013 PHyM Symposium	1 paper
Staturady Science Forram	1 paper
ISIR-RIEC Inter-Reseach Institure （Type S）workshop	1 paper
Nano-Macro Materials, Devices and System Research Alliance「Nextgenaration Electrnocs（G 1）section meeting（Yamagata UniversityJoint Symposium）	2 papers
The 74th Autumn Meeting,　2013	8 papers
The 42nd　Thin Film/Surface Science Seminor（2013）	1 paper
VJSE-2013	1 paper
JPS 2013 fall meeting	2 papers
JSAP Kansai Chapter	1 paper
10th Thin Film Materials and Devices Meeting	1 paper

The joint Annual Symposium of the Vacuum Society of Japan and the Surface Science Society of Japan	2 papers
1st Nano-Macro Alliance Young Reseachers Workshop	1 paper
23rd Annual Meeting of MRS-Japan 2013	1 paper
Opt Osaka 2014 in Tokyo Photosceince in Osaka 100-	1 paper
The 61th JSAP Spring Meeting, 2013	5 papers
2014 Annual (69th) Meeting	1 paper

Academic Degrees

Master Degree for Engineering K. Kawatani	Discovery of Micro-Scaled Electronic Domains in VO2 Thin Films and Clarification of the Relationship between the Domain Behavior and electronic property
Master Degree for Engineering T. Ichimura	Electric Field Control of Magnetic Ferrite Thin Film Device

Grant-in-Aid for Scientific Research

H. Tanaka	Novel Nano-Electronics based on Strongly Correlated Oxides	¥15,600,000
T. Kanki	Total Control of Phase Transition, Dinamics and Spatial Position of Nano-Scaled Domains with Strongly Correlated Electronic Phase	¥8,320,000
A. N. Hattori	Construction of 3d Transition Metal Oxide Nanostructures and Investigation Their Novel Properties	¥2,470,000
K. Fujiwara	Electronic Phase Control of the Room-Temperature Charge-Ordered State of Layered Ferrite	¥3,120,000

Entrusted Research

H. Tanaka	NEDO	Development of Spintronics Devices Using High Temperature Sustainable Fe Oxide Ferromagnetic Semiconductor	¥2,990,000

Contribution to Research

A. N. Hattori	Kansai Research Foundation for technology promotion	¥130,000
K. Fujiwara	The Murata Science Foundation	¥1,200,000
K. Fujiwara	Marubun Research Promotion Foundation	¥200,000

Cooperative Research

H. Tanaka	NIMS	¥0,000

Other Research Fund

H. Tanaka	JSPS	¥1,000,000
H. Tanaka	Ministry of Education, Culture, Sports, Science and Technology	¥283,056,000
H. Tanaka	Institute for Molecular Science	¥35,000,000

Department of Advanced Nanofabrication

Original Papers

[1]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., 84 (2013) 30-34.

[2]Radially Polarized Terahertz Waves from a Photoconductive Antenna with Microstructures, K. Kan, J. Yang, A. Ogata, S. Sakakihara, T. Kondoh, K. Norizawa, Y. Yoshida, H. Kitahara, K. Takano, M. Hangyo: Appl. Phys. Lett., 102 (2013) 221118.

[3]Determination of Transient Atomic Structure of Laser-Excited Materials from Time-Resolved Diffraction Data, Y. Giret, N. Naruse, S. L. Daraszewicz, Y. Murooka, **J. Yang**, D. M. Duffy, A. L. Shluger, K. Tanimura: Appl. Phys. Lett., 103 (2013) 253107.

[4]Structural Dynamics of Laser-Irradiated Gold Nanofilms, S. L. Daraszewicz, Y. Giret, N. Naruse, Y.

Murooka, J. Yang, D. M. Duffy, A. L. Shluger, K. Tanimura: Phys. Rev. B, 88 (2013) 184101.

[5]Twin-Peaks Absorption Spectra of Excess Electron in Ionic Liquids, R. M. Musat, T. Kondoh, Y. Yoshida, K. Takahashi: Radiat. Phys. Chem., 100 (2014) 32-37.

International Conferences

[1]Attosecond and Femtosecond Radiation-induced Phenomena (invited), Y. Yoshida: 3rd Asian Congress of Radiation Research (ACRR2013).

[2]RF gun based MeV transmission electron microscopy (invited), J. Yang: Workshop on femtosecond electron imaging and spectroscopy.

[3]Photocathode RF gun based transmission electron microscopy (invited), J. Yang: 5th Aisan forum for accelerators and detectors (AFAD2014).

[4]Femtosecond Pulse Radiolysis of Primary Process of Radiation Chemistry (invited), K. Norizawa, K. Kan, M. Gohdo, T. Kondoh, J. Yang, Y. Yoshida: DAE-BRNS 12th Biennial Trombay Symposium on Radiation & Photochemistry (TSRP-2014).

[5]Kansai Nanoscience and Nanotechnology Network (invited), Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[6]Application of Double-Decker Pulse Radiolysis (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, K. Norizawa, H. Kobayashi, Y. Yoshida: The 14th RIES-Hokudai International Symposium.

[7]Pulse Radiolysis Using Terahertz Probe Pulses (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, K. Norizawa, H. Kobayashi, Y. Yoshida: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[8]Development of Femtosecond Time-Resolved Electron Microscopy (poster), J. Yang, K. Kan, N. Naruse, T. Kondoh, M. Gohdo, Y. Yoshida, K. Tanimura: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[9]Generation of Ultrashort Electron Beam (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, K. Norizawa, H. Kobayashi, Y. Yoshida: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[10]Study of the Primary Process of Polystyrene Radiolysis by Means of Femto-Second and Nano-Second Pulse Radiolysis Technique (poster), M. Gohdo, T. Kondoh, K. Kan, J. Yang, A. Oshima, H. Shibata, S. Tagawa, Y. Yoshida: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[11]Observation of Dodecane Alkyl-Radical by the UV Femtosecond Pulse Radiolysis (poster), T. Kondoh, M. Gohdo, K. Kan, J. Yang, K. Norizawa, Y. Muroya, H. Kobayashi, A. Ogata, S. Tagawa, Y. Yoshida: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[12]Reactivity of Excess Electrons during Solvation Process in Alcohols Studied by Femtosecond Pulse Radiolysis (poster), K. Norizawa, T. Kondoh, M. Gohdo, K. Kan, J. Yang, A. Ogata, Y. Yoshida: The 17th

Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[13]Generation of Ultrashort Electron Beam for Attosecond Pulse Radiolysis (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, K. Norizawa, H. Kobayashi, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[14]Terahertz Pulse Radiolysis Based on Double-Decker Electron Beams (poster), K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, K. Norizawa, H. Kobayashi, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[15]Femtosecond Pulse Radiolysis Study of Poly-α-Methyl Styrene as a Model Compound of Polymer-Resist (poster), M. Gohdo, T. Kondoh, S. Tagawa, J. Yang, K. Norizawa, K. Kan, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[16]Study of the Primary Process of Polystyrene Radiolysis by Means of Femto-Second and Nano-Second Pulse Radiolysis Technique (poster), M. Gohdo, T. Kondoh, K. Kan, J. Yang, A. Oshima, H. Shibata, S. Tagawa, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[17]The Pulse Radiolysis Study of Radical Ions of Naphthalene Bis Imide Derivatives as an Optical Functional Material (poster), T. Kondoh, M. Gohdo, J. Yang, K. Kan, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[18]Reactivity of the Precursors of the Solvated Electrons in Neat Ethanol Studied by Femtosecond Pulse Radiolysis (poster), K. Norizawa, T. Kondoh, M. Gohdo, K. Kan, J. Yang, A. Ogata, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[19]Accelerator-based Femtosecond Transmission Electron Microscopy (poster), J. Yang, K. Kan, N. Naruse, T. Kondoh, M. Gohdo, Y. Yoshida, K. Tanimura: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[20]Measurement of Electron Beam Property of Femtosecond Time-Resolved MeV Electron Microscopy (poster), J. Yang, Y. Yoshida: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

[21]Femtosecond Time-Resolved Electron Microscopy Using a Radio-Frequency Relativistic-Energy Electron Gun (oral), J. Yang, K. Kan, N. Naruse, T. Kondoh, M. Godoh, Y. Yoshida, K. Tanimura: Electronmicroscopy and Multiscalemodeling (EMMM) 2013.

[22]Experimental Observation of Formation and Geminate Recombination of Hydrated Electron in Water Radiolysis (poster), J. Yang, T. Kondoh, K. norizawa, Y. Yoshida: 3rd Asian Congress of Radiation Research (ACRR2013).

