ISIR
OSAKA UNIVERSITY

MEMOIRS OF

The Institute of Scientific and Industrial Research

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Contents

Foreword

Kazuhiko Nakatani
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 LCLS (Former 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, LCLS 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 Science
	Architecture for Intelligence
Divison 2	
Advanced Materials &	Quantum Functional Materials
Beam Science	Semiconductor Materials and Processes
	Advanced Hard Materials
	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
	Biomolecular Science and Research
	Biomolecular Science and Regulation
	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 Cellulose Nanofiber Materials
Laboratories of 3rd Project	Laboratory of Cell Membrane Structural Biology

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

Mitsubishi Electric Collaborative Research Division for Wide-area Security Technology
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

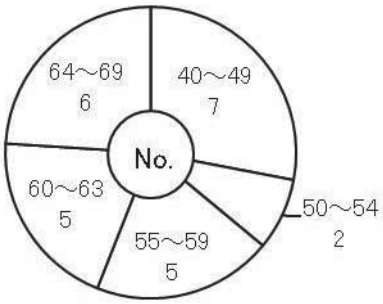
Machine Group
Measurement Group

Administrative Office

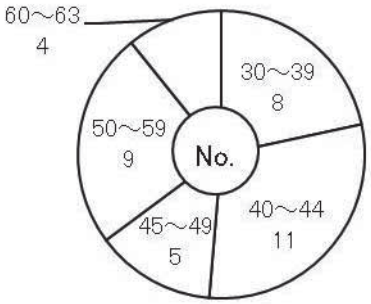
General Affairs Division
Research Cooperation Division

Staffs' Age (years old) –As of 3.31.2017

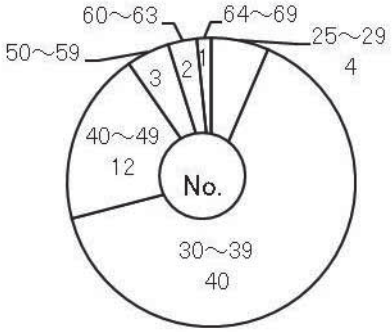
Professors



Associate Professors

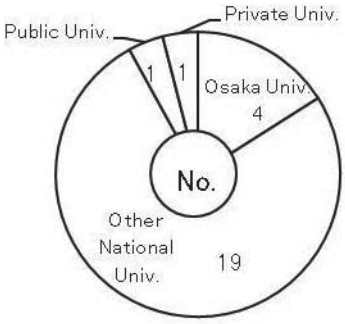


Assistant Professors

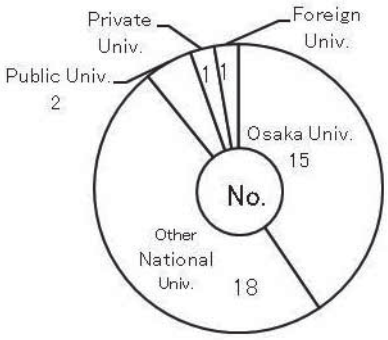


Staffs' Alma Master –As of 3.31.2017

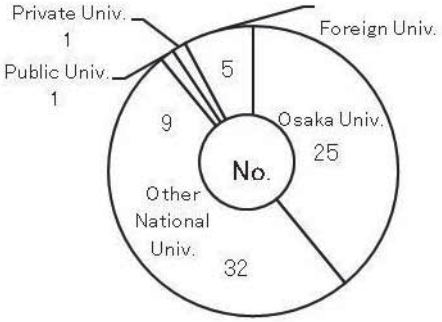
Professors



Associate Professors



Assistant Professors



2) Administration

Administration and management of ISIR are conducted by the Director selected from 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.

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

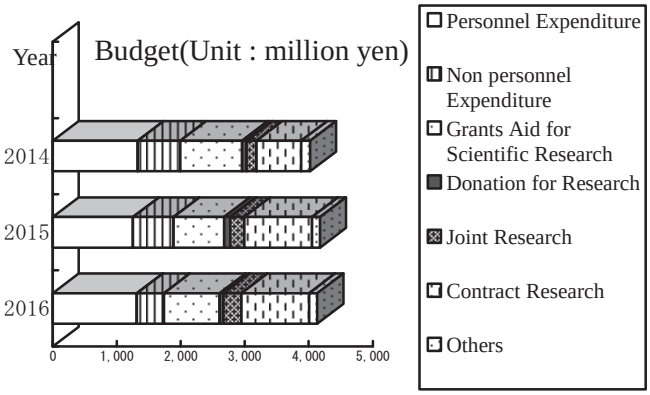
under the Director has been formed, and Advisory Board has been set up to introduce opinions from outside into the Institute.

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 2016 is 873,223,000yen.

・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
2016	10,111 (6)	25,750 (18)	17,410 (18)	3,200 (3)

Division / Year	Special Projects	Others	Total
2016	0 (0)	800 (2)	57,271 (47)

・Cooperative Researches and Contract Researches in the fiscal year 2016 are as follows: Cooperative Researches are carried out with 88 organizations and the budget for the fiscal year 2016 is 283,713,000 yen. The number of Contract Researches is 48 and the budget for the fiscal year 2016 is 1,056,731,000 yen.

4) International Research

Semiconductor Materials and Processes	Slovak Academy of Science	Slovakia	Control of Si surface properties by the chemical methods and improvement of conversion efficiencies of crystalline Si solar cells
	Zilina University	Slovakia	Fabrication of ultralow reflectivity Si surfaces by surface structure chemical transfer method and their properties
	Hangyang University	Korea	Defect elimination in IGZO thin films by cyanide method and improvement of electrical properties
	Inner Mongolia Normal University	China	Improvement of Si device characteristics by nitric acid oxidation method
Bio-Nanotechnology	Huazhong University of Science and Technology	China	Development of Single-Molecule Speed Control Technology
Molecular Excitation Chemistry	Pohang University of Science and Technology	Korea	photoresponsible materials research
	Shanghai University	China	environmental science research
	Chungnam National University	Korea	Advanced materials research
	Korea Atomic Energy Research Institute	Korea	Quantum Beam Science Research
Reasoning for Intelligence	ETH Zurich	Swiss	Significant pattern mining on continuous data
			Outlier detection with metric learning
			Significant pattern mining on networks
	Federation University Australia	Australia	Defying Gravity Behavior in Anomaly Detection
			Accurate Classification Uing Similarity Measure Based on Data Mass
			k-Nearest Neighbor Classification Using Data Mass
	Federation University Australia	Australia	Clustering Using Local Distribution Contrast

Reasoning for Intelligence	University of Nanjing	China	k-Nearest Neighbor Classification Using Data Mass
	University Rennes 1	France	Analysis for Mobile Big Data
	Max-Planck-Institute for Intelligent Systems	Germany	Causal Inference for Non-Linear System
	Nanyang Technological University	Singapore	Representative selection with structured regularization
	Beijing University	China	Efficient generalizaed fused Lasso
Beam Materials Science	Paris-Sud University	France	Study the reaction between a hydrated electron and hydronium ion at elevated temperatures
	University of Notre-Dame	USA	Study on thermalization process of electron in polar liquids produced by ionizing radiation
	Paris-Sud University	France	Synthesis of Metal Nanoparticles and Patterning in Polymeric Films Induced by Electron Nanobeam
	University of Birmingham	UK	Lamellar Orientation of Block Copolymer via Electron-beam Induced Polarity Switch in Nitrophenyl Self-assembled Monolayer
	University of Qeeensland	Australia	Synthesis of novel block copolymers for lithographic applications
Semiconductor Electronics	Purdue University	USA	Development of the graphene/metal nanowire composit device
	Oxford University	UK	Liquid-AFM measurements of glyco-functionalized graphene
Soft Nanomaterials	Indian Institute of Chemical Biology	India	Cheical Biology Applications of Organic Electron Acceptors
	Max Plank Institute (Mainz Laboratory)	Germany	Printable Organic Semiconductors and Flexible Devices
Advanced Interconnection Materials	Chen Kun University	Taiwan	Low temperature Ag Bonding
	The Institute of Metal Research, Chinese Academy of Sciences	China	Hea-resistant bonding

Advanced Interconnection Materials	Beijing University of Technology	China	The study of reliability of metal nanowires based on graphene materials
	Siemens	Germany	Power semiconductor packaging
	ECPE	Germany	WBG power packaging
	Technical University of Denmark	Denmark	Flexible thermoelectric module
Intelligent Media	Peking University	China	Computer vision
	Drexel University	USA	Computer Vision
	University of Rajshahi	Bangladesh	Computer Vision
	Hanoi University of Science and Technology	Viet Nam	Computer Vision
	Vietnam National University of Agriculture	Viet Nam	Computer Vision
Organic Fine Chemicals	Department of Medical Sciences, Thailand	Thailand	Development of peptide nucleic acid device for the diagnosis of dengue virus infection
	Eindhoven University of Technology	The Netherlands	Regulation of 14-3-3 functions by use of fusicoccin derivatives
	Tufts University	USA	The a3 isoform of subunit a of the vacuolar ATPase localizes to the plasma membrane of invasive breast tumor cells and is overexpressed in human breast cancer
	Castleman Disease Collaborative Network (CDCN)/University of Pennsylvania	USA	Establishing diagnostic criteria and therapuetic methods for Castleman's disease
	The United States Army Medical Research Institute for infectious diseases.	USA	Application of polyphenol derivatives for the inhibition of virus and bacterial infection
	University of Southern California	USA	Mode of action of fusicoccin derivatives on PC-12 cells
Biomolecular Science and Engineering	Albert Einstein College of Medicine	USA	Development of near-infrared chemiluminescent protein

Biomolecular Science and Engineering	Emory University	USA	Noninvasive autonomous control of neuronal activity deep inside brain with cell ular activity-dependent chemiluminogenetic probes
	University of Oxford	UK	Maintaining and differentiating iPS cells to cardiomyocytes. pH imaging in lysosomes in cardiomyocytes with genetically encoded indicator.
	NanoScope Technologies, LLC	USA	Development of a technology for an optical control and imaging of in vivo brain function with high time resolution
	DRVision Technologies LLC	USA	Live-cell fluorescent probes for neurological diseases
Biomolecular Science and Regulation	University of Hong Kong	Hung Kong, China	Function of drug efflux systems
	National Institute of Agricultural Research (INRA)	France	Regulation of drug efflux systems
Theoretical Nanotechnology	The SPIN Consiglio Nazionale delle Ricerche	Italia	
	Technical University of Dresden	Germany	Boron and frustration
	Institude for High Pressure Physicds, Russian Academy of Science	Russia	High-pressure synthesis
	Busan National University	Korea	Electronic Structure of Transition-metal Oxides
	Julich Research Center	Germany	Development and applications of first-principles calculation methods
Functional Nanomaterials and Nanodevices	Indian Institue of Technology, Hyderabard	India	Sn oxide-based gas sensors
	Ehwa Woman University	Korea	Obsevation of nano-doman by Kervn force microscopy
	Genova University	Italia	Functional Oxide-MEMS
	Purdue University	USA	3D correlated oxide nano-structures for

			nano-scaling phenomena and electronic phase change memory application.
Synthetic Organic Chemistry	RWTH Aachen University	Germany	Development of novel asymmetric Brønsted Acid Catalyzed Substitution
	Bielefeld University	Germany	Development of combination process of organocatalysis and biocatalysis
	Paris-Sud University	France	development of organocatalyzed [4+2] annulation
Nanocharacterization for Nanostructures and Functions	University of Kansas	USA	ETEM observation of nanomaterials under catalytic reaction conditions
	Utrecht University	The Netherlands	ETEM observation of Fischer-Tropsch synthesis catalysts
	Lawrence Berkeley National Laboratory	USA	In situ surface analyses of supported metal catalysts
			High resolution TEM observations of Au nanoparticles supported on metal oxides catalysts
	FEI Company	USA	Development of a high resolution envirionmental TEM
Advanced Hard Materials	Sun Moon University	Korea	Development of Multifunctional Nanomaterials and Processing Technology for Eco-friendly Applications
	Korea Institute of Ceramic Engineering and Technology	Korea	Low-powered (<15 mW) smart sensors for multiple gas detection by functionalized nano-structured materials
	Hanyang University	Korea	Academic Exchange in the field of Nanochemical Engineered New Functional Materials
Biomolecular Science and Reaction	Academia Sinica	Taiwan	Application of ZZ-BNC for novel SPR sensor
Quantum System Electronics	University of Regensburg	Germany	development of SiGeSelf-assmebled quanutm dots
	Rhur University Bochum	Germany	Photon-electron spin conversion
	Max-Planck Institute ,	Germany	Spin transports in 2D materials

	Stuttgart		
Architecture for Intelligence	Chulalongkorn University	Thailand	Machine Learning
	De La Salle niversity-Manila	Philippines	Empathic Computing
	University of Leuven	Belgium	Machine Learning
	imec	Belgium	Brain signal analysis
	Telecom Paris Tech	France	Embodied Agent
	Thammasat University	Thailand	Introductive Logic Programing
	University of California, San Diego	USA	Brain signal analysis
Accelerator Science	INFN/LNF	Italia	Spectro-imaging using FEL
Regulatory Bioorganic Chemistry	Universidade De Ciencia Tecnologia De Macao	China	Evaluation of DNA and RNA binding molecules
	University of Tronto	Canada	Chemical biology studies on trinucleotide repeat disease using repeat-binding molecules
	Max Planck institutes	Germany	Kinetic studies of ligand-inducible -1 ribosomal frameshifting
	Institute of Bioorganic Chemistry	Poland	X-ray crystallographic studies on complex DNA/RNA repeats between synthetic ligands
	Adam Mickiewicz University	Poland	Evaluation of repeat binding molecules in trinucleotide repeat disease model cells
	imec	Belgium	biodevices
	Natinal Singapore University	Shingapore	Development of methods detecting Chikungunya Virus Infection
	Univeristy of Oxford	UK	AFM studies on DNAs associated with lipid bilayer membranes
Advanced Electron Devices	IFW Dresden	Germany	Development for a Flexible Magnet Sensor Array
Advanced Electronic Devices	Holst centre	The Netherlands	Development for a Flexible Electrode Sheet
Advanced Nanofabrication	University of Maryland, College Park	USA	The study of radiation induced initial reaction of acrylate monomer

5) Symposia, Seminars, Workshops and Lectures

2016/4/3-4/8	26th IUPAC International Symposium on Photochemistry
2016/4/20-4/22	Molecular Chirality Asia 2016
2016/5/10	Research Exchange with Young Investigators from Thailand Research Fund
2016/5/13-5/14	Inetrnational Workshop on Qunatum Technologies (QTech2016)
2016/6/16	International workshop on New Energy Science and Engineering
2016/6/28	Thai-Japan Bilateral Exchange Meeting
2016/7/23-7/24	Lumino-Genetics Workshop
2016/07/27-7/29	Workshop on the superresolution imaging of "physiological functions" and the diagnostics of activity architecture in live cells
2016/8/8-8/11	9th International Conference on Physics and Applications of Spin-Related Phenoman in Solids (PASPS9)
2016/8/22	IWEC-16 7th International Workshop on Empathic Computing
2016/9/2	The 1st Bio-Nano-Photonics Workshop
2016/9/4-11	Thai-Japan Bilateral Exchange Meeting
2016/9/16	The 1st Midori Tekijuku
2016/9/21-22	WCTP 2016 － Workshop on Computation: Theory and Practice
2016/10/12-15	International Workshop on Nano-spin conversion science and quantum spin dynamics
2016/11/10-11/11	Seminar on Ceramic Science and Technology.
2016/11/18	The 2nd Bio-Nano-Photonics Workshop
2016/12/5	The 2nd Midori Tekijuku
2016/12/16	Data Mining on Sensing Data
2017/1/7	The Japan Society of Applied Physics (JSAP), Kansai-Branch seminer
2017/1/9-1/10	Nanotechnology Initiative Meeting "Materials Informatics Network"
2017/1/13-1/14	Bioluminescence imaging Workshop
2017/1/24-1/25	Symposium on Surface Science & Nanotechnology -25th Anniversary of SSSJ Kansai-
2016/1/25-1/28	Thai-Japan Bilateral Exchange Meeting
2017/2/18	International Symposium on Photochemistry of Supramolecules, Nanomaterials, and Biomaterials
2017/3/7	Some progress on Image Understanding and Vision based Human Machine Interaction
2017/3/18-3/20	Conference on technologies for biological measurements and analyses
2017/3/27	International Seminar on Advanced Nano- and Hybrid-Materials by Prospective Young Scientists
2017/3/29	The 3rd Bio-Nano-Photonics Workshop

Other Lectures and Seminars

2016/4/4	Niikura, Hiromichi	Waseda University School of Advanced Science and Engineering	professor	Direct imaging of electronic wave functions in attoseconds precision
2016/4/11	Joon-Shik Park	Korea Institute of Ceramic Engineering and Technology（KICET）	Senior Researcher	Recent Trend on Smart Sensor and Systems
2017/4/28	Kazuhiro Machida	Perkin Elmer	Sales manager	Practical seminnar for ChemOffice
2016/5/13	Junichi Kobayashi	Hokkaido University Faculty PharmaceuticalSciences	Professor Emeritus	Chemistry and Biology of Bioactive Natural Products from Marine and Other Sources
2016/6/1	Géraldine MASSON	Institut de Chimie des Substances Naturelles, ICSN-CNRS	Dr.	Visible Light Photoredox-Catalyzed Multicomponent Reaction
2016/6/3	Hiroshi Ohrui	Research Institute for Microbial Diseases	Specially Appointed Professor	It’s a real anti-AIDS drug? Development of EFdA.
2016/6/3	Alexander Breder	Institut für Organische und Biomolekulare Chemie	Prof.	Carbophilic Activation and Oxidative Functionalization of Carbon‐Carbon Multiple Bonds by means of Selenium-Catalysis
2016/6/29	Yukou Du	Soochow University	Professor	Gold Used as Catalyst/Co-catalyst for Electrocatalytic Oxidation Reaction
2016/8/1	Ken I. Berglund	Emory University School of Medicine	Research Associate	Integratedopto- and chemogenetics for control of neuronal activity by using physical and biological light
2017/8/5	Tetsuo Shimamoto	Lab-consultation	Chief Executive Officer	Practical seminnar for Elements
2016/11/1	Duck-Kyun Choi	Hanyang University	Professor	Conductivity Control of InGaZnO by UV and Its Application in Display
2016/11/9	Michael Houle	National Institute of Informatics	Professor	An Extreme-Value-Theoretic Foundation for Similarity

				Applications
2016/11/11	Steven De Feyter	Department of Chemistry, KU Leuven	Professor	Molecular self-assembly on graphene and graphite: from fundamentals to applications
2016/11/17	Thomas Wirth	Professor of Organic Chemistry, Cardiff University, UK	Prof.	Iodine Reagents in Synthesis and Flow Chemistry
2017/11/28	Vladislav Verkhusha	Albert Einstein College of Medicine	professor	Engineering of near-infrared fluorescent proteins, biosensors and optogenetic tools from bacterial phytochromes
2016/11/24	Ivo Starý	Head of the research group at the Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic	Prof.	Nonplanar Aromatics: Their Synthesis and Properties
2016/12/20	Manuel Gomez Rodriguez	Max Planck Institute for Software Systems	Research Scientist	RedQueen: An Online Algorithm for Smart Broadcasting in Social Networks
2017/1/10	Yvan Six	ÉCOLE POLYTECHNIQUE	Dr.	Transmetallation with titanium: [2+2+2] cyclotrimerisation reactions and a detour in the land of dihalocyclopropane compounds
2017/1/26	Ulrich Hoefer	Phillips University Marburg	Professor	Shedding light on internal interfaces
2017/1/26	F. Stefan Tauz	Forschungszentrum Julich	Professor	Imaging and manipulating molecules
2017/2/27	Woo-byoung Kim	Dankook University	Professor	Dye-sensitized Solar Cells and Quantum Dots
2017/3/8	Eva Olsson	Chalmers University Of Technology	Prof	In situ TEM studies of electrical, mechanical and thermal properties
2017/3/27	Gyu-Dam Lim	Hanyang University	Researcher	Thermal Shielding Performance of Copper Sulfide Nanoparticle Silicone Composite Using Near Infrared Absorption Property

2017/3/27	Seung Han Ryu	Hanyang University	PhD. Student	Enhancement Three-Dimensional Structure in Hexagonal Boron Nitride / Poly(methyl methacrylate) Composite by Combining Concepts of Segregated Structure and Double-percolation System for High Volume Ratio h-BN/PMMA Composite

7) Public Information Activity

Public information activity of ISIR in 2016 is as follows:

- Bulletin of ISIR 2016 (in both Japanese and English)
- Memoirs of the Institute of Scientific and Industrial Research, Osaka University Vol.73 2016 (in English)
- Annual Report of ISIR (in Japanese)
- SANKEN News Letters(in Japanese)
- Report on SANKEN Techno Salon 2016 (in Japanese)
- WWW home-page (http://www.sanken.osaka-u.ac.jp/)

8) Research Reports

The number of scientific and technological papers published in 2016 is 372**.** The details are described in the part of activity of divisions and facilities.

9) Scientific Awards

2017/3/18	T.OGUCHI	Journal of the Physical Society of Japan Outstanding Referee
2017/3/17	M TANIGUCHI	CSJ Award for Creative Work
2017/3/17	M.IIJIMA	JSBBA Award for Women Scientists
2017/3/11	K.KOZAKI	Linked Open Data Challenge Japan 2016 NTT Resonant Award
2017/2/25	K.KOZAKI	Urban Data Challenge 2016 Activity Track Silver Award
2017/2/23	H.KIYAMA	Funai Research Encouragement Award
2017/1/7	T.WASHIO	2016 IBM Faculty Award
2017/1/1	S.YAMASAKI	Japanese Society of Chemotherapy West Japan Branch Excellent Award

2016/12/28	A.SHIMOYAMA K.SUGANUMA S.NAGAO T.SUGAHARA	MES2016 Best Paper Award
2016/12/18	Y.YAGI Y.MAKIHARA D.MURAMATSU	IWRCV Best Poster Honorable Mention Award
2016/12/8	K.KAIHATSU	New Energy and Industrial Technology Development Organization, Finalist
2016/12/8	K.KAIHATSU	DS Pharma Animal Health Co., Ltd., Grand Prize
2016/12/6	T.GOTO	NCF Best Poster Award
2016/12/2	R.ASO	Inoue Foundation for Science
2016/11/30	H.KOGA	The 5th Nature Industry Award, NIKKAN KOGYO SHINBUN Award
2016/11/30	K.KAIHATSU	The 5th Nature Industry Award, Special Award
2016/11/24	K.IMAMURA	9th International Conference Solid State Surfaces and Interface Awards in The Best Young Researcher Contribution Content
2016/11/6	A.KONDA	MNC 2016 Most Impressive Poster
2016/10/28	M.NUMAO K.FUKUI S.HAYASHI	FAN 2016 Best Paper Award
2016/9/22	W.KANAMORI	Young Investigator Presentation Award 2016
2016/9/22	A.KONDA	Finalist of the 2016 Photronics sponsored Best Student Paper Award
2016/9/21	M.TANE	Murakami Young Researcher Award
2016/8/27	M.NUMAO	JACIII Best Paper Award
2016/8/24	M.NUMAO K.FUKUI T. NATTAPONG	PRICAI 2016 Best Workshop Paper Award
2016/8/9	K.ICHINOSE H.SASAI S.TAKIZAWA	Best Poster Award of Young Researchers Seminar on Synthetic Organic Chemistry 2016
2016/7/29	T.MAJIMA	The Photobiology Association of Japan Award
2016/7/27	H.KOGA	The 83rd Pulp and Paper Research Conference, Best Presentation Award

2016/12/28	A.SHIMOYAMA K.SUGANUMA S.NAGAO T.SUGAHARA	MES2016 Best Paper Award
2016/12/18	Y.YAGI Y.MAKIHARA D.MURAMATSU	IWRCV Best Poster Honorable Mention Award
2016/12/8	K.KAIHATSU	New Energy and Industrial Technology Development Organization, Finalist
2016/12/8	K.KAIHATSU	DS Pharma Animal Health Co., Ltd., Grand Prize
2016/12/6	T.GOTO	NCF Best Poster Award
2016/12/2	R.ASO	Inoue Foundation for Science
2016/11/30	H.KOGA	The 5th Nature Industry Award, NIKKAN KOGYO SHINBUN Award
2016/11/30	K.KAIHATSU	The 5th Nature Industry Award, Special Award
2016/11/24	K.IMAMURA	9th International Conference Solid State Surfaces and Interface Awards in The Best Young Researcher Contribution Content
2016/11/6	A.KONDA	MNC 2016 Most Impressive Poster
2016/10/28	M.NUMAO K.FUKUI S.HAYASHI	FAN 2016 Best Paper Award
2016/9/22	W.KANAMORI	Young Investigator Presentation Award 2016
2016/9/22	A.KONDA	Finalist of the 2016 Photronics sponsored Best Student Paper Award
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2016/7/29	T.MAJIMA	The Photobiology Association of Japan Award
2016/7/27	H.KOGA	The 83rd Pulp and Paper Research Conference, Best Presentation Award

2016/7/13	M.TSUTSUI	ATI Research Award
2016/6/28	H.YOSHIKAWA	Young Engineer Award
2016/6/28	K.SUGANUMA S.NAGAO H.YOSHIKAWA	PCIM Asia Young engineer award
2016/6/24	Y.KAWAHARA	JSAI Insentive Award
2016/6/17	Q.LIU	Excellent Student Award of the Society for Biotechnology, Japan
2016/6/16	Y.YAGI Y.MAKIHARA D.MURAMATSU	The 9th IAPR International Conference on Biometrics,Honorable Mention Paper Award
2016/5/23	K.KAIHATSU	Outstanding performance award
2016/5/17	S.YOSHIMOTO	LSI and System Workshop Poster Award
2017/4/23	H.SASAI S.TAKIZAWA M.SAKO	MC Asia 2016 Best Poster Prize
2016/4/20	T.SEKINO	The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology. Prizes for Science and Technology (Technology Category)

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, 2017 is as follows.

Field / Course	Science	Engineering	Engineering Science	Pharma-ceutical Science	Information Science and Technology	Frontier Biosciences	Total
Master Course	36	48	15	2	17	-	118
Doctor Course	23	31	3	2	12	5	76
Total	59	79	18	4	29	5	194

Number of students who had obtained Master's or Doctor's Degree in FY2016 is as follows.

Field / Degree	Science	Engineering	Pharmaceutical Science	Information Science and Technology	Total
Master’s Degree	9	24	2	7	42
Doctor’s Degree	7	3	1	2	13
Total	16	27	3	9	55

3. International Exchange

1) Exchange Agreement

At Present, academic exchange agreements are concluded with the following 30 organizations.

Otto-von-Guericke University, Magdeburg (Faculty of Natural Science)
Pukyong National University (Basic Science Research Institute)
Forschungszentrum Jülich GmbH
Pusan National University(College of Natural Sciences)
Hanyang University
National Taiwan University
Centre National de la Recherche Scientifique
RWTH Aachen University
Peking University (The School of Electronics Enginering and Computer Science)
National Taiwan Normal University(College of Science)
University of Geneva(Faculty of Science)
Inner Mongolia Normal University
University of Augsburg
Pohang University of Science and Technology
De La Salle University(College of Computer Studies)
Pohang University of Science and Technology(School of Environmental Science and Engineering / Department of Chemical Engineering)
Assiut University
Interuniversitair Micro-Electronica Centrum vzw (IMEC)
Tammasat University
University of Bordeaux

Bielefeld University（Faculty of Chemistry）
University of Minnesota (The Biotechnology Institute)
Korea Institute of Ceramic Engineering and Technology
Korea Atomic Energy Research Institute
Advanced Radiation Technology Institute/Korea Atomic Energy Research Institute
Eindhoven University of Technology (Department of Mechanical Engineering)
Pacific Northwest National Laboratory
Sun Moon University (College of Engineering)
Shanghai University (School of Environmental and Chemical Engineering)
Chulalongkorn University (Department of Computer Engineering, Faculty of Engineering)
Ecole Polytechnique

2) Foreign Researchers and Students

The Number of foreign researchers and students staying in ISIR as of March 31, 2017 is 89 in total. Details are, Assistant Professor(include of specially appointed staffs) (1), Specially Appointed Associate Professor(7), Specially Appointed Researcher(4), Specially Appointed Technical Staff(1), Part-time Employee (11), Graduate Students 52(Doctor Course,34, Master Course,18), Research Students (13).

Their nationalities are; China(43), Korea(9), Thailand(5), Indonesia(3), Bangladesh(4), India(4), The Netherland(1), Viet Nam(4), Russia(2), Taiwan(1), Philippine(2), Malaysia (2), Egypt(5), Germany.(1), Sri Lanka(2), Costa Rica(1).

The Number of visiting Research Scholar in 2016 is 54. Their nationalities are; China(11), Hong Kong(9), U.S.A.(12), Thailand(4), Korea(9), France(1),Canada(1), Denmark(2),Germany(4), Vietnam(1),Egypt(1), Slovakia(1),Belgium(2) , Indonesia(1), Iran(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 406 in total.

Number of ISIR staffs who have been working as committee members of International Conferences or Editorial Board of international academic journals are 144 in total. For more details, see the part of activity of divisions and facilities.

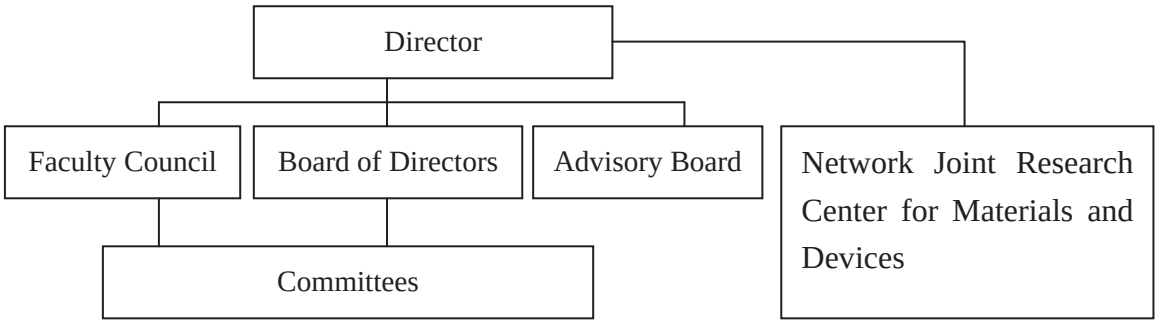
4. Concluding Remarks

(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. 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 seven departments; Information Science Departments (Knowledge Science, Intelligent Media, Architecture for Intelligence, Reasoning for Intelligence), Quantum Science Departments (Photonic and Electronic Materials, Semiconductor Electronics, and Advanced Electron Devices. The former four and the latter three 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.

Research Projects

- Quantum information technologies using photons and spins and materials research for semiconductor spintronic devices
- Quantum nanodevices and biosensor application using graphene and nanotube
- Development of noise-robust spoken dialogue robots and knowledge acquisition through dialogues
- Computer vision-based gait video analysis and its application to person authentication, medicine, and dairy
- Introduction of sensors to Constructive Adaptive User Interfaces
- Knowledge discovery from complex data, causal analysis and combinatorial discovery

Department of Quantum System Electronics

Professor: Akira OIWA
Associate Professor: Shigehiko HASEGAWA
Assistant Professor: Haruki KIYAMA
Guest Researcher: Shuichi EMURA
Specially Appointed Researcher: Yuji Sakai (1.11.2016-)
Postdoctoral Researcher: Yijin ZHANG (1.4.2016-)
Graduate Students: Yoshihito SUGETA, Tomohiko ABE, Masamitsu KIMURA, Ryoki SHIKISHIMA, Tomohiro NAKAGAWA, Yuta MIYAZAKI, Yuhei KUROKAWA, Masaki TADA, Yumi AOMATSU, Kazutoshi KAWAGUCHI, Seiu HIGASHIDE, Ryo YANAGIDANI
Under Graduate Students: Rio FUKAI, Ichiro TOYOSHIMA
Supporting Staff: Akiko WATANABE

Outlines

We study the quantum and spintronic devices that can control the quantum mechanical properties of light, electrons and spins. Single electron spin is a suitable candidate of a quantum bit (qubit) for quantum computation. Hence, we develop spin qubits and also quantum interfaces between single photons to single electron spins in quantum dots toward long distant quantum communications. We investigate magnetic semiconductors and spin currents generated by spin injections from ferromagnets to semiconductors. We study the growth and characterization of high quality materials and perform precise quantum transport measurements to explore novel phenomena emerging in quantum nano-structures that can control the photon, electron and spin degrees of freedom.

Research Projects

Fabrication of a single-hole transistor using SiGe self-assembled quantum dot and the observation of Kondo effect

Quantum dots (QDs) made of group IV materials are of great interest because many of isotopes have zero nuclear spins, which significantly extends the spin coherence time. In addition, SiGe self-assembled QDs, which show p-type characteristics, may have higher spin

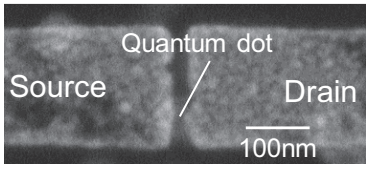


Fig.1 Scanning electron micrograph of the device.

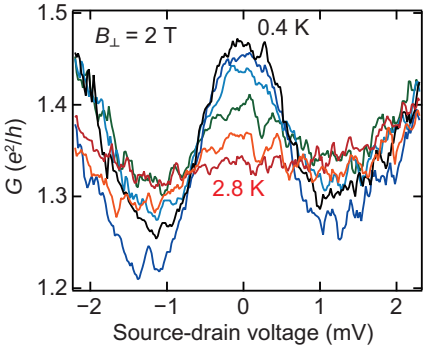


Fig.2 Source-drain bias voltage dependence of differential conductance.

coherence because the hyperfine interaction may be further suppressed for holes. We fabricated a single-hole transistor (Fig.1), and observed transport features characteristic to QDs such as Coulomb oscillations. Furthermore, differential conductance showed peaks around zero source-drain voltage (Fig. 2), which we attribute to Kondo effect.

Single-shot ternary readout of electron spins in a GaAs gate-defined quantum dot

Readout of electron spins in quantum dots is an indispensable technology for spin-based quantum information processing. There is already the scheme of binary spin readout, which is currently utilized in research and development. In this work, we first developed a new scheme of binary spin readout using quantum Hall edge states. Next we developed the scheme for ternary readout of two-electron spins by combining the new binary readout scheme and the existing scheme of binary spin readout using the orbitals in the dot. We verified the ternary spin readout by observing three different spin relaxation dynamics (Fig.3).

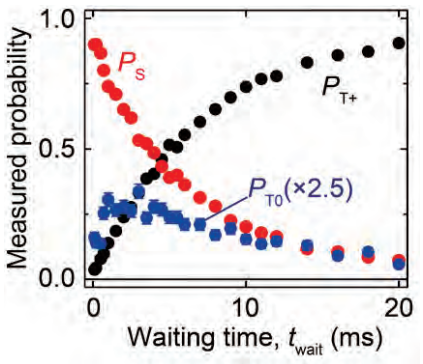


Fig.3 Time evolution of detection probabilities for three spin states, S, T0 and T+.

Crystal Growth and Characterization of Dilute Magnetic Semiconductors toward Application to Spintronic devices

Dilute magnetic semiconductors (DMSs) are gathering great interest as a candidate for new functional materials. Nitride-based DMSs such as GaCrN, GaGdN, and GaSmN have been grown by using plasma-assisted molecular beam epitaxy. It has been reported that these materials show hysteresis loops in their magnetization curves even at room temperature. In 2016, in order to integrate rare earth nitrides (intrinsic magnetic semiconductors) into GaN, GdN/GaN superlattices were grown. The GdN/GaN superlattices exhibited hysteresis loops in magnetic circular dichroism (MCD) versus magnetic field curves as well as in their magnetization curves. The findings provide evidence that the GdN/GaN superlattices have spin-dependent components in the conduction and /or valence bands near the Fermi level.

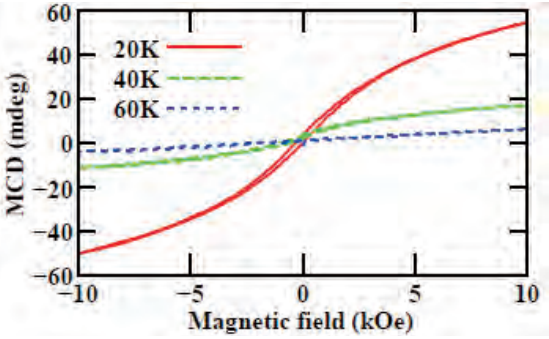


Fig.4 MCD peak intensity at 830 nm versus magnetic field curves for GdN/GaN

Spin Injection from Ferromagnets into III-Nitride Semiconductors

Spin injection from ferromagnets into III-Nitride semiconductors is a very important subject to realize semiconductor spintronic devices. We have demonstrated spin injection and detection through a Co/GaN Schottky barrier at RT. In 2016, we examined the structure of γ'-Fe_4N/AlN/GaN structures toward the improvement of spin injection efficiency. It was found that γ'-Fe_4N (111) and/or (001) layers were grown on AlN layers depending on the N flux. Moreover, AlN layers (several nm thick) work well as tunnel barrier layers.

Department of Semiconductor Electronics

Professor: Kazuhiko MATSUMOTO
Guest Professor: Kenzo MAEHASHI
Associate Professor: Koichi INOUE
Guest Associate Professor: Yasuhide OHNO
Assistant Professors: Yasushi KANAI, Takao ONO
Guest Researcher: Masato MIYAKE
Technical Staffs: Maiko NAMPO (1.7.2016-), Masami TANIOKU (1.1.2017-)
Graduate Students: Takashi IKUTA, Satoshi OKUDA,
Kaho KAMADA, Ryota HAYASHI, Yuki MORI
Ryo OKAZAKI, Takuya KAWATA
Under Graduate Students: Yuto ANZAI, Keisuke SAKAGUCHI
Supporting Staffs: Reiko YAMAUCHI, Ayumi ENOMOTO

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

Research Projects

Long-molecular Channel Transistor with Graphene Electrode

We have demonstrated to fabricate a long-molecular channel transistor using graphene electrodes separated by a 20- 40 nm wide gap to elucidate the transport properties of the molecule. Graphene has the advantages of the high conductivity and the affinity toward some organic molecules since it has the π-bonding carbon structure. Poly 3-hexylthiophene (P3HT) molecules (Fig.1) were self-assembled and formed bridges over the nano-gap of the graphene electrodes by the immersion of the samples into P3HT solution. It has been concluded that the transistor shows the p-type conduction, and carriers in the P3HT molecular chain are mediated by the small-polaron model from the temperature dependence of the characteristics.

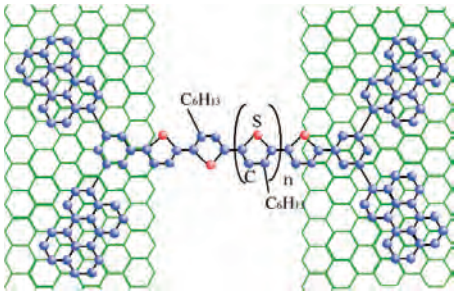


Fig.1 Schematic illustration of long-molecular channel transistor with graphene.

Evaluation of Detection Selectivity of Virus Detection using Glyco-functionalized Graphene Field-effect Transistor

For high-sensitive detection of influenza virus, various length of sugar chain, glycopolymer (longest), glycopeptide and glycan (shortest), were modified on graphene transistors and viral protein hemagglutinin was introduced to the transistors. In all cases almost same dissociation constant was obtained, since the structure of sialic acid terminus, binding site of the hemagglutinin, is common among the three sugar chains. Meanwhile, background noise was suppressed in glycan-modified graphene transistor and the detection limit was improved in double digits compared with other two. It is because short glycan and hemagglutinin captured by the glycan were stably kept inside the Debye length from graphene. This results leads to high sensitivity and selectivity of influenza virus detection using glyco-functionalized graphene transistor.

Development of Efficacy Evaluation System for Antiviral Drug using Glyco-functionalized Graphene Field-effect Transistor

Neuraminidase inhibitor is commercialized as anti-influenza drugs such as Zanamivir (Relenza®). We developed a novel platform for electrical assay for the drug efficacy using glyco-functionalized graphene transistor. No significant change in transfer characteristics was measured in the transistor with neuraminidase and Zanamivir, while hole current decrease was measured after Zanamivir removal. This is because neuraminidase reaction started after removal of its inhibitor, negatively charged sialic acid was released from graphene surface and hole carrier, once induced by the sialic acid, was decreased in the graphene. (Fig. 2). This result leads to the graphene platform for anti-influenza drug development.

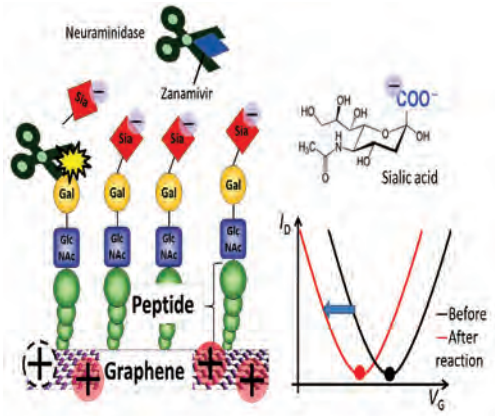


Fig. 2 Schematic image of the measurement of neuraminidase activity and its inhibition. After sialic acid release, the transfer characteristics shifted to negative direction.

Position-controlled single-crystalline graphene growth using patterned catalyst

We synthesized position-controlled single-crystalline graphene using patterned catalyst. Figure 3(a) shows schematic images of a patterning method. First, catalyst copper foils were oxidized to suppressed nuclear density of graphene. The oxidized layer of copper foils were patially etched using photolithography. After CVD growth using patterned copper foils, high-density graphene was grown in patterned areas. Figure 3(b) shows optical micrograph image of graphene which size of etched area was 75 μm square. The nuclear density of synthesized graphene depends on the size of etched. For 75 μm square the single-crastalline graphene was grown. We have demonstrated position-controlled single-crystalline graphene.

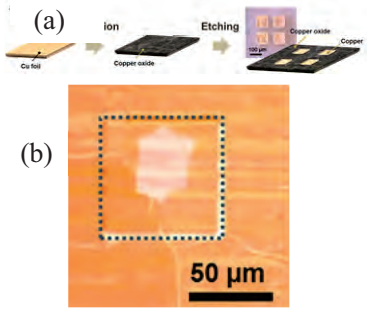


Fig. 3 (a) Schematic images of patterning a copper foil. (b) An optical micrograph of the copper foil after CVD.

Department of Advanced Electron Devices

Professor:	Tsuyoshi SEKITANI
Assistant Professors:	Kouichi SUDO
Specially Appointed Associate Professor:	Takafumi UEMURA
Assistant Professor:	Teppei ARAKI, Shusuke YOSHIMOTO
Specially Appointed Assistant Professor:	Yuki NODA, Hiroki OTA (1.8.2016-28.2.2017)
Specially Appointed Researcher:	Toshikazu NEZU, Afreen AZHARI
Technician:	Yuko KASAI, Naoko NANBA, Mihoko AKIYAMA, Hirokazu IIDA, Masaru SHIMIZU, Takako OYAMA, Yumi INOUE, Naoko KURIHIRA, Noriko TAYA, Toshihisa HAMAGUCHI, Chikira SEIICHI
Graduate Students:	Masaya KONDO, Ashuya TAKEMOTO
Under Graduate Students:	Sugiyama MASAHIRO, Fumika TANABE
Exchange Students:	Ren SMIS, Donald SWEN
Supporting Staff:	Michi UEDA, Taki HONMA, Tomoko TAKAHASHI

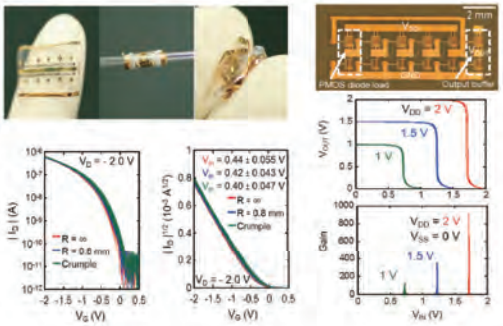
Outlines

Our laboratory has been carrying out research on the physical properties of materials used in flexible electronics and their applications on the basis of the excellent electrical and flexibility, self-assembly phenomena, and low-energy processability of organic materials. In particular, we succeeded in realizing a high integration of organic transistors by developing technologies based on the characteristics of organic materials in a wide range of fields. We established the fundamental technology for fabricating flexible organic thin-film transistors (TFTs) and developed ultraflexible electronics and stretchable electronics with excellent mechanical properties, demonstrating the usefulness of these devices for the first time in the world.

We have not only developed electronic devices, but also fabricated an 1) organic light-emitting diode (OLED) or 2) organic photoelectric conversion element [solar cell, optical photodetector (OPD)] on a 1-μm-thick plastic film, realizing imperceptible electronics. This is expected to become the next-generation human interface and is being studied in cooperation with medical doctors to apply them to devices for use in next-generation medicine and medical welfare.

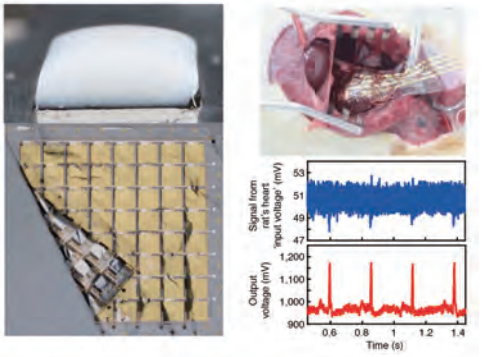
Research Projects

Fabrication of ultrathin polymeric gate insulator for 2 V organic transistor circuits



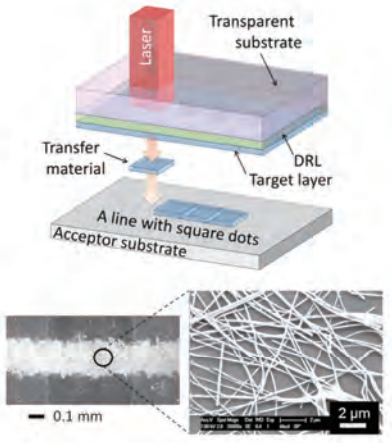
Low-voltage operation in flexible organic thin-film transistors (OTFTs) enables safe use in biomedical applications. Considering portable and implantable devices, a driving voltage of less than 3.5 V, which is available from general small batteries, is desired. To reduce the operation voltage, one strategy is to make the insulating layer thin without pin-hole. In this study, we developed a new fabrication process of an extremely thin insulator layer on Au gate electrode to reduce the driving voltage of OTFTs. By combining the pre-oxygen plasma treatment of an Au gate electrode surface with post-annealing treatment before and after chemical vapor deposition of parylene, we successfully obtained pin-hole free 18-nm-thick parylene insulating layer with a high yield. To demonstrate the high yield fabrication process of parylene insulating layer and the low-voltage operation of OTFTs, we fabricated a ring oscillator circuits oscillated with ≤ 2 V, where the yield was 97% for 360 transistors.

Ultraflexible organic amplifier with biocompatible gel electrodes



An implantable electronic system that monitors in vivo biological signals is expected to play an important role in realizing next-generation medical electronics. Long-term stability and reliability are among the biggest challenges for *in vivo* electronic systems. Here we demonstrate the fabrication of a biocompatible highly conductive gel composite comprising multi-walled carbon nanotube-dispersed sheet with an aqueous hydrogel. This gel composite exhibits admittance of 100 mS cm^{-2} and maintains high admittance even in a low-frequency range. On implantation into a living hypodermal tissue for 4 weeks, it showed a small foreign-body reaction compared with widely used metal electrodes. Capitalizing on the multi-functional gel composite, we fabricated an ultrathin and mechanically flexible organic active matrix amplifier on a 1.2-μm-thick polyethylene-naphthalate film to amplify (amplification factor: ~200) weak rat heart. It will broaden the potential application of flexible biomedical electronics from disposable flexible electronics used only during medical surgery to long-term implantable monitoring systems.

Printing technique of silver nanowire stretchable electrode by laser-induced forward transfer (LIFT) technique



Silver nanowires (AgNWs) are one of excellent candidate electrode materials in next-generation wearable devices due to their high flexibility and high conductivity. Development of patterning techniques for AgNWs electrode are very important to achieve the high throughput production assuming an application to roll-to-roll process. Here, we introduce a non-contact patterning method for AgNWs electrodes by laser-induced forward transfer (LIFT) technique. The technique enables precise print production with a width of 200 μm, low electrical resistivity 10^{-4} Ω cm and a 100% stretchability. Further, a electrode showed over 80% in optical transmittance and less than 100 Ω sq^{-1} in sheet resistance. By using LIFT technique, transparent conductive films and stretchable wirings can be printed on demand without damage to pre-printed elements, so that further development is expected for applications such as a wiring patterning for small quantity multipart production, a partial repair of conductive film and a laminated printing.

Implantable wireless system for ECoG monitoring and optogenetics manipulation

We have developed an implantable wireless sensor system for recording electrocorticogram (ECoG) with 64 channel 24-bit analog to digital converter (ADC) and remoting optogenetics with 2-channnel LED drivers. The proposed system is designed minimally to make it implantable into an animal, comprises a small main board and ADC boards. For non-invasive monitoring of bio-signal, the biocompatible & flexible ECoG electrodes and the LEDs probes are covered by shape-memory polymer to fit the irregularly surface of the brain. This system enables long-term ECoG monitoring and remote optegenetics operation for animals during free movements that could not be achieved by using conventional wired, heavy and large monitoring system.

Department of Intelligent Media

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Assistant Professor: Ikuhisa MITSUGAMI, Fumio OKURA
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Outlines

The studies in this laboratory focus on computer vision and media processing including basic technologies such as sensor design, and applications such as an intelligent system with visual processing functions. Some of our major research projects are development of a novel vision sensor such as an omnidirectional mirror, biomedical image processing such as an endoscope and microscope images, person authentication, intension, and emotion estimation from human gait, and its applications to forensic and medical fields, photometry analysis and its application to computer graphics, an anticrime system using a wearable camera, 3D shape and human measurement using infrared light.

Research Projects

Recovering Transparent Shape from Time-of-Flight Distortion

This paper presents a method for recovering shape and normal of a transparent object from a single viewpoint using a Time-of-Flight (ToF) camera. Our method is built upon the fact that the speed of light varies with the refractive index of the medium and therefore the depth measurement of a transparent object with a ToF camera may be distorted. We show that, from this ToF distortion, the refractive light path can be uniquely determined by estimating a single parameter. We estimate this parameter by introducing a surface normal consistency between the one determined by a light path candidate and the other computed from the corresponding shape. The proposed method is evaluated by both simulation and real-world experiments and shows faithful transparent shape recovery.

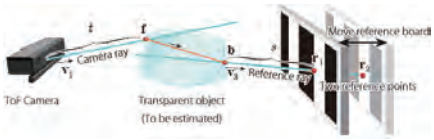

Fig.1 Overview of transparent shape measurement from time-of-flight distortion

GEINet: View-Invariant Gait Recognition Using a Convolutional Neural Network

This paper proposes a method of gait recognition using a convolutional neural network (CNN). Inspired by the great successes of CNNs in image recognition tasks, we feed in the most prevalent image-based gait representation, that is, the gait energy image (GEI), as an input to a CNN designed for gait recognition called GEINet. More specifically, GEINet is composed of two sequential triplets of convolution, pooling, and normalization layers, and two subsequent fully connected layers, which output a set of similarities to individual training subjects. We conducted experiments to demonstrate the effectiveness of the proposed method in terms of cross-view gait recognition in both cooperative and uncooperative settings using the OU-ISIR large population dataset. As a result, we confirmed that the proposed method significantly outperformed state-of-the-art approaches.

Fig.2 CNN structure for GEINet

Cross-Speed Gait Recognition Using Single-Support Gait Energy Image

This paper introduces a speed-invariant gait representation called single-support gait energy image (SSGEI), which realizes a good trade-off between the speed invariance and the stability by combining single-support phases and GEI concept. For this purpose, we firstly find out the optimal duration around single support phases using a training set so as to well balance the speed invariance and the stability. We then extract SSGEI by aggregating multiple single-support frames. Finally, we combine the proposed SSGEI with subsequent Gabor filters and metric learning for better performance. Experiments on the publicly available OU-ISIR Treadmill Dataset A composed of the largest speed variations demonstrated that the proposed method yielded 99.33% rank-1 identification rate on average for cross-speed gait recognition, which outperforms the other state-of-the-arts, and realized a low computational cost as well.

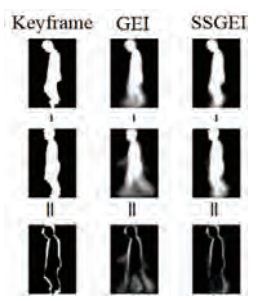

Fig.3 Difference images for key-frame, GEI, and SSGEI

Department of Reasoning for Intelligence

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Specially Appointed Researcher: Takayuki TAKAAI, Takeshi YOSHIDA
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Supporting Staff: Hiroko OKADA, Nana KUMASHIRO, Ayako FUJIWARA

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 machine learning and data mining. We also study the application of these techniques to variety of fields such as science, sensing, information network, quality/risk management, medicine, security, marketing and finance. Currently, we work on the following four research projects.

Research Projects

Statistical model extraction for low frequency events from big data

Data consisting of massive variables (extremely high dimensional data) representing numerous events and/or states became available by developments of computer network, sensing network and scientific measurement technologies. Examples are medical patient data on the 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 studied 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 data sampling methods for deriving statistical model on low frequency events embedded in a big data set. We also extended the methods for clustering, classification and anomaly detection by flowing the search activity in the last year.

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 studied a novel algorithm for searching causal structures governing data sets generated by some non-linear process with arbitrary noise.

Machine learning from high-dimensional data by using structured regularization

Intelligent information processing technologies for large-scale and high-dimensional data (so called, *Big Data* technologies) become increasingly important because of recent accelerating technical progresses in data acquisition and accumulation. It is often the case that we obtain more accurate estimate by introducing our presumed structural constraints on the observed variables to machine learning. We study theories and techniques for developing fast and accurate algorithms by using such structural constraints. Following the last year, we mainly developed fast algorithms for structured sparse learning and group structure learning in data. Furthermore, we applied these algorithms to several real-world problems including computer vision, and confirmed the utility of the algorithms in each application.

Statistically tested hypothesis discovery from large scale data

Techniques that discover combinatorial structures (patterns) from large databases have been developed and applied in a wide range of domains from drug discovery to marketing. Toward a deeper understanding of phenomena, in many fields in particular in natural sciences, there is a compelling need for discovering *statistically significant patterns* from large databases to statistically support the reliability of discovered knowledge. To this end, we develop scalable methods that find statistically reliable patterns from massive data, in which the false positive rate of patterns is rigorously controlled through the hypothesis testing process. There are two big problems to be solved: combinatorial explosion of the number of patterns and inflation of the false positive rate caused by repeating hypothesis testing. Following the last year, we have developed an efficient method that can find all feature combinations from continuous data while rigorously controlling the false positive rate. We have confirmed the effectiveness of our method on real-world benchmark datasets.

Department of Knowledge Science

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Exchange Student:	Tac Thong NGUYEN (FrontierLab program)
Supporting Staff:	Kikuko TANIBATA

Outlines

Intelligence of machines, e.g., to talk with humans, is still under development, while computation power and robot locomotion have drastically improved. To realize human-friendly and helpful robots, the spoken dialogue function, which human beings have in nature, is indispensable. We study basic technologies on spoken dialogue systems across several layers from acoustic signal processing to social interaction. We have also been involved in the ontology engineering, which organizes human knowledge and describes it in a machine-readable format.

Research Projects

Development of Human-Robot Interaction System based on Deep Learning

The fundamental functions for robots that interact with humans are the detection and direction estimation of speech (sound source localization: SSL) and speech recognition (Fig.1). The efficient processing of these functions is also important for the resource restricted situations, such as robots. We improve the accuracy and the processing speed of SSL and speech recognition based on deep learning.

We succeeded in a multiple SSL based on deep neural network by consistent labeling and a special network architecture. We also developed an adaptation technique of networks under various acoustic environments for the localization performance improvement. Experiments revealed that the performance dependency on sound position and the necessity of integration with traditional localization methods.

We proposed a training and node-pruning technique for acoustic model based on deep learning to reduce the memory usage and computational cost. We achieved a 95% reduction of memory usage and a 74% increase in speed of an NN's forward calculation on CPU.

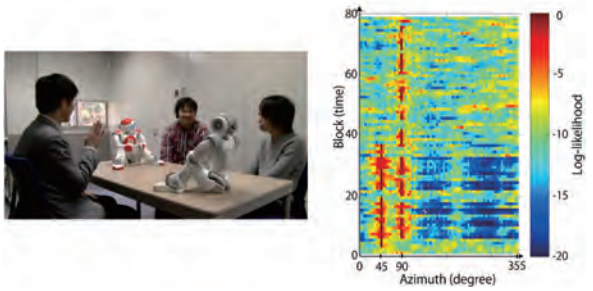

Fig.1 Human-robot interaction (left) and localization results of two speakers (right)

Knowledge Acquisition through Dialogues

To acquire new knowledge from an interlocutor's utterance is one of intelligent

abilities of human beings. Current dialogue systems talk with humans by using knowledge designed by its system developpers, but do not have ability to obtain new knowledge. Especially, since complete knowledge description in various domains is difficult, a technique that acquires such knowledge during dialogues is required.

This year, we proposed a method to estimate the category of an unknown word from its character sequence at two levels, i.e., at leaf and intermediate nodes in the target ontology. This enables the system to acquire domain knowledge while continueing dialogues by generating an implicit confirmation request with the estimated category (Fig.2). We set thresholds to determine whether or not the estimated categories should be incorporated into the system knowledge and set them by using the target data. Furthermore, we proposed another method to determine whether the estimated categories included in the implicit confirmation request are correct or not. We first collected user responses to the confirmation request by crowdsourcing. We then designed novel features for machine learning by considering the context of the confirmation request and shows the performance improvement.

We also continued to investigate several issues to improve acoustic and language models during dialogues for automatic speech recognizers, which will be required in spoken dialogue systems. As to language models, we presented a part of our study to obtain vocabulary in a bottom-up manner on the basis of non-parametric Baysian estimation at an international conference.

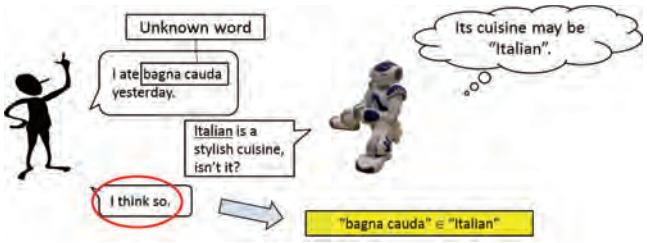

Fig.2 Example of implicit confirmation and acquiring category of unknown word

Intelligent Systems based on Ontological Engineering and Linked Data technologies

We study on developments of intelligent systems based on fundamental theories of ontological engineering and Linked Data technologies. The research issues include following 3 topics. 1) Theories about the fundamental issues on ontology and Linked Data from both scientific and engineering viewpoints, 2) Development of software tools for ontology and Linked Data building/utilization based on the theories, and 3) Developments of applications using them in domains. Currently, we develop ontologies and applications in several domains such as clinical medicine, biomimetics and open data in governments. For instance, we developed a web-based application to browse a disease ontology based on Linked Data (Fig.3). In 2016, we developed a keyword exploration system for product design based on biomimetics. The system are well received through user experiments by researchers in enterprises.

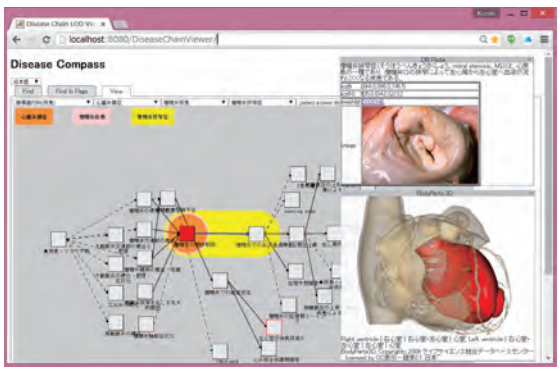

Fig.3 A browsing system for disease ontology based on Linked Data (http://lodc.ed-ontology.jp).

Department of Architecture for Intelligence

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Research Students:	Ekasit PHERMPHOONPHIPHAT (1.10.2016-)
Supporting Staff:	Megumi TANABE, Mitsuyo OHTSUKA, Akiko YAMAMOTO

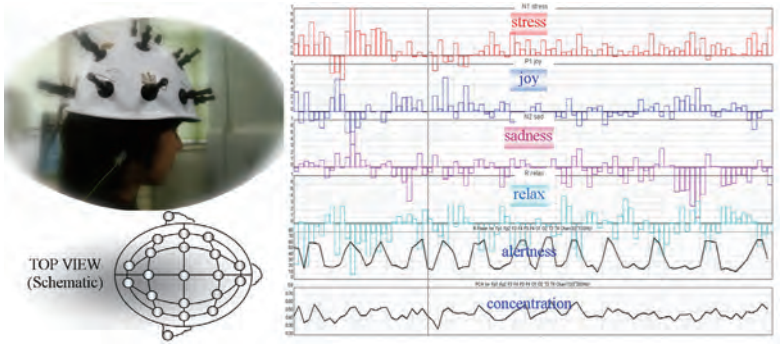
Outlines

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. Knowledge Discovery from Event Sequence Data, and 3. Intelligent Ubiquitous Sensor-Networks.

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.

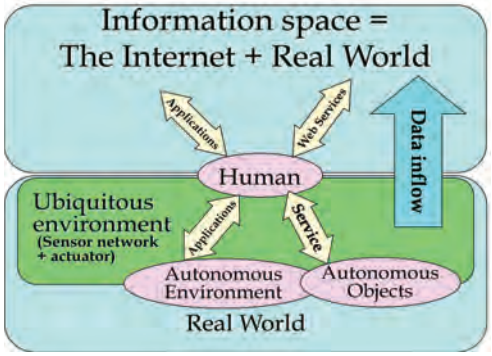


Knowledge Discovery from Event Sequence Data

Human behaviors and physical phenomena change over time. To extract rules or patterns inherent in the time varying data helps us to understand the phenomena, for

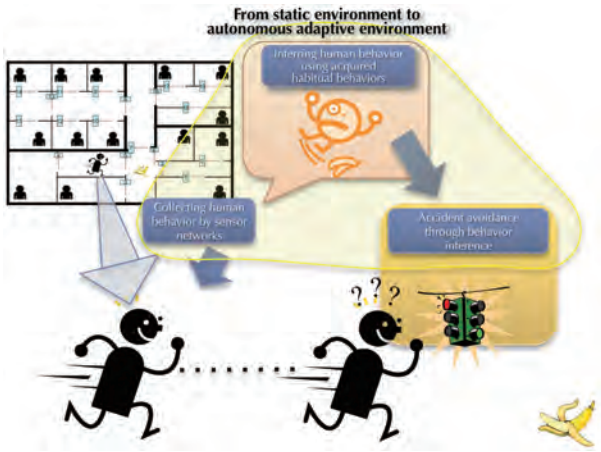
monitoring, and for support. In this laboratory, we have proposed a concept of "co-occurrence clusters" that should satisfy both space proximity of the events (cluster) and time proximity between clusters. Then, we proposed a novel algorithm to extract co-occurrence clusters. Moreover, we extended the algorithm to estimate time intervals of the events, called cluster sequence mining. We then applied these algorithms to extract damage patterns in a fuel cell and earthquake occurrence patterns. In a fuel cell application, from Acoustic Emission event sequence, we have succeeded to identify components that affect largely to the other components. Also in earthquake application, from a hypocenter list around Japan after the Tohoku earthquake, we have succeeded to identify earthquake co-occurrence patterns suggesting interactions between asperity that particularly appear in trench type earthquakes.

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.



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, Advanced Hard Materials, 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.

Research Projects

- Fabrication of ultra-low reflectance Si surfaces by surface structure chemical transfer method and improvement of efficiencies of crystalline Si solar cells
- Si nanopowder produced from Si swarf for hydrogen generation and battery materials
- Development of hetero-semiconductor oxide ceramic composites through self-organization route and their formation mechanisms
- Elastic properties analysis of Mg-Zn-Y alloys with long-period stacking ordered structures
- Development of oxide nanotubes having novel photo-chemical multifunctions by advanced structure tuning
- Development of printed flexible wiring and interconnection and characterization of their basic properties
- Development of WBG semiconductor system integration and basic interconnection research
- 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 Semiconductor Materials and Processes

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Associate Professor: Taketoshi MATSUMOTO
Assistant Professor: Kentaro IMAMURA, George HASEGAWA (- 30.9. 2016)
Specially Appointed Professor: Sumio TERAKAWA
Specially Appointed Researcher: Yuki KOBAYASI, Masayoshi NISHIYAMA
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Research Student: Meng QINGJI (1.10. 2016- 31.3. 2017), Sun CHAO (1.12. 2016- 31.3. 2017)
Supporting Staff: Masuko SUMIYOSHI (1.4. 2016- 30.9. 2016), Kazuko GODA (17.10. 2016- 31.3. 2017)

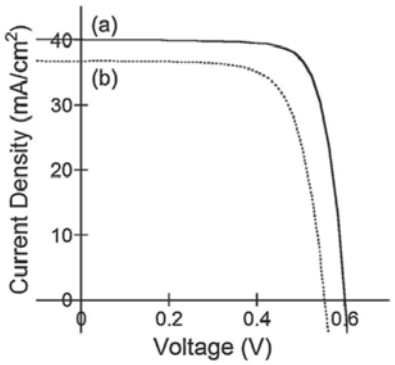
Outlines

The modern society is based on semiconductor technology. Our research aims at improvement of the characteristics of semiconductor products and development of 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) crystalline Si solar cells, and 2) Si nanopowder produced from Si swarf and its application.

Research Projects

Ultralow reflectivity surfaces by formation of nanocrystalline Si layer for crystalline Si solar cells [Original paper 6]

The surface structure chemical transfer (SSCT) method has been applied to fabrication of single crystalline Si solar cells with 170 μm thickness. The SSCT method, which simply involves immersion of Si wafers in H_2O_2 plus HF solutions and contact of Pt catalyst with Si taking only 7.5~30 s for 6 in. wafers, can decrease the reflectance to less than 3% by the formation of a nanocrystalline Si layer. However, the reflectance of the <nanocrystalline Si layer/flat Si surface/rear Ag electrode> structure in the wavelength region longer than 1000 nm is high because of insufficient absorption of incident light. The reflectance in the long wavelength region is greatly



	V_{oc} (V)	J_{sc} (mA/cm²)	FF	η (%)
a	0.600	40.1	0.770	18.5
b	0.555	36.7	0.717	14.6

Fig. 1 I–V curves under AM 1.5 100 mW/cm² irradiation for the solar cell with the <Ag/nanocrystalline Si layer/n^{++}-Si/p-Si substrate/B-diffused BSF/Ag> structure: (a) with surface passivation using PSG followed by heating at 925°C and hydrogen treatment at 400°C, (b) without surface passivation using PSG.

decreased by the formation of the nanocrystalline Si layer on pyramidal textured Si surfaces due to an increase in the optical path length. Deposition of phosphosilicate glass (PSG) on the nanocrystalline Si layer for formation of pn-junction does not change the ultralow reflectance because the surface region of the nanocrystalline Si layer possesses a refractive index of 1.4 which is nearly the same as that of PSG of 1.4–1.5. The PSG layer is found to passivate the nanocrystalline Si layer, which is evident from an increase in the minority carrier lifetime from 12 to 44 μs. Hydrogen treatment at 450 °C further increases the minority carrier lifetime approximately to a doubled value. The solar cells with the <front Ag electrode/nanocrystalline Si layer/pyramidal Si substrate/boron-diffused back surface field/Ag rear electrode> structure show a high conversion efficiency of 19.7% in spite of the simple cell structure without antireflection coating. In this case, the high short circuit photocurrent density of 41.0 mA/cm^2 under AM1.5 100 mW/cm^2 irradiation is obtained.

Hydrogen generation from water using Si nanopowder fabricated from swarf [Original paper 1]

Si nanopowder is fabricated from Si swarf by the simple beads milling method. Si nanopowder possesses the maximum crystallite size distribution at 7 nm and the average diameter of 12 nm. Fabricated Si nanopowder easily reacts with water, resulting in generation of hydrogen. The hydrogen generation rate strongly depends on pH value of the solutions and the temperature. When the pH and the reaction temperature are set at 13.0 and 50 °C, respectively, the hydrogen evolution rate in the initial 1 min reaches to ~580 mL/min g, i.e., more than 1000 mL hydrogen is generated from 1 g Si nanopowder in 2 min. Hydrogen generation stops when a 4.8 nm thick SiO_2 layer is formed on the surface of Si nanopowder.

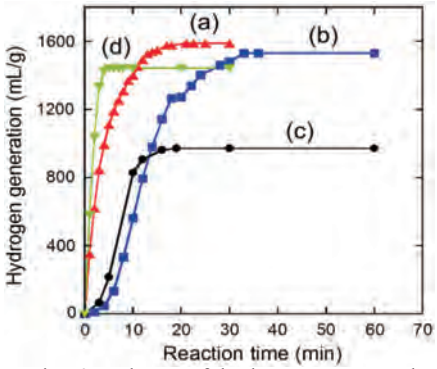


Fig. 2 Volume of hydrogen generated by the reaction of Si nanopowder with KOH aqueous solutions having following pH values and temperatures versus the reaction time: (a) pH 13.9, RT; (b) pH 13.4, RT; (c) pH 12.9, RT; (d) pH 13.0, 50 °C

Improvement of cyclability of Li-ion batteries using C-coated Si nanopowder electrode fabricated from Si swarf by delithiation capacity limitation [Original paper 13]

We have fabricated Si nanopowder from Si swarf using the simple ball milling method, and applied to Li-ion battery electrodes. Limitation of the delithiation capacity after deep lithiation at 0.01V is the most effective to achieve a constant high capacity for long cycles with limitation of the delithiation capacity at 1500 mAh/g. The delithiation capacity keeps constant at 1500 mAh/g until the 290th cycle, and it slightly decreases to 1480 mAh/g at the 300th cycle. However, without limitation of the lithiation and delithiation capacities in the voltage range between 1.5 and 0.01 V, the delithiation capacity decreases to 950 mAh/g at the 300th cycle. With limitation of the lithiation capacity at 1500 mAh/g after deep delithiation at 1.5 V, the delithiation capacity decreases to 860mAh/g at the 300th cycle.

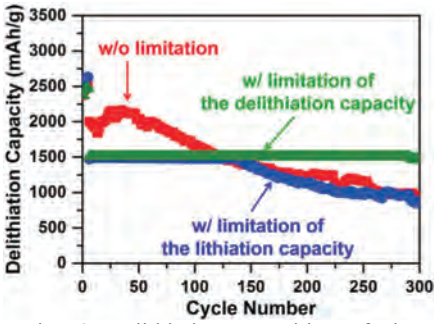


Fig. 3 Delithiation capacities of the C-coated Si nanopowder electrodes.

Department of Advanced Hard Materials

Professor:	Tohru SEKINO
Associate Professor:	Masakazu TANE
Assistant Professor:	Tomoyo GOTO
Assistant Professor:	Sung Hun CHO
Specially Appointed Researcher:	Hisataka NISHIDA
Graduate Students:	Sotaro BABA, Shengfang SHI, Shunghun EOM
	Hiroki NISHIYAMA Yuki RIKISO, Wanqing JIANG
	Yuto YAMASAKI, Akihiro UMEDA
Research Student:	Yong Hyun CHO
Supporting Staff:	Ai TAKAHARA, Mitsuru NISHISAKO (1.2. 2017-present)

Outlines

The importance of the material as a social infrastructure is increasingly growing in recent years. In this department, we are carrying out next-generation materials research and development of ceramics and metals from crosscutting point of view. The subject covers crystal structures, nano to macro scale hierarchical structural design and process control, fusion of various functions and fundamental understanding of materials characteristics for advanced hard and nanostructured materials. To achieve research goals, we are adapting: oxide and nonoxide ceramic-based composites with synergy functions, structure-function harmonized hetero-semiconductor ceramic composites, the original methodology for elastic properties measurement/analysis for advanced elasticity-controlled metal-based materials, structures/functions tuning of low-dimensional anisotropic oxide nanomaterials. Our emphasis is placed also on the practical application of developed materials and technologies as structure components for various devices and instruments, next generation biocompatible, environmental and energy materials, all which are the strongly demanded materials technologies to solve crucial problems arising in our society.

Research Projects

Elastic-modulus enhancement during room-temperature aging in metastable Ti-Nb-based alloys with low body-centered cubic phase stability.

Changes in the elastic properties during room-temperature aging (RT aging) of metastable Ti–Nb-based alloy single crystals with low body-centered cubic (bcc)-phase stability were investigated. The elastic stiffness components of the alloys were measured by resonant ultrasound spectroscopy during RT aging; the results revealed that shear moduli c' and c_{44} were increased by RT aging. On the basis of alloying element effects, TEM observations, and analysis of the changes in elastic properties by using a micromechanics model, it was deduced that the enhancements of shear moduli and electrical resistivity were possibly caused by the formation of a diffuse ω structure.

Development of physically and photochemically functionalized titania nanotubes through structure tuning.

Chemically-derived titania (TiO_2) nanotube (TNT) surface and crystal chemistry was modified by simple chemical treatment. Synthesized TNT powder was immersed into various concentration of hydroxide peroxide solution for different soaking time. It was found that the TNT color was changed from white to yellowish, and resultantly optical absorption edge was largely shifted (Fig.1). The optical bandgap values were hence largely red-sifted (~2.3 eV) from the value of pure TNT (3.4 eV). This is considered due to the modification of surface and/or crystal-structural by the peroxo-group through the treatment. In addition, the modified TNT exhibited good visible-light responsible photocatalytic properties for the organic dye molecule such as rhodamine B (RhB). These results imply that the structure modification for one-dimensional nanostructured oxides is a promising way to tune the advanced environmental-friendly functions.

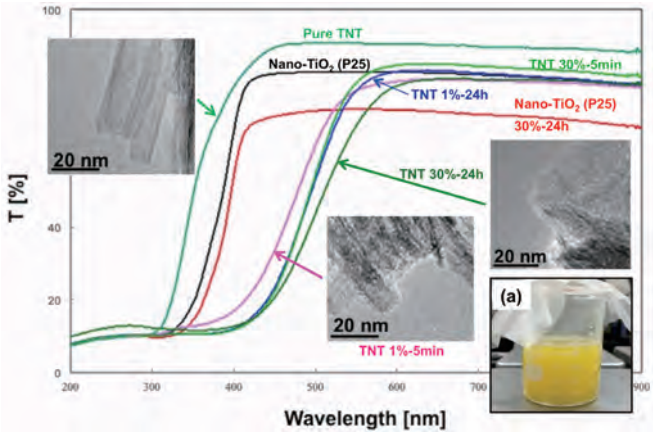


Fig.1 UV-vis diffused reflectance absorption spectra and TEM microstructures for the pure and H_2O_2-treated TNT samples. Inset (a) shows the color of water dispersion of treated TNT powder.

Hydrothermal synthesis of TiO_2-modified hydroxyapatite with various morphologies as photocatalyst

Hydroxyapatite (HAp) is known as one of the calcium orthophosphate, and it shows the biocompatibility, ion-exchange property, and protein adsorption behavior depends on its crystal faces. In this study, TiO_2-modified HAp with various morphologies was synthesized by hydrothermal treatment using urea decomposition at 160 ºC. After hydrothermal treatment, HAp and TiO_2 (anatase phase) were formed in products using 1.0-0.1 M urea solution. The morphology of synthesized HAp changed from small plate-shaped to long needle-shaped crystals with decreasing urea concentration. At that same time, the size of TiO_2 nanoparticle decreased with increasing urea concentration (Fig. 2). The relative supersaturation of solution with respect to HAp raised with increasing the solution pH by heat decomposition of urea. Therefore the urea concentration in the hydrothermal synthesis affected the morphological changes of HAp crystals. In addition, the decoloration test of methylene blue (MB) was performed using 25 ppm MB solution. From the results, the TiO_2-modified HAp clearly showed the photocatalytic decomposition of MB by UV irradiation, regardless of crystal morphology of HAp.

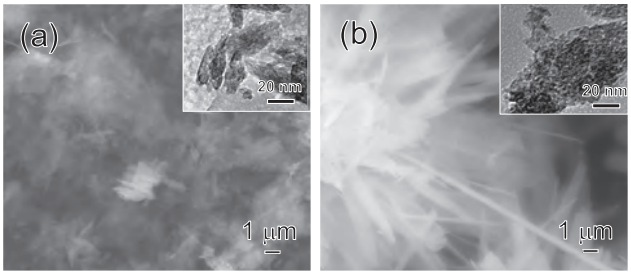


Fig. 2 SEM and TEM images of TiO_2-modified HAp synthesized hydrothermal treatment. (a) sponge- and (b) needle-shaped HAp, and TiO_2 nanoparticles (Insert images).

Department of Advanced Interconnection Materials

Professor: Katsuaki SUGANUMA
Specially Appointed Professor: Tetsuro MURAMATSU, Keiji YAMAMURA
Associate Professor: Shijo NAGAO
Assistant Professor: Tohru SUGAHARA
Specially Appointed Assistant Professor: Jinting JIU, Hao ZHANG, Chuantong CHEN
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Specially Appointed Researcher: Aishi SUATAKE, Hiroshi FUJITA, Shinya SEKI, Seiichiro KIHARA, Akio SHIMOYAMA, Norio ASATANI, Koji KIHARA,
Technical staff: Noriko KAGAMI, Yoshiko HARADA, Mingchun Hsieh, Yukiko Hirose
Graduate Students: Takuya KADOGUCHI, Kazuhiko SUGIURA、JunIchiro SAMEJIMA, Shuren Cong, Wanri LI, Sunjun NOH, Hao ZHANG, Shunsuke KOGA, Yue GAO, Hiroki YOSHIKAWA, Yusuke GOYA
Research Student: Lingying LI, Dawei HU
Supporting Staff: Keiko SUZUKI, Satomi YAMAWAKI, Asana YOSHIYA, Harumi HOSHIKAWA

Outlines

Through nanotechnologies and knowledge for organic/inorganic materials, we are conducting the development of environmentally conscious electronics system integration technologies for energy saving technology and also for IoT, i.e. lead-free soldering, power electronics interconnection materials, sensing devices with nano wires, and functional ceramic sensors by solution process.

Research Projects

· Ag Sinter Joining and Its Low Temperature Sintering Mechanism

We have established low temperature and low pressure joining technology for next generation power devices. Ag particles paste and even Ag films can be sintered and bonded below 200 ºC in air. Ag can absorb oxygen at low temperature along its grain boundaries resulting in formation of Ag-O liquid, which was proved by thermodynamic simulation. Under a slight stress in an assembled device, which is compressive stress caused by thermal expansion mismatch between a substrate and a Ag film, Ag-O liquid is squeezed out from grain boundaries. Fig. 1 shows TEM of Ag film bonding (SMB) and a schematic of Ag-O liquid eruption from grain boundary.

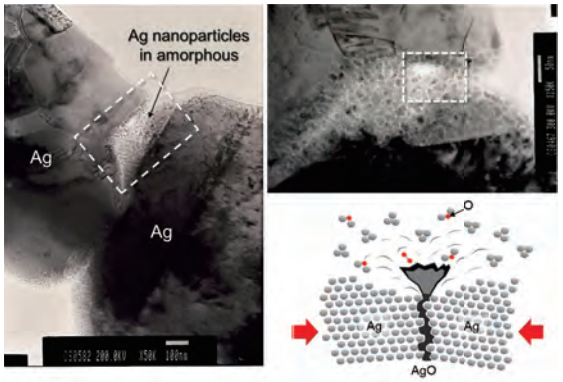


Fig. 1 TEM and Joining mechanism of Ag films in SMB process.

· Ag Sinter Joining for WBG Die-attach

We have proposed Ag sinter joining for wide band gap power semiconductors. Its high temperature performance and reliability exceed those of the conventional soldering or TLP. Fig.2 shows one example that the combination of Ag sinter joined die-attach with a newly developed nano polymer composite provides a super stable structure even in a sever thermal cycles by the micro porous joint structure filled with the nanocomposite.

Fig. 2 Ag sinter layer structure filled with heat-resistant naocomposite polymer.

· Transparent Stretchable Sensor

Low-temperature and self-reducible copper ink composed of copper-amino complexes and proper submicron copper seeds is successfully developed, which can increase the copper load of inks to make high performance thick and dense conductive patterns. These copper nuclei homogeneously attach to the copper seeds to activate their surface, which contributes to the connection and neck-growth between these submicron copper seeds to achieve high conductive copper patterns. Results show that the sintered copper pattern achieves a low resistivity of 11.3 μΩ cm at a low temperature of 140 °C for only 15 min. Furthermore, the sintered patterns keep a high-qualitative surface morphology and favorable thickness, and also exhibit a strong adhesion to polymer substrates which will be advantageous for the fabrication of wearable devices (Fig. 3).

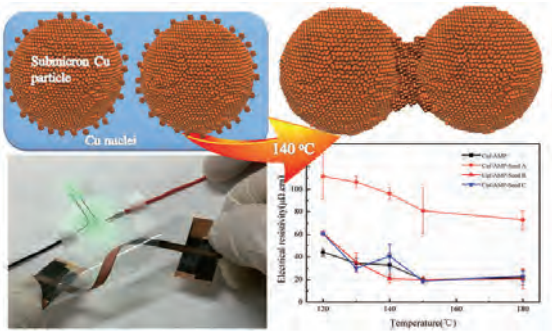


Fig. 3 AgNW trans parent pressure sensor and its tensile elongation test.

· Formation of Nanostructural Metal and Oxide Thin Films Applying for Electric Devices by Metal Organic Decomposition Method

Metal Organic Decomposition (MOD) Method is one of the attractive attention method to form the metal and oxide fine thin films as low energy consumption for sintering/curing. The precursor (inks), which are the starting material of metal salt and complex agent as stabilizer with solvent, are decomposed by using thermal heat or alternative heating method with printing technique for next generation electronics devices, and formed the thin films. Oxide precursor inks are developed in this study. Nanostructural metal oxide thin films by printing method were fabricated as gas sensors and organic photo voltaic (OPV) solar cells.

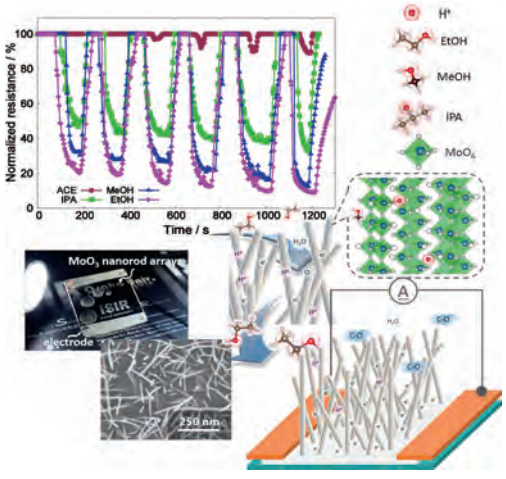


Fig.4 Ceramics nanorods sensor devices by solution process.

Department of Excited Solid-State Dynamics

Associate Professor: Shin-ichiro TANAKA
Associate Professor: Jun'ichi KANASAKI

Outline

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 elucidate the fundamentals of many-body interactions including electron-lattice, electron-electron, spin-orbit interactions, which rule the physics concerning the excitation-induced processes, by using extensive experimental studies:

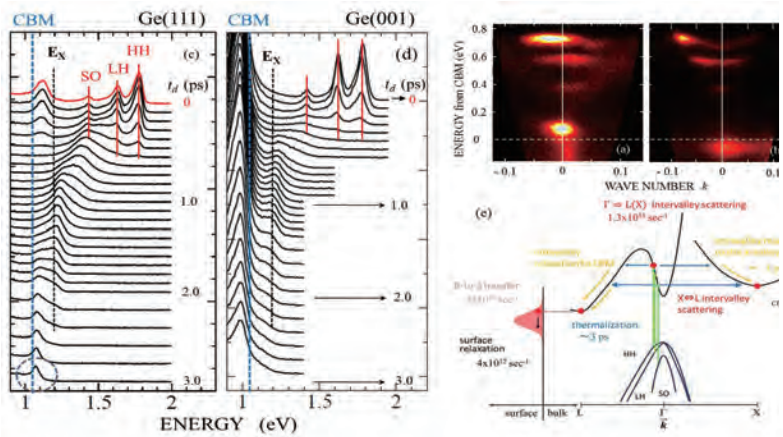
1) primary processes of the photoinduced structural changes,
2) ultrafast carrier dynamics in semiconductors and carbon materials
3) elemental processes of the many-body interaction following the excitation in solids

As topics in the first category, we direct determine photo-induced structural changes and novel structural orders on surfaces at the atomic levels, by means of scanning tunneling microscopy and spectroscopy. As topics of the second category, we have studied ultrafast carrier dynamics in semiconductors (IV and III-V) and carbon materials by using two- photon photoemission spectroscopy. As topic of the third category, we are developing new experimental methods using highly sophisticated electron and optical spectroscopies.

Research Projects

1. Momentum Space View of Ultrafast Electron Dynamics in Photo-excited Germanium

Ultrafast dynamics of excited carriers in group-IV semiconductors has been one research subject of considerable interest, both fundamentally and technologically. We have elucidated the momentum space dynamics of photo-excited electrons in germanium at 10K by time- and angle-resolved two photon photoelectron spectroscopy.



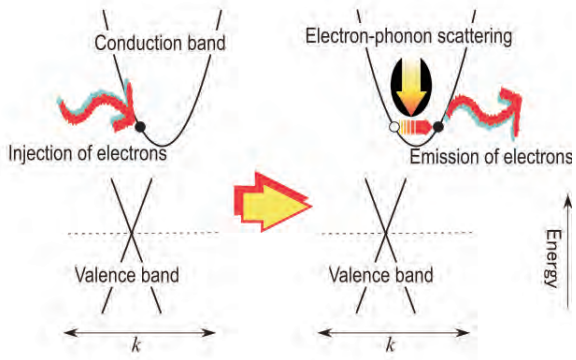
(a)(b) Nascent distributions of excited electrons just after the photoexcitation of Ge(111) and Ge(001) samples. The abscissa indicates the parallel component of wave vector and the ordinate is the energy of excited electrons. (c)(d) Time evolution of the electron distribution functions for Ge(111) and Ge(001). (e) A diagram showing the relaxation pathways of excited electrons.

Direct optical transitions with pump pulses (1.55 eV, 200fs, s-pol.) generate far-from equilibrium population of excited electrons in the Γ-valley conduction states, which consists of two strong packets associated with the transitions from heavy-hole (HH) and light-hole (LH) valence states together with a weak packet due to the transition from split-off (SO) states (Fig.1a&b). Excited electrons in the Γ-valley undergo the ultrafast intervalley transfers into the L- and X-valleys with a time constant of 60 fs, and then relax within the two sub-valleys. Excited electrons in the X-valley relax to the valley-bottom in 1 ps and eventually transfer to the L-valley (Fig. 1c&d). The transferred electrons then relax to the conduction band edge at the L-point. The L-valley excited electrons thermalize at 3 ps after excitation and form a Maxwell-Boltzmann distribution characterized by an electron temperature of 10 K (Fig. 1c). The relaxation pathways of excited electrons in photo-excited germanium are schematically shown in Fig. 1e.

2. Direct Observation of the Electron-phonon Coupling between Empty States in Graphite via High-resolution Electron Energy Loss Spectroscopy

The electron-phonon coupling (EPC) rules many properties of the condensed matter. The elemental quantity of EPC is the electron-phonon matrix element which reflects the probability of the electron scattering from the initial state $\phi_{k,i}$ to the final state $\phi_{k\pm q,j}$, via a phonon with the momentum q and branch ν. Therefore, it is highly desirable to experimentally investigate the probability of electron-phonon scattering while resolving all quantities, i.e., electron and phonon band indices i, j and ν, and electron and phonon momentum k and q in order to comprehensively understand EPC.

We investigated EPC in graphite was investigated via high-resolution electron energy loss spectroscopy (HREELS) and first-principle band calculations. Contrary to the case with high primary energy (~19 eV), where loss peaks due to all the phonon modes are observed as a result of the conventional impact-scattering mechanism, only a few phonons (ZA and ZO') are observed at lower primary energies (Ep<14 eV). These loss (gain) intensities in the HREELS spectra exhibit strong resonance behaviors depending on the kinetic energy of the injected electron beam. This result is attributed to a new scattering mechanism, where the incident electron is trapped at an unoccupied band, is scattered into another band via EPC with a specific phonon, and is finally detected by the analyzer, which is schematically shown in the figure bellow. The scattering intensity is related to the electron-phonon matrix element wherein the energy and momenta of both electron and phonon are resolved. This method is not limited to graphite and will be applicable to other materials in which EPC plays a crucial role in determining its properties, e.g., the BCS superconductor. The application of this method will provide a good experimental basis for a deeper understanding of EPC in condensed matter.



Department of Accelerator Science

Assistant Professor: Akinori IRIZAWA

Outline

Particle accelerators and quantum beams generated from them are widely applied for not only basic science but also industrial usage. The division of accelerator science conducts THz-FEL including high brilliant electron beam in view of generating quantum beam and its usage. The newest generation radiation right source, FEL can change wavelength from its laser feature, and also its high power, coherency, pulsed, polarization characters yield many aspects of utilization in basic and applied fields. THz-FIR is just located between the photons and the radio waves, and the technical development is still in progress, so called “THz gap”, for both light source and detector. We are searching for the new scientific fields, controlling materials and its properties, developing THz-detection techniques, collaborating with world-wide researchers and laboratories.

Research Projects

· Control of FEL wavelength

Last year a fast spectroscopic imaging and an in-situ sensitive spectroscopy have been succeeded by improving and controlling the beam condition and the optics. The FEL focused closely to the diffraction limit has established nonlinear responses on semiconductors. The maximum electronic field is up to 10 MV/cm retaining monochromatic character. The monochromaticity of FEL is corresponding to not only the energy dispersion of electron beam, but also the length of the pulse structure as described in Fig. 1. Here the variety of spectral dispersion of FEL for different conditioning of electron beam is shown in Fig. 2. In case of concerning only about the beam energy, corresponding to the integral area of spectrum, obtained FEL is no more monochromatic as shown in black line for the actual case. Careful execution of electron-beam conditioning must be required for the experiments

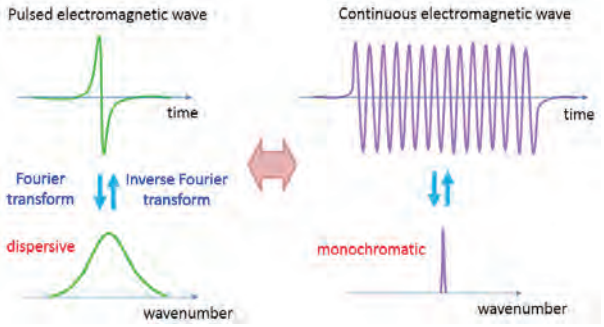


Fig. 1 Relation between pulse length and dispersion of wavelength.

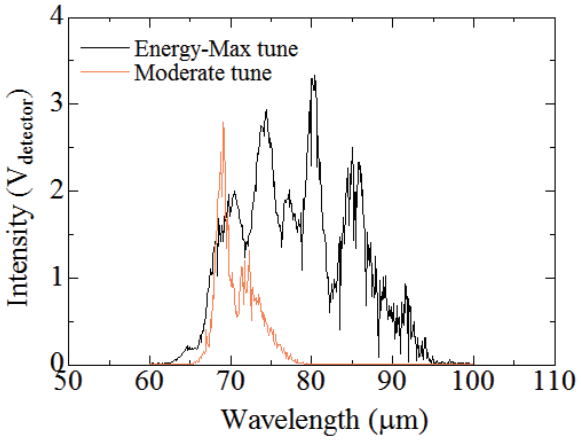


Fig. 2 Tuning effect on spectral dispersion of FEL.

concerning about wavelength (in other words, frequency or energy) dependence. When discussing the material response accompanying to the FEL wavelength in utilization research, a comprehensive understanding of the beam characteristics of FEL and physical properties of materials is required for each experiment on the FEL operator with close discussion with the users.

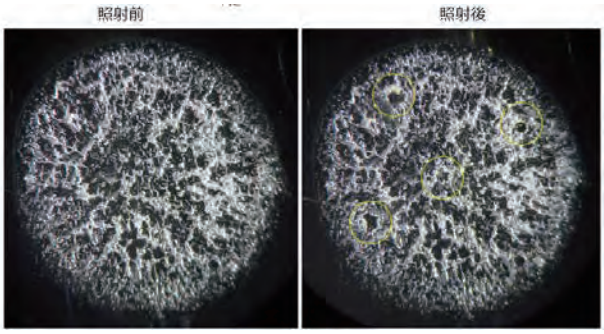


Fig. 3 Irradiation experiments of THz-FEL for Amyloid compound. Visible changes are observed for the sample after irradiation.

·Irradiation experiments

Additional to the users developed for the past few years, newly collaborated experiments with MIR-FEL facilities (KU-FEL in Kyoto University, FEL-TUS in Tokyo University of Science) are planned and now in progress in view of corporation through wide wavelength range of FEL. The crystalline of amyloid compounds by irradiating of FEL has been studied using FEL-TUS where the wavelength dependence of non-thermal process was discovered. The similar experiments is carried out in the different wavelength region, i.e., FIR, using THz-FEL in Osaka University for comparison. As a result, significant changes are also observed in view of wavelength selective non thermal process. Systematic and detailed experiments are demanded for comprehensive understanding of the wavelength-selective excitation process.

Department of Beam Materials Science

Professor: Takahiro KOZAWA
Associate Professor: Yusa MUROYA
Assistant Professor: Kazuo KOBAYASHI
Assistant Professor: Hiroki YAMAMOTO
Graduate Students: Satoshi ENOMOTO, Asuka KIMURA, Akihiro KONDA, Wataru KANAMORI, Yuko TSUTSUI,Satoshi ISHIHARA, Takahiro TANAKA
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.

Research Projects

Primary Processes of Radiolysis of High Temperature and High Pressure Fluids

Study on the radiolysis of water will be basically important to evaluate and control the radiation effects in many application fields. Being highly reactive at high temperature / high pressure condition (HTHP), the radiolytic products will induce various fast reactions. According to installation of HTHP cell into our pulse radiolysis system, ns time-resolved spectroscopy became possible. By using it and a spur diffusion kinetic model simulation, it was studied elemental reactions relating to H_2 production, whose reactivity at HTHP is still controversial. Rate constants for the reaction of a bimolecular self-reaction ($e^-_{aq} + e^-_{aq} + 2H_2O \rightarrow H_2 + 2OH^-$) and for that of H-atom with solvent ($H + H_2O \rightarrow H_2 + OH$) were evaluated at HTHP, which are shown in Fig.1 and Fig. 2, respectively. Both of the rate constants in subcritical region (>250 ºC) were evaluated to be obviously higher by more than an order of magnitude, suggesting that those reactions can be, contrary to the previous view, non-negligible or rather important reaction paths for H_2 production at HTHP.

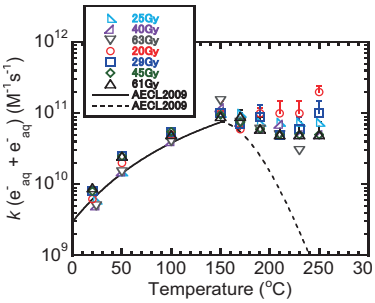


Fig. 1. Temperature dependence of the rate consntant for the reaction of the bimokecular self-reaction of two hydrated electron.

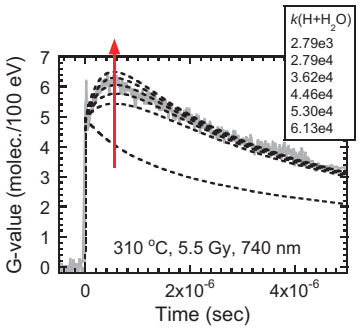


Fig. 2. Time behaviors of the dimer radical anion of iodide at 310 ºC, 25 MPa (probed at 740 nm).

Lamellar Orientation of Block Copolymer Using Porlarity switch of Nitrophenyl Self-assembled monolayer (SAM) Induced by Electron Beam

The combination of top-down and bottom-up approaches to nanopatterning has become an interesting research focus area. Recently, directed self-assembly (DSA) of block copolymers has abstracted significant research attentions as a promising nanolithography to surmount the fundamental limitations of conventional lithography. Controlling the surface chemistry of specific regions to locally change the orientation of block copolymer domains is very valuable by top-down lithography. In particular, EB lithography is suitable for the modification of substrate surface. The neutral wettability to the polystyrene-*block*-poly(methyl methacrylate) (PS-*b*-PMMA) block copolymers on modified surfaces such as random styrene-methacrylate copolymer films (PS-*r*-PMMA) or self-assembled monolayers (SAMs) has been studied to induce perpendicular orientation. However, current methods for achieving their patterned substrate template are generally complex. Lamellar orientation of the PS-*b*-PMMA block copolymer could be performed using the change of SAMs such as the conversion of the NO_2 group to an NH_2 group induced by EB irradiation. The resulting chemical patterns provide neutral surface layers for lamella orientation of PS-b-PMMA domains.

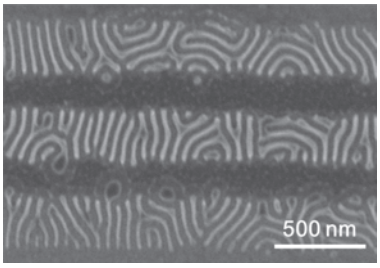


Fig. 3. SEM images of PMMA etched lamellar PS-*b*-PMMA block copolymer.

Reaction Mechanisms of *Deinococcus radiodurans* Nitric Oxide Synthase: Oxygen Activation Process

Nitric Oxide Synthase (NOS) is a cytochrome P450 mono-oxygenase that catalyzes the oxidation of L-arginine (Arg) to nitric oxide (NO). Recently a number of species of bacteria have been identified with NOS enzyme in the genome. *Deinococcus radiodurans*, which is remarkable for its extreme radiation resistance, contains NOS. To investigate reaction mechanisms of *D. radiodurans* NOS (DrNOS), the reactions were followed spectrophotometrically after pulse radiolysis of DrNOS. The ferrous heme reacted with oxygen to oxygenated form with a second-order rate constant of 2.8 x 10^8 M^{-1} s^{-1}. In the tetrahydrofolate (H_4F)-bound enzyme, the ferrous-oxy intermediate was found to decay another intermediate with a first order rate constant of 2.2 x 10^3 s^{-1}. In the absence of H_4F, this phase was absent. The intermediate further converted to the original ferric form with a first order rate constant of 4 s^{-1}.