Contributions to International Conferences and Journals

Y. Yoshida The 5th Asia Pacific Symposium on Radiation Chemistry (APSRC2014)

	(Organaizing Committtee)
Y. Yoshida	The 15th International Congress of Radiation Research (ICRR 2015) (Scientific Committee)

Publications in Domestic Meetings

Meeting of Particle Accelerator Society of Japan	6 papers
Meeting of Atomic Energy Society of Japan	13 papers
Meeting of Japanese Society of Radiation Chemistry	7 papers
Symposium of application using quantum beam in Takasaki	1 paper
Workshop of high blightness/rf electron gun	3 papers
Nano tech	1 paper
Meeting of Chemical Society of Japan	2 papers
Meeting of NIFS collabolation	1 paper
Japanese Society of Microscopy	1 paper
Meeting of beam physics	1 paper
Annual Meeting of the Physical Society of Japan	1 paper

Academic Degrees

Bachelar of Engineering S. Nishii	Study of the Formation Process of Dodecane Alkyl Radical by the Femtosecond Pulse Radiolysis
Bachelar of Engineering S. Yamaso	Femtosecond Pulse Radiolysis Study on Formation Process of Hydrated Electron in Water

Grant-in-Aid for Scientific Research

Y. Yoshida	Study of Attosecond and Femtosecond Pulse Radiolysis	¥28,080,000
T. Kondoh	Radiation-Induced Ultra-Fast Electron Transfer in Condensed Matter	¥1,820,000
K. Kan	Pulse Radiolysis in Terahertz Range	¥2,210,000

Entrusted Research

Y. Yoshida	MEXT	Osaka University Nano Science Technology Alliance	¥1,500,000

Cooperative Research

Y. Yoshida	Daikin Industries, Ltd.	¥2,500,000
Y. Yoshida	JAEA	¥0,000
Y. Yoshida	JAEA	¥0,000
Y. Yoshida	JAEA	¥0,000
J. Yang	AIST	¥0,000
Y. Yoshida	Hiroshima International University	¥0,000
Y. Yoshida	Kanazawa University	¥0,000
Y. Yoshida	Kyushu University	¥0,000

Department of Nanocharacterization for Nanostructures and Functions

Original Papers

[1]Impact of Preferential Indium Nucleation on Electrical Conductivity of Vapor-Liquid-Solid Grown Indium-Tin Oxide Nanowires, G. Meng, T. Yanagida, K. Nagashima, H. Yoshida, M. Kanai, A. Klamchuen, F. Zhuge, Y. He, S. Rahong, X. Fang, S. Takeda, T. Kawai: J. Am. Chem. Soc., 135 (2013) 7033-7038.

[2]WGS Catalysis and In Situ Studies of CoO_{1-x}, $PtCo_n/Co_3O_4$, and $Pt_mCo_{m'}/CoO_{1-x}$ Nanorod Catalysts, S. Zhang, J. Shan, Y. Zhu, A. I. Frenkel, A. Patlolla, W. Huang, S. J. Yoon, L. Wang, H. Yoshida, S. Takeda, F. F. Tao: J. Am. Chem. Soc., 135 (2013) 8283-8293.

[3]Stepwise Displacement of Catalytically Active Gold Nanoparticles on Cerium Oxide, Y. Kuwauchi, S. Takeda, H. Yoshida, K. Sun, M. Haruta, H. Kohno: Nano Lett., 13 (2013) 3073-3077.

[4]Restructuring Transition Metal Oxide Nanorods for 100% Selectivity in Reduction of Nitric Oxide

with Carbon Monoxide, S. Zhang, J. Shan, Y. Zhu, L. Nguyen, W. Huang, H. Yoshida, S. Takeda, F. F. Tao: Nano Lett., 13 (2013) 3310-3314.

[5]Direct O_2 Activation on Gold/Metal Oxide Catalysts through a Unique Double Linear O-Au-O Structure, K. Sun, M. Kohyama, S. Tanaka, S. Takeda: ChemCatChem, 5 (2013) 2217-2222.

[6]Three-dimensional Evaluation of Gettering Ability of Σ3{111} Grain Boundaries in Silicon by Atom Probe Tomography Combined with Transmission Electron Microscopy, Y. Ohno, K. Inoue, Y. Tokumoto, K. Kutsukake, I. Yonenaga, N. Ebisawa, H. Takamizawa, Y. Shimizu, K. Inoue, Y. Nagai, H. Yoshida, S. Takeda: Appl. Phys. Lett., 103 (2013) 102102-1--102102-4.

[7]A Study on the Mechanism for H_2 Dissociation on Au/TiO2 Catalysts, K. Sun, M. Kohyama, S. Tanaka, S. Takeda: J. Phys. Chem. C, 118 (2014) 1611-1617.

International Conferences

[1]Environmental TEM for Quantitative in-situ Microscopy at the Atomic Scale (invited), S. Takeda, H. Yoshida: Frontiers of in situ Transmission Electron Microscopy Workshop.

[2]Atomistic Structures of Gold Nanoparticulate Catalysts in Reaction Environments (oral), S. Takeda, Y. Kuwauchi, H. Yoshida, K. Sun, S. Tanaka, M. Kohyama, M. Haruta, T. Akita, T. Uchiyama: 23rd North American Catalysis Society Meeting（NAM23).

[3]Quantitative High-Resolution ETEM of Nanoparticulate Catalysts in Gases (invited), S. Takeda: Microscopy and Microanalysis 2013, Pre-Meeting Congress: Opportunities, Challenges and Outlook for In-situ Experiments in Liquids and Gases using Electron-Optical Instruments.

[4]In-situ Observation of the Changes in Shape and Surface Structure of Pt Nanoparticulate Catalysts in Reactant Gases by Aberration-corrected Environmental Transmission Electron Microscopy (oral), H. Yoshida, H. Omote, M. Haruta, S. Takeda: Microscopy and Microanalysis 2013.

[5]Singly Anchored Pt and Pd Atoms on Co3O4 and Their Catalytic Performance (poster), S. Zhang, F. Tao, A. I. Frenkel, S. Takeda: Microscopy and Microanalysis 2013.

[6]Restructuring Early Transition Metal Oxide for New Catalysis (poster), F. F. Tao, S. Zhang, H. Yoshida, S. Takeda: Microscopy and Microanalysis 2013.

[7]In-situ Atomic Resolution Environmental TEM as Quantitative Microscopy in Materials Science (invited), S. Takeda: The 8th Pacific Rim International Congress on Advanced Materials and Processing (PRICM-8).

[8]Quantitative High Resolution Environmental Transmission Electron Microscopy for Catalyst Chemistry (invited), S. Takeda, H. Yoshida, Y. Kuwauchi, T. Uchiyama: Fifteenth Annual Conference YUCOMAT 2013.

[9]Atomic-Resolution Environmental Transmission Electron Microscopy for Quantitative in-situ Microscopy in Catalyst Chemistry (plenary), S. Takeda: 22nd International Congress on X-ray Optics and Microanalysis (ICXOM22).

[10]Environmental TEM for Quantitative in-situ Microscopy in Catalyst Chemistry at the Atomic Scale (invited), S. Takeda, H. Yoshida: 246th ACS National Meeting & Exposition.

[11]Accumulation Ability of Σ3{111} Grain Boundaries in Si (oral), Y. Ohno, K. Inoue, Y. Tokumoto, K. Kutsukake, I. Yonenaga, N. Ebisawa, H. Takamizawa, Y. Shimizu, K. Inoue, Y. Nagai, H. Yoshida, S.Takeda: 7th International Workshop on Crystalline Silicon Solar Cells (CSSC7).

[12]Atomic-Resolution Environmental Transmission Electron Microscopy for Quantitative In-situ Microscopy in Catalyst Chemistry (invited), S. Takeda: The 1st East-Asia Microscopy Conference (EAMC-1).

[13]Structure of Surface Gold Oxide Film on Gold Nanoparticles in O2 Atmosphere (poster), K. Sun: The 1st East-Asia Microscopy Conference (EAMC-1).

[14]Atomic-Resolution Environmental Transmission Electron Microscopy for Quantitative in-situ Microscopy in Materials Science (invited), S. Takeda, H. Yoshida: 12th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures in conjunction with 21st International Colloquium on Scanning Probe Microscopy (ACSIN-12 & ICSPM21).

[15]Quantitative Environmental TEM toward Materials Process Characterization (invited), S. Takeda: International Workshop on Environmental Transmission Electron Microscopy (IWETEM 2013).

[16]In-Situ Environmental TEM Observation of Formation of Defects in Growing Carbon Nanotubes (poster), H. Yoshida, S. Takeda: 2013 MRS Fall Meeting & Exhibit.

[17]Structure of Nanoparticles during the Cobalt-Catalyzed Carbon Nanotube Growth (poster), Y. Kohigashi, H. Yoshida, S. Takeda: 2013 MRS Fall Meeting & Exhibit.

[18]Quantitative Atomic Resolution Environmental Transmission Electron Microscopy for Materials Process Characterization (invited), S. Takeda: 9th International Symposium on Atomic Level Characterizations for New Materials and Devices '13（ALC '13）.