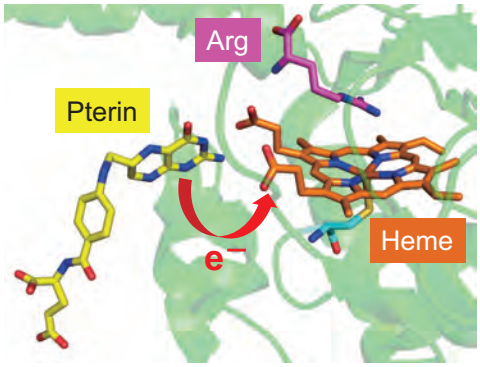
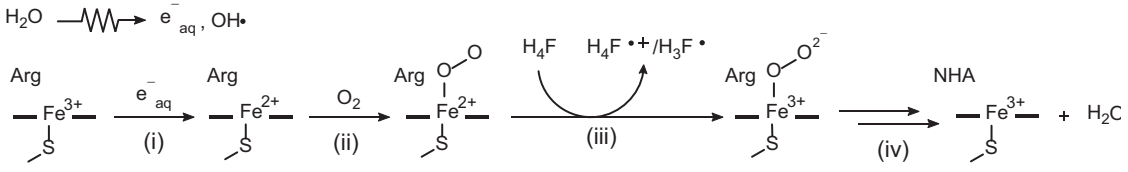


Fig. 4. Active site of *B. subtilis* NOS



Scheme Reaction Sequence after pulse radiolysis of DrNOS

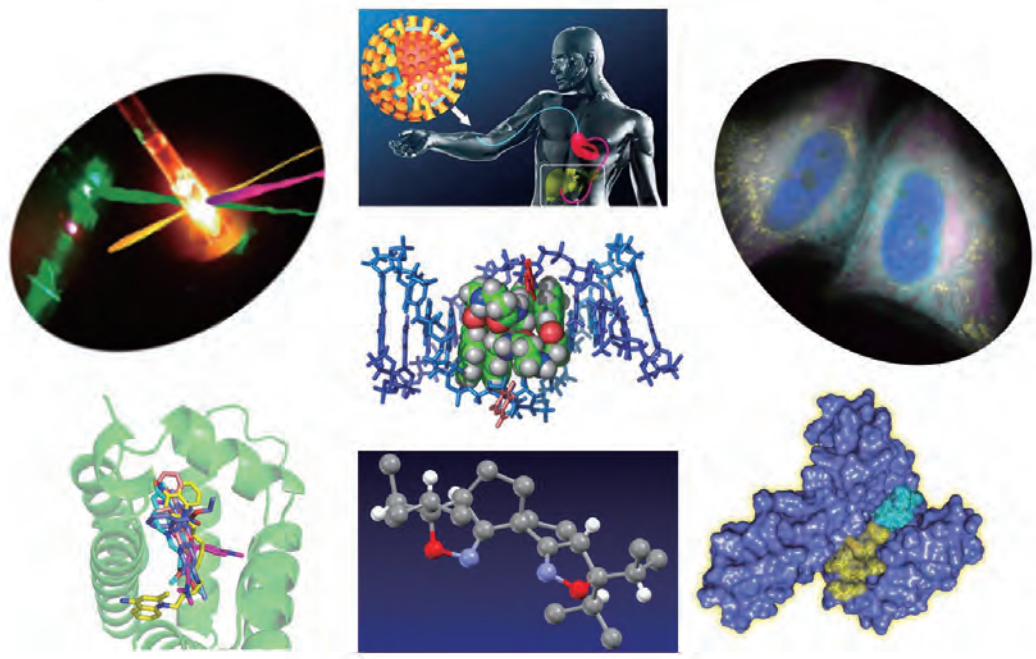
Division of Biological and Molecular Sciences

Outline

This Division consists of Biological Science Group and Molecular Science Group. The Biological Science Group of this departments has three departments; Dept. of Biomolecular Science and Reaction, Dept. of Biomolecular Science and Regulation, and Dept. of Biomolecular Science and Engineering. These departments are engaged in research in various fields of biological science including development of in vivo pinpoint DDS nanocarriers, development of therapeutic strategies to control infectious diseases and development of biosensors based on fluorescent protein and/or chemiluminescent protein.

The Molecular Science Group 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.

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



Department of Molecular Excitation Chemistry

Professor: Tetsuro MAJIMA
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Specially Appointed Assistant Professor: Sooyeon KIM, Peng ZHANG
Specially Appointed Professor: Akira SUGIMOTO
Guest Professor: Mikiji MIYATA
JSPS Foreign Researchers: Zaizhu LOU, Mingshan ZHU
Guest Foreign Researchers: Zhichao SUN (1.7.2016-), Shaoqing SONG (-24.6.2016), Elke DEBROYE (9.4.2016-4.6.2016), Gun-Hee MOON（9.6.2016-8.7.2016）, Xiaoyan CAI (-28.9.2016), Wei-Kang WANG (-18.10.2016)
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Research Student: Daming RUAN (1.11.2016-), Lei XU (1.10.2016-), Bo ZHUANG (1.10.2016-)
Supporting Staff: Sanae TOMINAGA (-25.11.2016)

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 two lasers, three-color three lasers, and electron pulse-laser
3. DNA photochemistry such as charge transfer in DNA and photosensitized DNA damage
4. Photocatalysts for solar energy conversion such as metal and metal oxide nanoparticles
5. Fluorescence detection of reactive oxygen species by novel fluorescent probes
6. Single-molecule and single-particle chemistry

Research Projects

Multi-beam chemistry

We have studied photochemistry of various reaction intermediates for years, because novel reactions are possible due to their higher excitation energies, while systematic information on them is scarce. For this purpose, we have employed the multi-beam

irradiation techniques such as pulse radiolysis-laser flash photolysis combined method and two-color two-laser photolysis. These studies have clarified various reaction processes of excited states of short-lived intermediates. Recently, we have systematically studied photoinduced electron transfer processes of excited radical ion species. This year, from femtosecond laser flash photolysis of the dyad molecules including $PDI^{\bullet-}$and acceptor, we confirmed that the electron transfer from excited $PDI^{\bullet-}$ is governed by the Marcus theory and electron transfer from the D_1 state is much faster than that from the D_0 state. In addition, we found the disproportionation reaction generating dianion species from excited $PDI^{\bullet-}$ as a new mechanism for bi-charged species in organic solid materials.

Kinetics of biomolecules accessed by single-molecule fluorescence measurement

We characterize weak transient interactions inducing RNA structural transition, opening and closing of a hairpin RNA in sub-μs time scale, through the improvement of FCS and the use of a technique allowing observation of a transient interaction as fluorescence "blinking". By adding nucleotides complementary to the loop region, the results suggest the increase in the opening frequency of the hairpin RNA.

Photofunctional molecules and materials toward materials science and biology

We developed live macrophage cell imaging and single particle imaging methods, using photoswitchable fluorescent diarylethene-doped polymer nanoparticles under Xe lamp irradiation. In addition, we achieved synthesis of sub-nanometer thickness two-dimensional (2-D) porphyrin polymers and evaluated their possibility for H_2 evolution photocatalyst over broadband light irradiation.

Functional self-assembly of fluorophore and anthrylphenylene dyads

We have developed a new molecular dyad of fluorophore and anthrylphenylene that forms various kinds of aggregates. As for rhodamine derivatives, a slipped-stacked J-aggregate is formed, which is accumulated in mitochondria of a living cell. Furthermore, the formation of exciton upon a near-infrared excitation was directly monitored by transient absorption measurement. The obtained results suggest a potential of fluorophore and anthrylphenylene dyad as a versatile functional material such as a light harvesting system and colorimetric sensor.

Nanocatalysts for light energy conversion

To design an efficient light energy conversion, the molecular interactions and reaction mechanisms at heterogeneous interfaces should be clarified. TiO_2 mesocrystals (TMC) have long-lived charges, leading to high photoconductivity and photocatalytic activity. Since the wide band gap of TiO_2 restricts its performance only in UV region, photosensitization with noble metals have been examined to extend the responsibility to visible and NIR region. Gold nanorods (AuNRs) with controllable size and tuneable SPR band were loaded on anatase TMC to show high activity for H_2 production (924 $\mu mol\ h^{-1}\ g^{-1}$) from aqueous methanol under visible and NIR irradiation. This is attributed to the effect of longitudinal SPR, but not to transversal SPR, of AuNRs and improved charge transfer due to the superstructure of TMC which retard the electron-hole recombination. The charge lifetime of 4.8 ns for AuNRs/TMC is 10-times longer than for AuNRs/TiO_2, confirming efficient charge separation of superstructure TMC.

Department of Synthetic Organic Chemistry

Professor: Hiroaki SASAI
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Assistant Professors: Kazuhiro TAKENAKA
Specially Appointed Assistant Professor: Mohamed Ahmed ABOZEID
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Under Graduate Student: Tomohiro TAKIISHI, Ryan Andy KHALAF (17.6.2016-10.8.2016)
Supporting Staff: Ayaka HONDA

Outlines

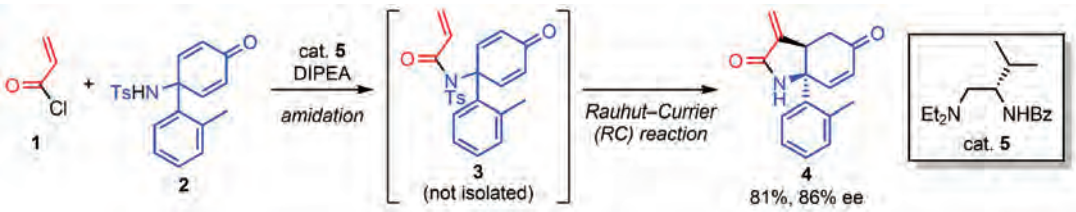
Asymmetric synthesis, a phenomenon fine-tuned to perfection by nature, forms the central theme of our research efforts. We have been interested in the design and syntheses of a novel class of chiral ligands that are unique in promoting new asymmetric reactions. The mechanisms of these organic reactions 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.

Research Projects

Multifunctional Catalysis: Stereoselective Construction of α-Methylidene-γ-Lactams *via* Amidation/Rauhut–Currier Sequence

The Rauhut–Currier (RC) reaction, in which two α,β-unsaturated carbonyl compounds are used as the substrates, provides a readily access to α-substituted enones, where one of the α,β-unsaturated carbonyl compounds acts as a latent enolate. However the use of two different α,β-unsaturated carbonyl compounds on the RC reaction led to a mixture of the homo- and hetero-couplings. Therefore, limited numbers of attractive systems have been developed for the RC reaction.

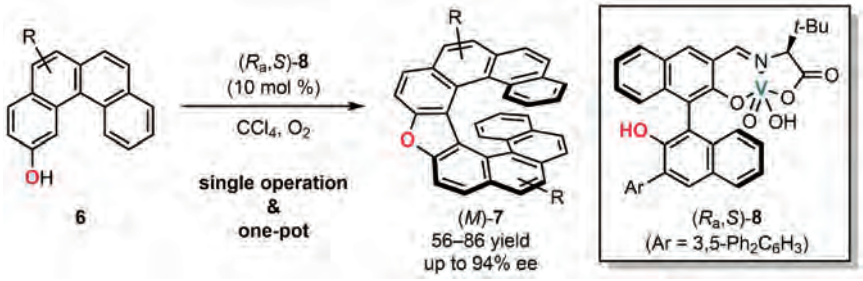
Herein we have developed a facile method for the construction of the α-methylidene-γ-lactam skeleton **4** *via* an amidation/RC reaction sequence with *N*,*N*-diisopropylethylamine (DIPEA) and novel chiral organocatalyst **5a**. The Brϕnsted base-mediated amidation of dienone **2** with acryloyl chloride (**1**), followed by the Lewis base-catalyzed C–C bond formation of intermediary **3** would lead to the formation of α-methylidene-γ-lactam **4** in 81% yield and 86% ee (Scheme 1).



Scheme 1. Enantioselective Synthesis of Heterocycles Bearing Two Contiguous Stereogenic Centers

Vanadium Complex Catalyzed Efficient Enantioselective Synthesis of Oxa[9]helicenes

Optically active helicenes and other related helical molecules have received considerable attention as a result of their high potential as chiral ligands, auxiliaries, organocatalysts, liquid crystals, and molecular motors. However, efficient enantioselective synthetic method of helicenes, in particular, oxahelicenes, is rather limited. This time, we developed a vanadium-catalyzed enantioselective sequential oxidative coupling/intramolecular cyclization of polycyclic phenol **6**. The newly developed vanadium complex (R_a,*S*)-**8** works as a redox and Lewis acid catalyst to promote this sequential reaction to give oxa[9]helicenes **7** in good yields with up to 94% ee (Scheme 2). The phenolic hydroxyl group in (R_a,*S*)-**8** would increase the activity of vanadium metal to accelerate the present reaction. The optically pure **7a** (R = H) was readily accessible by a single recrystallization of enantioenriched product from CH_2Cl_2 and hexane. X-ray crystallographic analysis of **7a** unambiguously demonstrated its helical structure and the absolute configuration was determined to be *M*.



Scheme 2 Enantioselective Synthesis of Oxa[9]helicenes Using Chiral Vanadium Catalyst

Palladium Enolate Umpolung: New Catalytic Strategy for Construction of α-Amino Carbonyl Moiety

Carbonyl groups bearing a nitrogen functionality at the α-position, which are found in a wide variety of natural products and biologically active compounds, have been recognized to be important in pharmaceutical sciences. Hence, the development of new catalytic methodology for the construction of such useful functional groups is still a central research topic in synthetic chemistry. We have successfully developed palladium-catalyzed transformations using readily available alkynyl cyclohexadienone substrates, which involves unusual nucleophilic interception of an intermediary palladium enolate. Based on this *palladium enolate umpolung* strategy, we achieved new catalytic installation of a nitrogen functionality at the carbonyl α-position. In this reaction, C–H, C–C, and C–N bonds were consecutively formed to give densely functionalized bicyclic α-amino carbonyl products in good yields.

Department of Regulatory Bioorganic Chemistry

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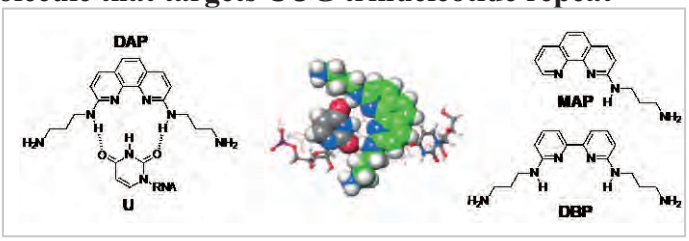
Specially Appointed Researchers: Takahiro OTABE (-31.4.2016), JinXing Li (-31.12.2016)
Graduate Students: Saki MATSUMOTO, Norhayati SABANI, Nursakinah MOHD ZAIFUDDIN, Jun MATSUMOTO, Yihuan LU, Hiroshi ITO, Kazuaki YAMAUCHI, Shota MIKI, Ayaka YANO, Anisa UL'HUSNA, Russell KOYEAN (1.10.2016-)
Research Assistants: Maki KIMURA, Ayako SUGAI, Yasue HARADA
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 synthetic ligands for specific sequence and structure of DNA/RNA, including trinucleotide repeat, 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.

Research Projects

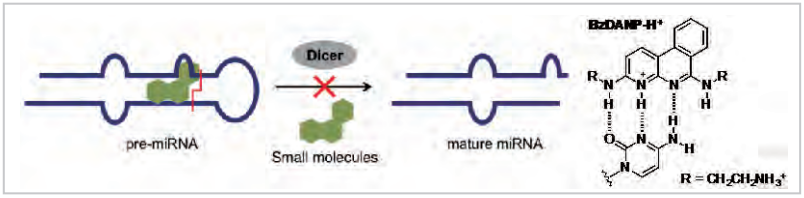
Design and synthesis of a small molecule that targets CUG trinucleotide repeat



Myotonic dystrophy type 1 (DM1) is caused by CTG trinucleotide repeat expansion. Recent studies reveal that the mechanism of DM1 involved a gain-of-function model due to a toxic RNA of the expanded r(CUG)$_n$ repeats. The expanded r(CUG)$_n$ repeats formed a hairpin structure and sequestered MBNL1 leading to the misregulation in splicing. Development of small molecules that bind to r(CUG)$_n$ repeats and suppress the sequestration of MBNL1 is one feasible strategy for treatment to DM1. We selected diaminophenanthroline derivative (DAP) as a recognition unit of U-U mismatch in r(CUG)$_n$ repeat hairpin structures for effective stacking interaction with neighboring base pairs and the reduction of electrostatic repulsion in intermolecular hydrogen bonding. Binding assays of DAP clearly showed the binding of DAP to r(CUG)$_9$. In addition, ESI-TOF-MS analysis showed that the binding of DAP to r(CUG)$_9$ resulted in the formation of 4:1 binding complexes. Structure-activity relationship studies revealed

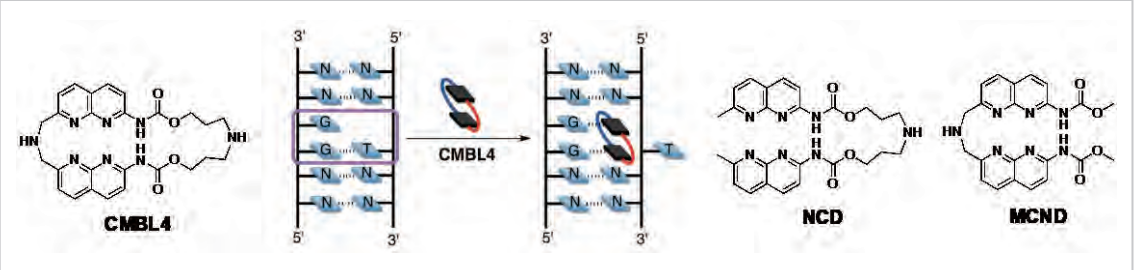
that the DAP-binding to r(CUG)n repeats requires two amino groups and three ring system.

Development of a small-molecule modulator of miRNA maturation



MiRNAs are small (20-25 nt) non-coding RNA that negatively regulate translation by binding to their target mRNAs. They are involved in many biological processes and diseases, thereby recognized as important drug targets. MiRNAs are produced by successive actions of two RNase III enzymes, Drosha and Dicer. Long primary miRNA transcripts (pri-miRNA) are cleaved in the nucleus by Drosha into shorter stem loop-structured pre-miRNAs. Pre-miRNAs are then transported to the cytoplasm where they are further cleaved to miRNAs by Dicer. A small molecule that modulates this maturation process can be a drug candidate. We have designed and synthesized BzDANP that can bind to a cytosine bulge in RNA duplexes by hydrogen bonding and stacking interactions. In this study, we evaluated binding of BzDANP to RNA and the effect on pre-miRNA processing by Dicer. SPR analysis revealed that BzDANP binds pre-miR-29a, which has a cytosine bulge near the putative Dicer cleavage site. In vitro Dicer assay showed that BzDANP significantly inhibited the cleavage of pre-miR-29a, suggesting the possibility of using a RNA-binding small molecule as a modulator of miRNA maturation.

Development of a cyclic mismatch binding molecule that binds to T/GG sequence



Expansion of trinucleotide repeats is known as causative gene mutation involving neurological diseases. Secondary structures of trinucleotide repeat DNA involve a number of mismatched base pairs and are known to be responsible for repeat expansion. We have reported mismatch binding ligands (MBLs) connecting two heterocycles linked by a linker. Binding of flexible linker-containing MBLs to nucleic acids should be accompanied with the penalty of entropy loss by the conformational change. We have designed and synthesized cyclic MBL (CMBL4), where two naphthyridines are connected by linkers at C-2 and C-7 positions. Conformational studies of CMBL4 supported that naphthyridine moieties in CMBL4 are in intramolecularly stacked conformations. We demonstrated that CMBL4 binds to 5'-T-3'/5'-GG-3' site that is one of the possible structural elements of $(TGG)_n$ repeat DNA. The binding of CMBL4 to T/GG site induced thymine flipping. The binding affinity of CMBL4 to T/GG site is higher than that of acyclic ligands (NCD and MCND). These results indicated that conformational restrictions of CMBL4 is important for recognition of T/GG site.

Department of Organic Fine Chemicals

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Specially Appointed Associate Professor: Kunihiro KAIHATSU
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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 molecules that potentially modulate protein-protein interactions. 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.

Research Projects

Small molecule antagonists of p300/β-catenin interaction

CBP and p300 are two highly similar proteins that play critical roles as "super-organizers" of transcription of genes. Because of their high degree of similarity, these two proteins have long been considered as playing redundant roles in biology. However, they play distinct roles, particularly in regards to the Wnt/β-catenin signaling cascade. The small-molecular Wnt modulator **ICG-001** is known as an inhibitor of the CBP/β-catenin interaction and induces differentiation in various stem/progenitor cells including cancer stem cells. Here, we developed direct small molecule antagonists of p300/β-catenin interaction (**YH249** and **YH250**) to confirm CBP/p300 coactivactor switching model that plays a very fundamental role in stem cell biology (Fig. 1). As anticipated, **YH249**/**YH250** maintain the pluripotency of both mouse and human ESC and human induced pluripotent stem (iPS) cells in a Wnt dependent manner [Original Paper 6].

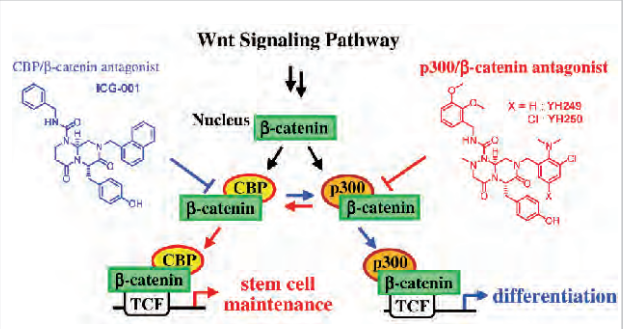

Fig 1. CBP/p300 switching model.

These compounds have also served as invaluable chemogenomic reagents to dissect the divergent roles of the extremely complex Wnt signaling cascade. (YH)

Discrimination of dengue virus serotypes using tolane-modified peptide nucleic acid

Dengue virus is an RNA positive-strand virus of the family *Flaviviridae*. The first infection causes mostly minor disease, but secondary infection with dengue virus of a different serotype may lead to more severe symptoms. Therefore, it is important to differentiate the serotypes. We synthesized PNA that possesses complementary sequence to dengue virus serotype 2 (DENV2) and modified it with tolane derivatives (Fig. 2a) for improving the sequence specificity. As we immobilized it on a magnetic bead (Fig. 3b), it allowed us to selectively detect DENV2 among other serotypes (Fig. 3c). (KK)

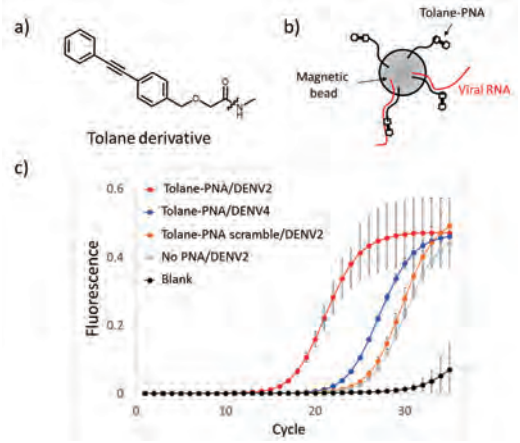

Fig 2. a) Tolane derivative, b) tolane-PNA immobilized magnetic bead, and c) RT-PCR detection of dengue viral serotype 2 captured by a tolane-modified magnetic bead.

Roles of V-type proton pump in mammalian early embryogenesis

Eukaryotic cells have ability to develop cell-polarity by setting each molecules to distinctive cellular domains through spatial combination of secretory and endocytic pathways. The endocytic and secretory compartments keep their interior acidic by inward flow of protons from the cytosol. The acidification is performed by an active proton pump vacuolar-type ATPase (V-ATPase). V-ATPase is a fairly large complex and its function is implicated in pathology [Original Paper 3]. The c subunit of the membrane intrinsic sector is encoded by a single locus, indicating that it is an essential component for all the V-ATPase complex distributing in various subcellular compartments. Loss of the c subunit function leads the most severe phenotypic consequence among all the V-ATPase subunit so far identified. Mouse embryos homozygous for a null-mutation can develop up to blastocyst stage, however, the mutant embryos fail to develop further to organize egg cylinders. Cells lacking the V-ATPase c subunit show severe defects in endocytic uptake of a tracer molecule from medium.

We analyzed the embryonic phenotype of the V-ATPase c subunit mutant in detail. The Voc mutant embryos differentiate the embryonic epithelial tissues, primitive endoderm, epiblast, and extraembryonic ectoderm, but the organization of these epithelium was affected severely. The visceral endoderm exhibits highly polarized architecture as discussed above. We found that the apicobasal polarity (A-P polarity) in the visceral endoderm layer was not properly established in the mutant embryos, resulting in the abnormal epithelial morphology, indicating that the V-ATPase function is required in the establishment and/or maintenance of the epithelial cell polarity during the early embryogenesis. (YW)

Department of Biomolecular Science and Reaction

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Supporting Staffs: Mayuko MURAI, Yumi YUKAWA (1.9.2016-), Minami TAKAI (1.9.2016-)

Outlines

The aims of this laboratory are the analysis of intermolecular reactions found in various biological phenomena, and the development of bio-industrially useful technologies by utilizing these reactions. In particular, we are now developing an *in vivo* pinpoint DDS (drug delivery system) nanocarrier (bio-nanocapsule) by mimicking the function of viruses, single cell-related technologies by utilizing an automated single cell analysis and picking up machine, an oriented immobilization technology for various biomolecules, and a bio-missile for selective degradation of pathogenic proteins *in vivo*. And, the active-site structures and catalytic mechanisms of various enzymes are being investigated by site-directed mutagenesis, various spectroscopies, and X-ray crystallography. Furthermore, we are conducting structural and functional analysis of bacterial two-component systems, which are involved in biofilm formation, pathogenicity, and drug resistance, to develop novel antibiotics against bacterial signal transduction.

Research Projects

Analysis of the early infection machinery of hepatitis B virus by using bio-nanocapsule

Hepatitis B virus (HBV) is considered to interact first with heparan sulfate proteoglycan (HSPG) *via* an antigen loop of HBV envelope S protein. Then, it is rapidly migrated to the sodium taurocholate cotransporter polypeptide (NTCP) *via* the myristoylated N-terminal sequence of the pre-S1 region, and it finally enters the cell by endocytosis.

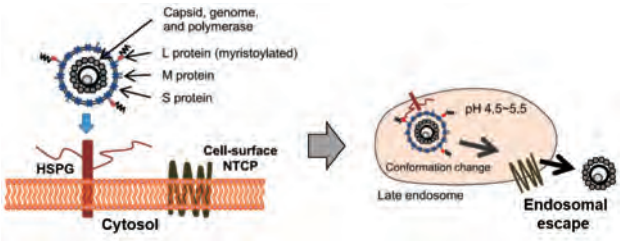

Fig.1 Model of early infection machinery for hepatitis B virus and bio-nanocapsule L in human hepatocytes.

However, the machinery of HBV migration from HSPG to NTCP has not been clarified. In the past, it was difficult to obtain a large amount of HBV, therefore biochemical analysis of HBV infection mechanism was difficult. In the last decade, we have established a human hepatic cell-specific DDS nanocarrier by using recombinant yeast-derived L protein particle (denoted as Bio-nanocapsule (BNC)). The human hepatic cell-specific binding and cellular uptake of BNC are similar to HBV. The cellular uptake pathway of HBV therefore was investigated by using this BNC. It was suggested that cellular uptake of both myristoylated BNC (myr-BNC) and HBV depend on NTCP, because Myr-BNC bound to NTCP *in vitro* and competitively inhibited HBV infection. Thus, myr-BNC would be a useful biomimic of HBV for the elucidation of early infection machinery of HBV. However, the cell entry rate of Myr-BNC and HBV was the same as that of BNC in HepG2 cells overexpressing NTCP. In addition, the cellular uptake of these particles was not dependent on NTCP but mainly on HSPG. These results suggest that cytosolic NTCP plays an important role in endosomal escape, while NTCP on the cell surface may not be involved in cellular uptake of HBV [Original Paper 6].

Novel antibiotics waldiomycin targets a highly conserved H-box motif of sensor histidine kinases

Two-component systems (TCSs), composed of sensor histidine kinase (HK) and its cognate response regulator, are a major bacterial signal transduction system. TCSs sense environmental changes and regulate gene expression to adopt the changes. Some TCSs are essential for bacterial viability or related to the virulence of pathogens. Therefore, TCS represents potential targets for alternative antibiotics and anti-virulence agents. Waldiomycin is an angucycline antibiotic that inhibits WalK, a growth-essential HK in Gram-positive bacteria including drug-resistant pathogens, by preventing its autophosphorylation. We found that this compound inhibited various class I HKs other than WalK [Original Paper 10]. NMR analyses with *Escherichia coli* EnvZ HK showed that waldiomycin directly bound to conserved H-box and X-region in the DHp domain of EnvZ [Original Paper 10]. It is well-known that H-box is a highly conserved motif among various class I HKs including the histidine residue to be phosphorylated upon HK activation. Studies using site-directed mutants of EnvZ and waldiomycin derivatives confirmed that both the H-box and X-region were necessary for binding and inhibition, though the H-box contributed more to the binding [Original Paper 10]. We showed that waldiomycin is an H-box inhibitor with broad specificity and propose the H-box as an attractive target for HK inhibitors.

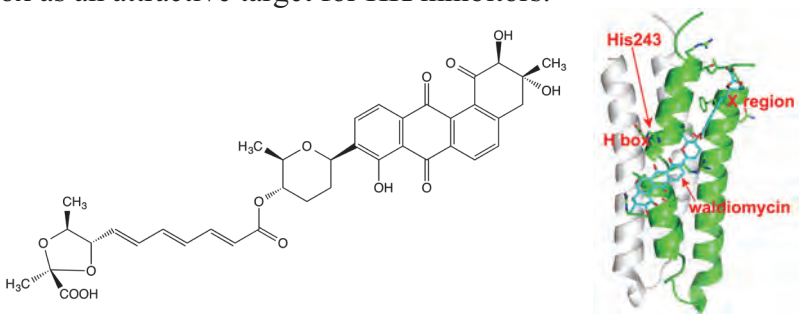

Fig. 2 Chemical structure of waldiomycin and its binding model on EnvZ DHp domain.

Department of Biomolecular Science and Regulation

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Associate Professor:	Tsuyoshi NISHI
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Postdoctoral Fellows:	Shoko NISHI
Graduate Students:	Katsuhiko HAYASHI, Martijn ZWAMA, Keita KAWASHIMA, Yuna TAKEUCHI
Specially Appointed Associate Professor:	Aixin YAN
Guest Professor:	Ruatam AMINOV, Yoshimi MATSUMOTO
Under Graduate Student:	Saki SHIGEYAMA, Kaori NAKAO
Supporting Staffs:	Aiko FUKUSHIMA, Aya IGARASHI, Sumie MATSUOKA

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.

Research Projects

Phenotype microarray analysis of the drug efflux systems in *Salmonella enterica*

A large number of drug efflux transporters have been identified in *Salmonella enterica*, and increased expression of these transporters confers drug resistance in this organism. Here we compared the respiration activities of the wild-type strain and a mutant with nine deleted transporters by phenotype microarray analysis. The mutant was susceptible to 66 structurally unrelated compounds including many antibiotics, dyes, detergents, antihistamine agents, plant alkaloids, antidepressants, antipsychotic drugs, and antiprotozoal drugs (Table 1). To investigate the effect of each transporter on the susceptibilities to these drugs, we used the single transporter mutants, several multiple deletion mutants, and the transporter overexpressor strains to determine minimum inhibitory concentrations of the compounds. The data indicate that the increased susceptibilities of the mutant lacking nine transporter genes are mainly dependent on the absence of the *acrAB* efflux genes as well as the *tolC* gene. In addition to the AcrAB-TolC efflux system, the results from the overexpressor strains show that AcrEF confers resistance to these compounds as well as AcrAB of Escherichia coli, MexAB-OprM and MexXY-OprM of *Pseudomonas aeruginosa*. The results highlight the importance of the efflux systems not only for resistance to antibiotics but also for resistance to antihistamine agents, plant alkaloids, antidepressants, antipsychotic drugs, and antiprotozoal drugs.

Inhibitor of the MexXY-Mediated Aminoglycoside Resistance in *Pseudomonas aeruginosa*

The emergence and spread of multidrug-resistant *P. aeruginosa* infections is of great concern, as very few agents are effective against strains of this species. Methanolic extracts from the Coptidis Rhizoma or Phellodendri Cortex markedly reduced resistance to anti-pseudomonal aminoglycosides in multidrug-resistant *P. aeruginosa* strains. Berberine, the most abundant benzylisoquinoline alkaloid in the two extracts, reduced aminoglycoside resistance of *P. aeruginosa* via a mechanism that required the MexXY multidrug efflux system; berberine also reduced aminoglycoside MICs in *Achromobacter xylosoxidans* and *Burkholderia cepacia*, two species that harbor intrinsic multidrug efflux systems very similar to the MexXY. Berberine appears to be a novel type inhibitor of the MexXY-dependent aminoglycoside efflux in *P. aeruginosa*. As aminoglycosides are molecules of choice to treat severe infections the clinical impact is potentially important (Morita Y, Nakashima K, Nishino K, Kotani K, Tomida J, Inoue M, Kawamura Y. Berberine is a novel type efflux inhibitor which attenuates the MexXY-mediated aminoglycoside resistance in *Pseudomonas aeruginosa*. Front Microbiol. 2016; 7:1223).

Table 1. Chemical compounds that selectively decreased the respiration activity of the efflux mutant lacking the nine drug efflux genes compared with the wild-type strain (Yamasaki S, Fujioka T, Hayashi K, Yamasaki S, Hayashi-Nishino M, Nishino K. Phenotype microarray analysis of the drug efflux systems in *Salmonella enterica* serovar Typhimurium. J Infect Chemother. 2016; 22:780-784).

Plate	Position	Decrease in respiration activity	Chemical compound
PM12B	E01, E02, E03, E04	−374	2,4-Diamino-6,7-diisopropylpteridine
PM17A	G03, G04	−107	Chlorambucil
PM12B	A10	−100	Carbenicillin
PM14A	A09, A10	−166	Sanguinarine
PM18C	G03	−83	Triclosan
PM13B	G10, G11, G12	−302	Trifluoperazine
PM15B	B09, B10, B11, B12	−304	5,7-Dichloro-8-hydroxy-quinaldine
PM16A	A09	−70	5-Chloro-7-iodo-8-hydroxyquinoline
PM20B	B01, B02	−128	Orphenadrine
PM20B	F09, F10	−121	Pridinol
PM14A	H07	−100	Promethazine
PM15B	D01	−101	Phleomycin
PM14A	A02, A03, A04	−178	Acriflavine
PM18C	H07	−131	2-Phenylphenol
PM11C	C01, C02, C03	−230	Bleomycin
PM16A	B03, B04	−167	Norfloxacin
PM20B	D05, D06	−119	Ciprofloxacin
PM18C	B06	−95	Pipemidic acid
PM11C	H10	−95	Ofloxacin
PM11C	B10	−85	Lomefloxacin
PM11C	E09, E10	−99	Nalidixic acid
PM16A	B10	−75	Trimethoprim
PM20B	E06, E07	−138	Dodine
PM13B	A05, A06, A07, A08	−361	Dequalinium
PM18C	D11	−86	Lidocaine
PM17A	E03	−79	Niaproof
PM12B	E09, E10	−196	Benzethonium chloride
PM12B	H09, H10	−138	Dodecyltrimethyl ammonium bromide
PM16A	C11	−82	Cetylpyridinium chloride
PM15B	D06, D07	−185	Domiphen bromide
PM19	G01, G02	−134	Lauryl sulfobetaine
PM20B	A01, A02, A03	−239	Amitriptyline
PM18C	F07	−78	Tinidazole
PM17A	D09, D10, D11	−187	Chlorpromazine
PM14A	G01, G02, G03, G04	−291	Chelerythrine
PM15B	F09, F10, F11	−320	Puromycin
PM15B	F05, F06, F07, F08	−349	Oleandomycin
PM13B	H09, H10, H11, H12	−281	Tylosin
PM15B	C05, C06, C07, C08	−276	Fusidic acid
PM19	A01, A02, A03, A04	−357	Josamycin
PM12B	H01, H02, H03	−267	Spiramycin
PM20B	H09, H10, H11	−249	Troleandomycin
PM12B	A07, A08	−159	Tetracycline
PM11C	A05, A06	−122	Chlortetracycline
PM11C	C09	−63	Minocycline
PM11C	F05, F06, F07, F08	−321	Erythromycin
PM11C	A09, A10, A11	−230	Lincomycin
PM20B	B09, B10	−450	Tetrazolium violet
PM20B	C01, C02, C03	−264	Thioridazine
PM19	D05, D06	−254	Iodonitro tetrazolium violet
PM20B	E01, E02	−169	Crystal violet
PM16A	E09	−79	Rifamycin SV
PM20B	D02, D03	−125	Proflavine
PM16A	F03	−93	Potassium tellurite
PM17A	G12	−95	Ceftoperazone
PM16A	A01	−72	Cefotaxime
PM13B	D02	−96	Cefuroxime
PM14A	F05, F06, F07	−250	Piperacillin
PM12B	B01, B02	−211	Oxacillin
PM13B	B01, B02	−189	Azlocillin
PM19	F01, F02	−159	Phenethicillin
PM12B	A01	−107	Penicillin G
PM13B	A03	−103	Ampicillin
PM11C	H01	−85	Cephalothin
PM11C	D09, D10, D11	−253	Nafcillin
PM11C	B05, B06, B07	−253	Cloxacillin

Department of Biomolecular Science and Engineering

Professor: Takeharu NAGAI
Associate Professor: Tomoki MATSUDA
Assistant Professors: Yoshiyuki ARAI, Masahiro NAKANO
Specially Appointed Associate Professor: Tetsuichi WAZAWA
Specially Appointed Assistant Professors: Megumi IWANO, Tetsuyuki ENTANI
Specially Appointed Researchers: Kunito YOSHIDA, Guirong BAI(-31.8.2006), Ryuichi ISHIDA, Tomomi KAKU
JST Collaborative Researcher: Masakazu AGETSUMA
Visiting Researcher: Syo SATO
Graduate Students: Kazushi SUZUKI, Noritaka FUKUDA, Yuki KUSHIDA, Shigenori INAGAKI, Yemima Dani RIANI, Hajime SHINODA, Jenny Rose Cruz TRINIDAD(30.9.2016-), Thitikorn PHANUPRAYOON(30.9.2016-), Mai ASHITANI, Ryoko SETO, Sonoko NAWATA, Nadim MD. HOSSAIN, TRAN Quang, Israt FARHANA, Taichi KIMURA, Masanori TSUJI
Under Graduate Students: Yoshimasa IKE, Syusaku UTO, Yuhei OGAMI
Special Auditor: Kris Gerard R. Alvarez(-29.7.2016)
Supporting Staffs: Kazuyo SAKAI, Aya HISATOMI

Outlines

One of the essence of biological phenomena is that nano-system consisting few to tens elements works in “cooperative” manner. To this end, we are developing several techniques to elucidate “the principle of the life system weaved by gap between minority and mass”. One approach is the use of the fluorescent proteins (FPs), which is spontaneously fluorescent without any enzymatic synthesis and any cofactors. Combination of FPs with fluorescence resonance energy transfer (FRET) technique allows us to develop functional indicators, by which we can spying localized molecular events in their natural environment within a living cell. By exploiting those techniques, we have created not only calcium-sensitive proteins to obtain an understanding of how intracellular calcium signals are generated and integrated, but also new fluorescent probes for the visualization of signal transduction cascades that are currently assayed by grinding millions of cells. Furthermore, we are developing novel optical techniques by which fluorescence signals can be efficiently detected. We strive to perform the paradigm shift from current biology to “minority biology” In addition, we are generating transgenic plants expressing bright and multicolor bioluminescent proteins to achieve energy-saving society.

Research Projects

Five colour variants of bright luminescent protein for real-time multicolour

bioimaging

We developed five new spectral variants of the bright luminescent protein, enhanced Nano-lantern (eNL), made by concatenation of the brightest luciferase, Nluc, with various colour hues of fluorescent proteins (Fig.1) [1]. eNLs allow five-colour live-cell imaging (Fig.2). Next, by insertion a fusion protein of calmodulin and M13 (CaM–M13) into Nluc, in which the conformational change of CaM–M13 by Ca^{2+}-binding induces the reconstitution of the split Nluc moiety, we developed an eNL-based Ca^{2+} indicator, GeNL(Ca^{2+}) with a 500% signal change. To test the applicability of GeNL(Ca^{2+}), we expressed GeNL(Ca^{2+}) in cardiomyocytes by means of an adeno-associated virus infection system. As a result, GeNL(Ca^{2+}) could be imaged at 60 Hz revealing a periodic luminescence change synchronized with cardiomyocyte contraction for 35 min.

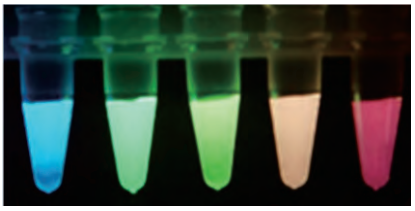


Fig.1 Luminescence image of five colour variants of eNL

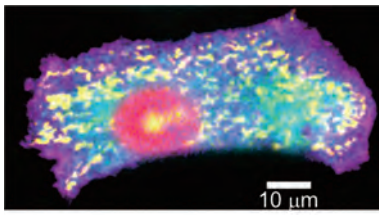


Fig.2 Multicolour luminescence image of subcellular structures using eNLs

Non-linear structured illumination microscopy by positively photoswitchable fluorescent protein, Kohinoor

Photoswtichable fluorescent proteins (PSFPs), in which the fluorescent on/off state can be controlled by the different wavelength of light irradiations, are widely used for superresolution imaging. In 2015, we developed novel PSPF, Kohinoor that can be switched from fluorescent off state to on state upon cyan light that is also used for the excitation of Kohinoor [2]. This feature enables non-linear relation between excitation light power and fluorescence. Here, we combined Kohinoor and non-linear structured illumination microscopy (NL-SIM), which is one of the methods of superresolution imaging, to break the diffraction limit. As a result, we achived the improved superresolution imaging than conventional linear SIM [3].

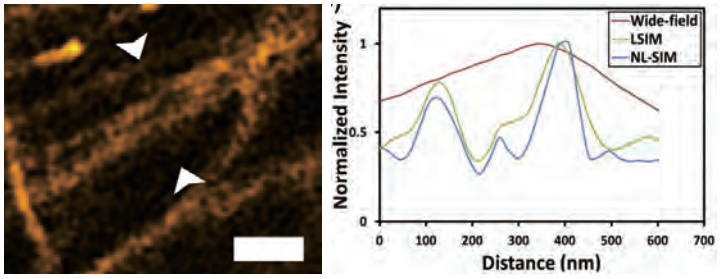


Fig. 3 NL-SIM by Kohinoor. Left: Superresolution image of Kohinoor-actin. Scale bar is 500 nm. Right, line profiles between arrows in left under various condition.

[1] Suzuki et al., Five colour variants of bright luminescent protein for real-time multicolour bioimaging, Nat. Commun., 7, 13718, 2016
[2] Tiwari et al., A fast- and positively photoswitchable fluorescent protein for ultralow-laser-power RESOLFT nanoscopy Nat. Methods, 12, 515-518, 2015
[3] Lu-Walther et al., Nonlinear structured illumination using a fluorescent protein activating at the readout wavelength PLoS ONE, 11, e0165148, 2016

Division of Next Industry Generation

Outline

This research division was established in October 2006 and is composed of three research departments. The goal of this division 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 Kazuhiko Nakatani, director of ISIR) has executed JSPS Core to Core program.

On December 14 4th Conference of SANKEN Core to Core Program and 5th imec Handai Interantional Symposium were held at Osaka Grand Front , on December 13 1st Osaka University COI International Conference as well, to share co-developed results.

Toward future global extension for collaboration with ISIR, on December 15 we had a face to face discussion among core to core members to get the way of future collaboration.

On February 13, opening ceremony of Osaka University ISIR imec center was held at imec 1 building among director Kazuhiko Nakatani, Jo De Boeck CTO&EVP, Chris Van Hoof imec fellow, then we confirmed more strengthen collaboration is going ahead.

In pararell, in Osaka univ. COI(Center of Innovation) program, the collaboration agreement were as a result contracted between 27companies and 17 research academia, then " Fostering of super-Nipponjin by human power activation" development has been going well under one roof followed by 5th Handai COI symposium held at Nakanoshima center on October 11 and 1st international Osaka university COI conference held at Osaka Grand Front on December 13, recpectively.

Research Projects

・JSPS 4th SANKEN core to core program nd 5th imec HandaiInternational conference were heldatOsakaGrand Front on December14 last year.

4th Core to core program is composed of 3 oral session and 1 poster session, at first professor Kazuhiko Matsumoto, the chair person, and professor Chris Van Hoof, imec fellow gave welcome words, then theme R1～R9 presentation were gven. Fruitful discussion were done among 42 participants. As for 5th imec Handai symposium, topics of flexible, organic electronics and bioelectrinics , life science were presented mutually and tight collaboration friendship were shared.

Snap shot of 5th imec Handai International conference

Reception of SANKEN international conference

・Osaka University ISIR imec center was established

Collaboration framework agreement between imec which is greatest and most advanced consorsium, Belgium and ISIR was first established as the Japanese university on November, 2011, since then we continue to collaborate regarding JSPS brain circulation, core to core program, and MEXT COI program. imec already had imec Japan OSAKA office in ISIR since 2013. In order to make stronger collaboration friendship and also to establish main hub in Europe, Osaka University

ISIR imec Center were eatablshed. On Februay 13, the opening ceremony was held among director Kazuhiko Nakatani, professor Jo De Boeck imec STO&EVP,and professor Chris Van Hoof imec fellow.

Opening ceremony of Osaka University ISIR imec Center

Time line	Title for Discussion (tentative)	provision of information	Title	Affiliation
Dec. 13(Tue) 10:00-10:20	**Welcome word &Overview of Osaka Univ. Core to Core Program**	Kazuhiko Matsumoto	Professor	ISIR, Osaka Univ.
10:20-10:40	**Horizon 2020 Overview, and Some Activities in imec**	Bernard Grundlehner	Researcher	imec (Holst Ctr)
10:40-11:00	**FP7 Activities and possibilities of International collaboration research**	Jan Van Fleteren	Professor	Imec Ghent
11:00-11:20	**International Academic Exchange Program between UK and Other Countries**	Sonia Contera	AssociateProfes sor	Univ. Oxford
11:20-11:40	**NSF-JSPS Exchange Program for Young Researchers**	David Janes	Professor	Purdue Univ.
11:40-12:00	**International Academic Exchange Program in Norway**	Sigurd Rolland Petterson	PhD Student	NTNU
12:00- 12:10	**Break**			
12:10-12:15	**Welcome Word for Lunch Meeting**	Kazuhiko Nakatani	Director	ISIR
12:15-12:35	**New Networking Program of ISIR for "Molecular Technology Research"**	Seiji Takeda	Vice Director	ISIR
12:35-13:15	**Free Discussion for Strategic Networking of New Sensing Devices**	All participants		
13:15-13:30	**Summary**	Mototsugu Ogura	Professor	ISIR

Agenda of **Workshop on a Stronger Collaboration Networking for "Soft Materials Sensing Devices Research"among Japan, EU and USA**

161215 Conclusion: ①PIRE, ②"Molecular technology research", and ③ERC program are interesting topics in today's discussion.

	Topics, proposals
imec-NL Bernard Grundlehner	• EC program: **Horizon2020** international collaboration program with 3rd countries 80billion Euro(2014-2020), chance to get ~ 13%, Topics with Japan: ICT, critical raw materials, aeronautics. **Candidates(application deadline): Micro, nanoelectronics April 2017, thin organic larger area April 2018, robotics, Japan parties(Osaka Univ.) can do apply only with EU parties.** **EC wants Japanese companies(big companies) for use in practical use as 3rd parties.**
imec Ghent Jan Van Fleteren	Additional information on Horizon2020: EC website, Horizon 2020 application contact person :JST ICT-31-2017 , Maria curie, **individual fellowship application every year**
Univ. Oxford Sonia Contera	• Brexit uncertain situation , though 25% R&D cost coming from EU , 22% students cost from EU 2 billion UK budget for R&D decided, funding between two laboratories, Inside Oxford joint funding, EPC engineering physic and chemistry program
Purdue Univ. David Janes	• NSF-JSPS(CREST, PRESTO, ALCA) joint program (**PIRE**: partnership for international research and education) We ask JSPS JST of younger researcher programs, they have guideline 4 M dollars , 5 years, US undergraduate students, graduate students, budget max 1 year NSF and JST award each country side. **① This PIRE program is interesting for ISIR Osaka university.** Basically bilateral academic exchange program, including some joint development budget
NTNU Sigurd Rolland Petterson	strategic research areas 2014-2023,NTNU.Total 110 Meuro from Horizon 2020, international partners, Bachelor and master programs, PhD programs There are no tuition fees at NTNU!!, Exchange out side EU requires TOFEL English proficiency. NTNU Japan in Tokyo, Hiroshi Matsumoto April 20116
Osaka Univ. Seiji Takeda Yoshihiko Hirotsu Mototsugu Ogura	• Looking for **next JSPS core to core program** • JSPS brain circulation program, **②global networking "Molecular Technology Research"** Oct.16-Mar.2019 Univ. Oxford, imec, KU Leuven, Max Planck etc • **③ERC program** (agreement with EC&JSPS): imec ERC grant holders: flexible electronics(Paul Heremans), life science(Liesbet Lagae), flexible circuits(Myny Kris) vs ISIR JSPS research fellow

conclusion of this workshop

Department of Intellectual Property Research

Specially Appointed Professor:	Hirokazu SHIMIZU
Invited Professor:	Akio KOBAYASHI
Specially Appointed Assistant Professor:	Yoshihiro KIMURA
Specially Appointed Assistant Professor:	Hisaaki KATO
Post-Doctoral Researcher:	Ping LAI

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 continued 2 consignment studies [(1) Developmental study for new element technologies to enable the value adding of natural materials; (2) Study for producing valuable materials in plants grown in artificial environment] and 1 Grants-in-Aid for Scientific Research [(3) Challenging Research (project members)]. These empirical studies were carried out.

Research Projects

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
-Symposium about genetically modified plants
-Development of manufacturing technology for tableting mold with low sticking characteristics (supplementary research)

New Element Technologies to Enable the Value Adding of Natural Materials

In order to develop applicable technologies for resolving social and environmental problems, potential abilities of plants were studied in artificial-environmental conditions. The developmental research for extending freshness of fruits was carried out.

New hydroponic-cultivation system using scrap glass was developed, and the technology was practically tested on a project in Second-Development Zone in the Umekita area.

Fig.1 Practical application test of new hydroponic-cultivation technology in Umekita area.

As an academic-industrial collaboration in food and health field, the framework to evaluate health foods academically was established.

Laboratory of Cellulose Nanofiber Materials

Associate Professor: Masaya NOGI
Specially Appointed Assistant Professor: Hirotaka KOGA
Supporting Staff: Hitomi YAGYU, Ikuko YUMEN
Yasuha IZUMI (1.12. 2016- 31.3. 2017)

Outlines

Cellulose nanofibers with widths 3-15 nm, mainly originating from higher plants, have attracted much attention due to their excellent properties including high physical strength, high aspect ratios and low thermal expansivity. We have developed a new type of paper based on cellulose nanofibers. The cellulose nanofiber paper, denoted nanopaper, offers high optical transparency and low coefficient of thermal expansion. At present, we are conducting the research and development of flexible nanopaper electronics and paper reactor for useful chemical production.

Research Projects

Hazy transparent nanopaper (Sci. Rep., 7, 41590 (2017))

Light scattering mechanism of hazy transparent cellulose nanopaper was clarified. The nanopaper with high total transmittance (over 90%) and tunable haze values (4.9-86.7%) was successfully prepared. The hazy transparent nanopaper scattered the incident light without losing light intensity. Therefore, the hazy transparent nanopaper is a promising candidate for optical diffusors in LED lighting (Fig. 1).

Fig. 1 Nanopaper-based LED diffusor.

Disposable paper memory (NPG Asia Mater., 8, e310 (2016))

Environment-friendly and disposable nonvolatile resistive paper memory consisting of 99.3 vol% cellulose nanofibers was successfully developed by collaboration with Prof. Takeshi Yanagida, Assis. Prof. Kazuki Nagashima (Kyushu University), and Dr. Umberto Celano (Imec) (Fig. 2). The paper memory demonstrated large memory window (over 10^7) and multilevel storage function. The biodegradability of our paper memory was also confirmed by burying it in natural soil for 26 days.

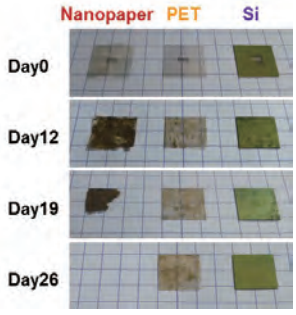


Fig. 2 Disposable paper memory.

Paper reactor

By collaboration with Assoc. Prof. Yuta Nishina (Okayama University), highly efficient continuous-flow nanocatalysis with a recycling and renewing system is demonstrated using a metal nanoparticle catalysts-anchored wood pulp paper reactor with tailored hierarchically porous channels (Fig. 3). Our strategy opens new doors for truly green sustainable chemical manufacturing.

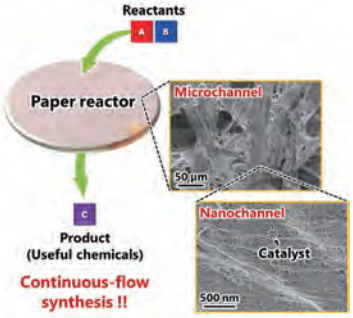


Fig. 3 Schematic of the paper reactor.

Laboratory of Cell Membrane Structural Biology

Specially Appointed Professor: Akihito YAMAGUCHI
Specially Appointed Associate Professor: Ryosuke NAKASHIMA
Specially Appointed Assistant Professor: Keisuke SAKURAI
Supporting Staff: 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. We had reported the first inhibitor-bound structures of AcrB and MexB in 2013. 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. Subsequently, we determined the crystal structure of MexB bound with LMNG. This structure suggests that the selectivity of substrate-binding pocket does not depend on only the molecular mass.

Research Projects

Crystal structure of MexB bound with LMNG

RND-type multidrug efflux pumps have two voluminous multisubstrate-binding pockets named proximal and distal pockets. High and low molecular mass drugs bind to proximal and distal pockets, respectively. Low molecular mass detergent dodecylmaltoside (DDM, MW 510) binds to the distal pocket of MexB in *Pseudomonas aeruginosa*. We determined the crystal structure of MexB bound with high molecular weight detergent. Lauryl maltose neopentyl glycol (LMNG) has molecular mass (MW: 1005) is higher than not only distal-binding drugs but also rifampicin and erythromycin, which are proximal-binding drugs. Contrary to the expectations, LMNG bound to the distal pocket. One of the two hydrophobic lauryl chains were inserted into the hydrophobic groove which is an inhibitor binding site. The other lauryl chain is elongated parallel to the groove. Two maltose moieties are located in the substrate translocation pathway overlapped with minocycline- and doxorubicin-binding sites. These results indicated that it is not simply determined whether substrates bind to proximal or distal pockets.

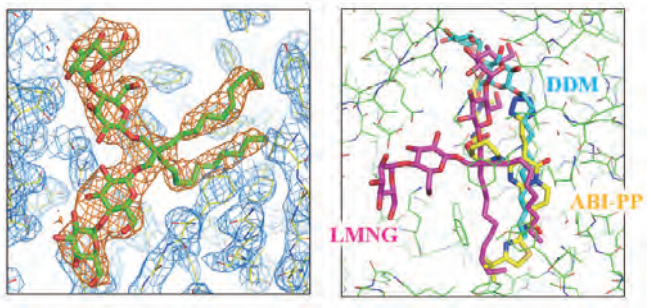


Figure 1 Structure of LMNG binding site
a. LMNG is shown in green. The electron density map (2*Fo*-*Fc*) is represented by orange mesh. b. Bound DDM and ABI-PP are superposed on the LMNG binding structure.

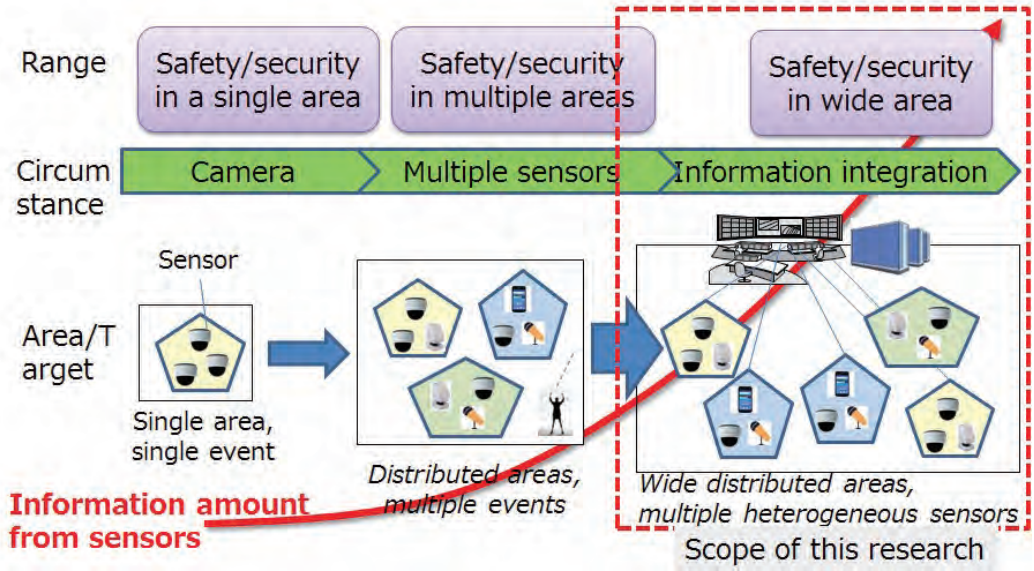
Mitsubishi Electric Collaborative Research Division for Wide-area Security Technology

Outline

The studies in this division focus on security technology to enhance safety and security in wide areas such as city. Some of our major research projects are generation and visualization of multi-modal sensor data space by integrating massive camera and sensor data, person matching for cross-camera tracking robust against observation views and occlusion situation, attribute-based high-speed person retrieval for efficient forensics, establishment of physical security level for understanding and predicting security risk.

Current Research Programs

- Generation and visualization of multi-modal sensor data
- People density estimation based on staying detection
- Cross-view person matching
- Occlusion handling for person matching
- Attribute-based high-speed person retrieval
- Establishment of physical security level



Security technology to enhance safety and security in various areas ranging from a single area at an event level to a wide area at a city level

Activities of Centers

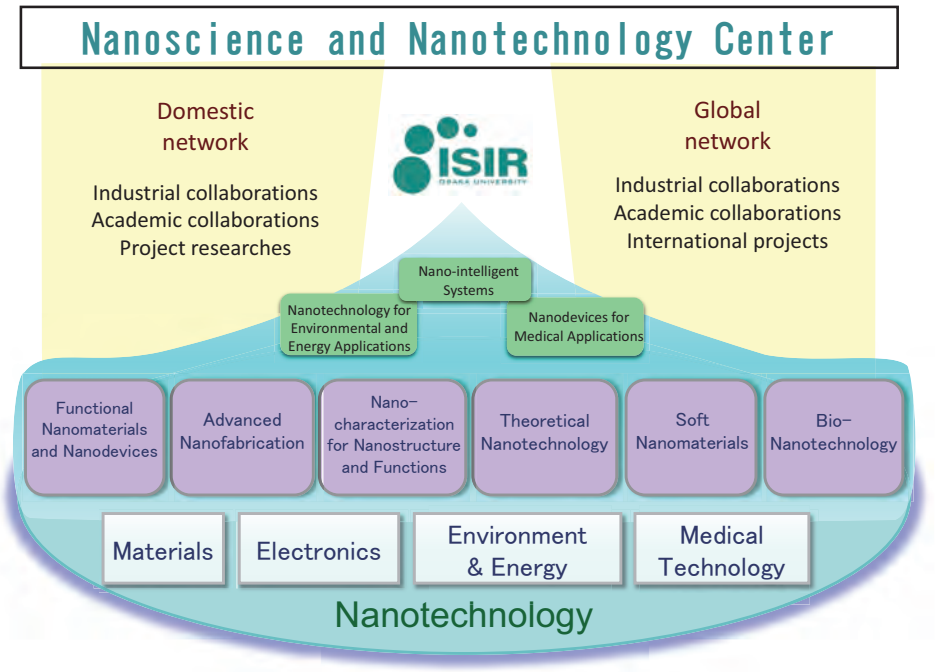
Nanoscience and Nanotechnology Center

Director, Professor: Seiji TAKEDA
Supporting Staff: Yuka UMEMOTO

Outlines

Nanoscience and Nanotechnology Center was founded in the Institute of Scientific and Industrial Research (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 fields. Following the reorganization of ISIR in 2009, the Center was enhanced and strengthened by building up a new structure centering on 6 full-time departments.

In the new Center, there are 18 research departments composed of 6 full-time departments, 3 departments concurrently serving as ISIR, 6 departments concurrently serving as Osaka University, and 3 departments headed by domestic and foreign visiting professors. Also, Advanced Nanotechnology Instrument Laboratory is newly opened in order to develop cutting edge researches on nanoscience and nanotechnology. Eliminating the term limit which was primarily set, the Center permanently focuses on the nano-system creation on the research field of a wide variety of materials including hard-, soft-, and bio-materials through the combination of top-down and bottom-up nanoprocess, and promotes the nanotechnology research to the new interdisciplinary science by an innovation through the approaches of theory and evaluation. The Center operatess Nanotechnology Platform Japan Program, Nanotechnology Open Facilities, Osaka University (Nanofabrication Platform Molecule & Material Synthesis Platform) from 2012. Furthermore, the Center aims to be a hub of nanotechnology research by forming broad networks between Japan and oversea countries.



Department of Functional Nanomaterials and Nanodevices

Professor:	Hidekazu TANAKA
Associate Professor:	Teruo KANKI
Assistant Professor:	Azusa HATTORI, Mahito YAMAMOTO
Research Fellow:	Tan Goon（2016.4.1-2017.3.31）
	Alexis BOROWIAK（2016.9.28-2018.9.27）
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Under Graduate Students:	Yoshihide TSUJI, Daiki KAWAMOTO, Takanobu YOKOGAWA
Supporting Staff:	Saeko TONDA, Natsuko SAKAKI, 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.

Research Projects

Development of Functional Oxide Nano-Mechanical System (Functional Oxide *NEMS) and its application to energy serving device.*

We demonstrated that an insulator-to-metal transition is driven by a quite low electric power using VO_2 freestanding nanostructures with 400 nm width. The critical power (P_C) inducing insulator-metal transition was compared with size dependence of clamped and freestanding nanowires. The required P_C in the nanowires with 400 nm in width was 450 nW at just below the transition temperature, which was approximately one order smaller than the freestanding micro wires with 1-μm-width. The device model considering thermal conductivity well explained that the origin of P_C changes is owing to a lower thermal conductivity in air than that in a substrate and small

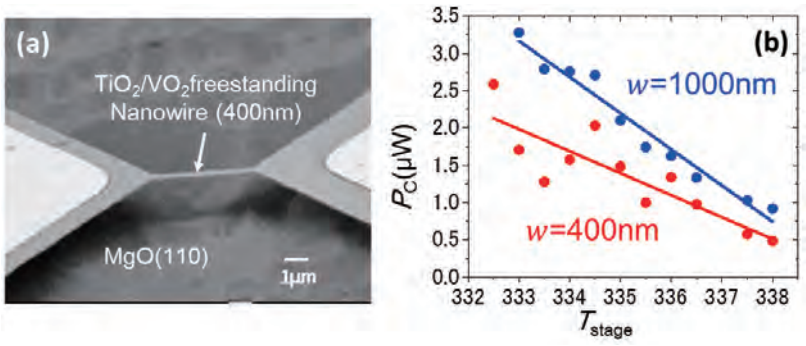

Fig. 1 (a)SEM image of VO_2 freestanding nanowires in 400-nm-width. .(b) Temperature dependence of P_C in freestanding nanowires with width of 400nm and 1000 nm.

cross-sectional area in nanowires with 400-nm-width. These results provide guidelines for achieving significant reductions in P_C in two-terminal phase-switching devices.

Enhancement of the resistance changes in the three dimensionally size controlled VO_2 nanowall wire

We produced hetero-nanowall wire (nw) structure using 3D nano-template pulsed laser deposition technique and investigated their conductive properties. Fig. 2 shows preciously size controlled VO_2 nw/TiO_2/3D-MgO structure: 40 nm-width VO_2 and 30 nm-width TiO_2 were homogenously and continuously grown onto the sidesurface of a 3D-MgO. Fig. 3 show temperature dependent resistivity (RT) of the 100 nm width VO_2 nw. One can see one steep step change with 150 nm electrode gap while the small multi step changes with 2 μm gap. The appearance of step changes in a RT curve indicate the occurrence of domain confinement effect. The simulation results showed that about 150 and ten electric nanodomains originate the small multi step and one steep step changes, respectively, due to the nano-confinement effect.

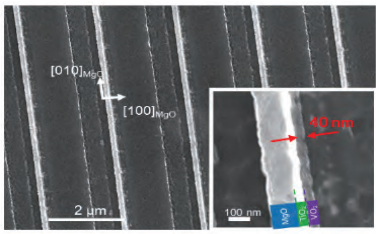

Fig. 2 SEM image of 40 nm width VO_2 nanowll wire grown on TiO_2/3D-MgO.

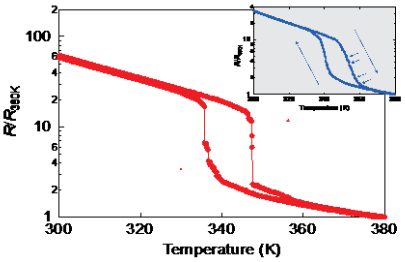

Fig. 3 RT curve for 100 nm width VO_2 nw with 150 nm-gap electrodes and 2 μm-gap (insets).

Construction of Functional Diodes Based on Correlated Oxides/Atomically Thin Semiconductors Heterostructures

Correlated oxides with exotic properties such as metal-insulator transition (MIT) show great potential for electronic applications particularly when integrated with semiconductors. However, such correlated oxide/semiconductor heterostructures have remained elusive since correlated oxides can be grown, in general, only on particular substrates. Here, using two-dimensional layered semiconductors that can be transferred onto any materials, we have fabricated correlated oxide/atomically thin semiconductor heterostructure devices with novel functionality. Fig. 4 shows an optical image and current-voltage characteristics of a heterojunction of VO_2 that shows MIT at 340 K and a semiconductor of few-layer WSe_2. Below 340 K, where VO_2 is insulator, the heterojunction shows an Ohmic-like behavior (the current is quite small, though). However, with increasing temperature, the junction shows a rectification behavior most likely due to the formation of a Schottky barrier between metallic VO_2 and WSe_2. These observations indicate that the VO_2/WSe_2 junction can be used for a diode with temperature -controlled rectification property.

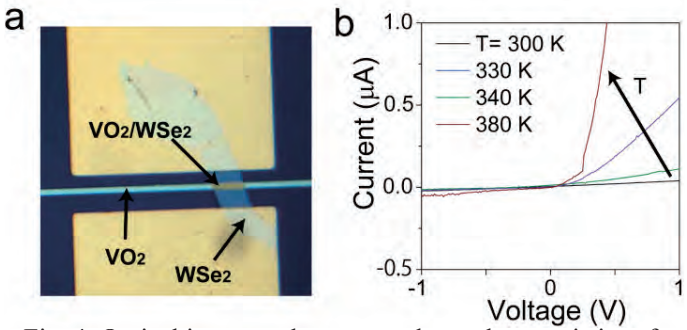

Fig. 4. Optical image and current-voltage characteristics of a VO_2/WSe_2 heterojunction.

Department of Advanced Nanofabrication

Professor: Yoichi YOSHIDA
Associate Professor: Jinfeng YANG
Assistant Professors: Takafumi KONDOH, Koichi KAN
Specially Appointed Associate Professor: Shigeki KAWAKAMI(16.10.2016~)
Specially Appointed Researcher: Masao GOHDO
Guest Professor: Hitoshi KOBAYASHI
Guest Associate Professor: Hiromi SHIBATA
Invited Professors: Masayuki ENDO, Atsushi OGATA, Shunichi GONDA, Seiichi TAGAWA, Kazumichi NAKAGAWA, Shigeki KAWAKAMI(~15.10.2016)
Graduate Students: Itta NOZAWA, Ryo ASAKAWA
Under Graduate Students: Takuya NISHIDA
Supporting Staff: Yukie TAKAHASHI

Outlines

In our research group, to realize advanced nanofabrication, the fundamental processes induced by quantum beams in materials are to be elucidated. As a tool, a femto/attosecond pulse radiolysis system is researching and developing. To reach the time resolution of attosecond, generating and measuring methods of the femto/attosecond electron pulses are studied. By applying our electron beam generation/control technology to electron microscope/electron diffraction device, we are aiming for new development in interdisciplinary fields of accelerator science, electron microscopy and radiation chemistry.

Research Projects

Generation and Diagnosis of Ultra-Short Electron Beams

The main purpose of this research is to generate an ultra-short electron beam with the bunch length of femtoseconds and attoseconds from a laser photo-cathode RF (Radio Frequency) linear accelerator and an arc-type magnetic bunch compressor and to diagnose the bunch length using bunch length measurement system based on an interferometric technique. In the current year, the optimal bunch compression condition for the bunch compressor was studied by using the bunch length measurement system. As a result, the electron beam was highly compressed when the achromatic condition was fulfilled in the bunch compressor. So far, as a result of this study, <10-fs electron beams were successfully generated and diagnosed.

Broadband spectroscopy of coherent transition radiation for advanced pulse width measurement

Broadband terahertz spectroscopy was conducted for diagnostics of ultrashort electron beam. Bunch length measurement ranging from sub-picosecond to femtosecond was enabled by a Michelson interferometer which had detectors of MCT (mercury cadmium telluride detector) and liquid helium cooled bolometer for broadband detection.

Bunch length was estimated as 8.7 fs from an interferogram of coherent transition radiation at linac phase and bunch charge of 110 degrees and 1.38 pC, respectively. Similar bunch length after relocation of this linac was obtained as compared with that before the relocation.

Study of excess electron dynamics in nonpolar liquids

To study the electron transport/transfer process in nonpolar liquids which have different molecular structure, for example linear alkanes having different chain lengths such as n-hexane, n-octane and n-dodecane and a spherical alkane having a branched chain such as isooctane, biphenyl-alkane solutions were examined by a femtosecond pulse radiolysis. Biphenyl was used for a probe molecule of excess electrons. In our recent study, it was observed that the generation rate constant of biphenyl radical anions was one order higher than that of diffusion limited reaction calculated from mobility in n-dodecane, this phenomenon was also observed in other linear alkanes. These phenomena suggest another electron transport mechanism in the initial process of radiation chemistry in saturated hydrocarbons. This finding is related to the electron transport and migration phenomenon in the polymer and is expected to be useful for improving the resolution of resist materials in next-generation EUV lithography.

Development of extended pulse radiolysis technique for understanding quantum beam induced reaction

We have been working on fs-pulse radiolysis to understand primary processes of quantum beam induced reactions. To enable variety of samples and to make measurement efficient, our fs-pulse radiolysis measurement system was upgraded and new technique extended the measurement. We started development of efficient transient absorption measurement system using supercontinuum as probe light and fluorescence detecting pulse radiolysis measurement system.

Development of UEM using the MeV-energy femtosecond electron pulses

Ultrafast observation technique with femtosecond and nanometer temporal-spatial resolutions would be very significant in material science and applications. We have designed and developed a first prototype of ultrafast electron microscopy (UEM) using a femtosecond-pulse and relativistic-energy electron beam. The femtosecond-pulse electron beam with the energy of 3.1 MeV and the pulse length of 100 fs have been generated using a radio-frequency electron gun. We succeeded to observe TEM images of gold and polystyrene nanoparticles in our UEM using the MeV-energy femtosecond electron pulses. In the ultrafast electron diffraction measurement, the single-shot observation is available. It would be very promising for studying the irreversible structural dynamics and making new discoveries in material science.

Department of Nanocharacterization for Nanostructures and Functions

Professor: Seiji TAKEDA
Associate Professor: Hideto YOSHIDA
Assistant Professor: Naoto KAMIUCHI, Ryotaro ASO
Graduate Students: Tetsuya UCHIYAMA, Kentaro SOMA, Takehiro TAMAOKA, Koki HAYANO, Takaaki FUJIMOTO, Ryo KITAMURA, Wataru KURODA
Supporting Staff: Mayumi TANIGUCHI

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. In particular, 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. Using ETEM, we study nanomaterials and nanodevices at the atomic scale when they actually exhibit their functions.

Research Projects

Development of phase-locked transmission electron microscopy

We developed phase-locked TEM to acquire image and spectral data, such as TEM images, electron holograms, and electron energy loss spectra, synchronized with the measurement of the dynamic response of a specimen under an applied AC voltage. In phase-locked TEM, a pulsed electron beam which is synchronized with an applied AC voltage is created. The specimen is irradiated by the phase-locked strobe electron beam that is characterized by beam intensity, targeted phase, and phase width (Fig. 1). The images and spectra that are acquired at the same target phase are integrated to obtain the final phase-locked images and spectra with sufficient S/N ratio. Phase-locked strobe images and/or spectra are obtained for model specimens of polycrystalline aluminum and an all-solid-state lithium ion battery (LIB). The spatial resolution in phase-locked strobe images is better than 0.12 nm even at a frequency of applied AC voltage of 1 kHz.

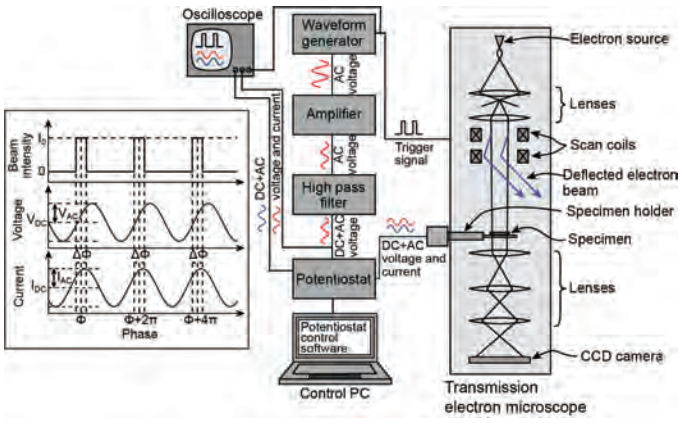

Fig.1 Diagram of phase-locked strobe TEM.

For the LIB specimens, it is shown that electrochemical impedance spectroscopy and cyclic voltammetry can be performed in a TEM apparatus, and could potentially be synchronized with phase-locked strobe imaging and spectroscopy.

Electron beam induced etching of carbon nanotubes

Gas mediated electron beam induced etching (EBIE) is one of the most promising methods for fabrication of nanoscale devices. For etching of materials by EBIE, a focused electron beam is scanned over the surface of the sample and promotes specific chemical reactions through interactions between primary electrons and gas molecules. In this study, we investigated the EBIE process of carbon nanotubes (CNTs) in oxygen by ETEM. A focused electron beam was repeatedly scanned along the white broken lines in scanning TEM (STEM) images in Fig. 2(a). The walls of the CNT were gradually etched over time. After 64 s, the CNT was completely cut, leaving a pair of open-ended CNTs. Figure 2(b) summarizes the normalized STEM image intensity as functions of the EBIE treatment time or the electron dose measured under various conditions. In oxygen, the EBIE rate increased as the partial pressure of oxygen increased. Furthermore, the EBIE rate for the CNTs supported on a SiN membrane was clearly larger than that for the CNTs suspended across a pore of the SiN membrane. We conclude that active oxygen species were introduced by secondary electrons emitted from the SiN membrane and promoted EBIE of the CNTs. We also found that EBIE rate for 200 keV electrons was larger than that for 80 keV electrons. EBIE by 200 keV electrons is not only induced by activated oxygen, but it is likely that the damage to the walls of the CNTs allowed for more effective etching by active oxygen species. We also formed nanogaps of 2–3 nm between the two ends of the cut CNTs as shown in Fig. 2(c). The size of nanogaps formed through our EBIE treatment by ETEM is more than half as small as that possible by SEM (>10 nm).

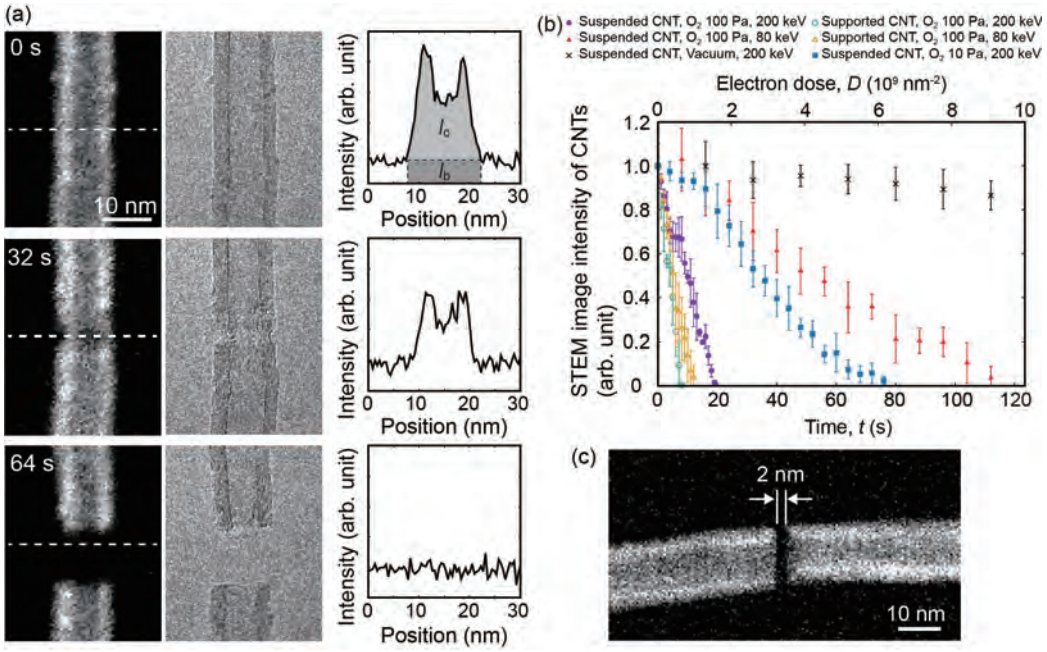

Fig.2 (a) EBIE of a multi-walled CNT in oxygen. (b) The decrease in normalized STEM intensity of the CNTs over time (EBIE rate) under various conditions. (c) Formation of a nanogap between two CNTs by EBIE.

Department of Theoretical Nanotechnology

Professor:	Tamio OGUCHI
Associate Professor:	Koun SHIRAI
Assistant Professors:	Kunihiko YAMAUCHI, Hiroyoshi MOMIDA
Specially Appointed Associate Professor:	Tetsuya FUKUSHIMA (2015.12.1~)
Specially Appointed Researcher:	Hiroki KOTAKA (~2016.4.30)
	Huyen Thi Ngoc VU (2016.4.1~2017.3.31)
Guest Professors:	Mitsuhiro MOTOKAWA, Takeo JO, Shigemasa SUGA
Visiting Researcher:	Tomoki YAMASHITA, Hitoshi FUJII
Graduate Students:	Naoki UEMURA, Takayoshi FUJIMURA, Masayuki FUKUICHI, Tetsuo TANAKA, Hiroshi KATSUMOTO, Motoyuki HAMAGUCHI, Kei IZUMI, Masaki TAHARA, Masahito KUMAKURA Thao Thi Phuong NGUYEN, Huyen Thi Ngoc VU (Specially Appointed Researcher)
Special Auditor:	Hung Ba TRAN (2016.10.5~2017.9.25)
Special research student:	Fumiaki KURODA
Undergraduate Student:	Shinichi KANEHIRA, Yousuke KANDA, Takao KOSAKA
Supporting Staffs:	Chiaki KURIBAYASHI

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.

Research Projects

Data-Science Assisted Materials Exploration

With the progress of high-performance computers and the sophistication of theoretical methods, it is now possible to predict properties for concrete materials with high accuracy by first-principles calculations starting from their constituent elements. However, to realize materials having desired properties, it is necessary to search for an enormous combination of materials spaces, that makes materials design difficult. Recently, efficiently searching approaches by combining data-science methods with first-principles calculations have been actively developed. We apply

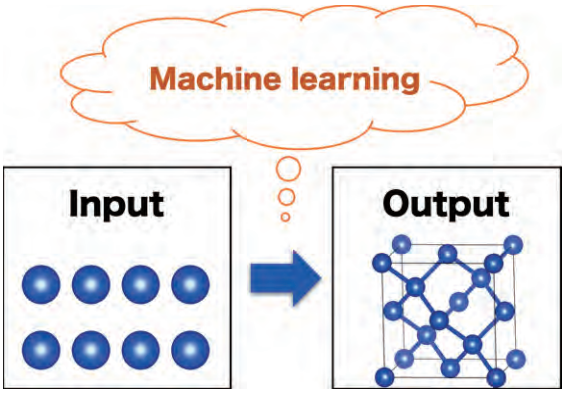

Fig1. Crystal structure prediction.

statistical learning methods such as Bayesian optimization and sparse modeling to develop tools for searching stable structures and predicting properties.

Development of crystal structure prediction method

Random search algorithm in combination with structure optimization technique using first-principles calculations was developed for crystal structure prediction. Furthermore, Bayesian optimization method was added to accelerate crystal searches. We started with simple systems to test the random search algorithm. Crystal structure prediction simulations were carried out for Y_2Co_{17}. Our predicted structures were in complete agreement with structures in experiments. We further tried a Bayesian optimization method to search the of Y_2Co_{17} efficiently. The structure prediction was succeeded with fewer trials. We could show the high efficiency of the Bayesian optimization

Bandstructure Calculation for Topological Matter

Topological matter has attracted much attention recently and developed its research in a wide region of material science. In the present research, as focusing on flexibility of perovskite structure, the first-principles materials design based on ferroelectric transition-metal oxides has been performed. It was revealed that the polar ionic distortion breaks the inversion symmetry so that the bands are spin split due to the spin-orbit coupling, which in turn results in the spin-valley coupling.

We collaborate with an experimental ARPES research group in Tohoku University to understand electronic structure of single-crystal tellurium. While it has been predicted that tellurium belongs to Weyl semimetal, which is a sort of topological matter, we clarified that the valence top is indeed a magnetic monopole regarded as Weyl point, where the spin texture is diverging.

First-Principles Study on Piezoelectricity of Wurtzite Materials

Piezoelectrics are widely used in various applications of modern electronic devices. AlN is an important candidate for high-temperature applications due to its high Curie temperature. Recently, significant enhancement of piezoelectricity by alloying with Sc has been found experimentally. We theoretically investigated the piezoelectricity of $Sc_xAl_{1-x}N$. We found that the piezoelectric constants of wurtzite-type $Sc_xAl_{1-x}N$ significantly were enhanced as x increases from 0 to 0.75. However, a structural study showed that the cubic-type phases become more stable than the wurtzite-type phases at x approximately 0.5 and higher. Our study on the chemical tendency on piezoelectricity in $A_{0.5}B_{0.5}N$ (A = Sc, Y, La and B = Al, Ga, In) indicates that Sc, Y, and La have the strongest effect on the enhancement of piezoelectric constants in AlN, GaN, and InN, respectively.

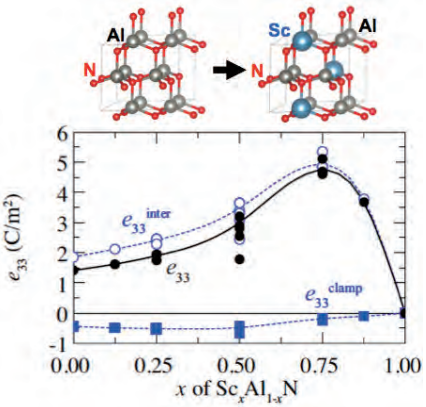

Fig.2 Calculated models and piezoelectric

Department of Soft Nanomaterials

Professor: Yoshio ASO
Associate Professor: Yutaka IE
Assistant Professor: Makoto KARAKAWA (-30.4.2016)
Masashi NITANI (-31.3.2017)
Guest Associate Professor: Makoto KARAKAWA (-1.6.2016)
Specially Appointed Researcher: Shreyam CHATTERGEE
JSPS Postdoctoral Researcher: Shunsuke TAMBA
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Keitaro YAMAMOTO, Takuya INOUE, Kakeru IZUNO
Supporting Staff: Keiko YAMASAKI
Technical Assistant Staffs: Takuji SEO, Yumi HIROSE

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 π-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 π-conjugated systems as organic semiconductors with high carrier mobility, and (2) functionalized molecular wires and metal-electrode-anchoring units applicable to molecular electronic devices.

Research Projects

We have newly designed a fluorine-containing, strongly electron-withdrawing decyanovinylidene terminal group for a structural component of electron-transporting semiconductors. This terminal group can be easily incorporated into π-conjugated frameworks, and a series of electron-accepting π-conjugated molecules having this terminal group has been synthesized for the application to n-channel organic field-effect transistors (OFETs) (Fig. 1). Electrochemical measurements indicated that these compounds showed low-lying lowest unoccupied molecular orbital (LUMO) energy levels, which could be fine-tuned by the combination of central unit. The thin films fabricated by solution process showed typical electron-transporting characteristics in OFETs under vacuum, irrespective of molecular alignment in the film

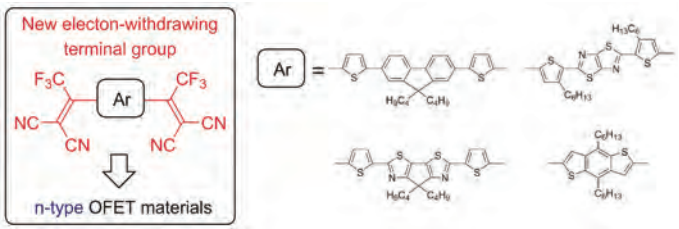

Fig. 1 New electron-accepting compounds with fluorine-containing dicyanovinylidence terminal groups

states, which was estimated from the X-ray diffraction and atomic force microscopy measurements of the films. When these devices were driven in air, some of them retained n-type characteristics depending on both the energy levels of LUMO and the kinetic barrier arising from a tight packing of the fluoroalkyl groups, which prevents the penetration of air oxidants [Original Paper 3].

We have also developed a new donor–acceptor copolymer P-PBTz-T^{12}-BDT based on pyradinobisthiazole (PBTz) as an acceptor unit for a p-type semiconductor of organic photovoltaics (OPVs) (Fig. 2). The PBTz unit was previously reported by us as a stronger acceptor unit than related benzobisthiazole (BBTz). The SCLC carrier mobility measurement of the polymer film showed the hole-transporting characteristics, and bulk-heterojunction (BHJ) OPV based on P-PBTz-T^{12}-BDT and PC$_{61}$BM showed a moderate power conversion efficiency (PCE), indicating that PBTz is positioned as a good candidate for the acceptor unit for the development of high-performance organic semiconducting materials [Original Paper 2].

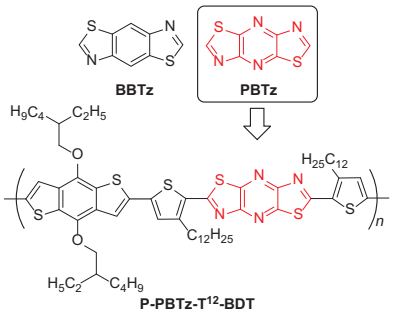

Fig. 2 Chemical structure of P-PBTz-T12-BDT

Recently, we found that the structural modification of certain linear electron-accepting π-conjugated compounds is clearly correlated with both the short-circuit current density (J_{SC}) of the BHJ OPV with P3HT donor polymer and the London dispersion (γ^d) components of the surface free energy (SFE) of the acceptors, that is, acceptors with large γ^d values led to the high OPV performance. We thus hypothesized that increasing γ^d might be a rational means of preparing high-performance non-fullerene acceptors. Therefore, to investigate further the influence of structural modification on the donor–acceptor interfaces, we synthesized a series of three-dimensional (3D) non-planar π-conjugated acceptors that consist of peripheral perylene bis(dicarboximide) (PDI) units with different central core units and different connectivity. Although these compounds showed little difference in the molecular properties, their BHJ OPVs showed different PCEs, ranging from 0.02 to 2.02%, and originating from the differences in the J_{SC} values. We found that the degree of charge-separation mainly influences the photovoltaic characteristics of the OPVs, and, furthermore, that the J_{SC} and γ^d of the surface free energy of the 3D acceptors are correlated (Fig. 3). Consequently, increasing the interfacial exposure of the π-conjugated framework increases the value of γ^d and orienting the PDI π-planes toward the donor–acceptor interfaces, which is desirable for the efficient charge separation into free carriers. This study successfully highlighted the importance of γ^d for the molecular design of non-fullerene acceptors for BHJ OPVs [Original Paper 6].

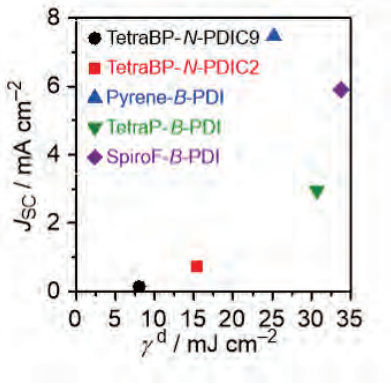

Fig. 3 Correlation between γ^d and J_{SC} values for acceptor materials

Department of Bio-Nanotechnology

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Associate Professor: Makusu TSUTSUI
Assistant Professor: Hiroyuki TANAKA, Kazumichi YOKOTA
Specially Appointed Professor: Tomoji KAWAI
Specially Appointed Associate Professor: Takahito OHSHIRO
Specially Appointed Assistant Professor: Wataru TONOMURA, Akihide ARIMA
Specially Appointed Researcher: Sanae MURAYAMA, Yuko ESAKI, Hiroko DEGUCHI, Yukari KUBOTA, Chie HOTEHAMA(-2016.5.31), Yayoi TSUMOTO(2016.11.16-),
Graduate Students: Takanori MORIKAWA, Sachie TANIMOTO, Tomoki HAYASHIDA
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.

Research Projects

Insulator-protected nanoelectrodes for fast tunneling current measurements

Single-molecule detections by tunneling current measurements have proven to be a potential approach for sequencing RNA, DNA, and even proteins that promise wide applications in bioanalytics and medicine. In this method, a pair of Au nanoprobes in 1 nm separation was used to record measureable yet infinitesimal pA-level change in the tunneling current occurring upon temporal trapping of single-nucleobases in the electrode gap. As the molecules cannot be suspended for no longer than several milli-seconds, it calls for fast and low-noise current sensing platform applicable for the measurements in aqueous solution. Here, we developed an insulator-protected nanoelectrode system for single-biomolecule detections in water. We used dielectric thin film coated MCBJs to create two Au nanoprobes with 1 nm separation whose entire surface except the nanoscale apex was covered with SiO_2 or Al_2O_3. By analyzing the

current flowing through the nano-exposed insulator-covered nanoelectrodes, we found prominent effects of ion-derived capacitance and its coupling to the amplifier voltage fluctuations on the noise measured. We demonstrated reduction of the noise by 50 nm thick coating of the electrodes with low-k dielectric layers that served to decrease the net capacitance of the nanoelectrodes. At the same time, we achieved faster response of the current amplifier circuit to small spike-like changes in the tunneling current observed during detections of single-nucleotides in buffer by the dielectric coating by virtue of the additive outcome of the capacitance reduction to weaken RC effects that blunt the electrical signals. The present findings suggest a potential use of insulator-protected nanoelectrode systems not only to enhance the signal-to-noise ratio in the electrical single-molecule detections but also for implementing fine tracking of fast molecular motion-derived current responses that would eventually lead to better discriminability of biomolecules.

Enhancement of detection rate for small particles by parallel pores

Solid-state pore devices, which are consisted of micro/nano size hole in a solid membrane, enable us to detect small particles, bacteria and virus at a high sensitivity, and attract great attention as promising bio-sensing devices.

To detect particles by pore devices, ionic current via a pore is measured, and an ion current blockade in passing of a particle through the pore gives a signal of the particle at a single particle resolution. Meanwhile, detection of samples in low concentration is an issue in the practical use of pore devices, because no signal is obtained without a passing of particles. In this year, we fabricated multiple pores (2–7) in a membrane for the enhancement of detection rate and evaluated the pore devices of those (Fig. 1 a).

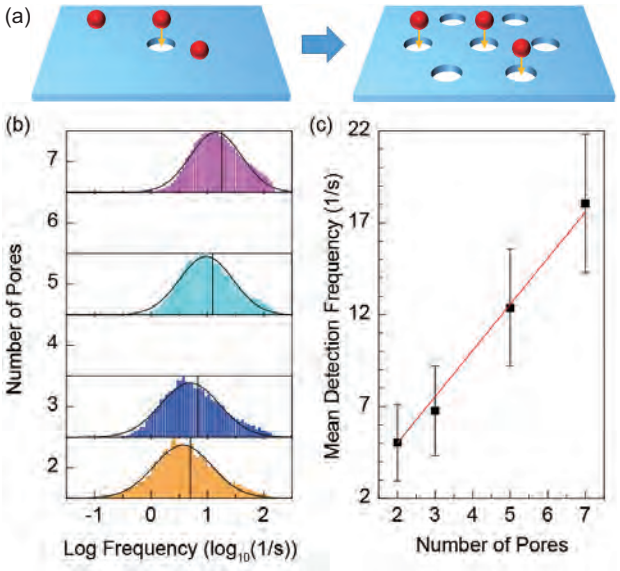


Fig. 1 (a) Schematic illustration for the detection rate enhancement by multiple pores, (b) logarithm normal distribution of detection frequency and (c) monotonic increasing of detection frequency to number of pores.

Detection frequency is assessed as an inverse of time interval between signals and logarithm normal distribution in detection frequencies was exhibited by means of signal acquisition with polystyrene particles (Fig.1. b). Furthermore, monotonic enhancement of detection frequency was confirmed on a specific pore design (Fig. 1. c), which indicates that the optimized structure of pores taking account of the spread of electric field is required to enhance detection rate by pore devices.

Fabrication of Ni(111) substrate for graphene growth

We have grown Ni(111) heteroepitaxially on muscovite and synthetic mica in vacuo for use as substrates for graphene formation. Annealing conditions were found that generated atomically flat surfaces (with rms surface roughness of less than 1 nm).

Department of Nanotechnology for Environmental and Energy Applications

Professor: Takahiro KOZAWA

Outlines

To address the urgent issues of environment and energy, we are developing the process and material technologies, by utilizing the facilities for nanofabrication available at the Nanoscience and Nanotechnology Center.

Research Project

Reaction mechanisms of photodecomposable quencher

With the reduction of feature sizes in semiconductor devices, it is expected to apply ionizing radiations to the high-volume production of semiconductor devices. In the next-generation lithography, the extreme ultraviolet radiation, the wavelength of which is 13.5 nm, will be used. A highly sensitive resist called a chemically amplified resist has been used as a patterning material. In this type of resists, the energy for the decomposition of sensitizers is first deposited, using the high-quality and highly expensive beam. Then, the chemical reactions for the solubility change of the resist are induced by providing low-quality and low-cost thermal energy. This mechanism enables highly resolved and sensitive patterning. However, the fluctuation of line edge, called a line edge roughness (LER), is a significant problem because the chemical reaction is a stochastic process. A photodecomposable quencher is a promising material for suppressing LER. In this project, the mechanism of LER suppression through the use of photodecomposalbe quenchers was clarifed, using the simulation on the basis of sensitization and reaction mechanisms.

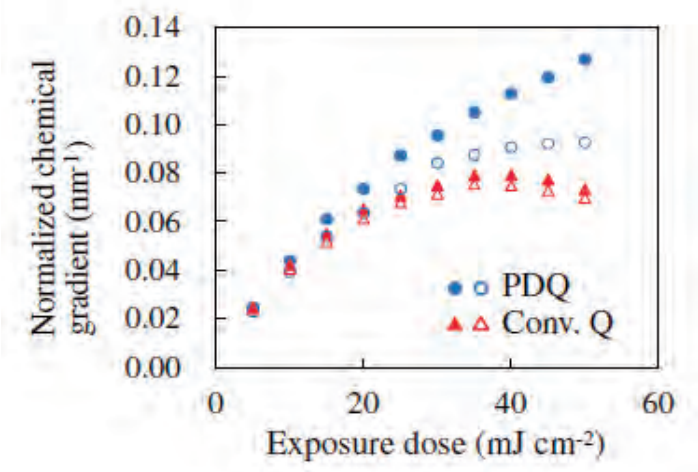


Fig. 1 Relationship between exposure dose (sensitivity) and chemical gradient (an indicator of LER).

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. Following the last year, we worked on the development of an extended method to cover the detection of phase anomalies of entangled quantum states.

Research Projects

We employed the following formula to decompose an observed state density matrix $\hat{\rho}_k$ into its normal component θ and anomalous component ω_k.

$$\min_{\theta,\omega_k\,(k=1,\ldots,K)} \sum_{k=1}^{K} \frac{1}{2} \left\| \hat{\rho}_k - \theta - \omega_k \right\|_F^2 + \gamma \sum_{k=1}^{K} \sqrt{\sum_{i,j=1}^{d} s_{ij}^2 \omega_{k,ij}^2}$$

However, this formula does not allow to detect the phase anomalies which are reflected to the complex elements but not to their absolute values, since it evaluates the change of the absolute values only. Following the last year, we extended this formula to take the complex elements into account. Its performance evaluation for the anomaly detection is currently underway by using some numerical simulations and real world experiments.

Department of Nanodevices for Medical Applications

Professor: Shun'ichi KURODA

Outlines

We are developing bio-industrially useful technologies on the basis of the analysis of intermolecular reactions found in various biological phenomena. In particular, we focus on an *in vivo* pinpoint drug delivery system with nanocarrier (bio-nanocapsule) by mimicking the function of viruses. In addition, we apply such bio-nanocapsules to an oriented immobilization technology for various biomolecules to achieve highly sensitive biosensor devices.

Research Projects

Analysis of the early infection machinery of hepatitis B virus by using bio-nanocapsule

Hepatitis B virus (HBV) is considered to interact first with heparan sulfate proteoglycan (HSPG) *via* an antigen loop of HBV envelope S protein. Then, it is rapidly migrated to the sodium taurocholate cotransporter polypeptide (NTCP) *via* the myristoylated N-terminal sequence of the pre-S1 region, and it finally enters the cell by endocytosis. However, the machinery of HBV migration from HSPG to NTCP has not been clarified. In the past, it was difficult to obtain a large amount of HBV, therefore biochemical analysis of HBV infection mechanism was difficult. In the last decade, we have established a human hepatic cell-specific DDS nanocarrier by using recombinant yeast-derived L protein particle (denoted as Bio-nanocapsule (BNC)). The human hepatic cell-specific binding and cellular uptake of BNC are similar to HBV. The cellular uptake pathway of HBV therefore was investigated by using this BNC. It was suggested that cellular uptake of both myristoylated BNC (myr-BNC) and HBV depend on NTCP, because Myr-BNC bound to NTCP *in vitro* and competitively inhibited HBV infection. Thus, myr-BNC would be a useful biomimic of HBV for the elucidation of early infection machinery of HBV. However, the cell entry rate of Myr-BNC and HBV was the same as that of BNC in HepG2 cells overexpressing NTCP. In addition, the cellular uptake of these particles was not dependent on NTCP but mainly on HSPG. These results suggest that cytosolic NTCP plays an important role in endosomal escape, while NTCP on the cell surface may not be involved in cellular uptake of HBV.

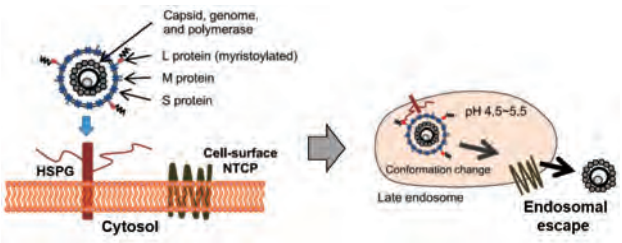


Fig.1 Model of early infection machinery for hepatitis B virus and bio-nanocapsule L in human hepatocytes.

Department of Nanosystem Design

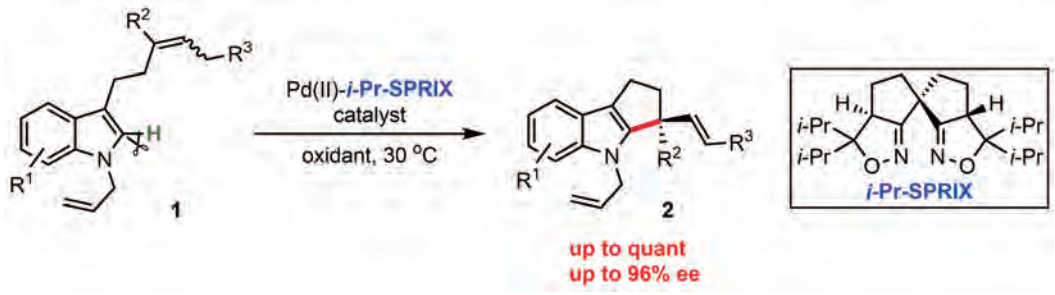
Guest Professor: Fumitoshi KAKIUCHI (1.4.2016-31.3. 2017)

Outlines

Asymmetric catalysis has generally been recognized as the most environmentally benign methodology for the preparation of optically active compounds. Over the past decade, direct functionalization of ubiquitous C–H bonds promoted by a transition metal catalyst has emerged as a straightforward and atom-economical synthetic route. In particular, such catalytic C–H bond functionalization of heterocyclic compounds provides a versatile protocol for the facile synthesis of pharmaceutical products.