[19]Atomic-Scale in-situ Observation of the Growth of Carbon Nanotubes (invited), S. Takeda: Workshop on Metallic Nanoparticles in Reactive Environment.

Publications in Domestic Meetings

The Japanese Society of Microscopy 2013	5 papers
The 74th JSAP Autumn Meeting, 2013	1 paper
The 69th ISIR academic meeting	1 paper
The 57th symposium of the Japanese Society of Microscopy	1 paper
Meeting 2013 for working group of five-institute alliance	1 paper
Technical seminar of new TEM of FEI	1 paper
Workshop on "research about the origin of activity of supported gold catalysts"	1 paper
Workshop of nanocarbon research department in Tokyo University of Science	1 paper
The 61th JSAP Spring Meeting, 2014	1 paper

Academic Degrees

Master Degree for Engineering K. Soma	Development of New Method for Dynamic TEM Observation and Application to All-Solid Secondary Battery
Master Degree for Engineering S. Maenou	In situ ETEM Observation of the Interaction between Carbon Nanotube and Water

Grant-in-Aid for Scientific Research

S. Takeda	Atomic-Scale Dynamic Analysis of Nano-Gap Electrode Interacting with Gas Molecules	¥36,400,000
H. Yoshida	Structural Determination of Nanoparticulate Catalysts during the Synthesis of Carbon Nanomaterials by Aberration-Corrected environmental transmission electron microscopy	¥1,690,000
N. Kamiuchi	Application of Nano-Structure Controlled Environmental Catalysts to Automotive Exhaust Gas Purification and Combustion of VOC	¥1,200,000

Entrusted Research

S. Takeda	Japan Science and Technology Agency	Development of Dynamic Imaging Technology of the Diffusion of Ions Across the Micro-Interface in Li Ion Battery	¥23,140,000

Contribution to Research

S. Takeda	UBE Scientific Analysis Laboratory, Inc	¥2,000,000
S. Takeda	Nippon Steel & Sumitomo Metal Corporation	¥500,000
S. Takeda	FEI Company Japan Ltd.	¥600,000

Cooperative Research

S. Takeda	Honda R&D Co.,Ltd.	¥10,200,000
S. Takeda	National Institute of Advanced Industrial Science and Technology	¥0,000

Department of Theoretical Nanotechnology

Original Papers

[1]First-Principles Study of X-ray Absorption Spectra of FeS_2, T. Oguchi, H. Momida: J. Phys. Soc. Jpn., 82 (2013) 065004/1-2.

[2]Atomic-Layer Alignment Tuning for Giant Perpendicular Magnetocrystalline Anisotropy of 3d Transition-Metal Thin Films, K. Hotta, K. Nakamura, T. Akiyama, T. Ito, T. Oguchi, A. J. Freeman: Phys. Rev. Lett., 110 (2013) 267206/1-5.

[3]Ab initio Study of Magnetic Coupling in $CaCu_3B_4O_{12}$ (B=Ti, Ge, Zr, and Sn), M. Toyoda, K. Yamauchi, T. Oguchi: Phys. Rev. B, 87 (2013) 224430/1-7.

[4]Highly Sensitive Spin-Crossover Transition in a Metal-Organic Molecular Crystal, K. Yamauchi, I. Hamada, T. Oguchi: Phys. Rev. B, 88 (2013) 035110/1-4.

[5]Extremely Large Magnetoresistance in the Nonmagnetic Metal $PdCoO_2$, H. Takatsu, J. J. Ishikawa, S. Yonezawa, H. Yoshino, T. Shishidou, T. Oguchi, K. Murata, Y. Maeno: Phys. Rev. Lett., 111 (2013) 056601/1-4.

[6]First-Principles Calculation of X-ray Absorption Spectra for the A-site Ordered Perovskite $CaCu_3Fe_4O_{12}$, T. Ueda, M. Kodera, K. Yamauchi, T. Oguchi: J. Phys. Soc. Jpn., 82 (2013) 094718/1-5.

[7]Influence of Lone Pair Doping on the Multiferroic Property of Orthorhombic $HoMnO_3$: ab initio Prediction, S. S. Subramanian, K. Yamauchi, T. Ozaki, T. Oguchi, B. Natesan: J. Phys.: Condensed Matter, 25 (2013) 385901/1-8.

[8]Electronic Structure of the Metallic Antiferromagnet $PdCrO_2$ Measured by Angle-Resolved Photoemission Spectroscopy, J. A. Sobota, K. Kim, H. Takatsu, M. Hashimoto, S.-K. Mo, Z. Hussain, T. Oguchi, T. Shishidou, Y. Maeno, B. I. Min, Z.-X. Shen: Phys. Rev. B, 88 (2013) 125109/1-5.

[9]Quantum Oscillations of the Metallic Triangular-Lattice Antiferromagnet $PdCrO_2$, J. M. Ok, Y. J. Jo, K. Kim, T. Shishidou, E. S. Choi, H.-J. Noh, T. Oguchi, B. I. Min, J. S. Kim: Phys. Rev. Lett., 111 (2013) 176405/1-5.

[10]Fermiological Interpretation of $FeTe_{1-x}Se_x$ Thin Crystal by Quantum Conductance Oscillation, H. Okazaki, T. Yamaguchi, T. Watanabe, K. Deguchi, S. Demura, S. J. Denholme, T. Ozaki, Y. Mizuguchi, H. Takeya, T. Oguchi, Y. Takano: Euro. Phys. Lett., 104 (2013) 37010/1-6.

[11]Temperature Dependence of Young's Modulus of Silicon, K. Shirai: Jpn. J. Appl. Phys., 52 (2013) 088002/1-2.

[12]Electronic Ferroelectricity Induced by Charge and Orbital Orderings, K. Yamauchi, P. Barone: J. Phys.: Condensed Matter, 26 (2014) 103201/1-17.

[13]Mechanism of Ferroelectricity in Half-Doped Manganites with Pseudocubic and Bilayer Structure, K. Yamauchi, S. Picozzi: J. Phys. Soc. Jpn., 82 (2013) 113703/1-5.

[14]Physical Guiding Principles for High Quality Resistive Random Access Memory Stack with Al_2O_3 Insertion Layer, M. Y. Yang, K. Kamiya, B. Magyari-Kope, H. Momida, T. Ohno, M. Niwa, Y. Nishi, K. Shiraishi: Jpn. J. Appl. Phys., 52 (2013) 04CD11/1-4.

[15]Hydrogen-Enhanced Vacancy Embrittlement of Grain Boundaries in Iron, H. Momida, Y. Asari, Y. Nakamura, Y. Tateyama, T. Ohno: Phys. Rev. B, 88 (2013) 144107/1-13.

International Conferences
[1]Ab-initio Study on Sodium Ion Batteries (invited), T. Oguchi: First Joint Symposium of Bordeaux University and Tohoku University.

[2]Novel Electronic States in Perovskite Oxides (invited), T. Oguchi: 5th IACS-APCTP International Conference on Novel Oxide Materials and Low Dimensional Systems.

[3]First-Principles Study on Structure Stabilities of α-S and Na-S Battery Systems (oral), H. Momida, T. Oguchi: American Physical Society: APS March Meeting.

[4]Quantum Oscillations of the Metallic Triangular-Lattice Antiferromagnet $PdCrO_2$ (oral), J. M. Ok, Y. J. Jo, K. Kim, T. Shishidou, E. S. Choi, H. J. Noh, T. Oguchi, B. I. Min. J. S. Kim: American Physical Society: APS March Meeting.

[5]Noncollinear Magnetic Order in Quadruple Perovskite $LaMn_3V_4O_{12}$ (oral), M. Toyoda, K. Yamauchi, T. Oguchi: American Physical Society: APS March Meeting.

[6]Structural Stability and Electronic Properties of $Na_2C_6O_6$ for a Rechargable Sodium-Ion Battery (oral), T. Yamashita, A. Fujii, H. Momida, T. Oguchi: American Physical Society: APS March Meeting.

[7]Electronic Nature of Defect States of Boron Crystals (oral), K. Shirai, N. Uemura: The 17th International Symposium on Intercalation Compounds (ISIC17).

[8]High Power Factor of $SrTiO_3$ and A New Route for High-Performance Thermoelectric Materials (oral), K. Shirai, K. Yamanaka: The 32nd International Conference on Thermoelectrics (ICT2013).

[9]High Thermoelectric Power Factor of $SrTiO_3$ and New Route for High-Performance Thermoelectric Material (oral), K. Shirai, K. Yamanaka: International Workshop of Computational Nano-Materials Design on Green Energy, JSPS Core-to-Core Program Workshop.

[10]First-Principles Study of α-Tetragonal Boron (poster), N. Uemura, K. Shirai: International Workshop of Computational Nano-Materials Design on Green Energy, JSPS Core-to-Core Program Workshop.

[11]Electronic Structure and Formation Energy of Copper Impurity in Silicon (poster), T. Fujimura, K. Shirai: International Workshop of Computational Nano-Materials Design on Green Energy, JSPS Core-to-Core Program Workshop.

[12]Dynamical Properties of Vacancy in Si (poster), K. Shirai, J. Ishisada: The 27th International Conference on Defects in Semiconductors.
[13]Dynamics of Hydrogen in Silicon (poster), K. Shirai, I. Hamada, H. Katayama-Yoshida: The 27th International Conference on Defects in Semiconductors.

[14]Theoretical Prediction of Novel Magnetoelectric Materials (invited), K. Yamauchi: Joint Workshop of Interactive Materials Science Cadet Program (IMSC), Osaka University, and S-1 JSPS Core-to-Core Program (A) Advanced Research Networks.

[15]Hyperfine Field at Sn in Ferromagnetic Heusler Alloys (poster), H. Momida, T. Oguchi: Joint Workshop of Interactive Materials Science Cadet Program (IMSC), Osaka University, and S-1 JSPS Core-to-Core Program (A) Advanced Research Networks.

[16]Hydrogen-Enhanced Vacancy Embrittlement of Grain Boundaries in Iron: First-Principles Calculations (oral), H. Momida, Y. Asari, Y. Nakamura, Y. Tateyama, T. Ohno: International Symposium on Atomistic Modeling for Mechanics and Multiphysics of Materials.

[17]First-Principles Study of Resistance Switching by Oxygen Vacancies in Al_2O_3 ReRAM (invited), H. Momida: Core-to-core Japan-Germany Workshop.

[18]Strain-Induced Topologically Insulating Phase of Sb_2Te (poster), E. Takasaki, H. Momida, T. Oguchi: Materials Research Society: 2013 MRS Fall Meeting.

[19]Computational Study of Discharge Reactions in the Na-Ion Battery System Na/FeS_2 (poster), H. Momida, T. Oguchi: The 14th RIES-Hokudai International Symposium (MOU).

[20]Electric Property Calculations of Disodium Rhodizonate $Na_2C_6O_6$ as a cathode Material for Na-ion Secondary Battery (poster), A. Fujii, H. Momida, T. Oguchi: The 17th Sanken International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

Contributions to International Conferences and Journals

T. Oguchi	The 16th Asia Workshop on First-principles Electronic Structure Calculations (International Organizing Committee)
K. Shirai	The CECAM workshop “Modeling the Physical Properties of Clustering Crystals”, Lausanne, Switzerland, at the Ecole Polytechnique Fédérale de Lausanne (EPFL) from 4-6 November 2013 (Co-chair)

Publications in Domestic Meetings

The Physical Society of Japan	13 papers
The Japan Society of Applied Physics	7 papers
Materials Research Society of Japan	2 papers
The Japan Institute of Metals and Materials	1 paper

Academic Degrees

Master Degree for Science Taufik Adi Nugraha	The Study of Vacancy in Gadolinium-Doped Gallium Nitride
Master Degree for Science K. Sakuma	Structural Study of Boron Carbide by First-Principles Calculation
Master Degree for Science E. Takasaki	Exploration of Sb_2Te-Based Topological Insulators from First-Principles Calculations
Master Degree for Science A. Fujii	Electronic Structure Calculations of $Na_xC_6O_6$ as a Future Cathode Material of Secondary Batteries
Master Degree for Engineering M. Deguchi	Theoretical Study on Magnetic Anisotropy of Pt and Transition Metal Multilayer Systems
Doctor Degree for	First-Principles Study on Dilute Magnetic States and Half Metallicity in

Science	Chalcopyrite Semiconductors		
M. Shahjahan			
Grant-in-Aid for Scientific Research			
K. Yamauchi	Theoretical Study on Multiferroics Based on Manganites		¥1,170,000
Entrusted Research			
T. Oguchi	JST	Exploring for New Functional Materials with Unusual Ionic States and Coordinations "Electronic Structure Analysis by First-principles Calculations"	¥12,350,000
Cooperative Research			
T. Oguchi	DENSO		¥1,500,000
T. Oguchi	Toyota Central R&D Labs., Inc.		¥0,000
Other Research Fund			
T. Oguchi	MEXT		¥5,000,000

Department of Soft Nanomaterials

Original Papers

[1]Three-Dimensional Electron-Accepting Compounds Containing Perylene Bis(dicarboximide)s as n-Type Organic Photovoltaic Materials, Y. Ie, T. Sakurai, S. Jinnai, M. Karakawa, K. Okuda, S. Mori, Y. Aso: Chem. Commun., 49 (2013) 8386-8388.

[2]Arenedithiocarboxyimide-Containing Extended pi-Conjugated Systems with High Electron Affinity, Y. Ie, S. Jinnai, M. Nitani, Y. Aso: J. Mater. Chem. C, 1 (2013) 5373-5380.

[3]Low Band-Gap Donor–Acceptor Copolymers Based on Dioxocylopenta[c]thiophene Derivatives as Acceptor Units: Synthesis, Properties, and Photovoltaic Performances, J. Huang, Y. Ie, M. Karakawa, Y. Aso: J. Mater. Chem. A, 1 (2013) 15000-15009.

[4]Synthesis and Properties of a Benzo[1,2-b:4,5-b']dithiophene Core pi-System that Bears Alkyl, Alkylthio and Alkoxy Groups at 3,7-Positions, S. Ota, S. Minami, K. Hirano, T. Satoh, Y. Ie, S. Seki, Y. Aso, M. Miura: RSC Advances, 3 (2013) 12356-12365.

[5]Narrow-Optical-Gap p-Conjugated Small Molecules Based on Terminal Isoindigo and Thienoisoindigo Acceptor Units for Photovoltaic Application, M. Karakawa, Y. Aso: RSC Advances, 3 (2013) 16259-16263.

[6]Near-Infrared Photovoltaic Performance of Conjugated Polymers Containing Thienoisoindigo Acceptor Units, M. Karakawa, Y. Aso: Macromol. Chem. Phys., 214 (2013) 2388-2397.

International Conferences

[1]Tripodal Anchoring Groups for Molecular Electronics (oral), Y. Ie, T. Hirose, K, Tanaka, H. Nakamura, M. Kiguchi, N. Takagi, M. Kawai, Y. Aso: The 15th Asian Chemical Congress Novel Functional pi-Systems and Materials.

[2]Highly Electron-Accepting π-Conjugated Compounds for Organic Field-Effect Transistor and Photovoltaic Application (invited), Y. Aso: The Sixth East Asia Symposium on Functional Dyes and Advanced Materials (EAS-6).

[3]Synthesis, Properties, and Electron-Accepting Characteristics of New π-Conjugated System Bearing Dithiophthalimide Units (oral), Y. Ie, S. Jinnai, M. NItani, M. Karakawa, Y. Aso: 15th International Symposium on Novel Aromatic Compounds (ISNA-15).

[4]Development of Thiophene-Based Three Dimensional pi-Electron Systems Containing Dicyanomethylene Groups (poster), S. Jinnai, Y. Ie, Y. Aso: 15th International Symposium on Novel

Aromatic Compounds (ISNA-15).

[5]Development of Solution-Processable n-Type Organic Semiconductors Based on Carbonyl-Bridged Thiazole-Fused Ring (poster), C. Sato, Y. Ie, Y. Aso: 15th International Symposium on Novel Aromatic Compounds (ISNA-15).

[6]4,9-Dihydro-s-indaceno[1,2-b:5,6-b']dithiazole-4,9-dione : A New Electronegative Unit for an n-Type Organic Semiconducting Materials (oral), Y. Ie, M. Nitani, Y. Aso: The 11th International Symposium on Functional ・-Electron System (Fp-11).

[7]Electron-Donor Function of [6,6]-Phenyl-C61-Butyric Acid Methyl Ester in Bulk Heterojunction Solar Cells (oral), Y. Ie, M. Karakawa, H. Yoshida, A. Saeki, H. Ohkita, Y. Aso: 2013 MRS Fall Meeting.

[8]Synthesis, Properties, and Photovoltaic Performance of D–A Copolymers Based on Dioxocyclopentene-Annelated Thiophenes as Acceptor Units (poster), J. Huang, Y. Ie, M. Karakawa, Y. Aso: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[9]Arenedithiocarboxyimide-Containing Extended pi-Conjugated Systems: Synthesis, Properties, and Application as n-Type Organic Semiconductor (poster), S. Jinnai, Y. Ie, Y. Aso: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[10]Synthesis and Properties of Solution-Processable n-Type Organic Semiconductors Based on Carbonyl-Bridged Thiazole-Fused Ring (poster), C. Sato, Y. Ie, Y. Aso: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[11]Synthesis, Properties, and Photovoltaic Performances of Novel D–A Copolymers Based on Naphtho[2,3-c]thiophene-4,9-dione as Acceptor Units (poster), J. Huang, Y. Ie, M. Karakawa, Y. Aso: CEMS International Symposium on Supramolecular Chemistry and Functional Materials 2013.