Research Projects

Indole alkaloids with a chiral quaternary carbon center are common to a vast number of biologically active compounds. Despite the tremendous efforts have been devoted to the enantioselective construction of chiral quaternary carbon centers, it remains a significant challenge. It has been highly desirable to design new and efficient methods for the enantioselective synthesis of indole scaffolds bearing chiral quaternary carbon centers. We disclose the first efficient and highly enantioselective annulation of 3-alkenylindole substrates **1** into tricyclic indole products **2** having quaternary carbon center (up to 96% ee) catalyzed by Pd–*i*-Pr-SPRIX complex. *N*-Allyl substituent of the precursors was found to have a high impact on both reactivity and selectivity. The C–H activation mechanism was supported by kinetic study (KIE = 2.01).



Scheme 1. Enantioselective Cyclization of Alkenylindole Derivatives Promoted by Pd–SPRIX Catalyst

Department of Nanosystem Design

Guest Professor: Shigeki TAKEUCHI (1.4.2016 - 31.3.2017)

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. In this year, we worked on the development of a new method based on our latest research outcome in collaboration with Department of Nano-Intelligent Systems. 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. Following the last year, we worked on the development of an extended method to cover the detection of phase anomalies of entangled quantum states.

Research Projects

In order to realize anomaly detection of the quantum state, we developed a method to decompose an observed state density matrix into its normal component and anomalous component in the former years. However, this method does not allow to detect the phase anomalies which are reflected to the complex elements but not to their absolute values, since it evaluates the change of the absolute values only, and it is impossible to detect anomalies in the phase change. Therefore, this year we extended this formula to take the complex elements into account. As a result, we developed a novel method which can estimate arbitrary change (error) to quantum entangled state jointly. We have shown that the method can detect the errors in the phase of density matrices, which was impossible by previous method. We also showed that it is also possible to detect complex errors using the new method. We will continue to collaborate with Department of Nano-Intelligent Systems to further introduce data mining and machine learning techniques to quantum information science.

Department of Nanosystem Design

Guest Researcher: Kazumasa OKAMOTO (1.10.2016-31.3.2017)

Outlines

Lithography using quantum beams such as UV light and ionizing radiation has been widely used not only for mass production of semiconductor devices but also as position controllable nano- and microprocesses. With the shrinkage of integrated process technology, current semiconductor mass production below10 nm has been expected by introduction of next-generation lithography technology using extreme ultraviolet light (EUV) and electron beam as exposure source. Elucidation of the radiation induced reaction in resist materials is very important issue to overcome problem of the limitation of nanolithography. Therefore, we studied not only the actual formation of nanostructures but also the elucidation of the mechanism of their formation and clarification of their control methods.

Research Projects

In order to improve the performance of chemically amplified resists for EUV lithography, we tried to promote deprotonation of the radical cation of base polymer of resist by adding additives with low acidity. As a result of screening of additives, we found that the addition of di-*p*-tolyl sulfone (DTS) is effective against the increase of resist sensitivity and contrast. Moreover, the minimum line width and line width roughness (LWR) was similar to that obtained with resist without additives. As a result of investigating the reaction mechanism in the system containing additives, it was confirmed that DTS acts as both a deprotonation promoter and an ion recombination inhibitor, which enhances the acid-generation efficiency and improves the performance of resists in lithographies using ionizing radiation such as EUV and electron beams.

We also studied a polystyrene - silica gel hybrid synthesized using acid through a decomposition of photoacid generator as a catalyst. And, the radiation chemistry was clarified using pulse radiolysis method.

Novel growth methods of nanoflower crystals composed of metal oxides from metal pieces such as Zn or Cu after plasma treatment were also investigated. Samples were exposed to UV lights and gamma-rays in ultrapure water (submerged photosynthesis of crystallites (SPSC)). It is possible to obtain crystals composed of metal oxides at normal temperature and pressure. SPSC is successful surfactant-free, low-temperature technique for metal oxide nanocrystallites fabrication. Furthermore, antibacterial properties for application were also evaluated.

Department of Nanosystem Design

Guest Researcher: Satoshi TSUKUDA (1.10.2016-31.3.2017)

Outlines

The combination of lithography and NPs fabrication technique is very useful in the manufacture of NP devices and sensors. In this study, we demonstrate formation of Au nanoparticle (NP) arrays on 2-D gel patterns based on poly(vinylpyrrolidone) (PVP), which were fabricated by electron beam (EB) lithography. Au NPs were preferentially formed on the PVP patterns by photoreduction in $HAuCl_4$-containing MeOH solutions without any surface treatment. The size of crosslinking networks of PVP, which depended on crosslinking density induced by EB irradiation, plays very important role for formation of Au NPs in the Au ion-containing solution under UV irradiation. We discussed the difference of fabricated Au NP arrays among different EB irradiation dose in terms of interaction between gel networks and Au NPs formation.

Research Projects

PVP films were prepared on Si substrate by spin-coating. The films were exposed to 75 kV EB to fabricate the 2-D line pattern (ELIONIX INC. ELS-7700T). Furthermore, for fabricating Au NPs on PVP patterns, UV irradiation was carried out the samples in $HAuCl_4$-containing MeOH solutions. Au NPs were successfully formed on PVP patterns by the photoreduction of Au ions (Fig. 1). As shown in Fig. 2, the number density of Au NPs on PVP patterns drastically increased with the increasing irradiation dose of EB to fabricate the PVP patterns. The induced crosslinking points in the gel increase generally with an increase of radiation dose, resulting in decreasing mesh size of gel networks. Therefore, this implies that the highly crosslinked inner gel networks of PVP, i.e., small mesh size of PVP, promotes the formation of Au NPs.

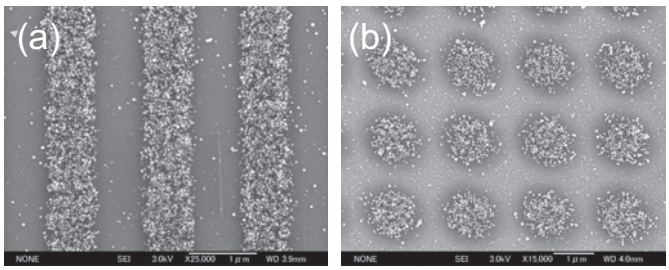


Fig.1 SEM images of Au NPs on PVP (a) line and (b) dot patterns.

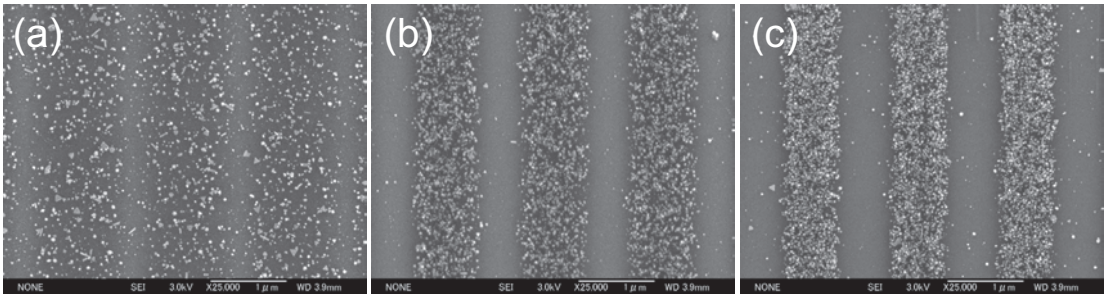


Fig.2 SEM images of Au NPs on PVP patterns fabricated by EB irradiation with (a) 10, (b) 30, and (c) 50 $\mu C/cm^2$.

Department of Nanosystem Design

Guest Professor: Jun TERAO (1.1.2017-31.3.2017)

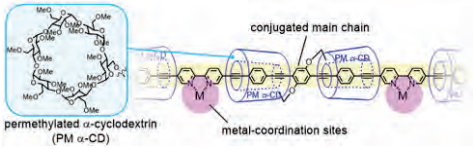
Outlines

Luminescent insulated conjugated polymer (molecular wires) have been extensively developed because of the requirements for flexibility, thermal stability, and processability of polymers. Recently, more advanced solid-state luminescent polymers, whose optical properties can be controlled by external stimuli, are of interest for application in the fields of displays and sensors.

Research Projects

Synthesis of insulated molecular wires with metal coordination sites

Herein, we report the synthesis of an insulated π-conjugated polymer containing 2,2'-bipyridine moieties as metal coordination sites. Metal coordination to the polymer enabled easy and reversible tuning of the luminescent color. To achieve solid-state luminescence, the conjugated main chain was highly insulated by permethylated α-cyclodextrin (PM-α-CD). This insulation suppresses undesired interpolymer interactions, which often cause self-quenching of the emission. As the result of synergistic effects of insulation and metal-coordination, the polymer film showed reversible changes in luminescent color in response to the metal ions. Some interesting features are summarized below.



Scheme 1. Structure of insulated molecular wires with metal coordination sites

Luminescent color change by ion sensing

The insulated polymer reported in this study maintained high emission efficiency and constant luminescent color even in polar solvents or in the solid state, in contrast to the uninsulated polymers. The luminescent color of the polymer could be tuned easily, directly, and reversibly by metal-coordination without changes to the main chain skeleton. This tuning methodology does not involve reconstruction of the corresponding monomers. These tuned luminescent colors by metal-coordination were successfully transferred to the solid state, giving efficient emission owing to the PM-α-CD-based three-dimensional insulation. Among conjugated metallopolymer films, the quantum yield of the Sn(IV)-coordinated polymer (Φ_{PL} = 0.46) was notably high. The coordination ability of the metal-free polymer was maintained in the solid state. The film showed reversible changes in luminescent color in response to metal ions. This functionality should be suitable for application in recyclable luminescent sensors or new patterning techniques of luminescence devices.

Department of Nanodevice Characterization

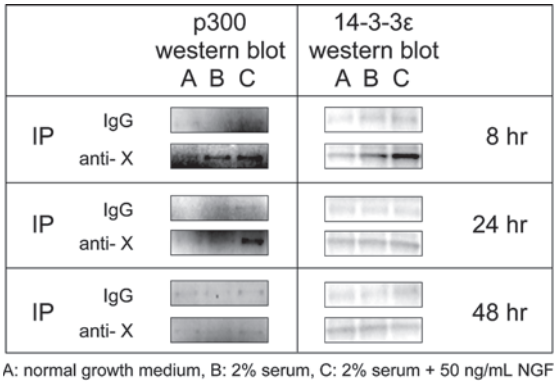
Guest Professor: Michel KAHN (2.5.2016-1.6.2016)

Outlines

Communication between the cell membrane and the nucleus is a critical process to control an array of cellular events including cell division and cellular differentiation and morphological changes. We were particularly interested in the biochemical events that occur during neuronal differentiation, *i.e.* the differentiation and morphological changes that a neuronal stem cell goes through to commit to become a neuron. In particular, we have begun to investigate the intermediate steps: exit from a state of "stemness", commitment to differentiation and morphological changes that occur after treatment of a neuronal stem/progenitor cell with nerve growth factor (NGF), which initiates neuronal differentiation and the outgrowth of neuritic processes.

Research Projects

We initiated studies using the PC-12 model system. PC-12 cells, a neural crest derived "stem-like" cell, can be grown in culture. PC-12 cells, will stop proliferating and undergo neuronal differentiation and neurite outgrowth after treatment with NGF. This initially involves an arrest of cell cycle. We found that this initial arrest of cell cycle, at least *in vitro*, requires a signal to be transmitted from the cell membrane integrated NGF-receptor to the nucleus. At least part of the signaling process requires activation of a protein kinase cascade, likely involving CaMKII and/or PKC to phosphorylate the Kat3 coactivator p300 on Serine89. We have previously determined that Serine89 phosphorylation is critical for differentiation of multiple cell types (Rieger *et al*. JBC 2016). Interestingly, p300 Serine89 is part of a consensus 14-3-3 binding site and that phosphorylation of Serine89 after NGF stimulation increases the affinity of 14-3-3ε with p300. We found another protein, tentatively designated as X here, to be involved in this process. This protein X is known but has not been extensively studied to date. It appears to be localized in the nucleus and in the cytoplasm, depending on specific conditions. X also has a predicted consensus 14-3-3 binding site and also binds to 14-3-3ε. X also binds to p300 (see Figure). We proposed that the binding of X to p300 or 14-3-3ε plays a critical role in regulating the differentiation process. To follow up on these studies, we are now performing proteomic analysis in collaboration with Dr. Masaya Ono at the National Cancer Center Japan to find the various interacting partners for X, 14-3-3ε and p300 in PC-12 cells undergoing neuronal differentiation.



A: normal growth medium, B: 2% serum, C: 2% serum + 50 ng/mL NGF

Figure. Co-immunoprecipitation of p300/14-3-3ε with X in PC-12 cells treated with NGF.

Department of Nanodevice Characterization

Professor: Jong Hyun Song (4.7. 2016 - 29.8. 2016)

Outlines

To construct one dimensional functional oxide nanostructures, top-down nanofabrication process (photo/nanoimprint lithography) and bottom-up nanoprocess (Pulsed laser deposition thin film growth technique) were combined. In these nanomaterials, we searched new physical properties toward low power consumption nanoelectornics devices.

Research Projects

Novel magnetic oxide of $SrIrO_3$ with large spin orbit interaction was formed as epitaxial thin films by pulsed laser deposition, and then successfully formed as micro-wire structures by photolithography. There micro-wired exhibited anomaly in their metal-insulator transition. In addition, $LaAlO_3/SrTiO_3$ artificial superlattice sample was formed as micro-wired sample. We will develop further nanostructuring to obtain low-dimensional functionalities in the transition metal oxides.

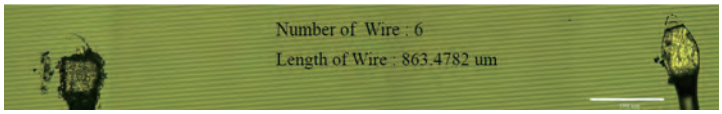


Fig. 1 Optical microscope image of $SrIrO_3$microwire array constructed by combination of pulsed laser deposition technique and photolithography technique.

Department of Nanodevice Characterization

Associate Guest Professor: Stanislav JURECKA (12.9. 2016- 21.10. 2016)

Outlines

Professor Kobayashi's laboratory has developed the fabrication method of black Si wafers with ultralow reflectivity below 3% by forming a nanocrystalline Si layer using the surface structure chemical transfer (SSCT) method. The size of Si nanocrystals increases with the depth. Professor Jurecka has analyzed the black Si surface structure and the optical properties by the numerical analysis. Professor Jurecka will measure the ellipsometric spectra and photoluminescence spectra, and numerically analyze the refractive index and extinction coefficient, and the depth dependence of the band-gap in a Si nanocrystal layer at the Professor Kobayashi's group. Passivation effect on a nanocrystalline Si layer will also be investigated in the same manner. The energy conversion efficiency will be improved by achieving ultralow reflectivity and high minority carrier lifetime simultaneously.

Research Projects

Characterization of Silicon Nanocrystal Structure Fabricated by The Surface Structure Chemical Transfer Method

A Si surface with ultralow reflectivity was fabricated by forming a nanocrystalline Si layer with the SSCT method. Professor Jurecka measured the ellipsometric spectra and photoluminescence spectra, and analyzed these data numerically. The porosity and microstructure observed by transmission electron micrographs showed good agreement with the results obtained from the ellipsometric and photoluminescence spectra. Passivated surfaces were investigated by the same methods, and Professor Jurecka is analyzing these results to find the best passivation condition.

Department of Nanotechnology for Industrial Applications

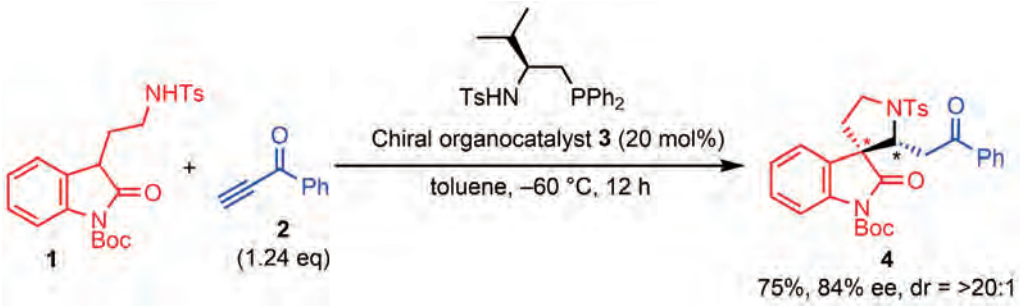
Guest Professor: Sylain JUGÉ (1.4. 2016- 6.5. 2016)

Outlines

The introduction of spirocycle, defined as a structure consisting of two perpendicular rings connected through one atom, results in the formation of a rigid tetrahedral center. This rigidity of the spirocyclic framework is expected to minimize the number of possible conformations, leading to high activities in various therapeutic areas, and achieving high stereoselectivities in asymmetric syntheses. Due to these distinct advantages associated with the spirocyclic skeleton, the asymmetric construction of spirocycles poses an attractive synthetic challenge, contributing to the discovery of complex molecules and new catalysts.

Research Projects

Spirooxindoles have attracted much attention in the area of antiviral drug discovery and development, owing to the high number of positive hits achieved by this scaffold. Although significant progress has been made in the asymmetric synthesis of diverse spirooxindoles, facile synthetic strategies capable of constructing multiple chiral centers from readily available substrates are still in high demand. As part of our effort to explore enantioselective domino processes, we have developed a highly enantioselective sequential reaction producing a single diastereomer of the natural product precursor **4**. The reaction of oxindole **1** with phenylprop-2-yn-1-one (**2**) was promoted by the chiral multifunctional phosphine catalyst **3** derived from (*S*)-valine, giving spirooxindole **4** in 75% yield with 84% ee.



Scheme 1. Enantioselective Synthesis of Spirooxindoles via Organocatalyzed Domino Reaction

Department of Nanotechnology for Industrial Applications

Guest Associate Professor Ming-Hsuan YANG (9.5. 2016- 24.6. 2016)

Outlines

In this project, an automatic pedestrian segmentation system is developed. Given a video and tracklets of bounding boxes of pedestrians, this system can automatically segment pedestrian regions which are helpful for public surveillance tasks.

Research Projects

Spatio-temporally Consistent Supervoxel Segmentation

We tackle with spatio-temporally consistent supervoxel segmentation based on graph-cut algorithm for pedestrian segmentation. Given an input video and tracklet of bounding boxes of pedestrians, superpixel segmentation is firstly applied for computational efficiency. Foreground and background Gaussian mixture model are then trained for terminal link (T-link) of the graph (Fig. 1). Furthermore, two types of neighborhood link (N-link): spatial link and temporal link are added to maintain spatial-temporally consistency of the segmentation result (Fig. 2). Finally, the graph-cut algorithm is applied to get the final segmentation result (Fig. 3).

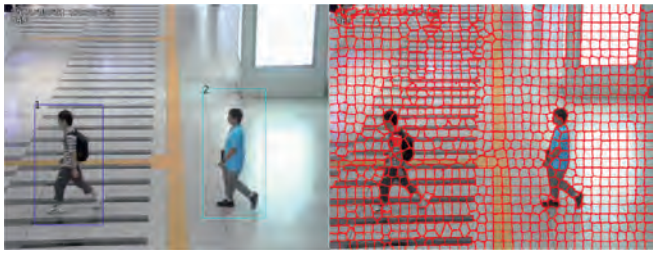


Figure 1. Input image, bounding box (left), superpixel segmentation (right).

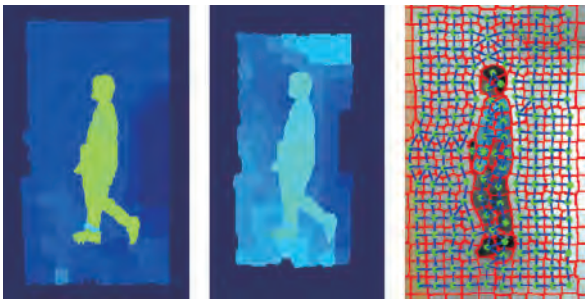


Figure 2. BG T-link (left), FG T-link (middle), Spatial N-link (right) of a pedestrian.

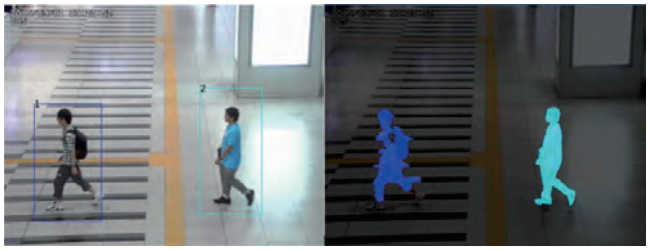


Figure 3. Input image, bounding box (left), final segmentation result (right).

Department of Nanotechnology for Industrial Applications

Guest Associate Professor: Mohamed Almokhtar Mohamed Mahmoud Abdel-Mola
(8.7. 2016- 30.9. 2016)

Outlines

Graphene is suitable material for spintronics and related applications because of weak spin-orbit interaction and low hyperfine interaction of electrons with carbon nuclei. Recently graphene spintronics devices have been reported, for example electron spin injection to graphene, graphene quantum dot devices and graphene Cooper pair splitters. Kondo effect is one of the phenomena related with electron spins and recently has been reported in quantum dot devices. In this study, we fabricated a multiple graphene quantum dot.

Research Projects

Multiple graphene quantum dots

We synthesized monolayer graphene on a cupper foil by a chemical vaper deposition method. Synthesized Graphene was transferred on Si/SiO_2 substrate from the cupper foil. We fabricated graphene quantum dots with sidegates by electron-beam lithography and reactive-ion etching. Figure 1 shows a SEM image of a graphene quantum dot device with a sidegate. The size of the graphene quantum dot is about 150 nm. We fabricated source-drain electrodes (Ti/Al 5nm/80nm) by electron -beam lithography and electron-beam evaporation. The graphene quantum dot devices were measured at $T \sim 20$ mK by a dilution refrigerator.

Figure 2 shows G as a function of source-drain voltage V_{sd} and backgate voltageV_g. Two kinds of Coulomb diamonds are observed, which indicates more than two quantum dots exists. Because the charging energy of one of the quantum dots is about 5 meV and that of the other is 1 meV, the size of the quantums were much different. The smaller quantum dots must formed at the constriction structure between the larger quantum dot and source-drain electrodes. This results indicates that quantum dots form at the constriction structure in graphene.

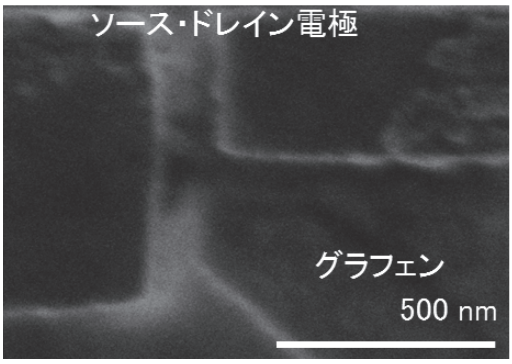


Fig.1, SEM image of a single graphene quantum dot.

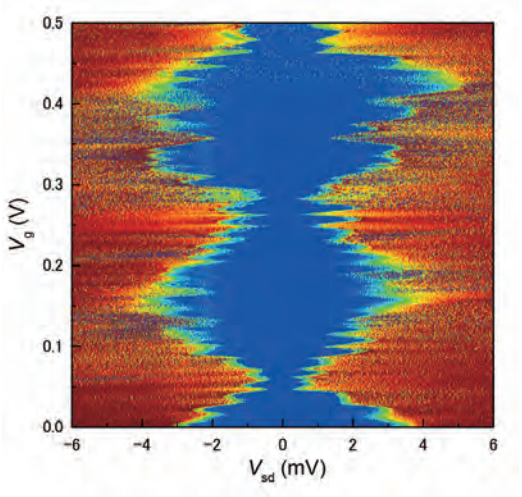


Fig.2, V G as a function of source-drain voltage V_{sd} and backgate voltageV_g.

Department of Nanotechnology for Industrial Applications

Guest Professor: Duck-Kyun CHOI (3.10. 2016- 13.11. 2016)

Outlines

Professor Choi's group has fabricated an InGaZnO thin film, and Professor Kobayashi's group has developed the HCN method to eliminate the defect states and the Nitric Acid Oxidation of Silicon (NAOS) method to eliminate the surface states. Professor Kobayashi's group will analyze change of the surface chemical composition of an InGaZnO thin film by the HCN and NAOS methods. Professor Choi's group will fabricate and analyze thin film transistors (TFTs), and analyze their characteristics. TFT performance will be improved by optimization of the condition for the HCN and NAOS methods.

Research Projects

Improvement of IGZO Thin Film Transistor Performance by Use of The Nitric Acid Oxidation Method and The HCN Methods

InGaZnO thin films formed in Professor Choi's group were treated to eliminate the defect and surface states by the HCN and NAOS methods developed by Professor Kobayashi's group, and they were investigated by X-ray photoemission spectroscopy and Fourier transform infrared spectroscopy. TFTs with an InGaZnO thin film treated by the HCN and NAOS methods are under fabrication in Professor Choi's group. The S value and gate leakage current of the fabricated TFTs will be estimated from the I_{ds}-V_{ds} and I_d-V_g curves, respectively. These data will be analyzed to discuss the effect of the HCN and NAOS methods on the TFT characteristics.

Nanofabrication Shop

Director, Professor: Hidekazu TANAKA
Technical Staff: Shouichi SAKAKIHARA

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.

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 135 fabrication requests from 14 laboratories in 2016. Figure 1 shows the transit of requests since 2005. Though there are abrupt changes in the number of requests which accompanied the increase and decrease of the major client, we wish to aim at the number of 100 requests from 10 laboratories.

Fig.1 The transit of requests since 2005.

As a new request, we made the separation device which separates contents with size. We made the flow channel whose ceiling height changes three kinds. Fig.2 (a) shows the cross section of the flow channel. The channel separates contents under 0.5μm, under 4μm and over 4μm in size. The channel made from silicone rubber (polydimethylsiloxane). Since it is soft, a ceiling falls and closed a channel if we take a large area. Preventing the ceiling falling, we reduced low height channel area and put posts between them. Green lines show lowest flow channel while gray area shows the post in Fig. 2 (b). Figure 2 (c) shows the separation of 6μm plastic beads and 1μm ones.

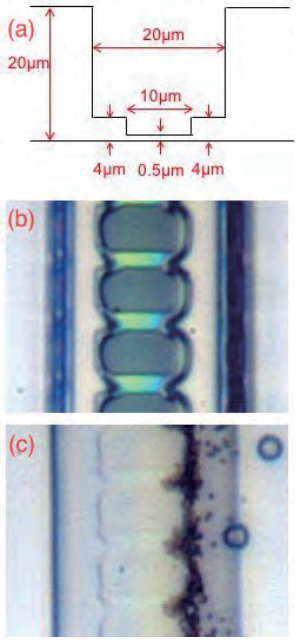


Fig.2 (a) Cross section of the flow channel. (b) The flow channel in top view of microscope. Green lines show flow channel of 0.5μm in height though gray areas shows posts. (c) Separation of 6 μm micro beads and 1 μm ones.

Advanced Nanotechnology Instrument Laboratory

Director, Professor: Hidekazu TANAKA
Specially Appointed Technical Staff: Michiko SAKUMA

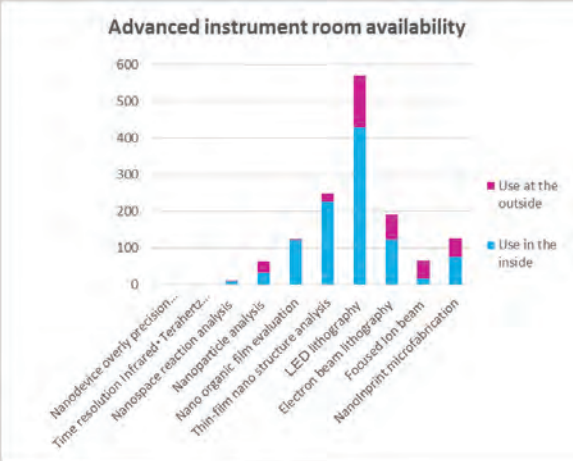
Outlines

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. The nano-device fabrication system and nano-device characterization systems on structure and electrical properties of nano device have been 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.

Research Projects

The use situation of the each equipments in the Advanced Instrument Laboratory is shown in the right figure.

The number of total use is 1399, increased 243 comparisons with last year.



Nanotechnology Open Facilities

Director, Professor:	Hidehiro YASUDA (-30.6. 2016)
	Seiji TAKEDA (1.7. 2016-)
Professors:	Hidekazu TANAKA
	Masateru TANIGUCHI
Specially Appointed Professors:	Hirotarou MORI
Assistant Professor:	Keita KOBAYASHI
Specially Appointed Assistant Professors:	Akira KITAJIMA
	Kimihiro NORIZAWA
Specially Appointed Researchers:	Miki KASHIWAKURA
	Kouji HIGUCHI
	Takashi TANIGUCHI
	Kazumi KONDA
Technical Supporting Staff:	Yoshimi MAEGAWA
Supporting Staff:	Kyoko SHIMOMITSU
	Keiko ENMI
	Masanobu YAMAZAKI (-31.3. 2017)

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 158 research themes in 2016.

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 equipment 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.

Research Projects

Bring-up Nanotechnology Open Facilities

The 158 research themes (except for technical consulting and non-publish the fruits) have been supported in the program in 2016. 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) Equipment utilization without assistance, (c) Technical substitution, (d) Collaborative research with NOF staff and (e) Using equipment 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 equipment 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
Assistant Professor (concurrent): Kazuhiro TAKENAKA, Shinji NITANI, Ryotaro ASO, Tomoyo GOTO, Mitsuko NISHINO
Technical Staff: Takanori TANAKA, Tsuyoshi MATSUZAKI, Hitoshi HANEOKA, Yosuke MURAKAMI
Technical assistant Staff: Takeshi ISHIBASHI, Mitsuru FUJISAKI
Support Staff: Etsuko TANI

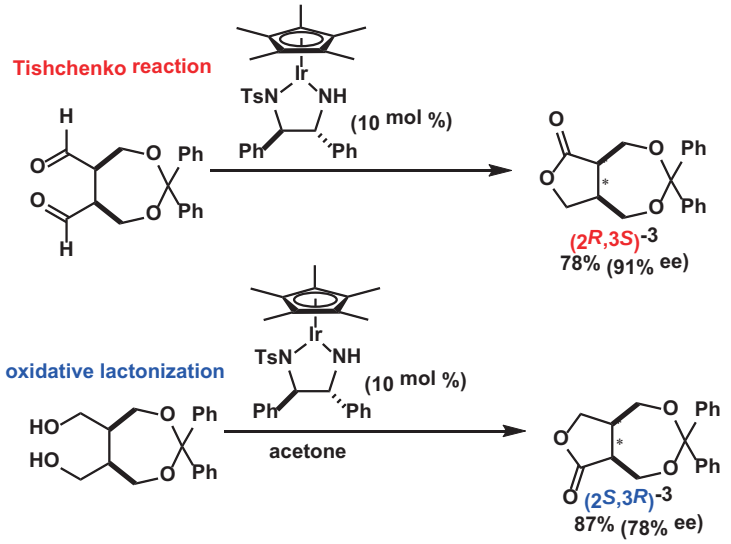
Outlines

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.

Research Projects

Development of iridium-catalyzed asymmetric Tishchenko-type reacrion

Tishchenko reaction is known as the synthetic method of the dimeric ester from the corresponding aldehydes. This reaction is redox neutral reaction which includes oxidation step and reduction step, so the reaction system is environmentally friendly process. This time we found that both enantiomers of the lactones can be prepared from the catalyst bearing the same chirality by changing the reaction, Tishchenko reaction or oxidative lactonization.



Asymmetric Tishchenko-type reaction and oxidative lactonization by chiral Ir catalyst

Research Laboratory for Quantum Beam Science

Director, Professor: Youichi YOSHIDA
Associate Professor: Yoshihide HONDA
Assistant Professor: Sachiko TOJO
Technical Staff: Kazuya FURUKAWA, Yuhei OKADA
Specially Appointed Professor: Goro ISOYAMA
Supporting Staff: Akira TOKUCHI, Kumiko KUBO
(Concurrent members)
Professors Yoichi YOSHIDA, Tetsuro MAJIMA, Takahiro KOZAWA
Associate Professors: Mamoru FUJITSUKA, Kiyohiko KAWAI, Jinfeng YANG, Yusa MUROYA,
Assistant Professors: Kazuo KOBAYASHI, Takafumi KONDO, Akinori IRIZAWA, Hiroki YAMAMOTO, Koichi KAN, Yasuko OSAKADA
Specially Appointed Assistant Professor: Kim Sooyeon

Outline

The Research Laboratory for Quantum Beam Science (RLQBS) has 3 electron linacs, i.e. a 40 MeV L-band linac, a 150 MeV S-band linac, an RF-Gun S-band linac, and three ^{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.

Research Projects

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

The results of operation for L-band linac: total score 3,694 hours, 287 days, 35 themes.

L-band linac was operated for 203 days except for maintenance use, 2,514 hours (Fig.1). The major troubles happened this year are described below. Electron-Gun and its peripherals: the circuit board of 27 MHz grid-pulse generator was damaged due to overheating of a transistor. The board was repaired after use of auxiliary board. The loose connection at the terminal of transformer due to unstable emission was tightened. The power supply of 6 V for the electro-optic device was replaced because of insufficient performance. Water circulation system: the often-happened shutdown of refrigerator due to overheating of a motor was improved by changing the thermal sensor. The regulation valve causing leakage of refrigerant was replaced. The several implements such as filter, valve, pump, flow meter, were replaced and/or

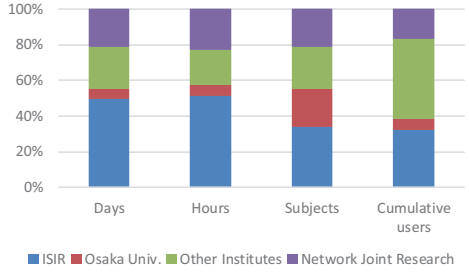


Fig.1 Results of L-band linac

equipped in the cold flow side of heat exchange system. Modulator: the semiconductor switch equipped instead of thyratron in the modulator, was successfully operated without troubles more than one year, however the equipment of protection diodes against inverse voltage led to a damage of regulation circuit. The relating part of circuit was repaired, but another protection method against noise is projected. Linac-operation program: to update the current old system, a new operation programs were designed and have been developed.

RF-gun S-band linac: The RF-gun S-band linac was moved to Cobalt building safely and was operated for 84 days and 1,180 hours except maintenance use.

Cobalt-60 facility: This facility was used in 97 times, 1,201 hours, for 26 subjects (Fig.2). The annual maintenance was made in July and the parts of interlock system were updated in March.

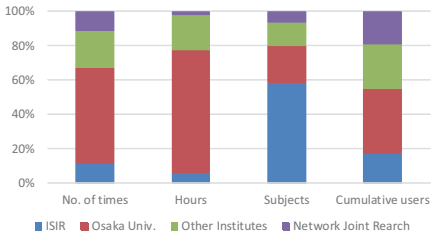


Fig.2 Results of Co-60 facility

Management (Joint use & Radiation safety management)

Accepted subjects relating from the joint-users are 50 in total (Fig.3). Specially programmed academic meetings were held twice (July. 12nd, 2016/ Feb, 17th, 2017) and the annual debrief session was held on March, 1st in 2017.

Visitors were more than 104. The training regarding radiation safety management was carried out for the registrants in May 18th. Special self-inspection was carried out twice a year.

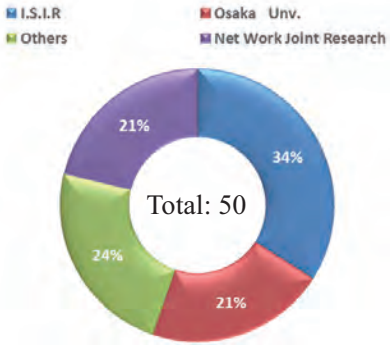


Fig.3 Accepted subjects

Pulse Radiolysis Resonance Raman Investigation of thioanisole

The structures of thioanisole radical cation ($ArSCH_3^{\bullet+}$) were studied by ns-Pulse radiolysis resonance Raman spectroscopy. Positive charge of $ArSCH_3^{\bullet+}$ delocalizes on S atom and benzene ring with increasing the double bond character of C_{Ph}-S bond. Semi-quinoidal structure of $ArSCH_3^{\bullet+}$ with conjugation between S atom non-bonding electron and π-electrons of benzene ring is found to be important for formation of dimer radical cation of $ArSCH_3$ ($(ArSCH_3)_2^{\bullet+}$). On the other hand, quinoidal structure of $ArSCH_3^{\bullet+}$ is not suitable for formation of $(ArSCH_3)_2^{\bullet+}$.

Production slow positron beam based on S-band linac

One set of power sources composed of klystron and modulator was removed from S-band linac due to the move of RF-Gun linac, meaning the reduction of maximum energy of electron beam. During a commissioning of the linac after removal of the power source, the circulation pump of water was failed in November certainly due to the rust, which was generated by the erosion of heat-exchanger already replaced. The replacement of the pump was made in March. A new moderator concerning positron production was computationally designed to reduce the size keeping high production efficiency and has been assembled.

Center for Collaborative Research Education and Training

Director:	Professor Akira OIWA
Head of Educational Affaires Board:	Professor Kazunori KOMATANI
Board Members:	Professor Hidekazu TANAKA
	Associate Professor Jyunichi KANASAKI
	Associate Professor You WADA
Head of International Affaires Board:	Professor Katsuaki SUGANUMA
Board Members:	Professor Takeharu NAGAI
	Assistant Professor Ryu TAKEDA
	Associate Professor Yutaka IE

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 Collaborative Research 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 countries and so on. To further promote and to continuously support such international exchange and collaborations, International Collaborative Research 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 countries. Currently ten 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

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

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

CNU-AMR lab.

College of Natural Sciences (CNS), Chungnam National University (CNU), Korea, and the Institute of Scientific and Industrial Research (ISIR), Osaka University, Japan, based on the agreement on academic exchange between CNS and ISIR, established a collaborative laboratory on each side on advance materials research between both institutions.

1. Synthesis of advanced materials
2. Properties of advanced materials
3. Functionalization of advanced materials

KAERI-QBS lab.

The Advanced Radiation Technology Institute of the Korea Atomic Energy Research Institute and ISIR have established a cooperative research laboratory on quantum beam science between both institutions. Its studies focus on generation and applications of quantum beams for advanced studies.

1. Studies on radiation chemistry by means of pulse radiolysis.
2. Generation and application of quantum beams using accelerators.
3. Materials science using quantum beams.

CU-ICT lab.

Department of Computer Engineering, faculty of Engineering Chulalongkorn University (CU), and ISIR have established a cooperative research laboratory on information and communication technology (ICT) between both institutions. Its studies focus on Artificial Intelligence.

1. Artificial Intelligence
2. Machine Learning
3. Data Mining

SMU-EMGRL lab.

College of Engineering (COE), Sun Moon University (SMU), and ISIR have established a cooperative global research laboratory on eco-materials science and technology (GRL) between both institutions. Its studies focus on the design, development and analysis of advanced environmental and energy eco-materials.

1. Photocatalysts for environmental protection and recovery systems.
2. Wide-wavelength photo-responsible nanomaterials.
3. Photon-management functionalization for advanced inorganic materials.

SU-ESR lab.

School of Environmental and Chemical Engineering (SEC), Shanghai University (SU), China, and ISIR have established a cooperative research laboratory on environmental science between both institutions. Its studies focus on environmental science research (ESR).

1. Environmental science of material transformation
2. Environmental compatible catalysts
3. Environmental compatible materials

Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials

Outline

Based on the former successes of multi-party alliance projects (Nano-Macro Materials, Devices and System Research Alliance of FY2010-FY2015), “Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials” (Five-star Alliance) was started in FY2016 to attempt strategic development of next generation Materials, Devices, and System for bridging human, environmental and materials as a cooperative research project with five outstanding university institutes, ISRI (Osaka University), Research Institute for Electronic Science (RIES: Hokkaido University), Institute of Multidisciplinary Research for Advanced Materials (IMRAM: Tohoku University), Laboratory for Chemistry and Life Science, Institute of Innovative Research (IIR: Tokyo Institute of Technology), and Institute for Materials Chemistry and Engineering (IMCE: Kyushu University).

This Five-star Alliance consists of three research groups covering the research areas of; “Electronics materials and devices (G1)”, “Environment and energy materials, device and systems (G2)”, and “Biological functions materials, devices and systems (G3)”. Not only within the group but also between groups, various types of multidisciplinary collaborative researches are carried out. In addition, the alliance has strong correlation with the “Network Joint Research Center for Materials and Devices”; these two projects are promoted to the inextricably. Through the significant cooperative researches as well as under the promotion programs for young scientist and students, the current dynamic alliance project aims to realize innovation that links human, environment and materials and devices.

The alliance was being run under the Steering Committee of five member Institutes (members from ISIR: Prof. T. Sekino (Chair) and Prof. K. Nakatani), and CORE Collaboration Center (member from ISIR: Prof. T. Sekino, Prof. T. Oguchi and Prof. H. Tanaka). The group members of ISIR in FY2016 are as follows.

(G1) Electronics materials and devices group (10 members)
Prof. T. Sekitani (Sub-leader), Prof. K. Matsumoto, Prof. Y. Aso, Prof. A. Oiwa, Prof. T. Oguchi, Prof. T. Kozawa, Prof. H. Tanaka, Prof. Y. Yoshida, Prof. T. Washio, Assoc. Prof. M. Nogi

(G2) Environment and energy materials, device and systems group (7 members)
Prof. H. Kobayashi (Sub-leader), Prof. K. Suganuma, Prof. T. Sekino, Prof. S. Takeda, Prof. T. Majima, Assoc. Prof. S. Tanaka, Assoc. Prof. Y. Honda

(G3) Biological functions materials, devices and systems group (12 members)
Prof. K. Nishino (Sub-leader), Prof. N. Kato, Prof. S. Kuroda, Prof. K. Komatani, Prof. H. Sasai, Prof. M. Taniguchi, Prof. K. Nakatani, Prof. T. Nagai, Prof. M. Numao, Specially Appointed Prof. A. Yamaguchi, Assoc. Prof. Y. Makihara, Assoc. Prof. T. Suzuki

Activities of Facilities

Workshop

Director Professor: Hiroaki SASAI
Technical Staff:
Machine Shop: Masayoshi OHNISHI, Yuki MATSUSHITA
Glassworks: Hiroaki MATSUKAWA, Noriyuki OGAWA

Outlines

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

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, and a 5 axis milling machine was introduced in 2014 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: 152 jobs (172 jobs in the previous year).
Glassworks: 83 jobs (82 jobs).

Electronic Processing Laboratory

Professor:	Kazunori KOMATANI
Professor:	Kazuhiko MATSUMOTO
Professor:	Akira OIWA
Associate Professor:	Shigehiko HASEGAWA
Associate Professor:	Koichi SUDOH
Assistant Professor:	Haruki KIYAMA
Assistant Professor:	Ryu TAKEDA

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. This laboratory also has an anechoic chamber that can be used for acoustic measurement, psychological experiments, etc.

The equipment and systems are 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 crystal cleaving system, a wire bonding system, and a small-size clean room. The anechoic chamber measures 4.0x7.2 meters (4.0 meters in height) and the sound pressure level in it is designed to be below 30dB.

This laboratory is utilized for experimental researches of surface structure analysis and electrode formation, the measurements of electronic and other properties of various materials, and the fabrication of photonic, electronic and molecular devices. It is utilized also for acoustic measurement and psychological experiment, etc. In the year of 2016, the equipment and systems were used from 7 laboratories and facilities.

The laboratory was determined to be reorganized into Anechoic Laboratory after careful discussion and approval from the institute. The equipment and systems were drastically arranged and a part of them was disposed towards the reorganization.

Library

Professor: Takeharu NAGAI
Librarian: Shizuka OGASAWARA
Supporting Staff: Katsuko TAKADA

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, 2017)

	Number of books	Journals	Newspapers
Japanese	5,037	160 titles	5 titles
Foreign	19,415	496 titles	1 title

Facilities Management Office

Professor: Takahiro KOZAWA
Temporary Staff: Harumi HOSHIKAWA(1.4.2016-31.10.2016)
Staff: Kayoko OHASHI (1.10. 2016-)

Outlines

Facilities Management Office works for the following matters:

1. Operation and maintenance of rooms belonging to Open Laboratory
2. Process of application procedure for Open laboratory.
3. Control of standard spaces of ISIR laboratories
4. Support of facility operation which ISIR Facilities Committee plans
5. Other facility issues

Research Projects

On 2016, the following 12researchers used Nanotech Open Laboratory.

Research Representative	Department
Prof. Hikaru KOBAYASHI	Institute of Scientific and Industrial Research
Prof. Kazuhiko MATSUMOTO	Institute of Scientific and Industrial Research
Prof. Akihito YAMAGUCHI	Institute of Scientific and Industrial Research
Prof. Takahiro KOZAWA	Institute of Scientific and Industrial Research
Prof. Kazuyuki YOSHIZAKI	Institute of Scientific and Industrial Research
Prof. Hidekazu TANAKA	Nanotechnology Open Facilities
Prof. Masateru TANIGUCHI	Nanotechnology Open Facilities
Prof. Yusuke MORI	Graduate School of Engineering
Prof. Yasufumi FUJIWARA	Graduate School of Engineering
Assoc. Prof. Yukio TAKAHASHI	Graduate School of Engineering
Prof. Kazuyoshi ITOH	Office for University-Industry Collaboration
Prof. Shinichi TAMURA	Graduate School of Medicine

Office of Information Network

Professor, Director:	Akira OIWA
Professor:	Kazunori KOMATANI
Professor:	Katsuaki SUGANUMA
Professor:	Shunichi KURODA
Professor:	Masateru TANIGUCHI
Associate Professor:	Yoshinobu KAWAHARA
Associate Professor:	Shijyo NAGAO
Technical Staffs:	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 5.

And we have offered poster printing services for ISIR researchers. Total number of poster printing was 494.

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: Takeharu NAGAI
Professors: Kazuhiko MATSUMOTO, Tohru SEKINO
Shun'ichi KURODA, Yoichi YOSHIDA
Specially Appointed Professor: Hirokazu SHIMIZU
Specially Appointed Assistant Professor: Hisaaki KATO

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"
Quarterly conferences
1st May 13, 2016
2nd August 5, 2016
3rd Nov. 11, 2016
4th Feb. 3, 2017

2) "SANKEN Zakkubaran Talk"
8 seminars

3) Publication of a booklet for introduction of ISIR's research activities to industry sectors
http://www.sanken.osaka-u.ac.jp/labs/air/research1.html

4) Publicity of ISIR's technologies at exhibitions etc.
9 exhibitions and one lecture-meeting

Use of Company Research Park

Number of Use: 23 companies [new use: 4 companies]

Coordination of Joint Research etc.

4 joint researches

Support for New Industry Creation Study Groups

4 study groups

Public Relations Office

Director, Professor:	Akira OIWA
Professors:	Yoshio ASO (-30.9.2016), Tohru SEKINO, Shun'ichi KURODA, Takashi WASHIO (1.10.2016-), Tamio OGUCHI (1.10.2016-)
Associate Professors:	Masakazu TANE (-30.9.2016), Toshihide OKAJIMA (-30.9.2016), Teruo KANKI Taketoshi MATSUMOTO (1.10.2016-), Shinobu TAKIZAWA (1.10.2016-) Yutaka Ie (1.10.2016-)
Assistant Professors:	Mahito SUGIYAMA (-30.9.2016), Kazumichi YOKOTA (-30.9.2016), George HASEGAWA (-30.9.2016), Fumio OKURA, Seiji YAMASAKI Haruki KIYAMA (1.10.2016-), Akinori IRIZAWA (1.10.2016-)
Staff:	Noriko MATSUMOTO (-15.6.2016), Atsumi ITO (-16.6.2016)
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 Relations 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 regular press conference had been started in 2013 in the collaboration with other offices of SANKEN.

Research Projects

The number of visitors in ICHO Festival:	666
The number of visits and visitors:	14 visits and 386 visitors
Press release:	31
Regular press conference:	22
The number of coverages:	543

Planning Office

Director, Specially Appointed Professor :	Yoshihiko HIROTSU
Vice Director :	Yoshikazu TANAKA
Staff :	Aya NISHIDA

Outlines

The Planning Office of ISIR was set up in 2009. The mission of this office is to support the following operations of our institute aiming at their high level achievement with efficiency.

1.Planning and information gathering on the middle-term objectives and management, annual projects, and self- and external-evaluations which are implemented under the evaluation committee of ISIR.

2. Planning and information gathering on international programs, publicity, financial affairs and research facilities under cooperation with the corresponding vice-directors.

3. Planning and information gathering on other subjects as necessary.

Technical Division

Director:	Noriyuki OGAWA
Group Leaders:	Noriyuki OGAWA (concurrent), Masayoshi OHNISHI
Chiefs:	Senjin AIHARA, Shouichi SAKAKIHARA, Tsuyoshi MATSUZAKI, Yuka OKUMURA
Staff:	Yuki MATSUSHITA, Kazuya FURUKAWA, Hitoshi HANEOKA, Yosuke MURAKAMI, Yuhei OKADA, Kimiaki TANIHATA, Takeshi ISHIBASHI, Hiroaki MATSUKAWA, Takanori TANAKA

Outlines

The Technical Division is research supporting group, which is the first organization in all research institutes attached to universities in Japan (April, 1982). We provide following professional matters for researchers:

Making experimental apparatuses and samples by machines.
Analysis of samples.
Operation, maintenance and development of experimental facilities.
Network and Server management.
To create and update websites.
Public relations activities.

In addition, we go to technical training and give guidance about expert technical instruction for researchers and students. Furthermore we are in charge of the following matters:

- Activities of safety and security (e.g. holding safety seminars, radiation protection management, self-defense firefighting, PCB management, and management of medicine and gas control systems)
- Outreach activities (e.g. craft lecture for children)
- Support some symposiums (e.g. video and live-streaming etc.)

Activities

- Holding safety and security seminar (53 participants).
- Holding craft lecture for children (60 participants).
- Holding joint technical report meeting with Institute for Protein Research (30 participants).

Licenses

Staffs have 80 licenses.