[12]Development of Fluorine-Containing π-Conjugated Systems towards n-Type Organic Semiconducting Materials (invited), Y. Ie: 4th International Fluorine Workshop.

[13]Synthesis, Properties, and n-Type Performances of Electronegative π-Conjugated Systems (invited), Y. Ie: The first Asian conference for “MONODUKURI” Strategy by Synthetic Organic Chemistry (ACMS).

[14]PCBM Alternative Acceptor Material for Organic Photovoltaic Cell (poster), M. Karakawa, T. Nagai, K. Adachi, Y. Ie, Y. Aso: 12th European Conference of Molecular Electronics.

[15]Synthesis and Characterization of New Wide-Range Light Absorption Oligomers for Organic Photovoltaics (poster), M. Karakawa, Y. Aso: 12th European Conference of Molecular Electronics.

[16]New Fulleropyrrolidine Derivatives as Acceptor Materials for Organic Photovoltaic Cells , M. Karakawa, T. Nagai, K. Adachi, Y. Ie, Y. Aso: 1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium.

Review Papers

Electronic Properaes and Photovoltaic Characteristics of Ryleneimide Compounds Bearing Multiaimensional Structures, Y. Ie, Y. Aso, Kokagaku, The Japanese Photochemistry Association, 44 (2013), 73-80.

Development of Organic Semiconductor Materials towards Solution Process, Y. Ie, Y. Aso, Monthly Display, Techno Times, 19 (2013), 1-8.

pi-Conjugated Functional Molecules for Molecular Electronics Materials, Y. Aso, Electrochemistry, 8 (2013), 273-276.

Patents

[1]K20130177, 2013-207724

[2]K20130131, 2013-181678

[3]K20130236, 2013-251554

[4]K20120414, 2013-104472

[5]K20120415, 2013-104475

[6]K20080156, 2008-290027

Contributions to International Conferences and Journals

Y. Aso	The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project (Organizing Committee)
Y. Aso	1st KANSAI Nanoscience and Nanotechnology International Symposium, 9th Handai Nanoscience and Nanotechnology International Symposium, 12th SANKEN Nanotechnology Symposium (Organizing Committee)
M. Nitani	The 17th SANKEN International Symposium 2014 Joined with The 2nd International Symposium of Nano-Macro Materials, Devices and System Research Alliance Project (Organizing Committee)

Publications in Domestic Meetings

The Chemical Society of Japan	18 papers
Symposium on Organic pi-Systems	1 paper
Symposium on Main Element Chemistry	2 papers
Symposium on Physical Organic Cheistry	3 papers

Academic Degrees

Doctoral Degree for Engineering H. Huang	Studies on Novel Donor–Acceptor Copolymers Based on Dioxocycloalkene-annelated Thiophenes as Acceptor Unit for Organic Thin-film Solar Cells
Master Degree for Engineering C. Sato	Synthesis, Properties and Semiconducting Characteristics of Electron-accepting pi-Conjugated Compounds Having Thiazole-fused Polycyclic System
Master Degree for Engineering S. Tone	Development of Fully Insulated Oligothiophenes Bearing Anchor Units at Both Terminal Positions
Master Degree for Engineering Y. Wang	Synthesis, Properties, and Photovoltaic Performances of pi-Conjugated Polymers Having Fluoroehter Substituents

Grant-in-Aid for Scientific Research

Y.Aso	Development of molecular electronics on the basis of the synthesis of pricisely designed molecular wires	¥10,790,000
Y.Ie	Development of functional pi-conjugated systems for single-molecular photovoltaics	¥1,430,000
Y.Ie	Develoment of functional pi-conjugated systems toward elucidation of charge-transporting mechanism in single-molecular devices	¥4,940,000

Y.Ie	Development and investigation of new functional materials for molecular architectonics		¥12,610,000
Entrusted Research			
Y.Ie	JST	Development of n-type organic semiconductor materials towards bulk heterojunction solar cells	¥8,034,000
Y.Ie	JST	Evaluation of organic field-effect tansistor devices	¥8,034,000
Y.Aso	JST	Practical implementation of acceptor materials for organic thin-film solar cells	¥4,810,000
Contribution to Research			
Y.Ie	TANAKA HOLDINGS Co., Ltd.		¥200,000
Cooperative Research			
Y.Aso	Sumitomo Chemical Co., Ltd.		¥1,000,000
Y.Aso	Daikin Industries, Ltd		¥2,500,000
M.Karakawa	TOYO INK SC		¥500,000

Department of Bio-Nanotechnology

Original Papers

[1]Tracking Single-Particle Dynamics via Combined Optical and Electrical Sensing, N. Yukimoto, M. Tsutsui, Y. He, H. Shintaku, S. Tanaka, S. Kawano, T. Kawai, M. Taniguchi: Scientific Reports, 3 (2013) 1855-1861.

[2]Trapping and Identifying Single-Nanoparticles Using a Low-Aspect-Ratio Nanopore, M. Tsutsui, Y. Maeda, Y. He, S. Hongo, S. Ryuzaki, S. Kawano, T. Kawai, M. Taniguchi: Applied Physics Letters, 103 (2013) 013108-013112.

[3]Thermoelectricity in Atom-Sized Junctions at Room Temperatures, M. Tsutsui, T. Morikawa, A. Arima, M. Taniguchi: Science Reports, 3 (2013) 3326-3332.

[4]Nonequilibrium Ionic Response of Biased Mechanically Controllable Break Junction (MCBJ) Electrodes, K. Doi, M. Tsutsui, T. Ohshiro, C.-C. Chien, M. Zwolak, M. Taniguchi, T. Kawai, S. Kawano, M. Di Ventra: The Journal of Physical Chemistry C, 118 (2014) 3758-3765.

[5]Fabrications of Insulator-Protected Nanometer-Sized Electrode Gaps, A. Arima, M. Tsutsui, T. Morikawa, K. Yokota, T. Kawai, M. Taniguchi: J. Appl. Phys., 115 (2014) 114310-114314.

[6]High Speed DNA Denaturation Using Microheating Devices, M. Furuhashi, Y. Okamoto, D. Onoshima, T. Ohshiro, S. Ryuzaki, K. Yokota, M. Tsutsui, M. Taniguchi, K. Nakatani, Y. Baba, T. Kawai: Applied Physics Letters, 103 (2013) 023112-023115.

[7] Polaron coupling in graphene field effect transistors on patterned self-assembled monolayer, Kazumichi Yokota, Kazuyuki Takai, Yasuhiko Kudo, Yoshiaki Satoa and Toshiaki Enokia: Phys. Chem. Chem. Phys., 16 (2013) 4313-4319.

[8]Fabrications of Insulator-Protected Nanometer-Sized Electrode Gaps, A. Arima, M. Tsutsui, T. Morikawa, K. Yokota, M. Taniguchi: Journal of Applied Physics, 115 (2014) 114310-114314.

International Conferences

[1]Emerging NGS Technology: Single Molecule Sequencing for miRNA (invited), M. Taniguchi: Next Generation Sequencers & Bioinformatics Summit Europe.

[2]Partial Sequencing of a Single DNA Molecule with a Scanning Tunnelling Microscope (oral), H.

Tanaka:　Alliance G3 Subcommittee, Taiwan Academia Snica.

[3]Single Molecule Electrical Sensing Technologies (invited), M. Taniguchi: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[4]Development of Bionanotechnology (oral), M. Taniguchi: nano tech 2014, The 13rd International Nanotechnology Exhibition & Conference.

[5]Next Generation DNA Sequencing Technologies (oral), M. Taniguchi: The Third International Symposium of Medical-Dental-Pharmaceutical Education and Research in Okayama.

[6]4th Generation DNA Sequencing Technologies (oral), M. Taniguchi: The Japan Society of Applied Physics and the Materials Research Society.

Review Papers

Electrode-Embedded Nanopores for Label-Free Single-Molecule Sequencing by Electric Currents, K. Yokota, M. Tsutsui, M. Taniguchi, RSC Advances, Royal Society of Chemistry, 4 (2014), 15886-15899.

Patents

[1]K20130221 Biomolecule sequencing apparatus, method, and program, 2014-011430

[2]K20120294 Sample introduction methods, 2013-099363

[3]K20130054 Thermoelectric element, and thermoelectric properties measurement method of the thermoelectric element, 2013-160841

[4]K20130059 Single molecule identification method, apparatus, and program, 2013-197443

[5]K20120307 Identification method of substance, 2013-047373

[6]K20120273 Spectroscopy and spectroscopic apparatus, 2013-028433

[7]K20130265 Chemical detection method, 2014-015110

[8]K20120352 Chemical detection method, 2013-141711

[9]K20130040 Biomolecule sequencing apparatus, method, and program, 2013-193498

[10]K20130055 Biomolecules thermal denaturation device and a method of manufacturing the same, 2013-175637

[11]K20130206 Biomolecule sequencing equipment for electrode, biomolecule sequencing apparatus, method, and program, 2014-031084

[12]G20120069WO Control method and control device for movement speed of substance, and use therefor, PCT/JP2013/051913

[13]G20120080WO Method for determining polynucleotide base sequence and device for determining polynucleotide base sequence, PCT/JP2013/059645

[14]G20120083WO Single particle analyzer and analysis method, PCT/JP2013/056690

[15]G20130020WO Sample analysis method, PCT/JP2013/071059

[16]G20130035US Method for controlling substance moving speed and apparatus for controlling the same, US 13/975,610

[17]KP2013025 How to determine the nucleotide sequence of a polynucleotide, and apparatus for determining the nucleotide sequence of the polynucleotide, 2013-541893

[18]K20070368 Organic field effect transistors and a manufacturing method thereof, 2008-223369

[19]G20050101TW Ambipolar organic field-effect thin layer transistor and a manufacturing method, 95110388

[20]G20090020EP Organic Field Effect Transistor and its Production Method, EP2159859 A3 / EP20090252087

Contributions to International Conferences and Journals

M. Taniguchi	Scientific Reports (Editorial Boral Member)

Publications in Domestic Meetings

The Institute of Electrical Engineers of Japan	1 paper
Annual Meeting of TheJapan Society of Applied Physics	11 papers
Annual Meeting of Japan Society for Molecular Science	2 papers
Annual Meeting of The Physical Society of Japan	2 papers
Annual Meeting of The Chemical Society of Japan	3 papers

Grant-in-Aid for Scientific Research

M.Taniguchi	Development of methods for controlling fluid dynamics of single molecules using gating nanopore devices	¥6,240,000
M.Tsutsui	Nanopore trapping method for single-virus detections	¥4,030,000
M.Tsutsui	Development of nanodevices for electrophoretic control and single-molecule sensing	¥6,630,000
H.Tanaka	Nanopore fabrication of graphene by SPM	¥780,000
H.Tanaka	Single molecule sequencing using graphene	¥5,590,000
K.Yokota	Development of Graphene Nanopore devices	¥1,040,000

Entrusted Research

M.Tsutsui	Ministry of Internal Affairs and Communications	Development of organic thermoelectric devices	¥7,652,000

Contribution to Research

M.Tsutsui	Tanikawa Fund Promotion of Thermal Technology	¥1,000,000

Cooperative Research

M.Taniguchi	Quantum Biosystems Inc.	¥0,000

Other Research Fund

M.Taniguchi	Ministry of Education, Culture, Sports, Science and Technology (MEXT)	¥285,285,000
M.Taniguchi	Kyoto University	¥38,000,000

Department of Nanotechnology for Environmental and Energy Applications

Original Papers

[1]Tunability of the k-Space Location of the Dirac Cones in the Topological Crystalline Insulator $Pb_{1-x}Sn_xTe$, Y. Tanaka, T. Sato, K. Nakayama, S. Souma, T. Takahashi, Z. Ren, M. Novak, K. Segawa, Y. Ando: Phys. Rev. B, 87 (15) (2013) 155105/1-5.

[2]Fermiology of the Strongly Spin-Orbit Coupled Superconductor $Sn_{1-x}In_xTe$: Implications for Topological Superconductivity, T. Sato, Y. Tanaka, K. Nakayama, S. Souma, T. Takahashi, S. Sasaki, Z. Ren, A. A. Taskin, K. Segawa, Y. Ando: Phys. Rev. Lett., 110 (20) (2013) 206804/1-5.

[3]Anomalous Dressing of Dirac Fermions in the Topological Surface State of Bi_2Se_3, Bi_2Te_3, and Cu-Doped Bi_2Se_3, T. Kondo, Y. Nakashima, Y. Ota, Y. Ishida, W. Malaeb, K. Okazaki, S. Shin, M. Kriener, S. Sasaki, K. Segawa, Y. Ando: Phys. Rev. Lett., 110 (21) (2013) 217601/1-5.

[4]Experimental Studies of the Topological Superconductor $Cu_xBi_2Se_3$, Y. Ando, K. Segawa, S. Sasaki, M. Kriener: J. Phys.: Conf. Ser., 449 (2013) 012033/1-5.

[5]Topological Insulator Materials, Y. Ando: J. Phys. Soc. Jpn (Invited review paper), 82 (10) (2013) 102001/1-32.

[6]Unusual Nature of Fully Gapped Superconductivity in In-Doped SnTe, M. Novak, S. Sasaki, M. Kriener, K. Segawa, Y. Ando: Phys. Rev. B (Rapid Communications), 88 (14) (2013) 140502(R)/1-5.

[7]Two Types of Dirac-Cone Surface States on the (111) Surface of the Topological Crystalline Insulator SnTe, Y. Tanaka, T. Shoman, K. Nakayama, S Souma, T. Sato, T. Takahashi, M. Novak, K. Segawa, Y. Ando: Phys. Rev. B, 88 (23) (2013) 235126/1-5.

[8]Relationship between Fermi Surface Warping and Out-of Plane Spin Polarization in Topological Insulators: A View from Spin- and Angle-Resolved Photoemission, M. Nomura, S. Souma, A. Takayama, T. Sato, T. Takahashi, K. Eto, K. Segawa, Y. Ando: Phys. Rev. B, 89 (4) (2014) 045134/1-6.

[9]Topological Surface Transport in Epitaxial SnTe Thin Films Grown on Bi_2Te_3, A. A. Taskin, F. Yang, S. Sasaki, K. Segawa, Y. Ando: Phys. Rev. B (Rapid Communications), 89 (12) (2014) 121302(R)/1-5.

International Conferences

[1]Searching for Possible Topological Superconductors with Time-Reversal Invariance (invited), Y. Ando: Gordon Research Conference on Superconductivity.

[2]Possible Topological Superconductivity in Doped Topological Insulators (invited), Y. Ando: Majoranas in Solid State Workshop.

[3]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: 2013 Swiss Workshop on Material with Novel Electronic Properties.

[4]Possible Bulk Topological Superconductors with Time-Reversal invariance (invited), Y. Ando: Conference on Majorana Physics in Condensed Matter, Ettore Majorana Foundation and Center for Scientific Culture.

[5]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: International Workshop on Superconductivity Research and Advanced by New Materials and Spectroscopies.

[6]Experimental Efforts to Realize Time-Reversal Invariant Topological Superconductors (invited), S. Sasaki, A. A. Taskin, K. Segawa, Y. Ando: International Symposium on Quantum Fluids and Solids (QFS2013).

[7]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Symposium on Frontiers of Solid State Physics.

[8]Ionic-Liquid Gating Experiment on Topological Insulators (poster), K. Segawa, Z. Ren, S. Sasaki, T. Tsuda, S. Kuwabata, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[9]Conductance Spectroscopy on Superconducting Topological Insulator Families (invited), S. Sasaki, A. A. Taskin, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[10]The Gating of Topological Insulator Thin Films and Exfoliated Crystals (poster), F. Yang, A. A. Taskin, M. Kishi, K. Eto, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[11]Phase Diagram of $Sn_{1-x}In_xTe$ -a Topological Superconductor Candidate (poster), M. Novak, S. Sasaki, M. Kriener, K. Segawa, Y. Ando: International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries 2013.

[12]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Colloquium, Max-Planck Institute for Solid State Research.

[13]Experimental Studies of Topological Insulators and Superconductors (invited), Y. Ando: FIRST-QS2C Workshop on Emergent Phenomena of Correlated Materials.

[14]Transport Studies of Topological Insulators (invited), Y. Ando: International Symposium on Nanoscale Transport and Technology (ISNTT2013).

[15]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Colloquium, Department of Physics, University of California Santa Barbara.

[16]Spin Pumping into the Surface State of Topological Insulators (invited), Y. Ando: Workshop on Topological Matter, Superconductivity and Majorana, Institute for Advanced Study, Hong Kong University of Science and Technology (HKUST).

[17]Transport Studies of Topological Insulators (plenary), Y. Ando: Trends in Nano Technology (TNT Japan 2014).

[18]Materials Efforts for Topological Insulators and Superconductors (invited), Y. Ando: FIRST International Symposium on Topological Quantum Technology.

[19]Topological Insulators and Superconductors: Materials Frontier (invited), Y. Ando: Quantum Matter and Materials Colloquium.

[20]New Topological Materials: Topological Crystalline Insulators and Topological Superconductors (invited), Y. Ando: 18^{th} International Winterschool on New Developments in Solid State Physics.

[21]Superconducting Topological Insulators (invited), Y. Ando: Theo Murphy International Scientific Meeting, Emergence of new exotic states at interfaces with superconductors.