Administrative Office （31-March , 2017）

Director : Yoshikazu TANAKA

General Affairs Division

Staffs: Masahiro KOMAKI
Sachiko YAMAMOTO
Takashi FUJIMORI
Tomoko SAWADA
Takahiro FUKUI
Kazumi HAYASHI

Supporting Staffs: Mie SHIMOE
Ayano KOMAI
Noriko SASAKAWA

Research Cooperation Division

Staffs: Otoji TANI
Takashi MATSUDO
Keisuke KODERA
Mai SHIMURA
Kaoru NAKAMURA
Shingo TABATA
Naoko MASAKI
Yasuko MUTSUI
Seigo OMASA
Misato KUBO
Mayu ESAKA
Momoko SAKAI
Masako MORITA
Etsuko UNO

Supporting Staffs: Syouko YAMOTO
Yumi WADA
Kazune OTANI
Kuniko NISHIMOTO
Yasuhiro UCHIDA

List of Achievements

Department of Quantum System Electronics

Original Papers

[1]Design of bull's eye structures on gate-defined lateral quantum dots, Rio Fukai, Tomohiro Nakagawa, Haruki Kiyama, Akira Oiwa: Japanese Journal of Applied Physics, 56 (2017) 04CK04-1-5.

[2]Conversion from Single Photon to Single Electron Spin Using Electrically Controllable Quantum Dots, Akira Oiwa, Takafumi Fujita, Haruki Kiyama, Giles Allison, Arne Ludwig, Andreas D. Wieck, and Seigo Tarucha: Journal of the Physical Society of Japan, 86 (2016) 011008-1-10.

[3]Single-Shot Ternary Readout of Two-Electron Spin States in a Quantum Dot Using Spin Filtering by Quantum Hall Edge States, H. Kiyama, T. Nakajima, S. Teraoka, A. Oiwa, and S. Tarucha: Physical Review Letters, 117 (2016) 236802-1-5.

[4]Signatures of Hyperfine, Spin-Orbit, and Decoherence Effects in a Pauli Spin Blockade, T. Fujita, P. Stano, G. Allison, K. Morimoto, Y. Sato, M. Larsson, J.-H. Park, A. Ludwig, A. D. Wieck, A. Oiwa, and S. Tarucha: Physical Review Letters, 117 (2016) 206802-1-206802-5.

[5]Fabrication of YH_3 thin film using Pd/Ni co-capping layer: Ni thickness effect, Kosuke Yabuki, Hiroaki Hirama, Nobuhiko Aoki, Masamichi Sakai, Yoshiaki Saito, Koich Higuchi, Akira Kitajima, Shigehiko Hasegawa, Osamu Nakamura: Journal of Crystal Growth, (2017) .

[6]Purification of commercial yttrium metal: Removal of fluorine, Ayato Takenouchi, Takashi Otomo, Kota Niwa, Masamichi Sakai, Yoshiaki Saito, Tomoyuki Kirigane, Masashi Kosaka, Shigehiko Hasegawa, Osamu Nakamura: Journal of Crystal Growth, (2017) .

[7]Low-temperature and low-H_2 pressure synthesis of hydride semiconductor $YH_{3-\delta}$ using Pd/Ni co-capped Y films, Kosuke Yabuki, Hiroaki Hirama, Masamichi Sakai, Yoshiaki Saito, Koichi Higuchi, Akira Kitajima, Shigehiko Hasegawa, Osamu Nakamura: Thin Solid Films, 624 (2017) 175-180.

International Conferences

[1]Coherent conversion from photons to electron spins using quantum dots (invited), Akira Oiwa: China-Japan Inetrnational Workshop on Quantum Technologies.

[2]Conversion from single photons to single electron spins in gate-defined quantum dots (invited), Akira Oiwa: 31th International Conference on Physics of Semiconductors.

[3]Photon-spin Quantum Interface for Quantum Communications Using Artificial Molecules (invited), Akira Oiwa: 20th SANKEN International Symposium.

[4]Conversion from single photon polarizations to single electron spins using gate-defined GaAs double quantum dots (invited), Akira Oiwa: 1st International Conference on Topological orders, quantum information, and emergent spacetime on quantum simulator.

[5]Magnetic and magneto-optical properties of $Ga_{1-x}Gd_xN$/GaN superlattices with GdN mole fraction enhanced up to 100% (oral), Yoshihito Sugeta, Shigehiko Hasegawa: The 18th International Conference on Crystal Growth and Epitaxy, Nagoya, Japan, August 7-12, 2016.

[6]Effects of carrier-doping on Sm-induced levels in GaSmN grown by plasma-assisted molecular beam epitaxy (poster), Yuta Miyazaki , Kentaro Dehara, Shigehiko Hasegawa: The 18th International Conference on Crystal Growth and Epitaxy, Nagoya, Japan, August 7-12, 2016.

[7]Fabrication of YH_3 thin film using Pd/Ni overlayer (poster), K. Yabuki, M. Sakai, K. Iizasa, K. Higuchi, A. Kitajima, S. Hasegawa, O. Nakamura: The 18th International Conference on Crystal Growth and Epitaxy, Nagoya, Japan, August 7-12, 2016.

[8]Purification of commercial yttrium metal: Removal of fluorine (poster), A. Takenouchi, T. Otomo, K. Niwa, Y. Saito, M. Sakai, D. Kirigane, M. Kosaka, S. Hasegawa: The 18th International Conference on Crystal Growth and Epitaxy, Nagoya, Japan, August 7-12, 2016.

[9]Fabrication of Sc and ScH_x ($x \fallingdotseq 2$) thin film and their Hall effect (poster), M. Nishimagi, T. Matsunaga, M. Sakai, K. Iizasa, K. Higuchi, A. Kitajima, S. Hasegawa: The 18th International Conference on Crystal Growth and Epitaxy, Nagoya, Japan, August 7-12, 2016.

[10]Friction coefficient lowering in high-hardness boron nitride films under ultra-high vacuum (oral), Masao Noma, Koji Eriguchi, Michiru Yamashita, Shigehiko Hasegawa: AVS 63rd International Symposium and Exhibition, Nashville, USA, November 6-11, Japan.

[11]Formation of superhard c-BN films on the body and edge of cutting tools by reactive plasma-assisted coating (RePAC) (poster), Masao Noma, Koji Eriguchi, Michiru Yamashita, Shigehiko Hasegawa: The 16th International Conference on Precision Engineering, Hamamatsu, Japan, November 14-16, 2016.

[12]Coatings of Boron Nitride Films for Vacuum Tribology by Reactive Plasma Assisted Coating (RePAC) Technology—Friction coefficient lowering under vacuum— (invited), Masao Noma, Koji Eriguchi, Michiru Yamashita, Shigehiko Hasegawa: The 7th Tsukuba International Coating Symposium, Tsukuba, Japan, December 8-9, 2016.

[13]Design of bull's eye structures on gate-defined lateral quantum dots (poster), Rio Fukai, Tomohiro Nakagawa, Haruki Kiyama, Akira Oiwa: 9th International Conference on Physics and Applications of Spin-Related Phenomena in Solids.

[14]Single-electron charge sensing in InAs self-assembled quantum dots (poster), Haruki Kiyama, Takashi Hirayama, Ryoki Shikishima, Sadashige Matsuo, Shoji Baba, Naomi Nagai, Kazuhiko Hirakawa, Seigo Tarucha, Akira Oiwa: 9th International Conference on Physics and Applications of Spin-Related Phenomena in Solids.

[15]Transport and optical properties of (110) GaAs quantum wells for photon-spin quantum state transfer using heavy hole states (poster), Tomohiro Nakagawa, Rio Fukai, Haruki Kiyama, Akira Oiwa: 9th International Conference on Physics and Applications of Spin-Related Phenomena in Solids.

[16]Single-shot ternary readout of electron spin states in a quantum dot coupled to quantum Hall edge states (oral), H. Kiyama, T. Nakajima, S. Teraoka, A. Oiwa, and S. Tarucha: 31th International Conference on Physics of Semiconductors.

[17]Efficient Control over Wavefunctions of Electrons in Self-Assembled InAs Quantum Dots using Side-Gating (poster), R. Shikishima, H. Kiyama, S. Baba, T. Hirayama, N. Nagai, K. Hirakawa, S. Tarucha, and A. Oiwa: Frontiers in Quantum Materials and Devices Workshop.

[18]Single-shot Readout of Three Two-electron Spin States in a Quantum Dot Coupled to Quantum Hall Edge States (poster), H. Kiyama, T. Nakajima, S. Teraoka, A. Oiwa, and S. Tarucha: Frontiers in Quantum Materials and Devices Workshop.

[19]Design of Bull's eye Structures on Lateral Quantum Dots (poster), Rio Fukai, Tomohiro Nakagawa, Haruki Kiyama, Akira Oiwa: The 20th SANKEN International Symposium.

[20]Magnetotransport in Narrow Gap Semiconductor InSb Quantum Wells (poster), Masaki Tada, Haruki Kiyama, Kouichi Akahane, and Akira Oiwa: The 20th SANKEN International Symposium.

[21]Single-shot Ternary Readout of Electron Spin States in a Quantum Dot Using Quantum Hall Edge

States (poster), H. Kiyama, T. Nakajima, S. Teraoka, A. Oiwa, and S. Tarucha: The 20th SANKEN International Symposium.

[22]Experimental generation of single photon-electron pairs from single entangled photon pairs", 33rd International Conference on the Physics of Semiconductors (oral), K. Kuroyama, M.Larsson, T.Fujita, S.Matsuo, S.R.Valentin, A.Ludwig, A.D.Wieck, A.Oiwa and S.Tarucha: 31th International Conference on Physics of Semiconductors.

[23]Quantum Photon-spin Interface Consisting of Gate-defined Quantum Dots and Surface Plasmon Structure (oral), Akira Oiwa: 2016 Workshop on Innovative Nanoscale Devices and Systems.

Review Papers

Detection of Cooper pair splitting and spin entanglement in parallel double quantum dot Josephson junction, R. S. Deacon, A. Oiwa, J. Seiler, S. Baba, Y. Kanai, K. Shibata, K. Hirakawa, S. Tarucha, Kotaibutsuri, AGNE Gijutsu Center, 51 (2016), 287-293.

Books

[1]Vecotor Analysis(School of Engineering, University of Tokyo) A. Oiwa, T. Okuzono , S. Matsuno, T. Oka, R. Arita, Maruzen, .

Contributions to International Conferences and Journals

A. Oiwa	9th International Conference on Physics and Applications of Spin-Related Phenomena in Solids (PASPS9) (Co-Chair of PASPS9)
A. Oiwa	China-Japan International Workshop on Quantum Technologies (QTech2016) (Organizing Committee)
A .Oiwa	20th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON20) (Program Committee)
A. Oiwa	International Conference on Solid State Devices and Materials (SSDM2016) (Program Committee)
A. Oiwa	Spintech9 (Program Committee)
S. Hasegawa	The 18th International Conference on Crystal Growth and Epitaxy (Session Chairs, Program Committee)
S. Hasegawa	The 18th International Conference on Crystal Growth and Epitaxy (Editorial Board)

Publications in Domestic Meetings

Japan Physical Society 72nd Annual Meeting	1 paper
Japan Physical Society 2016 Autumn Meeting	3 papers
The 77th JSAP Autumn meeting	3 papers
The 64th SAP Spring Meeting	4 papers
JPS 72th Annual Meeting	2 papers
JPS 2016 Autumn Meeting	4 papers
Nano Spin Conversion Science　Workshop in Kansai for Young Researchers	4 papers
21th Physics and Applications of Spin-related Phenomena in Semiconductors	1 paper

Academic Degrees

Master Degree for Science T. Nakagawa	Study of (001) quantum wells toward photon-electron spin conversion
Master Degree for Engineering R. Shikishima	Quantum transport and observation of Kondo effect in SiGe self-assembled quantum dots
Bachelor Degree for Engineering R. Fukai	Study of surface plasmon antenna in lateral quantum dots for photon-electron conversion with high efficiency
Master Degree for Engineering M. Kimura	Characterization of γ'-Fe_4N/GaN interface toward GaN-based lateral spin valve devices with high spin injection efficiency

Master Degree for Science Y. Miyazaki	Impact of carrier density on optical and magnetic properties in dilute magnetic semiconductor GaSmN
Bachelor Degree for Engineering I. Toyoshima	Study on fabrication of nitride semiconductor-based lateral spin valve devices

Grant-in-Aid for Scientific Research

A. Oiwa	Optical Spin Conversion	¥72,800,000
A. Oiwa	Studies on quantum state transfer and creation of entanglement between photons and electron spins using quantum dots	¥8,840,000
A. Oiwa	Realization of high quality one-dimensional wire using InSb quantum wells and exploration of Majorana fermions	¥2,080,000
H. Kiyama	Spin detection and control of spin relaxation process in InAs qauntum dots	¥3,380,000
A. Oiwa	Novel solid state physics via spatial controls of quantum pairs	¥0,000
A. Oiwa	Steering committee of Nano Spin Conversion Science	¥800,000
S. Hasegawa	Study of optimization methodologies for boron nitride films by controlling an ion-energy distribution function during plasma processing	¥600,000
S. Hasegawa	Complementary accumulation of spin and charge in hydride bipolar conductors	¥300,000

Entrusted Research

A. Oiwa	Japan Science and Technology Agency	Creation of a Poincaré interface through the convergence of electronics and photonics	¥71,630,000
A. Oiwa	Japan Science and Technology Agency	Development of novel solar cell with high coversion efficiency (~70%) based on the new principle	¥278,000

Cooperative Research

S. Hasegawa	Hyogo Prefectural Institute of Technology	Characterization of BN films grown by RePAC toward optical applications	¥0,000

Department of Semiconductor Electronics

Original Papers

[1]Graphene device array using transfer-free patterned growth on insulator for an electrolyte-gated sensor, Takashi Ikuta, Takeshi Oe, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Kazuhiko Matsumoto: Thin Solid Films, 612 (2016) 87-90.

[2]Glycan-functionalized graphene-FETs toward selective detection of human-infectious avian influenza virus, Takao Ono, Takeshi Oe, Yasushi Kanai, Takashi Ikuta, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Yohei Watanabe, Shin-ichi Nakakita, Yasuo Suzuki, Toshio Kawahara, and Kazuhiko Matsumoto: Jpn. J. Appl. Phys, 56 (2017) 030302/1-4.

[3]Switching of charge-current-induced spin polarization in the topological insulator BiSbTeSe2, Fan Yang, Subhamoy Ghatak, A. A. Taskin, Kouji Segawa, Yuichiro Ando, Masashi Shiraishi, Yasushi Kanai, Kazuhiko Matsumoto, Achim Rosch, and Yoichi Ando: PHYSICAL REVIEW B, 94 (75304) (2016) 1-10.

[4]Top-gated graphene field-effect transistors by low-temperature synthesized SiNx insulator on SiC substrates, Yasuhide Ohno, Yasushi Kanai, Yuki Mori, Masao Nagase and Kazuhiko Matsumoto: Japanese Journal of Applied Physics, 55 (6S1) (2016) 06GF09 1-4.

[5]Relationship between conductance fluctuation and weak localization in graphene, D. Terasawa, A. Fukuda, A. Fujimoto, Y. Ohno, Y. Kanai, and K. Matsumoto: , 95 (2017) 125427.

International Conferences

[1]Detection Kondo effect in Graphene Quantum Dots (oral), Yasushi Kanai, Takashi Ikuta, Takao Ono, Yasushide Ohno, Kenzo Maehashi, Koichi Inoue, and Kazuhiko Matsumoto: The 43rd International Symposium on Compound Semiconductor Week.

[2]An Application of Graphene Field Effect Transistor to Enzymatic Assay (oral), : The 43rd International Symposium on Compound Semiconductor Week.

[3]Graphene Field-Effect Transistor for Biosensor (invited), Kazuhiko Matsumoto , Ryota Hayashi, and Takao Ono: The 23rd International Workshop on Active-Matrix Flatpanel Displays and Devices.

[4]Graphene for Biosensor Applications (invited), Kazuhiko Matsumoto: The 2016 ECS SiGe, Ge, & related Compound Semiconductor Symposium.

[5]Sugar Chain Modified Graphene FET for Detection of Influenza Virus (invited), Kazuhiko Matsumoto: International Symposium on Materials for Chemistry and Engineering (IMCE 2017).

[6]Measurement of Enzyme Molecules and Their Reactions Using Graphene-FET Equipped with Microwells (oral), Takao Ono, Yasushi Kanai, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, and Kazuhiko Matsumoto: 2016 International Conference on Soild State Devices and Materials.

[7]Neuraminidase Assay Using Glycan-Functionalized Graphene Field-Effect Transistors (oral), Kaho Kamada, Takao Ono, Yasushi Kanai, Yasuhide Ohno, Kenzo Maehashi, Koichi Inoue, Yohei Watanabe, Toshio Kawahara, Yasuo Suzuki, Shinichi Nakakita, and Kazuhiko Matsumoto: AVS 63RD International Symposium and Exhibition.

[8]Selective Detection of Human & Bird Influenza Virus by Sugar Chain Modified Graphene FET (oral), Kazuhiko Matsumoto: Graphene 2016.

[9]Sugar Chain Modified Graphene FET for Selective Detection of Human & Bird Influenza Virus (oral), Kazuhiko Matsumoto: KJF-ICOMEP.

[10]Sugar Chain Modified Graphene FET for Virus Detection (oral), Kazuhiko Matsumoto: Graphene 2017.

[11]Position-Controlled Single-Crystalline Graphene Growth and Biosensor Array for Discriminating Subtype of Virus (poster), : The 20th SANKEN International Symposium.

[12]Affinity Assay of Human/Avian-Type Hemagglutinin Using Sialoglycan-Functionalized Graphene FET toward Influenza Diagnosis (poster), : The 20th SANKEN International Symposium.

[13]Evaluation of an Anti-influenza Drug Using Glycan-Functionalized Graphene Field-Effect Transistors (poster), : The 20th SANKEN International Symposium.

[14]Detection of Immunoglobulin E using Graphene-FET with Microfluidics (poster), : The 20th SANKEN International Symposium.

[15]Improved sensitivity of graphene biosensor using porphyrin linker (poster), : The 20th SANKEN International Symposium.

[16]Kondo Effect in Graphene Quantum Dots (poster), : 29th International Microprocesses and Nanotechnology Conference.

[17]The 2016 ECS SiGe, Ge, & related Compound Semiconductor Symposium (poster), : 29th

International Microprocesses and Nanotechnology Conference.

[18] (invited), Kazuhiko Matsumoto: 2016 年 Taiwan-Japan Science and Technology Forum.

Review Papers
Graphene biosensing -from DNA detection to influenza diagnosis, T. Ono, Y Kanai, Y. Ohno, K. Maehashi, K. Matsumoto, Material Stage, Technical Information Institute, 16 (2016), 65-70.

Patents
[1]K20160183Method, system and reagents for electrical detection and measurement of target substance, 2016-169810

[2]K20120385Thin film transistor and its fabrication method, 2013-045952

Academic Degrees

Doctor of Philosophy in Engineering T. Ikuta	Direct Graphene Synthesis on Insulator for an Electrolyte-gated Sensor Array and Long-molecule Channel Transistor with Graphene Electrode
Master Degree for Engineering K. Kamada	Development of Efficacy Evaluation System for Antiviral Drug using Glyco-functionalized Graphene Field-effect Transistor
Master Degree for Engineering R. Hayashi	Evaluation of Detection Selectivity of Virus Detection using Glyco-functionalized Graphene Field-effect Transistor
Master Degree for Engineering Y. Mori	Position Controlled Growth of Single Crystalline Graphene with the Patterned Catalyst
Bachelor Degree for Engineering Y. Anzai	Biosensing using Graphene Field-effect Transistor Equipped with Microfluidic Channel
Bachelor Degree for Engineering K. Sakaguchi	Channel-size Optimization and Drift Control in Graphene Field-Effect-Transistor Sensors

Grant-in-Aid for Scientific Research

K. Matsumoto	Molecular Architectonics: Orchestration of Single Molecules for Novel Functions	¥14,690,000
Y. Kanai	Realization of nanocarbon spin ransistor and developments for quantum devices	¥1,300,000
T. Ono	Measurement of enzymatic reaction using graphene and its applications	¥3,640,000

Entrusted Research

K. Matsumoto	Japan Science and Technology Agency	Develop Super Japanese by Human Power Activation/Enhancement of Industrial Competitiveness/Rich Society	¥162,423,000
K. Matsumoto	Japan Science and Technology Agency	Creation of two dimensional biological model platform with sugar chains functionalized graphene	¥34,489,000
K. Matsumoto	Ministry of Education, Culture, Sports, Science and Technology	Grant for Inter-University International Symposia	¥800,000

Contribution to Research

Y. Kanai	The Amada Foundation	¥1,000,000
Y. Kanai	The Murata Science Foudation	¥980,000
Cooperative Research		
K. Matsumoto	Toshiba Corporation	¥2,616,000
K. Matsumoto	Advanced Technology R&D Center, Mitsubishi Electric Corporation	¥500,000
K. Matsumoto	Murata Manufacturing Co., Ltd.	¥2,832,000
K. Matsumoto	Toshiba Corporation	¥2,616,000
Other Research Fund		
K. Matsumoto	JSPS	¥15,830,000

Department of Advanced Electron Devices

Original Papers

[1]Stretchable and Transparent Electrodes Based on Pattered Silver Nanowire by Laser-Induced Forward Transfer for Non-Contacted Printing Technique, T. Araki、H. Koga、T. Sekitani、K. Suganuma: Nanotechnology, 27 (2016) 45LT02 (8 pages).

[2]Ultraflexible and Ultrathin Polymeric Gate Insulator for 2 V Organic Transistor Circuits, T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: Applied Physics Express, 9 (2016) 061602-1-4.

[3]Ultraflexible Organic Amplifier with Biocompatible Gel, T. Sekitani: Nature Communications, 7 (2016) 11425(11 pages).

International Conferences

[1]Wireless Eeg Patch Sensor on Forehead Using On-Demand Stretchable Electrode Sheet and Electrode-Tissue Impedance Scanner, S. Yoshimoto、T. Araki、T. Uemura、T. Nezu、T. Sekitani: 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, (2016) 6269-6289.

[2]Implantable Wireless 64-Channel System with Flexible ECoG Electrode and Optogenetics Probe, S. Yoshimoto、T. Araki、T. Uemura、T. Nezu、M. Hirata、T. Sekitani: IEEE Biomedical Circuits and Systems Conference, (2016) 476-479.

[3]Biosignal Amplification Circuits Based on Ultra-Flexible Organic Thin-Film Transistors (invited), T. Uemura、T. Sekitani: International Thin-Film Transistor Conference (ITC2017).

[4]Wearable and Implantable Bio-Signal Monitoring Systems (invited), S. Yoshimoto、T. Araki、T. Uemura、T. Sekitani: 2016 Workshop on Innovative Nanoscale Devices and Systems.

[5]Ultraflexible and Stretchable Electronics for Wireless Bio-Signal Monitoring Systems (invited), T. Araki、S. Yoshimoto、Y. Noda、T. Uemura、T. Sekitani: The 20th SANKEN International - The 15th SANKEN Nanotechnology Symposium - 4th KANSAI Nanoscience and Nanotechnology - 12th Handai Nanoscience and Nanotechnology International Symposium - Molecular Technology Frontiers towards IoT World.

[6]Sheet-Type Organic Amplifier System Using Pseudo-CMOS Circuits for a Wireless Biosignal Detection (invited), T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: 5th imec Handai International Symposium.

[7]Implantable Bio-Signal Monitoring System with Ultrasoft Electrodes (invited), T. Sekitani、T. Araki、S. Yoshimoto、T. Uemura: International Conference on Electronic Materials and Nanotechnology for Green Environment ENGE2016.

[8]Patterned Top-Contact Fabrication for Short-Channel Organic Transistors (invited), T. Uemura: The

16th International Meeting on Information Display.

[9]Wearable and Implantable Bio-Signal Monitoring Systems (invited), T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: The 16th International Meeting on Information Display.

[10]High stability of silver nanowire based electrodes for bio-sensors (invited), T. Araki、S. Yoshimoto、T. Uemura、T. Sekitani: International Conference on Electronics Packaging (ICEP 2016).

[11]Printable stretchable electrodes based on silver nanowires (oral), T. Araki、T. Sekitani: International Nanotechnology Conference & Expoand Nanoeletronics and Bio medical Devices.

[12]Ultra-Flexible Organic Amplifier System Using Pseudo-Cmos Circuits for a Wireless Biosignal Detection (oral), T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: 2016 Materials Research Society.

[13]Ultra-Thin Parylene Gate Insulator for Low- Voltage-Operating Organic Transistor Circuits (oral), T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: 2016 Materials Research Society (MRS) Spring Meeting & Exhibit.

[14]Implantable ECoG Sensor with Flexible Electrode Sheet and Optogenetics Probe (poster), S. Yoshimoto、T. Araki、T. Uemura、T. Nezu、H. Hamanaka、M. Hirata、T. Sekitani: The 20th SANKEN International - The 15th SANKEN Nanotechnology Symposium - 4th KANSAI Nanoscience and Nanotechnology - 12th Handai Nanoscience and Nanotechnology International Symposium - Molecular Technology Frontiers towards IoT World.

[15]18-nm-thick Parylene Gate Insulator for Low-Voltage Operating and Ultraflexible Organic Transistors (poster), T. Uemura、T. Araki、S. Yoshimoto、T. Sekitani: The 20th SANKEN International - The 15th SANKEN Nanotechnology Symposium - 4th KANSAI Nanoscience and Nanotechnology - 12th Handai Nanoscience and Nanotechnology International Symposium - Molecular Technology Frontiers towards IoT World.

[16]Spontaneous Patterning of 20 μm-wide Electrodes Using Ag Nanowires for Transparent Organic Transistors (poster), T. Araki、Y. Noda、S. Yoshimoto、T. Uemura、T. Sekitani: The 20th SANKEN International - The 15th SANKEN Nanotechnology Symposium - 4th KANSAI Nanoscience and Nanotechnology - 12th Handai Nanoscience and Nanotechnology International Symposium - Molecular Technology Frontiers towards IoT World.

[17]Long-term implantable interface of high flexible multi-channel electrodes monitoring with wireless recording system (poster), T. Araki、S. Yoshimoto、T. Uemura、M. Hirata、T. Sekitani: Neuroscience 2016.

[18]Biological Signal Amplification Circuits Based on Organic Thin-Film Transistors (poster), T. Uemura、T. Nezu、S. Yoshimoto、T. Araki、T. Sekitani: International Conference on Flexible and Printed Electronics (2016 ICFPE).

Review Papers

Recent Progress in Solution-Processed Organic Field-Effect Transistors, T. Uemura, AAPPS Bulletin, AAPPS Bulletin, 26[2] (2016), 20-24.

Circuit and System Design using Flexible Sensor with Cross-Sectoral Cooperation, S. Yoshimoto, IEICE ICD, IEICE, 116[364] (2016), 25-28.

Printable and Stretchable Conductor for Flexible Electronics, T. Araki、T. Sekitani、K. Suganuma, Fine Chemicals, CMC Publishing Co.,Ltd., 45[6] (2016), 6–12.

Silver Nanowire-Based Stretchable and Transparent Electrodes, T. Araki、K. Suganuma、T. Sekitani,

Journal of The Japan Institute of Electronics Packaging, The Japan Institute of Electronics Packaging, 19 [4] (2016), 228–233.

Books

[1] Development of silver nanowire wiring for flexible wearable devices (E. Tamiya、T. Sekitani、T. Yagi) T. Araki、K. Suganuma、T. Sekitani, “Bio-sensing Device Technology for Connecting to IoT”, CMC Publishing Co.,Ltd., (136-143) 2016.

[2] Biometric system using stretchable electrodes (E. Tamiya、T. Sekitani、T. Yagi) S. Yoshimoto, “Bio-sensing Device Technology for Connecting to IoT”, CMC Publishing Co.,Ltd., (181-187) 2016.

[3] Printable and stretchable wiring for wearable devices (K. Suganuma) T. Araki、S. Yoshimoto、T. Uemura、K. Suganuma、T. Sekitani, “Advances in Healthcare Wearable Devices”, CMC Publishing Co.,Ltd., (45–51) 2016.

[4]Applications of Printed Silver Nanowires Based on Laser Induces Forward Transfer (LIFT)(S. Magdassi、A. Kamyshny) T. Araki、K. Suganuma、T. Sekitani, “Nano materials for 2D and 3D printing”, Wiley-VCH, (265–273) 2017.

Patents

[1]K20160001 Wiring sheet, sheet-like system, and structure operation support system, 2016-145777

[2]K20160005 Conductive composition, 2016-120219

[3]K20160071 Corrosion sensor and detection method for concrete structure, 2016-137168

[4]K20160072 Strain sensor and detection method for structure, 2016-137169

[5]K20160075 Electrode sheet and its manufacturing method, 2016-156414

[6]K20160076 Electrode sheet and biomedical signal measuring device equipped with it, 2016-112076

[7]K20160077 Electrode structure, biological signal measuring device and composition for adhesive form, 2016-233433

[8]K20160112 Electrode sheet, 2016-178924

[9]K20160167 Electrode sheet, 2016-195850

[10]K20160285 Temperature sensor, 2017-014178

[11]G20160015WO Biological signal measuring device, PCT/JP2016/073112

[12]G20160120WO Base material having a metal nanowire layer formed thereon and its manufacturing method, PCT/JP2017/010264

Contributions to International Conferences and Journals

S. Yoshimoto	2016 Design, Automation and Test in Europe (Technical Program Committee)
T. Uemura	The 16th International Meeting on Information Display (Technical Program Committee)
T. Sekitani	The 16th International Meeting on Information Display (Technical Program Committee)
T. Sekitani	International Thin-Film Transistor Conference (ITC2017) (Program Committee)

Publications in Domestic Meetings

LSI and System Workshop		1 paper
ICD workshop		1 paper
The 10th New Industry Promotion Review Committee FIT+ Attractiveness of new light source OLED		1 paper
The 64rd Spring Meeting, 2017		2 papers
IEICE technical report		3 papers

Grant-in-Aid for Scientific Research

T. Sekitani	Research and development of sheet type autonomic function monitoring system	¥18,460,000
T. Sekitani	Development of flexible spectral sensitivity sensor for agriculture IT	¥1,560,000
T. Araki	Printing formation of high performance flexible electronic devices using stretchable conductors and organic semiconductors	¥1,170,000
S. Yoshimoto	Patch type wireless electroencephalogram measurement system with biocompatible electrode sheet	¥1,950,000
T. Uemura	Elucidation of mechanism for low contact resistance in organic transistors and development of high speed device	¥3,510,000

Entrusted Research

T. Sekitani	Japan Science and Technology Agency	Manufacture evaluation of biological harmonic electronics device	¥6,500,000
T. Sekitani	Japan Agency for Medical Research and Development	Development of mammoset brain signal measurement system using flexible ultra thin film sensor sheet with built-in embedded IC	¥49,702,000
T. Sekitani	National Institute of Information and Communications Technology	Large capacity internal body - external wireless communication technology, research and development of large-scale brain information processing technology and its application for BMI	¥3,300,000
T. Sekitani	New Energy and Industrial Technology Development Organization	Research and development of carbon wiring sheet system technology for building IoT internode distribution and communication	¥14,000,000

Contribution to Research

T. Sekitani	Support Center for Advanced Telecommunications Technology Research, Foundation	¥1,000,000
T. Sekitani	Nakatani Foundation for Advancement of Measuring Technologies in Biomedical Engineering	¥100,000
T. Sekitani	Tokyo Electric Power Services CO.,Ltd.	¥3,000,000
T. Sekitani	Tokyo Electric Power Services CO.,Ltd.	¥2,000,000

Cooperative Research

T. Sekitani	Murata Manufacturing Co., Ltd.	¥1,500,000
T. Sekitani	Showa Denko K.K.	¥7,000,000
T. Sekitani	Daikin Industries,Ltd.	¥5,250,000
T. Sekitani	Nippon Shokubai Co., Ltd.	¥31,500,000
T. Sekitani	Asahi Glass Co., Ltd.	¥3,061,000
T. Sekitani	Group Corporate Communication Dept., Toyo Ink SC Holdings Co., Ltd.	¥1,000,000

T. Sekitani	JSR Corporation	¥2,496,000
T. Sekitani	Shinko Electric Industries Co., Ltd.	¥2,500,000
T. Sekitani	Mitsubishi Tanabe Pharma Corporation	¥14,000,000
T. Sekitani	Chemical Materials Evaluation and Research Base	¥8,000,000
T. Sekitani	SCREEN Holdings Co., Ltd.	¥288,000
T. Sekitani	PGV Co., Ltd.PGV	¥1,770,000
T. Sekitani	SCREEN Holdings Co., Ltd.	¥0,000
K. Sudou	Konan Gakuen	¥0,000
T. Uemura	ROHM Semiconductor	¥2,160,000

Department of Intelligent Media

Original Papers

[1]A Typing Assist System Considering Involuntary Hand Tremor, K. Wang, N. Takemura, D. Iwai, K. Sato: Transactions of the Virtual Reality Society of Japan, 21 (2) (2016) 227-233.

[2]View-invariant Gait Recognition Using Convolutional Neural Network, N. Takemura, K. Shiraga, Y. Makihara, D. Muramatsu, T. Echigo, Y. Yagi: IEICE Trans. on Fundamentals (A), J99-A (12) (2016) 440-451.

[3]View Transformation Model Incorporating Quality Measures for Cross-view Gait Recognition, D. Muramatsu, Y. Makihara, Y. Yagi: IEEE Transactions on Cybernetics, 46 (7) (2016) 1602-1615.

[4]Mental Fatigue Estimation Based on Facial Expression Change during Speech, R. Kawamura, N. Takemura, K. Sato: Transactions of the Society of Instrument and Control Engineers, 53 (1) (2017) 90-98.

[5] Scial Group Discovery Extracting Useful Features using Multiple Instance Learning, R. Sato, H. Habe, I. Mitsugami, S. Satake, K. Sumi, Y. Yagi: Journal of Japan Society for Fuzzy, Theory and Intelligent Informatics, 28 (6) (2017) 920-931.

[6]Abnormality tracking during video capsule endoscopy using an affine triangular constraint based on surrounding features, Y. Yanagawa, T. Echigo, H. Vu, H. Okazaki, Y. Fujiwara, T. Arakawa, Y. Yagi: IPSJ Transactions on Computer Vision and Applications, 9 (3) (2017) 1-10.

[7]Analysis of Gait Changes Caused by Simulated Left Knee Disorder, T. Ogawa, H. Yamazoe, I. Mitsugami, Y. Yagi: EAI Endorsed Transactions on Creative Technologies, 3 (9) (2016) e1.

International Conferences

[1]Recovering Transparent Shape from Time-of-Flight Distortion, K. Tanaka, Y. Mukaigawa, H. Kubo, Y. Matsushita, Y. Yagi: Proc. of the 29th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2016), (2016) 4387-4395.

[2]GEINet: View-Invariant Gait Recognition Using a Convolutional Neural Network, K. Shiraga, Y. Makihara, D. Muramatsu, T. Echigo, Y. Yagi: Proc. of the 8th IAPR Int. Conf. on Biometrics (ICB 2016), (O19) (2016) 1-8.

[3]Gait Collector: An Automatic Gait Data Collection System in Conjunction with an Experience-based Long-run Exhibition, Y. Makihara, T. Kimura, F. Okura, I. Mitsugami, M. Niwa, C. Aoki, A. Suzuki, D. Muramatsu, Y. Yagi: Proc. of the 8th IAPR Int. Conf. on Biometrics (ICB 2016), (O17) (2016) 1-8.

[4]Speed Invariance vs. Stability: Cross-Speed Gait Recognition Using Single-Support Gait Energy Image, C. Xu, Y. Makihara, X. Li, Y. Yagi, J. Lu: Proc. of the 13th Asian Conf. on Computer Vision

(ACCV 2016), (2016) 52-67.

[5]Gait Energy Response Function for Clothing-invariant Gait Recognition, X. Li, Y. Makihara, C. Xu, D. Muramatsu, Y. Yagi, M. Ren: Proc. of the 13th Asian Conf. on Computer Vision (ACCV 2016), (2016) 257-272.

[6]Gait Gate: An Online Walk-through Multimodal Biometric Verification System using a Single RGB-D Sensor, M. Hasan, Y. Makihara, D. Muramatsu, Y. Yagi: Proc. of Workshop on Human Identification for Surveillance (HIS): Methods & Applications (in conjunction with ACCV 2016), (2016) 330-344.

[7]Flower Species Identification Using Deep Convolutional Neural Networks, T. T. N. Nguyen, V. V. Le, T. L. Le, H. Vu, N. Pantuwong, Y. Yagi: Proc. of Regional Conference on Computer and Information Engineering 2016, (2016) 1-6.

[8]Motion parallax representation for indirect augmented reality, F. Okura, Y. Nishizaki, T. Sato, N. Kawai, N. Yokoya: Proc. of the 15th IEEE Int'l Symp. on Mixed and Augmented Reality (ISMAR 2016), (2016) 105-106.

[9]Mental Fatigue Estimation Based on Luminance Change of Facial Image, R. Kawamura, N. Takemura, K. Sato: Prof. of the 2016 IEEE/SICE International Symposium on System Integration, (2016) 526-531.

[10]Gaze Estimation Based on Eyeball-Head Dynamics, I. Mitsugami, Y. Okinaka, Y. Yagi: Proc. of the 1st International Workshop on Human Activity Analysis with Highly Diverse Cameras (HDC2017), (2017) 48-52.

[11]Human Motion Analysis for Intention-Gait Modeling, I. Mitsugami: The International Conference of Information and Communication Technology for Embedded Systems (2016).

Review Papers
Toward Construction of a Large-scale Gait Video Database, Y. Makihara, F. Okura, I. Mitsugami, M. Niwa, D. Muramatsu, Y. Yagi, Journal of the Society of Biomechanisms, the Society of Biomechanisms, 40[3] (2016), 167-172.

Video-based Gait Analysis System, D. Muramatsu, Y. Makihara, Y. Yagi, The journal of the Institute of Image Information and Television Engineers, The Institute of Image Information and Television Engineers, 70[5] (2016), 10-13.

Patents
[1]K20150090 Health status estimation device, 2016-090680

[2]G20160125WO Health status estimation device, PCT/JP2017/005089

[3]K20110430 Optical system and imaging device, 2012-170401

[4]K20080025 3D Shape Measurement Method and Program, K20080025

[5]K20080447 Compound omnidirectional camera, K20080447

[6]K20090153 High precision PSF estimation method using blur model and its application to code, K20090153

[7]K20090358 Ominidirectional imaging system, K20090358

[8]G20150097 Method for evaluating dual-task performance and system for evaluating dual-task,

Contributions to International Conferences and Journals

Y. Makihara	The 4th IAPR Asian Conf. on Pattern Recognition (ACPR 2017) (Program Co-chair)
Y. Makihara	The 30th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2017) (Reviewer)
Y. Makihara	2017 ACM Int. Conf. on Multimedia Retrieval (ICMR 2017) (Program Committee Member)
Y. Makihara	The 28th British Machine Vision Conf. (BMVC 2017) (Reviewer)
Y. Makihara	The 16th International Conference on Computer Vision (ICCV 2017) (Reviewer)
Y. Makihara	The 9th International Conference on Knowledge and Systems Engineering (KSE-2017) (Program Committee Member)
Y. Makihara	IPSJ Transaction on Computer Vision and Applications (Associate Editor)
D. Muramatsu	The 9th IAPR International Conference on Biometrics (ICB 2016) (Reviewer)
D. Muramatsu	The 23rd Int. Conf. on Pattern Recognition (ICPR 2016) (Technical Member)
D. Muramatsu	The 2017 International Conference on Biometrics Engineering and Application (ICBEA 2017) (Reviewer)
D. Muramatsu	The 4th IAPR Asian Conf. on Pattern Recognition (ACPR 2017) (Program Committee Member)
I. Mitsugami	The 23rd Int. Conf. on Pattern Recognition (ICPR 2016) (Technical Member)
I. Mitsugami	The 5th International Conference on Informatics, Eletronics & Vision (ICIEV 2016) (Reviewer)
I. Mitsugami	The 15th IEEE International Symposium on Mixed and Augmented Reality (ISMAR 2016) (Reviewer)
I. Mitsugami	The 13th Asian Conf. on Computer Vision (ACCV 2016) (Reviewer)
I. Mitsugami	2016 IEEE Int. Conf. on Imaging, Vision & Pattern Recognition (icIVPR 2016) (Program Committee Member)
I. Mitsugami	The 8th annual International Conference on Information and Communication Technology for Embedded Systems (IC-ICTES 2017) (International Advisory)
I. Mitsugami	3D Vision 2016 (3DV 2016) (Reviewer)
I. Mitsugami	The 11th Int. Conf. on Signal Image Technology and Internet-based Systems (SITIS 2016) (Program Committee Member)
I. Mitsugami	IEEE Virtual Reality 2017 (Reviewer)
I. Mitsugami	2017 IEEE Int. Conf. on Imaging, Vision & Pattern Recognition (icIVPR 2017) (Program Committee Member)
I. Mitsugami	The 4th IAPR Asian Conf. on Pattern Recognition (ACPR 2017) (Program Committee Member)
I. Mitsugami	The 16th IEEE International Symposium on Mixed and Augmented Reality (ISMAR 2017) (Reviewer)
I. Mitsugami	6th International Conference on Informatics, Electronics and Vision (ICIEV2017) (Publicity Chair)

Publications in Domestic Meetings

The Institute of Systems, Control and Information Engineers	2 papers
Information Processing Society of Japan, Special Interest Group on Computer Vision and Image Media	7 papers
The 19th Meeting on Image Recognition and Understanding	3 papers
The 6th Symposium on Biometrics, Recognition, and Authentication	11 papers
2017 Symposium on Cryiptography and Information Security	1 paper
The Institute of Image Information and Television Engineer	1 paper
The Institute of Electronics, Information and Communication Engineering, Technical Group on Biometrics	2 papers
Annual Meeting on the Institute of Electronics, Information and Communication Engineers	1 paper

Academic Degrees

PhD for Information Science K. Tanaka	Model-based Analysis of Translucent Objects using Spatially and Temporally Modulated Light
Master Degree for Information Science S. Ikuma	Individual identification of dairy cows using gait and texture features based on RGB-D video analysis
Master Degree for Information Science J. Kamimura	Paper property classification using convolutional neural networks considering camera and light positions
Master Degree for Information Science A. Suzuki	Gait recognition robust to carrying status based on joint intensity metric learning
Master Degree for Information Science C. Lo	Construction of pedestrian data set including gaze information
Bachelor Degree for Engineering Y. Kashimoto	Visualization and Analysis of STHOG for Person Re-identification across Cameras
Bachelor Degree for Engineering Y. Shigeki	Performance Evaluation for View Slection Assuming Gait Recognition by Drone Camera
Bachelor Degree for Engineering A. Nagano	Classification of Microscopic Images of Drug Resistant Strains Using Convolutional Neural Networks
Bachelor Degree for Engineering T. Nada	(Confidential)

Grant-in-Aid for Scientific Research

Y. Yagi	Multi-modal gait recognitoin in the wild and its application to criminal investigation	¥14,950,000
Y. Makihara	Gait-based age estimation and aging process modeling	¥5,330,000
D. Muramatsu	Person recognition from data pair without common region	¥1,170,000
I. Mitsugami	Motion Extraction for Gait Analysis	¥1,300,000
F. Okura	Estimating and visualizing health condition of dairy cows using 4D spacetime sensing	¥1,300,000

Entrusted Research

Y. Yagi	Japan Science and Technology Agency	Behavior Understanding based on Intention-Gait Model	¥46,540,000
Y. Yagi	NEC Corporation	Research on Video-based Gait Analysis for Person Re-idenitification	¥4,320,000
F. Okura	Ministry of Internal Affairs and Communication (SCOPE)	Improving realism and effectiveness of pre-captured AR systems using exemplar image databases	¥1,183,000

Cooperative Research

Y. Yagi	Aida Engineering Co. Ltd.	¥3,000,000
Y. Yagi	Information Technology Research and Development Center, Mitsubishi Electric Corporation	¥18,000,000
Y. Yagi	Konica Minolta, Inc.	¥3,600,000
Y. Yagi	Qoncept, Inc.	¥3,240,000
Y. Yagi	the National Institute of Information and Communications Technology	¥0,000
Y. Yagi	Ideafront, Inc.	¥0,000

Y. Makihara	the National Institute of Information and Communications Technology	¥0,000

Department of Reasoning for Intelligence

Original Papers

[1]Quantum-state anomaly detection for arbitrary errors using a machine-learning technique, S. Hara, T. Ono, R. Okamoto, T. Washio and S. Takeuchi: Physical Review A, 94 (2016) 042341.

[2]Defying the gravity of learning curve: a characteristic of nearest neighbour anomaly detectors, K. M. Ting, T. Washio, Jonathan R. Wells and Sunil Aryal: Machine Learning, 106 (1) (2017) 55–91.

[3]Efficient generalized fused Lasso and its applications, B. Xin, Y. Kawahara, Y. Wang, L. Hu and W. Gao: ACM Transactions on Intelligent Systems and Technology, 7 (4) (2016) 60:1-60:22.

[4]Representative selection with structured sparsity, H. Wang, Y. Kawahara, C. Weng and J. Yuan: Pattern Recognition, 63 (2017) 268-278.

International Conferences

[1]Potential Social Impact of Compact and Smart Sensors in IoT Era, T. Washio: Proc. of The 50th Hawaii International Conference on System Sciences (HICCS2017), (2017) -.

[2]Comparative Research on Social Risk Reduction by Smart Hazard Monitoring Sensors, T. Washio: Proc. of The 50th Hawaii International Conference on System Sciences (HICCS2017), (2017) -.

[3]NanoScale and Ultratrace Sensing for IoT using Machine Learning and Ultratrace Sensing for IoT using Machine Learning, T. Washio: Proc. of The 20th Annual Conference on Knowledge Based and Intelligent Information & Engineering Systems (KES2016), (2016) .

[4]Information Decomposition on Structured Space, M. Sugiyama, H. Nakahara and K. Tsuda: Proc. of 2016 IEEE International Symposium on Information Theory (ISIT2016), (2016) 575-579.

[5]s, S. Shimizu: Proc. of Conference on Statistics and Causality 2014, (2016) 153-184.

[6]Dynamic mode decomposition with reproducing kernels for Koopman spectral learning, Y. Kawahara: Advances in Neural Information Processing Systems, 29 (2016) 911-919.

[7]Finding Combinations of Binary Variables with Guaranteed Accuracy (oral), Y. Baba, M. Sugiyama and T. Washio: Workshop on Adaptive and Scalable Nonparametric Methods in Machine Learning, the 30th Annual Conference on Neural Information Processing Systems (NIPS2016).

[8]Error Asymmetry in Causal and Anticausal Regression (oral), P. Blöbaum, S. Shimizu and T. Washio: Workshop on Statistical Causal Inference and its Applications to Genetics (Center of Mathematics Research).

[9]Defying the Gravity of Learning Curves: Are More Samples Better for Nearest Neighbor Anomaly Detectors? (invited), T. Washio: The 9th International Conference on Similarity Search and Applications (SISAP2016).

[10]Quantum state estimation and discrimination (invited), S. Takeuchi and T. Washio: SPIE Photonics West OPTO: Advances in Photonics of Quantum Computing, Memory, and Communication X.

[11]Accurate Sensing Based on Output Integration of Multiple Devices Using Machine Learning (oral), T. Washio: ImPACT International Symposium on InSECT 2016.

[12]A non-Gaussian model for causal discovery in the presence of hidden common causes of hidden common causes (invited), S. Shimizu: Munich Workshop on Causal Inference and Information Theory, Munich, Germany, May 23-24, 2016.

[13]A non-Gaussian approach for causal structure learning in the presence of hidden common causes (invited), S. Shimizu: CRM Workshop: Statistical Causal Inference and its Applications to Genetics, Montreal, Canada, July 25-29, 2016.

[14]Koopman spectral learning of dynamical systems (invited), Y. Kawahara: UK-Japan AI Research Workshop.

Review Papers

Structured Sparse Estimation and Its Optimization, Y. Kawahara, The journal of the Institute of Electronics, Information and Communication Engineers, 99[5] (2016), 386-391.

Machine Learning and Its Prospect in Chemics Research, T. Washio, Chemistry today, Tokyo Kagaku-Dojin Publishing Company, 552 (2017), 53-56.

One Cell Identification by using Nano-Pore and Machine Learning, M. Taniguchi, T. Washio and T. Kawai, Chemistry, Kagaku-Dojin Publishing Company, 72[2] (2017), 33-38.

Recent Advances on Significant Pattern Mininig, M. Sugiyama, Communications of the Operations Research Society of Japan, The Operations Research Society of Japan, 62[4] (2017), 226-232.