Review Papers

Condensed Matter Physics and New Materials -Examples of Superconductors and Topological Insulators-, Y. Ando, Mathematical Sciences, SAIENSU-SHA Co., Ltd., [605] (2013), 26-31.

Contributions to International Conferences and Journals

Y. Ando	Europhysics Letters (EPL) (Co-Editor)
Y. Ando	Advanced Materials Interfaces (International Advisory Board)
Y. Ando	International Conference on Topological Quantum Phenomena (TQP2014) (Chair, Program Committee)
Y. Ando	Materials and Mechanisms of Superconductivity Conference (M2S 2015) (International Advisory Board)

Y. Ando	7th International Conference "Science and Engineering of Novel Superconductors" of the Forum on New Materials (International Advisory Board)	

Publications in Domestic Meetings

Fall Meeting of the Physical Society of Japan 2013	11 papers
4th Annual Meeting of Topological Quantum Phenomena in Condensed Matter with Broken Symmetries	7 papers
69th Annual Meeting of the Physical Society of Japan	7 papers

Grant-in-Aid for Scientific Research

Y. Ando	Creation of Innovative Devices Based on Topological Insulators	¥11,050,000
Y. Ando	Explorations of Novel Quantum Phenomena in Topological Insulators and Superconductors	¥136,760,000

Department of Nano-Intelligent Systems

Original Papers

[1]Anomaly Detection in Reconstructed Quantumn StatesUsing a Machine Learning Technique, S. Hara, T. Ono, R. Okamoto, T. Washio, S. Takeuchi: Phys. Rev. A, 89 (2014) 022104.

[2]LiNearN: A New Approach to Nearest Neighbour Density Estimator, J. R. Wells, K. M. Ting, T. Washio: Pattern Recognition, (2014) in press.

International Conferences

[1]A Novel Structural AR Modeling Approach for a Continuous Time Linear Markov System, C. K. Kengne, L. C. Fopa, A. Termier, N. Ibrahim, M.-C. Rousset, T. Washio, M. Santana: Proc. of The IEEE International Conference on Data Mining series (ICDM) Workshop 2013, (2013) 104-113.

[2]Efficiently Rewriting Large Multimedia Application Execution Traces with few Event Sequences, T. Washio: Proc. of the 19th ACM SIGKDD Iternational Conference on Knowledge Discovery and Data Mining, (2013) 1348-1356.

[3]Structural Analysis of IBR-2 Based on Continuous Time Canonicality (oral), M. Demeshko, T. Washio, Y. Pepyolyshev: ANS National Meeting; 2013 ANS Winter Meeting Technical Sessions.

[4]Issues for Modeling from Big Data (invited), T. Washio: Workshop on Computation: Theory and Practice.

[5]Rare Flood Scenario Analysis Using Observed Rain Fall Data (oral), T. Washio, Y. Iba: JSST 2013: International Conference on Simulation Technology.

Review Papers

Modeling From Big Data, T. Washio, ISCIE Journal 'Systems, Control and Information', The Institute of Systems, Control and Information Engineers, 58[1] (2014), 3-8.

Books

[1]Modeling from Big Data T. Washio, “Big Data Management”, NTS Inc., 2[4] (57-67) 2014.

Contributions to International Conferences and Journals

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)
T. Washio	ECML/PKDD'13: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Guest Editorial Board)
T. Washio	SDM2013 : SIAM International Conference on Data Mining (Senior Program Committee)
T. Washio	ACM SIGKDD'13: The 19th ACM SIGKDD Conference on Knowledge Discovery

	and Data Mining (Program Committee)
T. Washio	The 22nd International Conference on Information and Knowledge Management (CIKM 2013) (Program Committee)
T. Washio	ICDM 2013 IEEE International Conference on Data Mining (Workshop Co-Chair)
T. Washio	ECML/PKDD'13: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Program Committee)
T. Washio	NIPS2013: Neural Information Processing Systems 2013 (Reviewer)
T. Washio	SDM2014 : SIAM International Conference on Data Mining (Senior Program Committee)
T. Washio	The 18th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2014) (Publicity Chair)
T. Washio	The 18th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2014) (Program Committee)
T. Washio	Society for Industrial and Applied Mathematics (Program Director)
T. Washio	DS-2014: the Seventeenth International Conference on Discovery Science (Program Committee)
T. Washio	JSAI-isAI 2014 (Advisory Committee)
T. Washio	ACM SIGKDD'14: The 20th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. Washio	ICDM 2014: IEEE International Conference on Data Mining (Program Committee)
T. Washio	ECML/PKDD 2014: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases 2014 (Program Committee)
T. Washio	The Second IEEE ICDM (IEEE International Conference on Data Mining) Workshop on Causal Discovery (CD 2014) (Organizing Committee)

Publications in Domestic Meetings

The 27th Annual Conference of the Japanese Society for Artificial Intelligence	3 papers
The Institute of Electrical Engineers of Japan	1 paper
Operations Research Society of Japan	1 paper
The 16th Information-based Induction Sciences Workshop	1 paper
Incomplete Data Analysis and Causal Inference	1 paper

Academic Degrees

Bachelor Degree for Engineering T. Kamon	Anommaly Detection in Crowd Scenes by Using Structured Regularization
Bachelor Degree for Engineering K. Otsuki	Causal Structure Reasoning for Non-Stationary Time Series by Using Non-Gaussianity
Bachelor Degree for Engineering S. Okada	Portfolio Selection Using Componentwise Kernel Learning
Master Degree for Engineering I. Umemura	Anommaly Detection in Process by Using Grouped Regularization
Master Degree for Engineering K. Sugimoto	Group Regularized PCA Using Submodularity

Grant-in-Aid for Scientific Research

T. Washio	Development and Application of Statistical Estimation and Simulation Principles in a Super High Dimensional Data Space	¥10,140,000
T. Washio	Learning Probabilistic Simulation Models of Event and Scenario Occurences under Rare and Special Conditions	¥1,560,000
Y. Kawahara	Hardware-Friendly Machine Learning by Regularized Learning with Integer Parameters Based on Discrete Convexity	¥650,000

S. Shimizu	Causal Structure Learning from Multiple High-Dimensional Datasets and its Application to Life Sciences	¥910,000
A. Kanemura	Robust Signal Processing that Captures Local Structures by Probabilistic Models on Dense Patches	¥650,000

Entrusted Research

T. Washio	National Cerebral and Cardiovascular Center	Clinical Study over Multiple Facilities on a Numerical Model of Chronic Heart Failure and its Validity	¥500,000
T. Washio	Fujitsu Laboratories LTD.	Study on Technical Basis for Data Analysis	¥2,000,000
Y. Kawahara	Japan Science and Technology Agency	Knowledge Discovery from Super-High Dimensional Data Based on Combinatorial Computation	¥10,166,000

Cooperative Research

T. Washio	Japan Science and Technology Agency	¥1,140,000
Y. Kawahara	NEC Co.	¥1,575,000
Y. Kawahara	Honda R&D Co.,Ltd.	¥2,640,000

Other Research Fund

Y. Kawahara	JSPS/NUS Joint Project	¥2,450,000

Department of Nanodevices for Medical Applications

Original Papers

[1]Facile Electrochemical Biosensor Based on a New Bifunctional Probe for Label-Free Detection of CGG Trinucleotide Repeat, H. He, J. P. Xia, X. Q. Peng, G. Chang, X. H. Zhang, Y. F. Wang, K. Nakatani, Z. W. Lou, S. F. Wang: Biosensors and Bioelectronics, 49 (11) 282-289.

[2]High Speed DNA Denaturation Using Microheating Devices, M. Furuhashi, Y. Okamoto, D. Onoshima,T. Ohshiro, S. Ryuzaki, K. Yokota, M. Tsutsui, M. Taniguchi, K. Nakatani, T. Kawai: Appl. Phys. Lett., 103 (11) 023112.

[3]Detection of Hepatitis C Virus by Single-Step Hairpin Primer RT-PCR, F. Takei, H. Tani, Y. Matsuura, K. Nakatani: Bioorg. Med. Chem. Lett., 24 (1) 394-396.

International Conferences

[1]Coumarin Fluorochrome Binds to Rev Responsible Element RNA with Extremely Large Absorption Shift , : RNA 2012, the 18th Annual Meeting of the RNA Society.

[2]Synthesis and Application of New Modified DNA Having Cytosine-bulge Binding Fluorescence Molecule , : Technologies for Medical Diagonosis and Therapy (G3 Meeting).

[3]New PCR Monitoring System Using DNA Primer Having Cytosine-Bulge and Covalent Binding Fluorescence Molecule , : The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[4]Regulation of RNA Secondary Structure and Function (invited), : Imaging and Sensing Biomolecular Function and Assembly.

[5]Toward Regulation of RNA Structure and Function by Small Molecules (invited), : A3RONA 2013.

[6]Small Molecule Interaction to RNA (invited), : The 16th Japan-Korea Seminor on Organic Chemistry.

[7]Small Organic Molecules Regulating RNA Structure and Function (invited), : First Osaka University-EPFL International Symposium.

[8]Small Organic Molecules Regulating RNA Structure and Function #2 (invited), : Asian Chemical Biology Initiative.

Review Papers
The Chemistry of PCR Primers: Concept and Application, F. Takei, K. Nakatani, Israel Journal of Chemistry, John Wiley & Sons, Inc., 53 (2013), 401-416.

Publications in Domestic Meetings

The 94th CSJ Annual Meeting 2014	1 paper
8th Annual Meeting of Japanese Society for Chemical Biology	1 paper
15th RNA meeting	1 paper

Grant-in-Aid for Scientific Research

K. Nakatani	Riboswitch Reengineering Using a Synthetic 8-Substituted Purine Library	¥16,250,000
K. Nakatani	RNA Loop-Loop Interaction Modulated by Small Molecules	¥4,030,000
F. Takei	The High Sensitive Virus Detection System Using Hairpin Primer PCR Method	¥6,240,000

Cooperative Research

K. Nakatani	Furukawa Electrical Advanced Engineering Co.,Ltd	¥0,000

Handai Multi-Functional Nanofoundry

Original Papers
[1]Magnetoresistance Generated by Combination of Spin-Orbit Interaction and Applied Magnetic Field in Bipolar Conductors, M. Sakai, D. Kodama, Y. Okano, T. Sakuraba, Z. Honda, A. Kitajima, A. Oshima, K.Higuchi, S. Hasegawa, O. Nakamura: Jpn. J. Appl. Phys., 52 (2013) 093001-1-8.

[2]Enhancement of Hydrogen Uptake for Y and Gd Films by Thin Nisurface Overlayers, H. Hirama, M. Hayakawa, T. Okoshi, M. Sakai, K.Higuchi, A. Kitajima, A. Oshima, S. Hasegawa: J. Crystal Growth, 378 (2013) 356-360.

[3]Influence of Hydrogen Incorporation on Texture and Grain Size inYH2 Films, T. Okoshi, M. Hayakawa, H. Hirama, M. Sakai, K. Higuchi, A. Kitajima, A. Oshima, S. Hasegawa: J. Crystal Growth, 378 (2013) 388-392.

[4]Crystal Growth of Magnetic Dihydride GdxY1−xH2 for Generation of Spin Current, T. Sakuraba, H. Hirama, M. Sakai, Z. Honda, M. Hayakawa,T. Okoshi, A. Kitajima, A. Oshima, K. Higuchi, S. Hasegawa: J. Crystal Growth, 378 (2013) 351-355.

[5]Aluminum-Doped Zinc Oxide Electrode for Robust (Pb,La)(Zr,Ti)O3 Capacitors: Effect of Oxide Insulator Encapsulation and Oxide Buffer Layer, Y. Takada, T. Tsuji, N. Okamoto, T. Saito, K. Kondo, T. Yoshimura, N. Fujimura, K. Higuchi, A. Kitajima, A. Oshima: Journal of Materials Science: Materials in Electronics, in press .

International Conferences
[1]Hall Effect and Magnetoresistance in GdxY1-xH2 (x≒0.4) (poster), T. Sakuraba, M. Sakai, T. Arai, Y. Tanaka, H. Hirama, Z. Honda, A. Kitajima, K. Higuchi, A. Oshima, S. Hasegawa: The 12th Asia Pacific Physics Conference.

[2]Optical Assessment of Carrier Effective Mass in GdxY1-xH2 (0≦x≦1) (poster), S. Haruyama, M. Sakai, T. Sakuraba, H. Hirama, Z. Honda, A. Kitajima, K. Higuchi, A. Oshima and Shigehiko

HASEGAWA1: The 12th Asia Pacific Physics Conference.

[3]Electrical Properties of PbLaZrTiOx Capacitors with Conductive Oxide Buffer Layer on Pt Electrodes (poster), T. Saito, Y. Takada, T. Tsuji, N. Okamoto, K. Kondo, T. Yoshimura, N. Fujimura, K. Higuchi, A. Kitajima, A. Oshima: 2013 Joint UFFC, EFTF and PFM Symposium.

[4]Comparative Study of Electrical Properties of PbLaZrTiOx Capacitors with Al-Doped ZnO and ITO Top Electrodes (poster), Y. Takada, T. Tsuji, N. Okamoto, T. Saito, K. Kondo, T. Yoshimura, N. Fujimura, K. Higuchi, A. Kitajima, A. Oshima: 2013 Joint UFFC, EFTF and PFM Symposium.

Comprehensive Analysis Center

Original Papers

[1]Enantioselective multicatalytic synthesis of α-benzyl-β-hydroxyindan-1-ones, T. Suzuki, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: Synthesis, 45 (2013) 2134-2136.

[2]Oxo-carboxylato-molybdenum(vi) complexes possessing dithiolene ligands related to the active site of type II DMSOR family molybdoenzymes, H. Sugimoto, M. Sato, L. J. Giles, K. Asano, T. Suzuki, M. L. Kirk, S. Itoh: Dalton Trans, 42 (2013) 15927-15930.

[3]Pd(II)-SDP-catalyzed enantioselective 5-exo-dig cyclization of γ-alkynoic acids: application to the synthesis of functionalized dihydrofuran-2(3H)-ones containing a chiral quaternary carbon center, V. Sridharan, L. Fan, S. Takizawa, T. Suzuki, H. Sasai: Org. Biomol. Chem., 11 (2013) 5936-59420133.

International Conferences

[1]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The Sixteenth International Symposium on Relations between Homogeneous and Heterogeneous Catalysis.

[2]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyaryo, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The Eighth International Symposium on Integrated Synthesis（ISIS-8）.

[3]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyaryo, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: Thieme Nagoya Symposium.

[4]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyaryo, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: 14th Tetrahedron Symposium.

[5]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyaryo, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The 17th Sanken International Symposium, The 2nd International Symposium of Nano-Macro Materials, Device, and System Research Alliance Project, Suita, Osaka, Japan, January 21-22, 2014.

[6]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols and Aldehydes (poster), T. Suzuki, Ismiyaryo, Y. Ishizaka, K. Ghozati, D.-Y. Zhou, K. Asano, H. Sasai: The 23rd French-Japanese Symposium on Medicinal and Fine Chemistry.

[7]Synthesis of Helicene-Based Phosphinite Ligands (poster), T. Tsujihara, N. Nozaki, A. Jonai, Y. Sato, T. Suzuki, M. Hatanaka: International Symposium for the 70th Anniversary of the Tohoku Branch of the Chemical Society of Japan.

Grant-in-Aid for Scientific Research

T. Suzuki	The Development of Organic Symthesis Based on Auto Hydrogen Transfer Reaction	¥1,430,000

Contribution to Research

T. Suzuki	JSR	¥500,000
T. Suzuki	Nitto Kasei Corp	¥500,000

Cooperative Research

T. Suzuki	Panasonic	¥500,000

Other Research Fund

T. Suzuki	Renovation Center of Instrument for Science Education and Technology	¥8,000,000
D.Y. Zhou	Renovation Center of Instrument for Science Education and Technology	¥10,500,000
T. Suzuki	National Institute of Natural Sciences, Institute for Molecular Science	¥1,380,000

Research Laboratory for Quantum Beam Science

Original Papers

[1]γ-Ray Radiolysis and Theoretical Study on Radical Ions of Star-Shaped Oligofluorenes Having a Truxene or Isotruxene as a Core, M. Fujitsuka, S, Tojo, J.-S. Yang, T. Majima: Chem. Phys., (2013) 118-123.

International Conferences

[1]The Effect of Radicals on Performance of Polymer Electrolyte Fuel Cell (poster), Y. Ida, G. Watanabe, Y. Akiyama, Y. Honda, S. Nishijima: The 7th Asian Conference on Electrochemical Power Sources (ACEPS-7).

[2]Study of Radical-Induced Degradation of Polymer Electrolyte Membrane (poster), G. Watanabe, Y. Ida, Y. Akiyama, Y. Honda, S. Nishijima: The 7th Asian Conference on Electrochemical Power Sources (ACEPS-7).

[3]EDegradation Process of Fuel Cell Membrane Observed by Positron (oral), : 16th International Conference on Positron Annihilation (ICPA-16).

Grant-in-Aid for Scientific Research

S.Tojo	Decomposition of organic pollutants by the space controlled quantum beam reaction	¥3,250,000

Entrusted Research

Y.Honda	Ministry of the Environment	Construction of Decontamination Scenario Based on the Dynamic States of Cesium and Development of Decontamination Method by Magnetic Force Control	¥2,100,000

Cooperative Research

Y. Honda	DAIKIN Industries, Ltd.	¥2,500,000