Patents

[1]K20160139 A method, an instrument and a memory media for classification analysis, 2016-244326

[2]K20160184 A method and an instrument for sample identification, and a method for input parameter estimation by using chemical sensing, 2016-230468

[3]K20160265 A method and an instrument for sample identification by using chemical sensors, 2017-034419

[4]G20160075WO A method, an instrument and a memory media for number analysis, PCT/JP2016/087821

[5]G20160084US Evaluation Information Provision System and Evaluation Information Provision Method, PCT/JP2016/080827

[6]K20110229 Device, method, and program for interactive feature selection, JP2014-009272

[7]K20110230 Optimal-query generation device, optimal-query extraction method, and discriminative-model learning method, PCT/JP2012/007900

[8]K20110251 Device, method, and program for visualization of multi-dimensional data, JP2013-161226

Contributions to International Conferences and Journals

T. Washio	The 22nd ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. Washio	International Journal, Knowledge and Information Systems (KAIS), Springer (Associated Editor)
T. Washio	Journal of Data Mining and Knowledge Discocvery (Editorial Board)
T. Washio	The 2016 IEEE International Conference on Data Mining (ICDM) (Area Program Committee Chair)
T. Washio	The 2016 IEEE International Conference on Data Mining (ICDM) (Steering

	Committee)
T. Washio	The 2017 IEEE International Conference on Data Mining (ICDM) (Area Program Committee Chair)
T. Washio	The 2017International Joint Conference on Artificial Intelligence (IJCAI) (Senior Program Committee)
T. Washio	The 23rd SIGKDD Conference on Knowledge Discovery and Data Mining (2017SIGKDD) (Program Committee)
T. Washio	The 21st Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2017) (Senior Program Committee)
T. Washio	The 21st Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2017) (Steering Committee)
T. Washio	The 4th IEEE International Conference on Data Science and Advanced Analysis (DSAA2017) (Research Track Program Chair)
T. Washio	Special Session:Advanced Informatic Measurement using Statistics, Machine Learning and Pattern Recognition, The 4th IEEE International Conference on Data Science and Advanced Analysis (DSAA2017) (Program Committee)
M. Sugiyama	The 20th Pacific Asia Knowledge Discovery and Data Mining Conference (PAKDD 2016) (Program Committee)
M. Sugiyama	The 22th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2016) (Program Committee)
M. Sugiyama	The 26th European Conference on Machine Learning and 19th Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD 2016) (Program Committee)
M. Sugiyama	The 8th Asian Conference on Machine Learning (ACML 2016) (Program Committee)
S. Shimizu	Behaviormetrika (Coordinating editor)
Y. Kawahara	21st Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD'17) (Program Committee)
Y. Kawahara	33rd International Conference on Machine Learning (ICML'16) (Program Committee)
Y. Kawahara	25th International Joint Conference on Artificial Intelligence (IJCAI'16) (Program Committee)
Y. Kawahara	22nd SIGKDD Conference on Knowledge Discovery and Data Mining (KDD'16) (Program Committee)
Y. Kawahara	2016 European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Program Committee)
Y. Kawahara	31st AAAI Conference on Artificial Intelligence (Program Committee)
Y. Kawahara	Neural Networks (Editorial Board)

Publications in Domestic Meetings

Annual Meeting of The Institute of Electrical Engineers of Japan	1 paper
The Japan Society of Applied Physics, Autumn Meeting	1 paper
The Society of Chemical Engineers, Japan, The 82th Annual Meeting	1 paper
Japan Welding Society, Spring Meeting	1 paper
The 81st Annual Scientific Meeting of the Japanese Circulation Society	1 paper
The Japanese National Committee of CIGRE, H28 Meeting	1 paper
The 27th Meeting of Electric Power & Energey, The Institute of Electrical Engineers of Japan	1 paper
The 30th Annual Meeting of The Japanese Society for Artificial Intelligence	6 papers
The 30th Annual Meeting of Japanese Society of Computational Statistics	1 paper
The 30th Annual Conference of the Japanese Society for Artificial Intelligence	1 paper
The 103th Meeting of SIG-FPAI	1 paper
The 14th Information-Based Induction Sciences Workshop	1 paper
Meeting of Japan Institute of Marketing Science	1 paper
The 30th Annual Meeting of The Japanese Society for Artificial Intelligence	2 papers

The 102th Meeting of SIG-FPAI 1 paper

Academic Degrees

Doctor Degree for Engineering K. Nagata	Study on Biologically Relevant Toxicogenomic Predictive Modeling using Machine Learning
Master Degree for Engineering A. Oka	Probabilistic Variational Reasoning on Large Scale Switching Linear Dynamic System
Master Degree for Engineering Y. Baba	Frequent Itemset Mining Using Sampling with Guaranteed Accuracy
Bacheler Degree for Engineering A. Fukunaga	Significant Tree Pattern Mining Using Testability
Bacheler Degree for Engineering Y. Yoneda	Learning Interpretable Classification Rules Using Discretization on Continuous Variables
Bacheler Degree for Engineering T. Bito	Water Area Extraction from Earth Observation Data Using Structured Support Vector Machine

Grant-in-Aid for Scientific Research

T. Washio	Development and Application of Statistical Estimation and Simulation for Super-high Dimensional Data Space	¥8,710,000
Y. Kawahara	Meta learning algorithm for structured sparse modeling	¥2,210,000
Y. Kawahara	Development of machine learning algorithms based on discrete convex analysis and its applications	¥3,250,000
Y. Kawahara	Hardware-friendly machine learning by integer parameter regularized learning with discrete convexity	¥0,000
M. Sugiyama	Finding Significant Subgraphs from Big Graph data	¥1,170,000

Entrusted Research

T. Washio	Japan Science and Technology Agency	Ecxtraction of Information Characterizing Cell Physiology from Super-High-Resolution Image Time Series	¥7,670,000
T. Washio	National Cerebral and Cardiovascular Center Hospital	Analysis of Hart Failure Case Big Data Using a Data Mining Method LAMP	¥1,400,000
T. Washio	Japan Science and Technology Agency	Exploration of Novel Measurement and Analysis Approaches by Deep Synthesis and Investigation of Machine Learning and Advanced Measurement Technologies	¥4,420,000
M. Sugiyama	Japan Science and Technology Agency	Scalable Technologies for Finding Significant Patterns	¥22,620,000

Contribution to Research

T. Washio	Asian Office of Aerospace Research and Development (AOARD)	¥2,961,000
T. Washio	IBM Corporation Global University Programs Program Director Dianne Fodell	¥1,050,000

Cooperative Research

T. Washio	National Cerebral and Cardiovascular Center Hospital	¥36,000
T. Washio	Kobe Steel, Ltd	¥1,080,000
T. Washio	Nagano Science Co. Ltd	¥0,000

T. Washio	National Institute for Materials Science	¥0,000
T. Washio	The Kansai Electric Power Company, Incorporated	¥0,000
T. Washio	Nagano Science Co. Ltd	¥0,000
Y. Kawahara	JFE Steel Corporation	¥2,400,000
Y. Kawahara	BIJIN & Co. Inc., University of Tsukuba	¥0,000
Y. Kawahara	Mizuno Corporation	¥500,000
Y. Kawahara	NTT Communication Science Laboratories	¥0,000

Department of Knowledge Systems

Original Papers

[1]Noise-robust MUSIC-based Sound Source Localization using Steering Vector Transformation for Small Humanoids, Ryu Takeda, Kazunori Komatani: Journal of Robotics and Mechatronics, 29 (1) (2017) 26-36.

[2]Size Effect on Call Properties of Japanese Tree Frogs Revealed by Audio-Processing Technique, Ikkyu Aihara, Ryu Takeda, Takeshi Mizumoto, Takuma Otsuka, Hiroshi G. Okuno: Journal of Robotics and Mechatronics, 29 (1) (2017) 247-254.

[3]Estimating Response Obligation by Focusing on User States in Multi-Party Human-Robot Dialogues, Takaaki Sugiyama, Kotaro Funakoshi, Mikio Nakano, Kazunori Komatani: Transactions of the Japanese Society for Artificial Intelligence, 31 (3) (2016) C-FB2_1-9.

[4]A Refinement Method to Improve Ontology Quality based on a Comparison of Concept Hierarchies, Takeshi Masuda, Kouji Kozaki: Transactions of the Japanese Society for Artificial Intelligence, 32 (2) (2017) E-G71_1-10.

International Conferences

[1]Unsupervised Adaptation of Deep Neural Networks for Sound Source Localization using Entropy Minimization, Ryu Takeda, Kazunori Komatani: Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing, (2017) 2217-2221.

[2]Discriminative Multiple Sound Source Localization based on Deep Neural Networks using Independent Location Model, Ryu Takeda, Kazunori Komatani: Proceedings of IEEE Workshop on Spoken Language Technology , (2016) 603-609.

[3]Bayesian Language Model based on Mixture of Segmental Contexts for Spontaneous Utterances with Unexpected Words, Ryu Takeda, Kazunori Komatani: Proceedings of International Conference on Computational Linguistics, (2016) 161-170.

[4]Expanding Science and Technology Thesauri from Bibliographic Datasets using Word Embedding, Takahiro Kawamura, Kouji Kozaki, Tatsuya Kushida, Katsutaro Watanabe, Katsuji Matsumura: Proceedings of the 28th IEEE International Conference on Tools with Artificial Intelligence, (2016) 8 pages.

[5]Semantic Data Acquisition by Traversing Class-Class Relationships over Linked Open Data, Atsuko Yamaguchi, Kouji Kozaki, Kai Lenz, Yasunori Yamamoto, Hiroshi Masuya, Norio Kobayashi: Proceedings of the 6th Joint International Semantic Technology, (2016) 136-151.

[6]Ontology Refinement System for Improving Consistency of Classification among Brother Concepts, Takeshi Masuda, Kouji Kozaki, Kazunori Komatani: Workshop and Poster Proceedings of the 6th Joint

International Semantic Technology, (2016) 74-77.

[7]SPARQL Builder: Constructing SPARQL Query by Traversing Class-Class Relationships for Life Science Databases, Atsuko Yamaguchi, Kouji Kozaki, Kai Lenz, Yasunori Yamamoto, Hiroshi Masuya, Norio Kobayashi: Workshop and Poster Proceedings of the 6th Joint International Semantic Technology, (2016) 58-61.

[8]Refining JST thesaurus and discussing the effectiveness in life science research, International Workshop on Intelligent Exploration of Semantic Data, Tatsuya Kushida, Takeshi Masuda, Yuka Tateisi, Katsutaro Watanabe, Katsuji Matsumura, Takahiro Kawamura, Kouji Kozaki, Toshihisa Takagi: Proceedings of International Workshop on Intelligent Exploration of Semantic Data (IESD2016), (2016) 12 pages.

[9]Toward Lexical Acquisition during Dialogues through Implicit Confirmation for Closed-Domain Chatbots, Kohei Ono, Ryu Takeda, Eric Nichols, Mikio Nakano and Kazunori Komatani: Proceedings of Second Workshop on Chatbots and Conversational Agent Technologies, (2016) 8 pages.

[10]An Ontological Framework for Representing Topological Information in Human Anatomy, Takeshi Imai, Kazuhiko Ohe, Emiko Shinohara, Masayuki Kajino, Ryota Sakurai, Kouji Kozaki, Riichiro Mizoguchi: Proceedings of the 7th International Conference on Biomedical Ontology, (2016) 6 pages.

Review Papers
Speech Interaction based on Hierarchical Understanding of Spoken Utterances, Kazunori Komatani, Journal of The Society of Instrument and Control Engineers, The Society of Instrument and Control Engineers, 55[10] (2016), 878-883.

Linked Data for JST Science and Technology Thesaurus: For construction of knowledge infrastructure that links science and technology information, Takahiro Kawamura, Katsutaro Watanabe, Katsuji Matsumura, Tatsuya Kushida, Kouji Kozaki, Journal of Information Processing and Management, Japan Science and Technology Agency, 59[12] (2016), 839-848.

Civic Tech and LOD - Through Activities in Kansai Area -, Kouji Kozaki, Hiroshi Ueda, Toru Takahashi, Information Processing, The Information Processing Society of Japan, 55[7] (2016), 620-625.

Books
[1]Chapter 7-57 What is Ontology Enhanced Thesaurus?(Masatsugu Simomura) Riiciro Mizoguchi, Kouji Kozaki, “Tokoton Easy Biomimetics”, The Nikkan Kogyo Shimbun, Ltd., (134-135) 2016.

[2]Chapter 8 Knowledge Structuring for Sustainable Development and the Hozo Tool(Francisco J. Garcia-Penalvo, Alicia Garcia-Holgado) Jenny S. Huang, Kouji Kozaki, Terukazu Kumazawa, “Open Source Solutions for Knowledge Management and Technological Ecosystems”, IGI Gloval, (195-221) 2017.

Contributions to International Conferences and Journals

K.Komatani	ACL 2016 (Programme Committee)
K.Komatani	Interspeech2016 (Programme Committee)
K.Komatani	SIGDIAL 2016 (Programme Committee)
K.Komatani	DADA 2016 (Programme Committee)
K.Komatani	SLT 2016 (Reviewer)
K.Komatani	ACL 2017 (Reviewer)
K.Komatani	IWSDS 2017 (Scientific Committee)
K.Kozaki	JIST2016 (Programme Committee)
K.Kozaki	IESD2016 (Organaizing Committtee)
K.Kozaki	KEOD2016 (Programme Committee)

K.Kozaki	ISWC2016 (Local Organizing Committee)

Publications in Domestic Meetings

The Japan Society of Artificial Intelligence	9 papers
Information Processing Society of Japan	1 paper

Academic Degrees

Master Degree for Engineering S. Torimura	Evaluation of Keyword Explorer and a Proposal of Guideline for Expanding Ontology on Biomimetics
Bachelor Degree for Engineering K. Nishida	A Ranking Method for Paths among Resources in Linked Data and its Improvement

Grant-in-Aid for Scientific Research

K. Komatani	Acquiring Domain Knowledge through Dialogues for Dialogue Systems	¥5,720,000
K. Kozaki	Intelligent Exploration of Semantic Data through Domains based on Multi-dimension Viewpoint Management of Ontologies	¥3,120,000
K. Kozaki	A Cross Sectional Analysis Platform for Local Problems based on Integration of Public Information, Open Data and Social Information	¥1,950,000
R. Takeda	Automatic Improvement of Acoustic and Language Models of Automatic Speech Recognition through Spoken Dialogue	¥1,300,000

Entrusted Research

K. Kozaki	Tokyo University	Research on Use of Advanced Medical Information based on a Medical Knowledge Infrastructure	¥300,000

Cooperative Research

K. Komatani	Honda Research Institute Japan Co., Ltd.	¥3,600,000
K. Komatani	Honda Research Institute Japan Co., Ltd.	¥600,000

Department of Architecture for Intelligence

Original Papers

[1]Continuous Music-emotion Recognition Based on Electroencephalogram, N. Thammasan, K. Moriyama, K. Fukui, and M. Numao: IEICE Transactions, E99-D (4) (2016) 1234-1241.

[2]Familiarity Effects in EEG-based Emotion Recognition, N. Thammasan, K. Moriyama, K. Fukui, and M. Numao: Brain Informatics, (2016) 1-12.

[3]Development and Application of the Renewable Energy Regional Optimization Utility Tool for Environmental Sustainability: REROUTES, K. Hori, T. Matsui, T. Hasuike, K. Fukui, and T. Machimura: Renewable Energy, 93 (2016) 548-561.

[4]Food CMS, Integrated Information Sharing System of Food Production, Marketing, and Consumption, T. Kashima, S. Matsumoto, K. Fukui, and T. Hasuike: Information Engineering Express, 2 (3) (2016) 31-42.

International Conferences

[1]Application of Deep Belief Networks in EEG-based Dynamic Music-emotion Recognition, N. Thammasan, K. Fukui, and M. Numao: Proc. The International Joint Conference on Neural Networks (IJCNN 2016), (2016) .

[2]Sleep Pattern Discovery via Visualizing Cluster Dynamics of Sound Data, H. Wu, T. Kato, T. Yamada, M. Numao, and K. Fukui: Proc. The 29th International Conference on Industrial, Engineering & Other Applications of Applied Intelligent Systems (IEA/AIE 2016), (2016) .

[3]Distance-based Evaluation Function for Firstorder Rule Construction, N. Khamsemanan, C. Nattee, and M. Numao: Proc. 26th International Conference on Inductive Logic Programming (ILP 2016), (2016) .

[4]An Investigation of Annotation Smoothing for EEG-based Continuous Music-emotion Recognition, N. Thammasan, K. Fukui, and M. Numao: Proc. The 2016 IEEE International Conference on Systems, Man, and Cybernetics (SMC 2016), (2016) 3323-3328.

[5]Integrating Class Information and Features in Cluster Analysis based on Evolutionary Distance Metric Learning, W. Kalintha, S. Ono, M. Numao, and K. Fukui: Proc. the 20th Asia-Pacific Symposium on Intelligent and Evolutionary Systems (IES-2016), (2016) .

[6]Error Detection of Ocean Depth Series Data with Area Partitioning and Using Sliding Window, S. Hayashi, S. Ono, S. Hosoda, M. Numao, and K. Fukui: Proc. IEEE 15th International Conference on Machine Learning and Applications (ICMLA 2016), (2016) 1029-1033.

[7]Implementation of Integrated Information Sharing System of Food Production, Marketing, and Consumption, T. Kashima, S. Matsumoto, T. Hasuike, and K. Fukui: Proc. 2016 5th IIAI International Congress on Advanced Applied Informatics, (2016) 791-796.

[8]Feature Function Design in Conditional Random Field Using Decision Tree Learning Applied to Error Detection of Ocean Observation Data, Y. Kamikawaji, H. Matsuyama, K. Fukui, S. Hosoda, and S. Ono: Proc. The 2016 IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2016), (2016) .

[9]Personal Sleep Pattern Visualization via Clustering on Sound Data, H. Wu, T. Kato, T. Yamada, M. Numao, and K. Fukui: Proc. AAAI 2017 Joint Workshop on Health Intelligence, (2017) 592-599.

[10]Kernelized Evolutionary Distance Metric Learning for Semi-supervised Clustering, W. Kalintha, S. Ono, M. Numao, and K. Fukui: Proc. 31st AAAI Conference on Artificial Intelligence, Student Abstract and Poster Program, (2017) 4945-4946.

[11]Multimodal fusion of EEG and musical features in music-emotion recognition, N. Thammasan, K. Fukui, and M. Numao: Proc. 31st AAAI Conference on Artificial Intelligence, Student Abstract and Poster Program, (2017) 4991-4992.

[12]An Investigation of Effect of Bioluminescent Light on Human using Electroencephalogram (poster), N. Thammasan, M. Iwano, K. Moriyama, K. Fukui, K. Kawintiranon, Y. Buatong, S. Inagaki, T. Wazawa, T. Nagai, and M. Numao: The 23nd International Display Workshop in conjunction with Asia Display (IDW/AD2016), Fukuoka, Japan, December 7-9, 2016.

[13]Development and Application of a Multi-Objective Optimization Tool for Renewable Energy Mix in Municipalities (oral), K. Hori, T. Matsui, S. Ono, K. Fukui, T. Hasuike, and T. Machimura: The 12th Biennial International Conference on EcoBalance, Kyoto, Japan, October 3-6, 2016.

[14]Music-emotion Recognition based on Wearable Dry-electrode Electroencephalogram (oral), P. Senachakr, N. Thammasan, K. Fukui and M. Numao: Workshop on Computation: Theory and Practice (WCTP-2016), Cebu City, Philippines, September 21-22, 2016.

[15]Multimodal Latent Feature Learning for Psycho-Physiological Stress Modelling and Detection (oral), J. L. Hagad, K. Fukui, and M. Numao: 7th International Workshop on Empathic Computing (IWEC 2016),

Phuket, Thailand, Aug 22-26, 2016.

[16]Application of Annotation Smoothing for Subject-independent Emotion Recognition based on Electroencephalogram (oral), N. Thammasan, K. Fukui, and M. Numao: 7th International Workshop on Empathic Computing (IWEC 2016), Phuket, Thailand, Aug 22-26, 2016.

Review Papers

Applications of Data Mining, S. Tsumoto, K. Yada, K. Fukui, T. Onoda, A. Abe, and H. Nakajima, Japan Journal of Medical Informatics, Japan Association for Medical Informatics, 36 (2016), 315-324.

Human Resource Development of AI Engineers, K. Fukui, Journal of the Japanese Society for Artificial Intelligence, Japanese Society for Artificial Intelligence, 32 (2017), 68.

Patents

[1]K20150352 Sleep state analysis supporting device and sleep state analysis supporting program, JP2016-089830

Contributions to International Conferences and Journals

M. Numao	New Generation Computing (Area Editor)
M. Numao	Frontiers of Science Symposium (Advisory Board)
M. Numao	Pacific Rim International Conference on Artificial Inteligence (Program Committee Member)
M. Numao	International Workshop on Empathic Computing (Organizer/Program co-Chair)
M. Numao	Workshop on Computing Theory and Practice (General Co-chairs)
M. Numao	ICT4 Aging Well (Program Committee Member)
K. Fukui	Workshop on Computation: Theory and Practice (WCTP-2016) (Program Committee Member)
K. Fukui	Workshop on Mathematical Modeling and Problem Solving (PDPTA'16) (Program Committee Member)
K. Fukui	International Conference on Business Management of Technology (BMOT2016) (Program Committee Member)

Publications in Domestic Meetings

The 30th Annual Meeting on Japanese Society for Artificital Intelligence	7 papers
The 108th SIG Mathematical Modeling and Problem Solving, The Information Processing Society of Japan	1 paper
The 26th Intelligent System Symposium	1 paper
2016 Fall Meeting on The Oceanographic Society of Japan	1 paper
The 68th SIG Information Systems, The Institute of Electrical Engineers of Japan	1 paper

Academic Degrees

Master Degree for Information Science S. Hayashi	Error Detection of Ocean Data considering Spacial Autocorrelation
Master Degree for Information Science W. Fujita	Two-Stage Reinforcement Learning Algorithm for Quick Cooperation in Repeated Games
Master Degree for Information Science M. Furukawa	Evaluation of Music on Automatic Composition System reflecting Affection

Grant-in-Aid for Scientific Research

M. Numao	Distributed Inference to Support Inter-Subjective Formalization and Its Application to Sensor Network	¥0,000
K. Fukui	Causality Mining from Event Sequence Data and Its Applications to Causality Discovery in Earthquakes and Damages	¥1,170,000

Cooperative Research

M. Numao	office FUKUROU Co., Ltd., Tokyo City University	¥0,000

Other Research Fund

K. Fukui	Panasonic Corporation	¥1,300,000

Department of Semiconductor Materials and Processes

Original Papers

[1]Hydrogen generation from water using Si nanopowder fabricated from Si swarf, K. Imamura, K. Kimura, S. Fujie, H. Kobayashi: J. Nanopart. Res., 18 (2016) 116-1-7.

[2]The photoluminescence of multicolor silicon, E. Pincik, R. Brunner, H. Kobayashi, M. Mikula, P. Vojtek, J. Gregus, Z. Zabudla, K. Imamura, P. Svec, Jr.: J. Chin. Adv. Mater. Soc., 8 (2016) 158-171.

[3]Intra-grain conduction of self-doped polyaniline, Y. Usami, K. Imamura, T. Akai, D.-C. Che, H. Ohoyama, H. Kobayashi, T. Matsumoto: J. Appl. Phys., 120 (2016) 084308-1-7.

[4]Improvement of the positive bias stability of a-IGZO TFTs by the HCN treatment, M.-H. Kim, M.-J. Choi, K. Kimura, H. Kobayashi, D.K. Choi: Solid-State Electronics, 126 (2016) 87-91.

[5]Optical Simulation for Multi-Striped Orthogonal Photon-Photocarrier-Propagation Solar Cell ((MOPSC)-S-3) with Redirection Waveguide, A. Ishibashi, H. Kobayashi, T. Taguchi, K. Kondo, T. Kasai: 3D Res, 7 (2016) 33-1-5.

[6]Light trapping of crystalline Si solar cells by use of nanocrystalline Si layer plus pyramidal texture, K. Imamura, T. Nonaka, Y. Onitsuka, D. Irishika, H. Kobayashi: Appl. Surf. Sci., 395 (2017) 50-55.

[7]Ultrathin SiO_2 layer formed by the nitric acid oxidation of Si (NAOS) method to improve the thermal-SiO2/Si interface for crystalline Si solar cells, T. Matsumoto, H. Nakajima, D. Irishika, T. Nonaka, K. Imamura, H. Kobayashi,: Appl. Surf. Sci., 395 (2017) 56-60.

[8]Multifractal analysis and optical properties of nanostructured silicon layers, S. Jurecka, T. Matsumoto, K. Imamura, H. Kobayashi: Appl. Surf. Sci., 395 (2017) .

[9]About the optical properties of oxidized black silicon structures, E. Pincik, R. Brunner, H. Kobayashi, M. Mikula, M. Kučera, P. Švec Jr., J. Greguš, P. Vojtek, Z. Zábudlá, K. Imamura, M. Zahoran: Appl. Surf. Sci., 395 (2017) .

[10]Mechanism of ultra-low reflectivity for nanocrystalline Si/crystalline Si structure formed by surface structure chemical transfer method, K. Imamura, D. Irishika, H. Kobayashi: J. Appl. Phys., 121 (2017) 013107-1-5.

[11]Effect of HCN passivation on silicon oxide thin layer, M. Kopani, M. Mikula, E. Pincik, H. Kobayashi, M. Takahashi: J. Chinese Adv. Mater. Soc., 5 (2017) 57-64.

[12]Beads-milling of waste Si sawdust into high-performance nanoflakes for lithium-ion batteries, T. Kasukabe, H. Nishihara, K. Kimura, T. Matsumoto, H. Kobayashi, T. Kyotani: Sci. Rep., 7 (2017) 42734-1-10.

[13]Improvement of cyclability of Li-ion batteries using c-coated Si nanopowder electrode fabricated from Si swarf with limitation of delithiation capacity, K. Kimura, T. Matsumoto, H. Nishihara, T. Kasukabe, T. Kyotani and H. Kobayashi: J. Electrochem. Soc., 164 (6) (2017) A995-1001.

International Conferences

[1]~20% efficiency black Si solar cells fabricated by the SSCT method with simple structure (plenary), H.

Kobayashi: 14th International Symposium on Novel and Nano Materials (ISNNM-2016).

[2]High efficiency crystalline Si solar cells fabricated with new chemical technologies and Si nanopowder for hydrogen generation and photoluminescence (invited), H. Kobayashi: Solid State Surfaces and Interface 2016 (SSSI 2016).

[3]High conversion efficiency black Si solar cells with a nanocrystalline Si layer (invited), K. Imamura: Solid State Surfaces and Interface 2016 (SSSI 2016).

[4]Li ion battery with Si nanopowder fabricated from Si swarf (invited), T. Matsumoto, K. Kimura, H. Kobayashi: Solid State Surfaces and Interface 2016 (SSSI 2016).

[5]Hydrogen Generation in the Body to Avoid Oxidation Stress (oral), H. Kobayashi, R. Imamura: 1st International Conference on COI Program.

[6]Development of electrochemical planarization method for fabrication of atomically flat 4H-SiC wafers (poster), T. Akai, K. Imamura, H. Kobayashi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, and 4th KANSAI Nanoscience and Nanotechnology International Symposium.

[7]Achievement of High Efficiency Nanocrystalline Si/Crystalline Si Solar Cells with PSG passivation (poster), D. Irishika, K. Imamura, H. Kobayashi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, and 4th KANSAI Nanoscience and Nanotechnology International Symposium.

[8]Effective passivation method for ultra-low Reflectivity Nanocrystalline Si/Si solar cells using phosphosilicate (poster), Y. Onitsuka, K. Imamura, H. Kobayashi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, and 4th KANSAI Nanoscience and Nanotechnology International Symposium.

[9]Greatly Improved of Cyclability for Li-ion Batteries Using Si Nanopowder Electrode Fabricated from Swarf (poster), K. Kimura, T. Matsumoto, Y. Kanatani, T. Higo, H. Kobayashi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, and 4th KANSAI Nanoscience and Nanotechnology International Symposium.

Patents

[1]K20090216 Method for removal of contamination on semiconductor surfaces and producing semiconductor manufacturing apparatuses, K20090216

[2]K20150198 Soild preparation, method of solid preparation, and method of hydrogen generation, PCT/JP2017/000749

[3]K20160210 Anode materials od Li ion batteries, Li ion batteries and operation method, and method of production of Li ion battery anode or anode materials, 21602210071.

[4]K20090325 Method of producing semiconductor manufacturing apparatuses, producing appraruses of semiconductor manufacturing apparatuses, semiconductor manufacturing apparatuses, and materials for surface structure transfer, TW555077

[5]K20160110 Method of producing Si small powder, and/or its aggregates and materials for hydrogen generation for human bodies and its production methods, and hydrogen water, its production methods and producing apparatuses, JP2016-162520

[6]K20160044 Composite resin materials, production apparatuses for composite resin materials, and

method of producing composite resin materials and additives for composite resin materials, JP2016-161307

[7]K20080345 Solar cells, its production methods, and its solar cell manufacturing apparatuses, TW54465

[8]K20150345 Li ion battery anodes, Li ion batteries, methods of producing Li ion battery anode materials, and itd production apparatuses, JP2016-076663

Contributions to International Conferences and Journals

H. Kobayashi	Applied Surface Science (Editor)
H. Kobayashi	Solid State Surfaces and Interface 2016 (SSSI 2016) (Science Committee Chairperson)
T. Matsumoto	Solid State Surfaces and Interface 2016 (SSSI 2016) (Science Committee)
K. Imamura	Solid State Surfaces and Interface 2016 (SSSI 2016) (Science Committee)

Publications in Domestic Meetings

Japan Applied Physics Meeting	7 papers
Surface Scinece Society of Japan	2 papers
Battery Symposium in Japan	2 papers
The Electrochemical Society of Japan	2 papers
Japan Applied Physics Meeting-Kansai	1 paper
The Electrochemical Society of Japan-Kansai	1 paper
Symposium on Photon and Beam Science	1 paper

Academic Degrees

Doctor of Science T. Akai	Surface modification for SiC and Si using electrochemical methods and their mechanism
Doctor of Science D. Irishika	Ultralow reflectance Si surfaces by nanocrystalline Si layer and fabricatin of high effiency crystalline Si solar cells
Doctor of Science K. Kimura	Fabrication of Si materials and application to energy devices
Master of Science Y. Onitsuka	Effective passivation method for nanocrystalline Si layer using phosphosilicate grass and improvement of conversion efficiency of crystalline Si solar cells
Master of Science S. Fujie	Hydrogen generation by the reaction of Si nanopowder with water
Master of Science Y. Yamada	Passivation of silicon surface with nitric acid SiO_2 layer and fabrication of silicon solar cells with point-conact electrode

Grant-in-Aid for Scientific Research

H. Kobayashi	Fabrication of Si nanoparticles from Si swarf and application of Si nanoparticles to silicon solar cells	¥9,230,000
G. Hasegawa	Application of thin Si nanoparticles to anodes of Li ion batteries with high capapcities.	¥2,600,000

Entrusted Research

H. Kobayashi	Japan Science and Technology Agency	Fabrication of silicon surface with ultra-low reflectivity with the interface control method and development of crystalline silicon solar cells with ultra-high efficiency	¥63,934,000

Cooperative Research

H. Kobayashi	Nisshin Kasei Co. Ltd.	¥0,000

Other Research Fund

H. Kobayashi	The Iwatani Naoji Foundation	¥2,000,000

Department of Advanced Hard Materials

Original Papers

[1]Photocatalytic activity under UV/Visible light range of Nb-doped titanate nanostructures synthesized with Nb oxide, Jong Min Byun, Hye Rim Choi, Young Do Kim, Tohru Sekino, Se Hoon Kim: Applied Surface Science, 415 (2016) 126-131.

[2]RGO/Ag_2S/TiO_2 ternary heterojunctions with highly enhanced UV-NIR photocatalytic activity and stability, T. Liu, B. Liu, L. Yang, X. Ma, H. Li, S. Yin,T. Sato, T. Sekino, Y. Wang: Applied Catalysis B: Environmental, 204 (2017) 593-601.

[3]Smart window coating based on F-TiO_2-KxWO_3 nanocomposites with heat shielding, ultraviolet isolating, hydrophilic and photocatalytic performance, Tongyao Liu, Bin Liu, Jing Wang, Linfen Yang, Xinlong Ma, Hao Li, Yihong Zhang, Shu Yin, Tsugio Sato, Tohru Sekino and Yuhua Wang: Scientific Reports, 6 (2016) Article number 27373.

[4]Fabrication of a TiO_2-P25/(TiO_2-P25+TiO_2 nanotubes) junction for dye sensitized solar cells, N. H. Hao, G. Gyawali, T. Sekino, S. W. Lee: Progress in Natural Science: Materials International, 26 (4) (2016) 375-379.

[5]Induction of Oxidative Stress in HeLa Cells with Reactive Oxygen Species generated in Titanium Oxide Nano-tubes, Hisataka Nishida, Tomonari Tanaka, Yoshitomo Honda, Tomoyo Goto, Sunghun Cho, and Tohru Sekino: Nano Biomedicine, 81 (1) (2016) 41-50.

[6]Oxidation of Pentatitanium Trisilicide (Ti_5Si_3) Powder at High Temperature, J. Matsushita, T. Satsukawa, N. Iwamoto, X. L. Wang, J. F. Yang, T. Goto, T. Sekino, X. Y. Wu, S. Yin, T. Sato: Materials Science Forum, 868 (2016) 38-42.

[7]Influence of Heater Diameter on the Temperature Distribution and Melt Convection in a Directional Solidification System for Mono-Like Silicon Growth, M. M. Gao, H. Y. Jing, J. Li, S. Liang, H. B. Li, T. Sekino: Materials Science Forum, 868 (2016) 100-104.

[8]Translucency and low-temperature degradation of silica-doped zirconia, Takashi Nakamura, Yoshiro Nakano, Hirofumi Usami, Kazumichi Wakabayashi, Hiroshi Ohnishi, Tohru Sekino, and Hirofumi Yatani: Dental Materials Journal, 35 (4) (2016) 571–577.

[9]Thermal conductivity of hot-pressed hexagonal boron nitride, Takafumi Kusunose, and Tohru Sekino: Scripta Materialia, 124 (2016) 138–141.

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[15]Tribological Behaviors of Dense Gelcasting Nanocomposites, Sung Hun CHO, Sang Hoon Jeong, Bum Sung Kim, Tohru Sekino, Soo Wohn Lee, Seung-Ho Kim: Materials Science Forum, 868 (2016) 56-60.

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[2]Photocatalytic Property of TiO_2-modified Hydroxyapatite Synthesized by Hydrothermal Method (oral), Tomoyo Goto, Sung Hun Cho, Tohru Sekino: 26th IUPAC International Symposium on Photochemistry, Oaska Japan, April 3-8, 2016.

[3]Synthesis and Characterization of TiO_2 nanotubes by Microwave Assisted Hydrothermal Method: An effect of process parameters on Nanostructures formation (poster), Cho Sung Hun, Tohru Sekino: 26th IUPAC International Symposium on Photochemistry, Oaska Japan, April 3-8, 2016.

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Patents

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Contributions to International Conferences and Journals

T. Sekino	International Journal of Applied Ceramic Technology (Associate Editor)
T. Sekino	Functional Materials Letters (Editorial Board)
T. Sekino	Journal of Silicate Based and Composite Materials (Editorial Board)
T. Sekino	High Temperature Materials and Processes (International Editorial Board)
T. Sekino	IUPAC Photochemistry 2016 (Local Organizing Committee)
T. Sekino	The Science of Engineering Ceramics (EnCera2016) (Organizing Committee)
T. Sekino	The 7th International Symposium on Functional Materials (ISFM2016) (International Advisory Committee)
T. Sekino	The International Symposium on Advanced Functional Materials (ISAFM2016) (International Advisory Committee)
T. Sekino	The 4th International Conference on Competitive Materials and Technology Processes (IC-CMTP4) (The Organizers)
T. Sekino	The International Symposium on Eco-Materials Processing and Design (ISEPD 2017） (Organizing Committee/Editorial Committee)

T. Sekino	Materials Challenges in Alternative and Renewable Energy 2017 (MCARE2017) (International Advisory Committee)
T. Sekino	The 12th Pacific Rim Conference on Ceramic and Glass Technology (,PacRim 12) (Symposium Organizer)
T. Sekino	The 3rd International Conference Tech-connection of Advanced Materials (TAM2017) (Steering Committee)
T. Sekino	6th Advanced Functional Materials and Devices (AFMD-2017) (International Advisory Committee)
T. Sekino	Advanced Ceramics and Technologies for Sustainable Energy Applications toward a Low Carbon Society (ACTSEA2017) (International Advisory Committee)
T. Sekino	The 34th Korea-Japan International Seminar on Ceramics 2017 (Organizing Committee)
T. Sekino	The International Symposium on Hybrid Materials and Processing (HyMaP 2017) (Vice Chair)
T. Sekino	The 42th International Conference & Exposition on Advanced Ceramics & Composites (ICACC) (Symposiuym Co-organizer)
T. Sekino	International Conference on Characterization and Control of Interfaces for High Quality Advanced Materials (ICCCI 2018) (Organizing Committee)
T. Sekino	The 13th Pacific Rim Conference on Ceramic and Glass Technology (,PacRim 13) (Organizing Committee)
M. Tane	Materials Transactions (Editrial committee)

Publications in Domestic Meetings

The Jaoanese Society for Dental Materials and Devices, The 67th General Session	2 papers
The Ceramic Society of Japan, Tokai Branch Symposium	1 paper
The Ceramic Society of Japan, Kansai Branch Award Memorial Symposium	1 paper
Japan Academy of Esthetic Dentistry, the 27th Conference	1 paper
The Ceramic Society of Japan, The 29th Fall Meeting	5 papers
2016 Fall Meeting, The Japan Institute of Metals and Materials	2 papers
Young Scientist Seminar on Bulk Ceramics Research 2016	1 paper
The Ceramic Society of Japan, Environemtal and Resource Divisiton Seminar	1 paper
Ceramics Research Symposium 2016	3 papers
The Japan Institute of Light Metals, Kansai Branch Young Scientists and Students Seminar	1 paper
New Ceramics Forum, the 225th Seminar	1 paper
The 20th Symposium on Ceramics in Medicine, Biology and Biomimetics	1 paper
The Ceramic Society of Japan, 2017 Annual Meeting	8 papers
8th Annual Meeting of Japan Society for Medical Application of Stable Isotope and Biogas	1 paper
2017 Spring Meeting, The Japan Institute of Metals and Materials	1 paper

Academic Degrees

Master Degree for Engineering H. Nishiyama	Change in elastic properties and internal friction in β-phase Ti alloys during room-temperature aging
Master Degree for Engineering Y. Rikiso	Crystal Structure Control of Zirconia Ceramics by Incorporation of Reduced Titanium and Oxygen Vacancy
Master Degree for Engineering W. Jiang	Fabrication and Semiconductor Properties of Binary Oxyde Composites via Sponteneous Phase Separation

Grant-in-Aid for Scientific Research

T. Sekino	Physical Photochemical Functionalization of Oxide Nanotubes through Hierarchical Structure Tuning	¥57,330,000
M.Tane	Development of original method for the determination of single-crystalline elastic properties	¥910,000

M.Tane	Elastic properties of Mg alloys and Mg-based intermetallics	¥1,690,000
T. Goto	Hydrothermal synthesis and investigation of Transition metal substituted hydroxyapatite for environmental remediation materials.	¥1,690,000

Contribution to Research

T. Sekino	Nikkato Corporation	¥1,000,000
T. Sekino	Inaba Rubber Co. Ltd.	¥1,500,000
T. Sekino	Hakusui Tech Co. Ltd.	¥500,000
M. Tane	The Light Metal Educational Foundation, Inc.	¥150,000
M. Tane	The Iron and Steel Institute of Japan (ISIJ)	¥1,000,000
T. Goto	The Kazuchika Okura Memorial Foundation	¥1,000,000
M. Tane	The Light Metal Educational Foundation, Inc.	¥200,000

Cooperative Research

T. Sekino	Sun Moon University	¥4,605,000
T. Sekino	Korea Institute of Ceramic Engineering and Technology (KICET)	¥4,790,000
T. Sekino	Lotus Alloy Co., Ltd.	¥420,000
T. Sekino	Daiichi Kigenso Kagaku Kogyo Co., Ltd.	¥1,500,000
M. Tane	Toray Co.,Ltd	¥1,000,000

Department of Advanced Interconnection Materials

Original Papers

[1]Die-attaching silver paste based on a novel solvent for high-power semiconductor devices, Jinting Jiu, Hao Zhang, Shijo Nagao, Tohru Sugahara, Noriko Kagami, Youji Suzuki, Yasuyuki Akai, Katsuaki Suganuma: Journal of Materials Science, 51 (7) (2016) 3422-3430.

[2]Fast, scalable, and eco-friendly fabrication of an energy storage paper electrode, Hirotaka Koga, Hidetsugu Tonomura, Masaya Nogi, Katsuaki Suganuma and Yuta Nishina: Green Chemistry, 18 (2016) 1117-1124.

[3]Dry-growth of silver single-crystal nanowires from porous Ag structure, Chuantong Chen, Shijo Nagao, Jinting Jiu, Hao Zhang, Tohru Sugahara and Katsuaki Suganuma: Applied Physics Letters, 108 (26) (2016) 263105:1-5.

[4]Diverse Adsorption/Desorption Abilities Originating from the Nanostructural Morphology of VOC Gas Sensing Devices Based on Molybdenum Trioxide Nanorod Arrays, Shuren Cong, Tohru Sugahara, Tingting Wei, Jinting Jiu, Yukiko Hirose, Shijo Nagao, and Katsuaki Suganuma: Advanced Materials Interfaces, 3 (14) (2016) 1600252:1-8.

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[6]Understanding corrosion mechanism of Sn–Zn alloys in NaCl solution via corrosion products characterization, J.-C. Liu, Z.-H. Wang, J.-Y. Xie, J.-S. Ma, G. Zhang and K. Suganuma: Materials and Corrosion, 67 (5) (2016) 522-530.

[7]Stretchable and transparent electrodes based on pattered silver nanowire by laser-induced forward transfer for non-contacted printing technique, Teppei Araki, Rajesh Mandamparambil, Dirk van Bragt, Jinting Jiu, Hirotaka Koga, Jeroen van den Brand, Tsuyoshi Sekitani, Jaap den Toonder, Katsuaki Suganuma: Nanotechnology, 27 (45) (2016) 45LT02 (8pp).

[8]Effects of intermetallic-forming element additions on microstructure and corrosion behavior of Sn−Zn

solder alloys, Jian-Chun Liu, Zheng-Hong Wang, Jing-Yang Xie, Ju-Sheng Ma, Qing-Yu Shi, Gong Zhang, Katsuaki Suganuma: Corrosion Science, 112 (2016) 150-159.

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[13]Nano-volcanic Eruption of Silver, Shih-kang Lin, Shijo Nagao, Emi Yokoi, Chulmin Oh, Hao Zhang, Yu-chen Liu, Shih-guei Lin & Katsuaki Suganuma: Scientific Reports, 6 (2016) 34769.

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[15]In situ bridging effect of Ag2O on pressureless and low-temperature sintering of micron-scale silver paste, Hao Zhang, Yue Gao, Jinting Jin, Katsuaki Suganuma: Journal of Alloys and compounds, 696 (2017) 123–129.

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[19]Mechanical Deformation of Sintered Porous Ag Die Attach at High Temperature and Its Size Effect for Wide-Bandgap Power Device Design, Chuantong Chen , Shijo Nagao, Hao Zhang, Jinting Jiu, Tohru Sugahara, Katsuaki Suganuma, Tomohito Iwashige, Kazuhiko Sugiura, Kazuhiro Tsuruta: Journal of Electronic Materials, 46 (2) (2017) 1576–1586.

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Jinting Jiu, Samaneh Ranjbar, Yukiko Hirose, Makoto Karakawa, Shijo Nagao, Tom Aernouts and Katsuaki Suganuma: Journal of Materials Chemistry C, 2017 (4) (2017) 889-895.

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[1]Cu paste sinter joining for die-attach of high Tj power devices realized by PEG solvent optimization (oral), Shijo Nagao, Katsuaki Suganuma: PCIM ASIA 2016.

[2]Effect of Conductive Nanomaterials on Radio-waves Transmission Performance of Printed Antenna (oral), Koga H., Nogi M., Suganuma K.: IEEE NANO 2016.

[3]High Thermal Stability of SiC Packaging with Thermosetting Imide-Based Nanocomposite Encapsulating Materials Combined with Sintered Ag Paste Die-Attach (oral), Shijo Nagao, Zhang Hao, Katsuaki Suganuma: 16th International Conference on Nanotechnology (IEEE NANO 2016).

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[5]Power device packaging targeting high temperature operation with maximum T_case = 250ºC (oral), Shijo Nagao, Zhang Hao, Katsuaki Suganuma: 49th International Symposium on Microelectronics.

[6]Electromigration behavior in sintered Ag-paste wire bonding under high current density (oral), GChuantong Chen, Shijo Nagao and Katsuaki Suganuma: 15th International Symposium on Microelectronics and Packaging (ISMP 2016).

[7]Interconnection Technology for WBG Power Devices (Keynote) (invited), GK.Suganuma: 15th International Symposium on Microelectronics and Packaging (ISMP 2016),.

[8]Nano-ink development for wearable printed electronics (Invited) (invited), GK. Suganuma, M. Nogi, H. Koga, J. Jiu, and T. Sugahara: International Conference on Radiation Curing in Asia.

[9]Conductive Adhesive and Stress Migration Direct-bonding (Keynote) (invited), Shijo Nagao: Xiamen International Workshop 2016 on Soft Matter.

[10]Thermostable electroless plating optimized for Ag sinter die-attach realizing high TJ device packaging (oral), H. Zhang, S. Nagao, T. Sugahara, K. Suganuma: ESTC 2016.

[11]Development and Potential of self-reductive Cu submicron particle paste for high temperature die-attach material (poster), Shijo Nagao, Tohru Sugahara, Jinting Jiu, and Katsuaki Suganuma: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium 2016.

[12]Two-step Sintering of Submicron Cu Particle/Cu Complex Ink for High Conductive Patterns and Their Application on Flexible Antenna (poster), Jinting Jiu, and Katsuaki Suganuma: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium 2016.

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ICFPE 2016.

[16]High Thermal Stability of SiC Packaging with Thermosetting Imide-Based Nanocomposite Encapsulating Materials Combined with Sintered Ag Paste Die-Attach (oral), Takuo Sugioka, Shijo Nagao, Satoshi Ogawa, Teruhisa Fujibayashi, Yasutaka Sumida, Zhang Hao, Katsuaki Suganuma: 16th International Conference on Nanotechnology (IEEE NANO 2016).

[17]Effect of Conductive Nanomaterials on Radio-waves Transmission Performance of Printed Antenna (oral), Goya Y., Koga H., Nogi M., Suganuma K.: IEEE NANO 2016.

[18]Cu paste sinter joining for die-attach of high Tj power devices realized by PEG solvent optimization (oral), Hiroki Yoshikawa, Shijo Nagao, Takahiko Sakaue, Yoichi Kamikoriyama, Takahumi Sasaki, Katsuaki Suganuma: PCIM ASIA 2016.

[19]Gas Sensor Property of MoO3 Nanorod Arrays synthesized by Metal Organic Decomposition Method (invited), T. sugahara, S. Cong, K. Suganuma: KJ Ceramics 33: The 33rd International Korea-Japan Seminar on Ceramics.

[20]Enhancement of Efficiency of the Organic Solar Cell by Applying a Simple Solution-Processed MoOx Buffer Layer (poster), Shuren Cong, Afshin Hadipour, Tohru Sugahara, Jinting Jiu, Yukiko Hirose, Karakawa Makoto: 2016 E-MRS Spring Meeting and Exhibi.

[21]Gas Sensor Property of MoO3 Nanorod Arrays synthesized by Metal Organic Decomposition Method (poster), T. sugahara, S. Cong, K. Suganuma: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium 2016.

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Printed electrode technology for wearable devices, K.Suganuma, Fine Chemical, CMC Publishing Co.,Ltd., 45[8] (2016), 5-14.

Thermal-resist packaging of power device realized by accurate weight-load-controlling sintering jigs T. Shimoyama, S. Nagao, K. Suganuma, Electronics Pakaing Technology, Gicho Business Communications Co., Ltd., 32[12] (2016), 22-25.

Books
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[2] The development of silver nanowire which aimed for wearable and stretchable devices. (E. Tamiya, T. Sekitani, Y. Yagi) T. Araki, K.Suganuma, T. Sekitani, “Bio-sensing Device Technology for Connecting to IoT”, CMC, (136-144) 2016.

[3] (K.Suganuma) K.Suganuma, “Development of health care wearable device”, CMC, 2017.

[4] (K.Suganuma) T. Sugahara, “Development of health care wearable device”, CMC, (168) 2017.

[5] (K.Suganuma) T. Sugahara, “Development of health care wearable device”, CMC, (116) 2017.

Patents
[1]K110420B1, Metal nanowire-contained transparent conductive films and its coating liguid. 2016-164659

[2]K20150308, Conductive paste, connecting electrode structure and its fabrication method.2016-091804

[3]K20160005 Conductive composition.2016-120219

[4]K20160023 Joining instrument.2016-158565

[5]K20160103 Semiconductive instrument.2016-130300

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[7]K20160330 Conductive composition and semiconductive instrument. 2017-009524

[8]K20160363 Joining materials, its preparation method and fabrication of joining structure.2017-032043

[9]KB2016004, Heat treatment method2016-092104

[10]G20150081WO, Method of forming an amorphous silver coating for direct bonding, PCT/JP2017/004943

[11]G20160044WO,SILVER PARTICLE PRODUCING METHOD,SILVER PARTICLES, AND SILVER PASTE, PCT/JP2016/071627

[12]G20160120WO Metal nanowire layer contained substrate and its fabrication method. PCT/JP2017/010264

[13]K20110377 Fabrication of electrically conductive path and its conductive composition which can be shaped by light irradiation or microwave heating. 2012-061816

[14]KP2013051, Conposition of Cu conductive path and its fabrication method.2013-544197

[15]KP2014007, Electrically conductive adhesive contained electrical devices, 2013-556513

[16]KP2015044 Joining method. 2015-515653

[17]G20120037CN, Conposition of Cu conductive path and its fabrication method., 201280055788.5

[18]G20120096CN, TRANSPARENT CONDUCTIVE INK, AND METHOD FOR PRODUCING TRANSPARENT CONDUCTVE PATTERN, 201380021843.29999

[19]K20080084, Preparation of solder and its bonded joints.K20080084

[20]K20080371, Preparation of electrical materials and related electrical and light-emitting devices. K20080371

[21]K20090402, Polyurethane-used strechable electrical pattern and substrate material.,K20090402

Grant-in-Aid for Scientific Research

K. Suganuma	Science of Hetero-Interface of Advanced Power Devises in Extreme Environments	¥17,160,000
K. Suganuma	ストレスマイグレーションを利用した構造材接合	¥1,950,000
T. Sugahara	ナノ材料応用に向けたデバイス製造プロセスの簡略化と半導体ガスセンサ特性の向上	¥2,210,000
T.Daio	固体高分子形燃料電池の科学状態劣化を明らかにする３次元電顕解析	¥502,000

Entrusted Research

K. Suganuma	NEDO	SIP（戦略的イノベーション創造プログラム）／次世代パワーエレクトロニクス／SiC に関する拠点型共通基盤技術開発／SiC 次世代パワーエレクトロニクスの統合的研究開発	¥33,114,000
K. Suganuma	NEDO	クリーンデバイス社会実装推進事業／次世代半導体を用いた超小型電力変換モジュールの多用途社会実装	¥30,291,000
K. Suganuma	JST	高周波化を実現する GaN パワーモジュール実装技術開発	¥6,500,000
T. Sugahara	JSPS	海外への研究者派遣／海外からの研究者受入れプログラム	¥454,000

Cooperative Research

K. Suganuma	Cemedine Co.
K. Suganuma	Showa Denko Co.
K. Suganuma	Pi Crystal Co.
K. Suganuma	Denso Co.
K. Suganuma	Sharp Co.
K. Suganuma	Siemens AG Co., Senju metal Co., Showa Denko Co.
K. Suganuma	Senju metal Co.
K. Suganuma	Soken Co., Denso CO.
K. Suganuma	Mitsui Mining and Smelting Co.　Hikoshima Smelting Co.
K. Suganuma	Denshi Giken Co.
K. Suganuma	Nippon Shokubai
K. Suganuma	Stanley Electtic Co.
K. Suganuma	Huawei Co.
K. Suganuma	Uyemura Inductries Co.
K. Suganuma	Huawei Co.
K. Suganuma	ASTOM Co.
K. Suganuma	Yamato Scientific Co.
K. Suganuma	Sumitomo Erectric CO.
K. Suganuma	E Thermogenetech Co.
K. Suganuma	Cemedine Co.
K. Suganuma	imec
K. Suganuma	E Thermogenetech Co.
K. Suganuma	JX metal Co.
K. Suganuma	AIST
Z. Hao	ROHM Semiconductor

Other Research Fund

K. Suganuma	COI	¥17,421,000

Department of Excited Solid-State Dynamics

Original Papers

[1]Phonon-assisted indirect transitions in angle-resolved photoemission spectra of graphite and graphene, Pourya Ayria, Shin-ichiro Tanaka, Ahmad R. T. Nugraha, Mildred S. Dresselhaus, and Riichiro Saito: Physical. Review. B, 94 (2016) 75429-1-12.

[2]Liquid-phase growth of few-layered graphene on sapphire substrates using SiC micropowder source, Takahiro Maruyama, Yutaka Yamashita, Takahiro Saida, Shin-ichiro Tanaka, Shigeya Naritsuka: Journal of Crystal Growth, 11 (2016) 053-1-4.

[3]Formation of hot-electron ensembles quasiequilibrated in momemtum space by ultrafast momentum scattering of highly excited hot electrons photoinjected into Γ-valley of GaAs, H. Tanimura, J. Kanasaki, K. Tanimura, J. Sjakste, N. Vast, M. Calandra, and F. Mauri: Physical Review B, 93 (16) (2016) 161203（R)-1-5.

[4]Comparison of electronic-excitation-induced structural modification of Carbon-based nanomaterials with that of semiconductor surfaces, N. Itoh, C. Itoh, and J. Kanasaki: NANO, 11 (6) (2016) 1630001-1-17.

International Conferences

[1]robing of the dispersion of the phonon that couples with the Dirac electrons in graphene: an ARPES study (poster), S. Tanaka: International Conference on Low-Energy Electrodynamics in Solids. (LEES2016).

[2]Direct probing of the electron-phonon scattering in graphene: detection of the phonon-dispersion by the angle-resolved photoelectron spectroscopy (poster), S. Tanaka: 39th International Conference on Vacuum Ultraviolet and X-ray Physics (VUVX2016).

[3]Evaluation of the spin orbit interaction in the 5d valence band of the Au film and the Si(111) sqrt(3)×sqrt(3) Au surface: A study by the Auger electron photoelectron coincidence spectroscopy (poster), K. Mase and S. Tanaka: 39th International Conference on Vacuum Ultraviolet and X-ray Physics (VUVX2016).

[4]Direct probing of the electron-phonon scattering in the graphene and graphite by the use of the angle-resolved photoelectron spectroscopy (invited), S. Tanaka: 12th Asian International Seminar on Atomic and Molecular Physics (AISAMP12.

[5]Electronic Structure of Surface Conduction Band of Ge(001)-c(4x2) and Ge(111)-c(2x8) Surfaces Studied by Two-photon Photoelectron Spectroscopy (poster), J. Kanasaki, I. Yamamoto, J. Azuma: Atomically-Controlled Surfaces, Interfaces & Nanotechnology (ACSIN) 2016.

[6]Band Structure and Electronic Dynamics at Ge(001) and (111) Surfaces (poster), J. Kanasaki, I. Yamamoto, J. Azuma: The 20th SANKEN International, The 15th SANKEN Nanotechnology Symposium.

[7]Direct Imaging of Surface Electron Relaxation and Surface Conduction Band Structures of Ge(001) and (111) Surfaces (poster), J. Kanasaki, I. Yamamoto, J. Azuma: Symposium on Surface Science & Nanotechnology 2017.

[8]Momentum Space View of Ultrafast Carrier Dynamics in Photo-Excited Semiconductors (invited), J. Kanasaki, I. Yamamoto, J. Azuma: The 3rd Annual World Congress of Smart Materials 2017.

Contributions to International Conferences and Journals

S. Tanaka Scientific Reports (Editor)

Publications in Domestic Meetings

Physical Society of Japan	2 papers
Surface Science Society of Japan	2 papers
Japanese Society for Synchrotron Radiation Research	2 papers

Grant-in-Aid for Scientific Research

S.Tanaka	High-resolution angle-resolved photoelectron spectroscopy with energy- and polaization- controlled photons for layered materials.	¥1,800,000
J. Kanasaki	Development of ultimate time- and space-resolved spectroscopy and application to the study of photo-induced phase transformation	¥2,600,000

Department of Accelerator Science

Original Papers

[1]Luminescence induced by electrons outside zinc oxide nanoparticles driven by intense terahertz pulse trains, Masaya Nagai, Shingo Aono, Masaaki Ashida, Keigo Kawase, Akinori Irizawa, Goro Isoyama:

New. J. Phys., 19 (2017) 053017 1-9.

International Conferences
[1]Intense Terahertz Wave of Free Electron Laser and Its Novel Interaction with Solids (invited), Akinori Irizawa: Advanced Accelerator & Radiation Physic.

[2]Nonlinear response on solids by intense THz wave. (invited), Akinori Irizawa: ACSIN2016, Rome.

Review Papers
Generation of Terahertz Radiation by Electron Accelerators, Heustun Zen, Norihiro Sei, Akinori Irizawa, Masahiro Kato: Chemical industry, 68(3) 176-181, (2017)

Contributions to International Conferences and Journals
Akinori Irizawa WIRMS2017 Oxford UK (International Advisory Committee)

Department of Beam Materials Science

Original Papers
[1]Theoretical study of fabrication of line-and-space patterns with 7 nm quarter-pitch using electron beam lithography with chemically amplified resist process: IV. Comparison with experimental results, Takahiro Kozawa: Jpn. J. Appl. Phys., Vol. 55 (2016) 056503.

[2]Challenges in Development of Sub-10 nm Resist Materials, T. Kozawa, J. J. Santillan, and T. Itani: J. Photopolym. Sci. Technol., Vol. 29 (2016) 717-723.

[3]Analysis of stochastic effects in chemically amplified poly(4-hydroxystyrene-co-t-butyl methacrylate) resist, Takahiro Kozawa, Julius Joseph Santillan, Toshiro Itani: Jpn. J. Appl. Phys., Vol. 55 (2016) 076501.

[4]Analysis of line-and-space resist patterns with sub-20 nm half-pitch fabricated using high NA exposure tool of extreme ultraviolet lithography, Takahiro Kozawa, Julius Joseph Santillan, Toshiro Itani: Jpn. J. Appl. Phys., Vol. 55 (2016) 096501.

[5]Theoretical study of fabrication of line-and-space patterns with 7 nm quarter-pitch using electron beam lithography with chemically amplified resist process: V. Optimum beam size, Takahiro Kozawa: Jpn. J. Appl. Phys., Vol. 55 (2016) 106502.

[6]Theoretical study of relationships among resolution, line width roughness, and sensitivity of chemically amplified extreme ultraviolet resists with photodecomposable quenchers, Takahiro Kozawa, Julius Joseph Santillan, Toshiro Itani: Jpn. J. Appl. Phys., Vol. 55 (2016) 116501.

[7]Relationship between sensitizer concentration and resist performance of chemically amplified extreme ultraviolet resists in sub-10 nm half-pitch resolution region, Takahiro Kozawa, Julius Joseph Santillan, Toshiro Itani: Jpn. J. Appl. Phys., Vol. 56 (2016) 016501.

[8]Requirement for Suppression of Line Width Roughness in Fabrication of Line-and-Space Patterns with 7 nm Quarter-Pitch Using Electron Beam Lithography with Chemically Amplified Resist Process, Takahiro Kozawa: J. Photopolym. Sci. Technol., Vol. 29 (6) (2016) 809-816.

[9]Ab initio spur size calculation in liquid water at room temperature, Yusa Muroya, Asokendu Mozumder: Chemical Physics Letters, 657 (2016) 102-106.

[10]Local density augmentation of supercritical water probed by 4,40-bpyH radical: A pulse radiolysis study, Zhe Liu, Zhong Fang, Yusa Muroya, Haiying Fu, Yu Yan, Yosuke Katsumura, Mingzhang Lin: Chemical Physics Letters, 657 (2016) 78-82.

[11]Redox-Dependent Dynamics in Heme-Bound Bacterial Iron Response Regulator (Irr) Protein, Kazuo Kobayashi, Megumi Nakagaki, Haruto Ishikawa, Kazuhiro Iwai, Mark R. O'Brian, and Koichiro Ishimori: Biochemistry, 55 (29) (2016) 4047-4054.

[12]Rational Tuning of Superoxide Sensitivity in SoxR, the [2Fe-2S] Transcription Factor: Implications of Species-Specific Lysine Residues, Mayu Fujikawa, Kazuo Kobayashi, Yuko Tsutsui, Takahiro Tanaka, Takahiro Kozawa: Biochemistry, 56 (2) (2017) 403-410.

[13]Chemically Amplified Molecular Resists based on Noria Derivatives Containing Adamantyl Ester Groups for Electron Beam Lithography, Hiroki Yamamoto, Hiroto Kudo, Seiichi Tagawa, Kazumasa Okamoto, Takahiro Kozawa: J. Vac. Sci. Technol.B, 34 (2016) 041606/1-041606/5.

[14]Controlled Array of Gold Nanoparticles by Combination of Nano Imprint and Self-assembly, Hiroki Yamamoto, Akira Ohnuma, Bunsho Ohtani, Takahiro Kozawa: J. Photopolym. Sci. Technol., 29 (2016) 765-768.

[15]Structural Control of Hybrid Colloidal Particle Surface by Plasma-etching Treatment, Akira Ohnuma, Hiroki Yamamoto, Takahiro Kozawa, Bunsho Ohtani: Chem. Lett., 45 (2016) 979-981.

[16]Synthesis and Resist Properties of Calixarene Polymers with Pendant Haloalkyl Groups, Hiroto Kudo, Hiroki Ogawa, Hiroki Yamamoto, Takahiro Kozawa: J. Photopolym. Sci. Technol., 29 (2016) 495-500.

[17]Dynamics of radical cations of PHS in the presence and absence of triphenylsulfonium triflate as determined by pulse radiolysis of its highly concentrated solution, Kazumasa Okamoto, Takuya Ishida, Hiroki Yamamoto, Takahiro Kozawa, Ryoko Fujiyoshi, Kikuo Umegaki: Chem. Phys. Lett, 657 (2016) 44-48.

[18]Optical trapping of nanoparticles on a silicon subwavelength grating and their detectin by an ellipsometric technique, Naoya Taki, Yasuhiro Mizutani, Tetsuo Iwata, Takao Kojima, Hiroki Yamamoto, Takahiro Kozawa: Optomechatronics, 10 (2016) 24-31.

[19]Synthesis of Metal Nanoparticles and Patterning in Polymeric Films Induced by Electron Nanobeam, Hiroki Yamamoto, Takahiro Kozawa, Seiichi Tagawa, Muneyuki Naito, Jean-Louis. Marignier, Mehran Mostafavi, and Jacqueline Belloni: J. Phys. Chem. C, 121 (2017) 5335-5340.

International Conferences

[1]Challenges in sub-10 nm fabrication using EUV lithography, (oral), Takahiro Kozawa, J.J. Santillan, T Itani: 14th Fraunhofer IISB.

[2]Analysis of metal resist used for extreme ultraviolet lithography (oral), Takahiro Kozawa: 2016 International Symposium on Extreme Ultraviolet Lithography.

[3]Relationship between photon shot noise and secondary electron blur in line edge roughness formation (oral), Takahiro Kozawa: IEUVI Resist TWG Meeting.

[4]Electron solvation process, spur reaction process at high temperature (oral), Yusa Muroya, Tetsuro Yoshida, Wataru Kanamori, Yosuke Katsumura, Shinichi Yamashita, Takahiro Kozawa: 3rd International Workshop on Radiation Effects in Nuclear Technology (RENT3).

[5]Radiolysis of Water at High Temperature and High Pressure Conditions Studied by a Picosecond Time-resolved Electron Pulse Radiolysis (poster), Yusa Muroya, Wataru Kanamori, Yosuke Katsumura, Shinichi Yamashita, Takahiro Kozawa: 20th International Nuclear Plant Chemistry Conference (NPC 2016).

[6]Electron solvation and spur reaction processes in polar liquids at high temperature condition (poster), Yusa Muroya, Tetsuro Yoshida, Shinichi, Yamashita, Yosuke Katsumura, Takahiro Kozawa: International Conference on Ionizing Processes (ICIP 2016).

[7]Pulse radiolysis study on bimolecular recombination reaction of two hydrated electrons at high temperature and pressure (poster), Wataru Kanamori, Yusa Muroya, Hiroki Yamamoto, Shinichi Yamashita, Yousuke Katsumura, Takahiro Kozawa: International Conference on Ionizing Processes (ICIP 2016).

[8] Redox-dependent DNA distortion in a SoxR protein-promoter complex studied using fluorescent probes(poster), Kazuo Kobayashi (Osaka University, Japan): The 26th IUPAC Symposium on Photochemistry.

[9]Dissolution Behavior of Poly(methyl methacrylate) Using by Quartz Crystal Microbalance (poster), Akihiro Konda, Hiroki Yamamoto, Shusuke Yoshitake, Takahiro Kozawa: Photomask Japan 2016.

[10] Study on Sensitization Processes and Dissolution Behavior in Chemically Amplified Extreme Ultraviolet Resist (poster), Hiroki Yamamoto (Osaka University, Japan): The 26th IUPAC Symposium on Photochemistry.

[11]Dependence of Dissolution Behavior of Main-Chain Scission Type Resists on Molecular Weight (oral), Akihiro Konda, Hiroki Yamamoto, Takahiro Kozawa and Shusuke Yoshitake: SPIE Photomask Technology.

[12]Study on Resist Performance of Noria Derivatives Modified with Various Protection Ratios of Acetal Moieties for EUV lithography (poster), Hiroki Yamamoto, Hiroto Kudo, Takahiro Kozawa: 2016 International Symposium on Extreme Ultraviolet Lithography.

[13]Dependence of Dissolution Kinetics of ZEP 520A on Change of Molecular Weight Induced by Electron Beam Irradiation (poster), Akihiro Konda, Hiroki Yamamoto, Takahiro Kozawa, and Shusuke Yoshitake: MNC2016 29th International Microprocesses and Nanotechnology Conference.

[14]Lamellar orientation of block copolymer using polarity switch of Nitrophenyl self-assembled monolayer (SAM) induced by electron beam (oral), Hiroki Yamamoto, Guy Dawson, Takahiro Kozawa, Alex P. G. Robinson: SPIE Advanced Lithography.

Books

[1] Overview of the Physioligical Reactions of the Monodehydroascorbate Racial (Emma Parsons) Kazuo Kobayashi, “Ascorbic Acid Properties, Synthesis and Applications”, Nova Science Pub Inc, - (1-28) 2017.

Patents

[1]K20080228 Material components of supporting films and measurement procedure for evaluating absorption coefficient of thin films against extreme ultraviolet radiation, K20080228

Contributions to International Conferences and Journals

T. Kozawa	2016 International Symposium on Extreme Ultraviolet Lithography (Program Steering Committee)
T. Kozawa	29th International Microprocesses and Nanotechnology Conference (Organaizing Committtee)
T. Kozawa	30th International Microprocesses and Nanotechnology Conference (Organaizing Committtee)
T. Kozawa	29th International Microprocesses and Nanotechnology Conference (Steering Vice Chair)
H. Yamamoto	29th International Microprocesses and Nanotechnology Conference (Program

Steering Committee)

Publications in Domestic Meetings

The 53th Japan Radioisotope Association Meeting	2 papers
NGL2016	1 paper
The 77th JSAP Autumn Meeting 2014	1 paper
The 89th Annual Meeting of the Japanese Biochemical Society	2 papers
The 59th Meeting of Japanese Society of Radiation Chemistry	2 papers
2016 Annual meeting of Atomic Energy Society of Japan in Autumn	1 paper
The 64th JSAP Spring Meeting 2015	2 papers
2017 Annual meeting of Atomic Energy Society of Japan in Spring	1 paper

Academic Degrees

Master Degree for Engineering W. Kanamori	Study on production mechanism of molecular hydrogen from radiolysis of water at high temperature and pressure
Master Degree for Engineering Y. Tsutsui	Reaction Mechanisms of Deinococcus radiodurans Nitric Oxide Synthase: Oxygen Activation Process

Grant-in-Aid for Scientific Research

T. Kozawa	Study on nano chemistry induce in nanofabrication materials using combination of quantum beams	¥7,930,000
Y. Muroya	Study on radiolysis of supercritical water to establish the basis of water chemistry of Gen-IV reactor.	¥5,460,000
H. Yamamoto	Creation of Nanofabrication process for extreme quantum beam using organic-inorganice hybrid nanoparticles	¥4,030,000
H. Yamamoto	Development of fine wire for mass production to achieve the precision of less than 1 nm	¥1,300,000

Entrusted Research

T. Kozawa	Japan Society for the Promotion of Science	Study on reactions between hydrated electrous and hydronium ions under high temperature condition	¥150,000
Y. Muroya	Central Research Institute of Electric Power Industry		
Y. Muroya	Nippon Nuclear Fuel Development Co., Ltd. (NFD)	Practical development of the flexible waste management method enhancing potential of MA P&T technology	

Contribution to Research

T. Kozawa	Clariant (Japan) K.K. President Norio Minari	¥1,000,000
T. Kozawa	Clariant(Japan) K.K. President Shigeki Tanaka	¥2,000,000

Cooperative Research

T. Kozawa	Toyo Gosei Co., Ltd
T. Kozawa	NuFlare Technology, Inc.
T. Kozawa	Zeon Corporation

Other Research Fund

T. Kozawa	Clariant (Japan) K.K.	¥556,000

Department of Molecular Excitation Chemistry

Original Papers

[1]Sequence-Dependent Photocurrent Generation through Long-Distance Excess-Electron Transfer in DNA, S.-H. Lin, M. Fujitsuka, and T. Majima: Angew. Chem. Int. Ed., 55 (30) (2016) 8715-8717.

[2]Pt-Au Triangular Nanoprisms with Strong Dipole Plasmon Resonance for Hydrogen Generation

Studied by Single-particle Spectroscopy, Z. Lou, M. Fujitsuka, and T. Majima: ACS Nano, 10 (6) (2016) 6299-6305.

[3]Unprecedented Intramolecular Electron Transfer from Excited Perylenediimide Radical Anion, C. Lu, M. Fujitsuka, S. Ano, A. Sugimoto, and T. Majima: J. Phys. Chem. C, 120 (23) (2016) 12734–12741.

[4]3D-array of Au-TiO_2 Yolk-shell as Plasmonic Photocatalyst Boosting Multi-Scattering with Enhanced Hydrogen Evolution, X. Shi, Z. Lou, P. Zhang, M. Fujitsuka, and T. Majima: ACS Appl. Mater. Interfaces, 8 (46) (2016) 31738-31745.

[5]Covalently-attached-ferrocene dyads: synthesis, redox-switched emission, and observation of the charge-separated state, M. Abe, H. Yamada, T. Okawara, M. Fujitsuka, T. Majima, and Y. Hisaeda: Inorg. Chem., 55 (1) (2016) 7-9.

[6]Structures of 4-Substituted Thioanisole Radical Cations Studied by Time-resolved Resonance Raman Spectroscopy during Pulse Radiolysis and Theoretical Calculations, S. Tojo, M. Fujitsuka, and T. Majima: RSC Adv., (6) (2016) 109334-109339.

[7]TiO_2 mesocrystal with nitrogen and fluorine codoping during topochemical transformation: efficient visible light induced photocatalyst with the effect of codopants, P. Zhang, M. Fujitsuka, and T. Majima: Appl. Catal. B Environ., 185 (2016) 181-188.

[8]Facile preparation of nitrogen and fluorine codoped TiO_2 mesocrystal with visible light photocatalytic activity, O. Elbanna, P. Zhang, M. Fujitsuka, and T. Majima: Appl. Catal. B Environ., 192 (2016) 80-87.

[9]Singlet-Singlet and Singlet-Triplet Annihilations in Structure-Regulated Porphyrin Polymers, M. Fujitsuka, K. Satyanarayana, T.-Y. Luh, and T. Majima: J. Photochem. Photobiol. A Chem., 331 (2016) 56-59.

[10]Mesolytic processes with benzylic carbon-oxygen bond cleavage in radical anions of aryl benzyl ethers studied by eletron pulse radiolysis in DMF, M. Yamaji, S. Tojo, M. Fujitsuka, A. Sugimoto, and T. Majima: Bull. Chem. Soc. Jpn., 89 (2016) 798-803.

[11]Au/$La_2Ti_2O_7$ Nanostructures Sensitized with Black Phosphorus for Plasmon-Enhanced Photocatalytic Hydrogen Production in Visible and Near-Infrared Light, M. Zhu, X. Cai, M. Fujitsuka, J. Zhang, and T. Majima: Angew. Chem. Int. Ed., 56 (2017) 2064-2068.

[12]In-situ Observation of Single Au Triangular Nanoprism Etching to Various Shapes for Plasmonic Photocatalytic Hydrogen Generation, Zaizhu Lou, Sooyeon Kim, Peng Zhang, Xiaowei Shi, Mamoru Fujitsuka , and Tetsuro Majima: ACS Nano, 11 (1) (2016) 968-974.

[13]Eco-friendly photosynthesis of H_2O_2 through O_2 reduction on carbon nitride frameworks incorporated with multiple hetero-elements, G.-h. Moon, M. Fujitsuka, S. Kim, T. Majima, X. Wang, and W. Choi: ACS Catal., 7 (4) (2017) 2886-2895.

[14]TiO_2 mesocrystals composited with gold nanorods for highly efficient visible-NIR-photocatalytic hydrogen production, O. Elbanna, S. Kim, M. Fujitsuka, and T. Majima: Nano Energy, 35 (2017) 1-8.

[15]Facet-Dependent Photoreduction on Single ZnO Crystals, E. Debroye, J. V. Loon, H. Yuan, K. Janssen, Z. Lou, S. Kim, T. Majima, and M. Roeffaers: J. Phys. Chem. Lett., 8 (2) (2016) 340–346.

[16]Two-Dimensional Au-Nanoprism/rGO/Pt-Nanoframe as Plasmonic Photocatalysts with Multi-Plasmon-Modes Boosting Hot Electron Transfer and Hydrogen Generation, Z. Lou, M. Fujitsuka, and T. Majima: J. Phys. Chem. Lett., 8 (4) (2017) 844-849.

[17]Photo-accelerated Hole Transfer in Oligothiophene Assemblies, C. Lu, M. Fujitsuka, and T. Majima: J. Phys. Chem. C, 121 (1) (2016) 649-655.

[18]Dual Character of Excited Radical Anions in Aromatic Diimide Bis(Radical Anion)s: Donor or Acceptor?, C. Lu, M. Fujitsuka, A. Sugimoto, and T. Majima: J. Phys. Chem. C, 122 (8) (2017) 4558-4563.

[19]Hot electron driven hydrogen evolution using anisotropic gold nanostructures assembled monolayer MoS2, P. Zhang, M. Fujitsuka, and T. Majima: Nanoscale, 9 (2016) 1520-1526.

[20]Graphitic-C_3N_4 hybridized N-doped $La_2Ti_2O_7$ two-dimensional layered composites for efficient visible-light-driven photocatalyst, Xiaoyan Cai, Junying Zhang, Mamoru Fujitsuka, Tetsuro Majima: Appl. Catal. B Environ., 202 (2017) 191-198.

[21]One-Step Synthesis of Nonstoichiometric TiO_2 with Desired (101) Facets for Enhancing Photocatalytic H_2 Evolution, W.-K. Wang, M. Gao, X. Zhang, M. Fujitsuka, T. Majima, and H.-Q. Yu: Appl. Catal. B Environ., 205 (2017) 165-172.

[22]Porous Bimetallic PdNi Catalyst with High Electrocatalytic Activity for Ethanol Electrooxidation, Y. Feng, D. Bin, B. Yan, Y. Du, T. Majima, and W. Zhou: J. Colloid Interface Sci., 493 (2017) 190-197.

International Conferences

[1]DUAL ELECTRON TRANSFER PATHWAYS FROM THE EXCITED C_{60} RADICAL ANION: ENHANCED REACTIVITIES DUE TO PHOTOEXCITATION OF REACTION INTERMEDIATES (invited), Mamoru Fujitsuka, Tetsuro Majima: 2016 Korea Japan International Symposium on Frontier Photoscience.

[2]TWO DIMENSIONAL PORPHYRIN POLYMER SYNTHESIZED BY SIMULTANEOUS COORDINATION OF METAL AND AXIAL-LIGAND IN COVALENT ORGANIC FRAMEWORKS (poster), Shih-Hsun Lin, Mamoru Fujitsuka, Tetsuro Majima: 26th IUPAC Symposium on Photochemistry in Osaka.

[3]Single-Molecule and Single-Particle Imaging of TiO_2 Photocatalytic Reactions (invited), T. Majima: International Symposium on Nanostructured Photocatalysts and Catalysts (NPC2016).

[4]Development of TiO_2 photocatalysts (invited), T. Majima: CJK2016 Korea (Asan) Conference.

[5]Singlet-oxygen Detection during PDT (invited), Sooyeon Kim, Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[6]Two Dimensional Porphyrin Polymers and Their Photochemical Properties (oral), Yasuko Osakada, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on Solar Driven Photocatalysis.

[7]Pt-Au Triangular Nanoprisms with Strong Dipole Plasmon Resonance for Hydrogen Generation Studied by Single-particle Spectroscopy (oral), Zaizhu Lou, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[8]Black phosphorous: 2D visible and near-infrared-activated photocatalyst for H_2 evolution (oral), Mingshan Zhu, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[9]Atomic Layer Deposition-Confined Nonstoichiometric TiO_2 Nanocrystal with Tunneling Effect for Solar Driven Hydrogen Evolution (oral), Peng Zhang, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[10]Facile preparation of nitrogen and fluorine codoped TiO_2 mesocrystal with visible light photocatalytic activity (oral), Ossama A. Elbanna, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[11]Au-TiO_2 Yolk-shell Nanostructure: Solar Driven Photocatalyst (oral), Xiaowei Shi, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[12]Shape Dependence of TiO_2 Photocatalyst (oral), Wei-Kang Wang, Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[13]$La_2Ti_2O_7$-based Composite Materials: Solar Driven Photocatalysts (oral), Xiaoyan Cai Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[14]Electron Transfer Processes Studied by fs-Laser Flash Photolysis (oral), Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[15]Singlet Oxygen Detection during PDT (oral), Sooyeon Kim, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[16]Unprecedented Intramolecular Electron Transfer from Excited Perylenediimide Radical Anion (oral), Chao Lu, Mamoru Fujitsuka, and Tetsuro Majima: International Symposium on New Energy Science and Engineering.

[17]Single-Molecule, Single-Particle Chemistry of Nanocatalysis for Light Energy Conversion (plenary), Tetsuro Majima: International Symposium on Activation and Selective Conversion of Energy-Related Molecules.

[18]DNA CONFORMATIONAL CHANGES MONITORED BY CONTROLLING THE FLUORESCENCE BLINKING (oral), Kiyohiko Kawai, Atsushi Maruyama, Tetsuro Majima: 22nd International Round Table on Nucleosides, Nucleotides and Nucleic Acids.

[19]Photoinduced charge transfer in nanomaterials (invited), Tetsuro Majima: 2016 Electron Donor Acceptor Interactions, Gordon Research Conference.

[20]Single-Molecule, Single-Particle Chemistry of Nanocatalysis for Light Energy Conversion (plenary), Tetsuro Majima: The 70th anniversary of KCS and the 40th anniversary of KRICT.

[21]Peer Review Processes of ACS journals (plenary), Tetsuro Majima: 2016Workshop on Peer Review.

[22]Peer Review (plenary), Tetsuro Majima: The Editor's Workshop (2016-A02).

[23]TiO_2 Mesocrystals for Efficient Photocatalyst (invited), Tetsuro Majima: Materials Challenges in Alternative and Renewable Energy- MCARE-2017.

[24]Visible and near-IR light responsible photocatalysts composited with 2D nanomaterials (plenary), Tetsuro Majima: 2nd International Workshop on Graphene and C_3N_4-based Photocatalysts (IWGCP2).

Review Papers

Development of tailored TiO_2 mesocrystals for solar driven photocatalysis, Peng Zhang, Mamoru Fujitsuka, and Tetsuro Majima, J. Energy Chem., Elsevier, 25 (2016), 917-926.

Fluorescence Probe to Visualize Singlet Oxygen during Photodynamic Therapy, S. Kim, M. Fujitsuka, T. Majima, Dojin Newa, Dojin Chemicals, 159 (2016), １－７.

Report of 26th IUPAC International Symposium on Photochemistry, M. Fujitsuka, T. Majima, Radiation Chemistry, Japanese Radiation Chemistry Society, 102 (2016), 62.
Charge Transfer Dynamics in DNA Revealed by Time-Resolved Spectroscopy, M. Fujitsuka, T. Majima, Chem. Sci., Royal Society of Chemistry, 8 (2017), 1752-1762.

Books
[1]Photochemistry of DNA (T. Majima. M. Iino, Y. Shichida, T. Todo) T. Majima, "Tetsuro Majima", Asakura Publish, (296-297) 2016.

[2]Photochemical reactions of DNA (T. Majima. M. Iino, Y. Shichida, T. Todo) T. Majima, "Tetsuro Majima", Asakura Publish, (298-299) 2016.

Patents
[1]KB2016002 Metal oxides mesocrystals and their synthetic method, 2016-102699

[2]KB2016002 Metal oxides mesocrystals and their synthetic method, KB2016002

[3]KP2014012 Tatanium oxides mesocrystals, KP2014012

[4]KP2015015 Metal oxides mesocrystals and their synthetic method, KP2015015

[5]G20130068CN Metal oxides mesocrystals and their synthetic method, G20130068CN

Contributions to International Conferences and Journals

T. Majima	Photochemistry and Photobiology (Associate Editor)
T. Majima	Rapid Communication in Photoscienece (International Editorial Board)
T. Majima	ChemPlusChem (Co-Chair)
T. Majima	Council of Asian Science Editors (Vice President)
T. Majima	26th IUPAC Symposium on Photochemistry in Osaka (Chairperson)
T. Majima	2016 Korea Jaoan International Smposium on Frontier Photoscience 2016 (Chairperson)
T. Majima	International Symposium on New Energy Science and Engineering (Chairperson)
T. Majima	International Symposium on Solar Driven Photocatalysis (Chairperson)
T. Majima	2nd International Workshop on Graphene and C_3N_4-based Photocatalysts (IWGCP2) (Organizing member)
M. Fujitsuka	26th IUPAC Symposium on Photochemistry in Osaka (General secretary)
Y. Osakada	26th IUPAC Symposium on Photochemistry in Osaka (Organizing member)

Grant-in-Aid for Scientific Research

T. Majima	Single-molecule chemistry of nanocatalysis for light energy conversion	¥26,910,000
T. Majima	High efficient solar energy conversion materials by rare metal-doped semiconductor photocatalyst	¥1,100,000
T. Majima	High Performance Plasmon Enhanced Electrocatalytic Oxidation in Photoassisted Fuel Cell with Visible-Light Irradiation	¥1,100,000
K.Kawai	Single molecule RNA imaging triggered by weak transient association	¥5,460,000
K. Kawai	Single molecule-level analysis of super-coiled DNA dynamics	¥780,000
Y. Osakada	Development of nobel neural activation methods using hybrid materials via interface photoregulation	¥5,850,000
Y. Osakada	Development of X-ray excitable luminescent materials beyond 1000 nm for deep depth imaging	¥1,560,000

Entrusted Research

K. Kawai	Japan Science and Technology Agency	Development of molecular technology that enables the control of fluorescence blinking	¥5,486,000
T. Majima	Japan Science and Technology Agency	Metal oxides mesocrystals and their synthetic method	¥3,900,000

Department of Synthetic Organic Chemistry

Original Papers

[1]Asymmetric Brønsted Acid Catalyzed Substitution of Diaryl Methanols with Thiols and Alcohols for the Synthesis of Chiral Thioethers and Esters, A. Chatupheeraphat, H.-H. Liao, S. Mader, M. Sako, H. Sasai, I. Atodiresei, M. Rueping: Angew. Chem. Int. Ed., 55 (2016) 4803-4807.

[2]Efficient Enantioselective Synthesis of Oxahelicenes Using Redox/Acid Cooperative Catalysts, M. Sako, Y. Takeuchi, T. Tsujihara, J. Kodera, T. Kawano, S. Takizawa, H. Sasai: J. Am. Chem. Soc., 138 (2016) 11481-11484.

[3]Organocatalyzed [4+2] Annulation of All-Carbon Tetrasubstitued Alkenes with Allenoate: Synthesis of Highly Functionalized 2H, and 4H-Pyran Derivatives, T.-Thuy-Duong Ngo, K. Kishi, M. Sako, M. Shigenobu, C. Bournaud, M. Toffano, R. Guillot, J.-P. Baltaze, S. Takizawa, H. Sasai, G. Vo-Thanh: ChemstrySelect, 1 (2016) 5414-5420.

[4]Facile Synthesis of Spirooxindoles via an Enantioselective Organocatalyzed Sequential Reaction of Oxindoles with Ynone, S. Takizawa, K. Kishi, M. Kusaba, J. Bai, T. Suzuki, H. Sasai: Heterocycles, 95 (2017) 761-767.

International Conferences

[1]Vanadium(V)-Catalyzed Enantioselective Synthesis of Oxa[9]helicene (poster), Sako, M.; Takizawa, S.; Takeuchi, Y.; Tsujihara, T.; Ichinose, K.; Kodera, J.; Yoneyama, S.; Kawano, T.; Sasai, H.: Molecular Chirality Asia 2016, Osaka, Japan, April 20-22, 2016.

[2]Facile Synthesis of α-Methylidene-γ-Lactams via Amidation and Rauhut-Currier Reaction Sequence (poster), Kishi, K.; Takizawa, S.; Arteaga, F. A.; Sasai, H.: Molecular Chirality Asia 2016, Osaka, Japan, April 20-22, 2016.

[3]Pd(II)-SPRIX Catalyzed Enantioselective Fujiwara-Moritani Annulation of Alkenylindoles (poster), Abozeid, M. A.; Takizawa, S.; Sasai, H.: Molecular Chirality Asia 2016, Osaka, Japan, April 20-22, 2016.

[4]Palladium Enolate Umpolung: Catalytic Cyclative Difunctionalization of Alkynyl Cyclohexadienones Using SPRIX Ligand (poster), Takenaka, K.; Mohanta, S. C.; Sasai, H.: Molecular Chirality Asia 2016, Osaka, Japan, April 20-22, 2016.

[5]Recent Progress in Enantioselective Pd-SPRIX Catalysis (invited), Sasai, H.: 27th International Conference on Organometallic Chemistry, Melbourne, Australia, July 17-22, 2016.

[6]Construction of Highly Functionalized Compounds via Metal Free Transformations (invited), Sasai, H.: International Conference on Organic Chemistry, Las Vegas, USA, August 10-11, 2016.

[7]Enantioselective Synthesis of α-Methylidene-γ-Lactams via Amidation and Rauhut-Currier Reaction Sequence (oral), Kishi, K.; Takizawa, S.; Mader, S.; Rueping, M.; Sasai, H.: Selectivity in Chemo- and Biocatalysis (Aachen-Osaka Joint Symposium), Aachen, Germany, September 5-7, 2016.

[8]Recent Progress in Pd-SPRIX Catalyzed Enantioselective Reactions (oral), Takenaka, K.; Mohanta, S. C.; Abozeid, M. A.; Takizawa, S.; *Sasai, H.: JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.

[9]Efficient Enantioselective Synthesis of Oxahelicenes Using Redox/Acid Cooperative Catalysts (oral), Takizawa, S.; Sako, M.; Sasai, H.: JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.

[10]Synthesis of Heterocyclic Compounds through Organocatalytic Domino Reaction (oral), Kusaba, M.; Kishi, K.; Takizawa, S.; Sasai, H. JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.: JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.
[11]Chiral Iron Catalysts Bearing SPRIX Ligand (poster), Niida, Y.; Takenaka, K.; Takizawa, S.; Sasai, H.: JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.

[12]Enantioselective Oxidative Coupling of Phenol Derivatives Using Chiral Vanadium(V) catalysts (poster), Aoki, T.; Sako, M.; Takizawa, S.; Sasai, H.: JSPS core-to-core Workshop Program -Green Process-, Dijon, France, September 22-23, 2016.

[13]Enantioselective Carbon-Carbon Bond-Forming Reactions Catalyzed by Vanadium(V) Complexes (invited), Takizawa, S.; Sako, M.; Sasai, H.: The 10th International Vanadium Symposium Chemistry, Biological Chemistry & Toxicology (V10), Taipei, Taiwan, November, 6-9, 2016.

[14]Exploration of Organocatalytic Enantioselective [n+2] Type Annulations (invited), Sasai, H.: International Symposium on Catalysis and Fine Chemicals 2016 (C&FC 2016), Taipei, Taiwan, November 10-14, 2016.

[15]Recent Progress on Pd-SPRIX Catalyzed Enantioselective Reactions (poster), Chaki, B. M.; Mohanta, S. C.; Abozeid, M. A.; Takenaka, K.; Takizawa, S.; Sasai, H.: The 10th International Symposium on Integrated Synthesis (ISONIS-10), Awaji Island, Japan, November 18-19, 2016.

[16]Efficient Enantioselective Synthesis of Oxahelicenes Using Redox/Acid Cooperative Catalysts (poster), Takizawa, S.; Sako, M.; Sasai, H.: The 10th International Symposium on Integrated Synthesis (ISONIS-10), Awaji Island, Japan, November 18-19, 2016.

[17]Synthesis of Heterocyclic Compounds through Organocatalytic Double Michael Reaction (poster), Kusaba, M.; Kishi, K.; *Wathsala, H. D. P.; Takizawa, S.; Sasai, H.: The 10th International Symposium on Integrated Synthesis (ISONIS-10), Awaji Island, Japan, November 18-19, 2016.

[18]Vanadium(V) Complex-Catalyzed Enantioselective C–C Bond Forming Reactions (poster), Sako, M.; Takizawa, S.; Sasai, H.: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 6-7, 2017.

[19]Development of Novel Spiro-Type Chiral Ligands Bearing Pyrazole Donors (poster), Shigenobu, M.; Takenaka, K.; Sasai, H.: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 6-7, 2017.

[20]Phosphine-Catalyzed Umpolung Tandem Michael Addition of Alkynylester (poster), Kishi, K.; Takizawa, S.; Kusaba, M.; Sasai, H.: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 6-7, 2017.

[21]Enantioselective Aza-Wacker Reaction Promoted by Pd-SPRIX Catalyst (poster), Sen, A.; Takenaka, K.; Sasai, H.: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 6-7, 2017.

[22]Chiral Iron Catalysts Bearing SPRIX Ligand (poster), Niida, Y.; Takenaka, K.; Takizawa, S.; Sasai, H.: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship

Program), Awaji Island, Japan, March 6-7, 2017.

Patents

[1]K20150146 Preparation of Phosphorus-containing Polythiophene Derivatives

[2]K20080099 Preparation of Arene- and Heteroarene-based Polymers by Using Hypervalent Iodine Reagents

[3]K20080100 New Heteroaromatic Compounds

[4]K20080101 New Heteroaromatic Polymers

Contributions to International Conferences and Journals

H. Sasai	Molecular Chirality Asia 2016 (Organizing Committtee (Chair))
S. Takizawa	Molecular Chirality Asia 2016 (Organizing Committtee)
K. Takenaka	Molecular Chirality Asia 2016 (Organizing Committtee)

Publications in Domestic Meetings

The 24th Seminar on Organic Synthetic Chemistry	1 paper
Drug Development Research Center Symposium	1 paper
The 11th Frontier of Organic Synthetic Chemistry	1 paper
JSPC2016 Summer Symposium	3 papers
The 36th Organic Chemistry Junior Researcher's Seminar	4 papers
IMS Symposium -The Trend of Organometallic Chemistry-	1 paper
The 63rd Symposium on Organometallic Chemistry, Japan	2 papers
The 46th Congress of Heterocyclic Chemistry, Japan	1 paper
Workshop for Organic Synthetic Method Based on Green Chemistry	1 paper
The 110th Symposium on Organic Synthesis, Japan	1 paper
The 9th Symposium on Organocatalysis, Japan	1 paper
The Research Meeting of Fine Chemicals	1 paper
The 97th CSJ Annual Meeting	11 papers

Academic Degrees

Ph.D. M. Sako	Development of Enantioselective C-C Bond Forming Reactions Catalyzed by Chiral Vanadium Complex
Ph.D. M. Shigenobu	Development of Spiro-type Chiral Ligands Based on Isoxazole Transformation
Master Degree for Science K. Ichinose	Development of Asymmetric Oxidative Coupling of Carbazole Derivatives Using Chiral Vanadium Catalyst
Master Degree for Science S. Yoneyama	Development of Enantioselective Iron Catalysis

Grant-in-Aid for Scientific Research

S. Takizawa	Practical Asymmetric Transformation Utilizing Multifunctional Catalysts	¥2,860,000
S. Takizawa	Development of Visualization Monitoring Technology for Chemical Reactions	¥2,080,000
K. Takenaka	New Synthetic Strategy for Carbonyl Compounds Based on Palladium Enolate Umpolung	¥1,560,000

Entrusted Research

H. Sasai	Japan Science and Technology Agency	Control of Chirality by Immobilized Ligands Based on Metal-bridging Polymer	¥2,600,000
H. Sasai	Japan Science and Technology Agency	Practical Transformation Based on Catalytic Asymmetric Domino	¥3,202,000

		Reactions	
T. Hirao	Japan Science and Technology Agency	Development of Advanced Molecular Transformation Technology Based on Design of Environmental Benign Redox Systems Consisting of Early Transition Metals	¥4,550,000

Contribution to Research

H. Sasai	Nagase ChemteX Corporation	¥1,200,000
S. Takizawa	The Sumitomo Foundation	¥1,000,000

Other Research Fund

S. Takizawa	Japan Society for the Promotion of Science	¥800,000

Department of Regulatory Bioorganic Chemistry

Original Papers

[1]Amphiphilic DNA tiles for controlled insertion and 2D assembly on fluid lipid membranes: the effect on mechanical properties, C. Dohno, S. Makishi, K. Nakatani, S. Contera: Nanoscale., 9 (2017) 3051-3058.

[2]Fluorescence turn-on hairpin-probe PCR, F. Takei, K. Nakatani: Chem. Commun., 53 (2017) 1393-1396.

[3]A 2,7-diamino-1,4,8-triazanaphthalene derivative selectively binds to cytosine bulge DNA only at a weakly acidic pH, H. Aikawa, A. Yano, K. Nakatani: Org. Biomol. Chem., 15 (2017) 1313-1316.

[4]A Ligand that Targets CUG Trinucleotide Repeats, J. Li, J. Matsumoto, L.-P. Bai, A. Murata, C. Dohno, K. Nakatani: Chem. Eur. J., 22 (2016) 14881-14889.

[5]BzDANP, a small-molecule modulator of pre-miR-29a maturation by Dicer, A. Murata, T. Otabe, J. Zhang, K. Nakatani: ACS Chem. Biol., 11 (2016) 2790-2796.

[6]Development of 2, 7-Diamino-1, 8-Naphthyridine (DANP) Anchored Hairpin Primers for RT-PCR Detection of Chikungunya Virus Infection, H. Chen, M. Parimelalagan, F. Takei, H. C. Hapuarachchi, E. S.-C. Evelyn Siew-Chuan Koay, L. C. Ng, P. S. Ho, K. Nakatani, J. J. H. Chu: PLOS Negl. Trop. Dis., 10 (2016) e0004887.

[7]Synthesis of 1H-pyrrolo[3,2-h]quinoline-8-amine derivatives that target CTG trinucleotide repeats, J. Matsumoto, J. Li, C. Dohno, K. Nakatani: Bioorg. Med. Chem. Lett., 26 (2016) 3761-3764.

[8]Cyclic mismatch binding ligand CMBL4 binds to the 5'-T-3'/5'-GG-3' site by inducing the flipping out of thymine base, S. Mukherjee, C. Dohno, K. Asano, K. Nakatani: Nucl. Acids Res., 44 (2016) 7090-7099.

[9]Fluorescence probe for detecting CCG trinucleotide repeat DNA expansion and slip-out, T. Shibata, K. Nakatani: ChemBioChem., 17 (2016) 1685-1688.

[10]Naphthyridine-Benzoazaquinolone: Evaluation of tricyclic system for the binding to (CAG)n Repeat DNA and RNA, J. Li, A. Sakata, H. He, L.-P. Bai, A. Murata, C. Dohno, K. Nakatani: Chem. Asian. J., 11 (2016) 1971-1981.

International Conferences

[1]Binding of amphiphilic DNA to lipid membrane regulated by formation of higher order structures (poster), C. Dohno, H. Yamaguchi, S. Makishi, K. Matsuzaki, K. Nakatani: ISNAC2016.

[2]Development of small molecules targeting the CUG repeats that cause myotonic dystrophy type 1 (poster), J. Li, J. Matsumoto, C. Dohno, K. Nakatani: ISNAC2016.

[3]In vitro selection of pre-miR-29a loop mutant against the cyclic mismatch binding ligand (CMBL) (oral), S. Mukherjee, A. Murata, K. Nakatani: ISNAC2016.

Patents

[1]K20160061 Nucleic acid detection element and method, 2016-176726

[2]K20160133 Nucleic acid detection method and PCR reagent, 2016-176730

[3]K20160200 Inhibitor targeting microRNA formation and its production technique, 2017-024460

[4]G20150084US 仮 CAG repeat contraction by small molecule, 62/374072

Publications in Domestic Meetings

10th Annual Meeting of Japanese Society for Chemical Biology	1 paper
The 97 th CSJ Annual Meeting 2016	7 papers

Academic Degrees

Doctoral Degree for Science S. Matsumoto	Development of gene regulation system using ligand-inducible –1 robosomal frameshifting
Master Degree of Science H. Ito	Synthesis of naphthyridine-modified peptide library and binding to trinucleotide repeat DNA

Grant-in-Aid for Scientific Research

K. Nakatani	Chemical Biology Studies on Trinucleotide Repeat Disease using Repeat-Binding Molecules	¥0,000
K. Nakatani	Chemical Biology Studies on Trinucleotide Repeat Disease using Repeat-Binding Molecules	¥64,220,000
C. Dohno	Transformation and Recognition of shape of lipid membrane by DNA nanostructures	¥1,820,000
A. Murata	Induction of -1 ribosomal frameshifting by a small molecule and its application to protein transport and localization	¥1,950,000
T. Yamada	Development of small molecules which inhibit expansion of a CAG trinucleotide repeat tract	¥2,080,000
T. Shibata	Construction of functional molecular robots using RNA/RNP nanostructures	¥0,000

Entrusted Research

K. Nakatani	Japan Agency for Medical Research and Development	Development of Digtal Hairpin Primer PCR for Diagnosis of Hepatitis	¥990,000
K. Nakatani	Ministry of Education, Culture, Sports, Science and Technology-Japan	Employment expansion of excellent young researcher	¥6,059,000

Cooperative Research

K. Nakatani	Nitto Kasei Co., Ltd.	¥864,000
K. Nakatani	Yamato Scientific Co. Ltd.	¥2,400,000
K. Nakatani	JT	¥8,064,000

Department of Organic Fine Chemicals

Original Papers

[1]Small-molecule stabilization of the 14-3-3/Gab2 protein-protein interaction (PPI) interface, D. Bier, M. Bartel, K. Sies, S. Halbach, Y. Higuchi, Y. Haranosono, T. Brummer, N. Kato and C. Ottmann:

ChemMedChem, 11 (8) (2016) 911-918.

[2]Mechanism and clinical significance of IL-6 combined with TNF-α or IL-1 for the induction of acute phase proteins SAA and CRP in chronic inflammatory diseases, IS.-N. J. Song and K. Yoshizaki: J. Alcohol. Drug Depend., 4 (3) (2016) 1-4.

[3]The a3 isoform of subunit a of the vacuolar ATPase localizes to the plasma membrane of invasive breast tumor cells and is overexpressed in human breast cancer, K. Cotter, R. Liberman, G. Sun-Wada, Y. Wada, D. Sgroi, S. Naber, D. Brown, S. Breton and M. Forgac: Oncotarget, 7 (29) (2016) 46142-46157.
[4]Combined treatment with cotylenin A and phenethyl isothiocyanate induces strong antitumor activity mainly through the induction of ferroptotic cell death in human pancreatic cancer cells, T. Kasukabe, Y. Honma, J. Okabe-Kado, Y. Higuchi, N. Kato and S. Kumakura: Oncol. Rep., 36 (2) (2016) 968-976.

[5]Effect of catechin-treated masks on the prevention of influenza infection : An exploratory randomized study, K. Ide, H. Yamada, N. Takuma, Y. Kawasaki, H. Morohoshi, A. Takenaka and K. Kaihatsu: Jpn. J. Clin. Pharmacol. Ther., 47 (6) (2016) 229-234.

[6]Specific direct small molecule p300/β-catenin antagonists maintain stem cell potency, Y. Higuchi, C. Nguyen, SY. Yasuda, M. McMillan, K. Hasegawa and M. Kahn: Curr. Mol. Pharmacol., 9 (3) (2016) 272-279.

[7]International, evidence-based consensus diagnostic criteria for HHV-8–negative/idiopathic multicentric Castleman disease, D. C. Fajgenbaum, T. S. Uldrick, A. Bagg, D. Frank, D. Wu, G. Srkalovic, D. Simpson, A. Y. Liu, D. Menke, S. Chandrakasan, M. J. Lechowicz, R. S. M. Wong, S. Pierson, M. Paessler, J.-F. Rossi, M. Ide, J. Ruth, M. Croglio, A. Suarez, V. Krymskaya, A. Chadburn, G. Colleoni, S. Nasta, R. Jayanthan, C. S. Nabel, C. Casper, A. Dispenzieri, A. Fosså, D. Kelleher, R. Kurzrock, P. Voorhees, A. Dogan, K. Yoshizaki, F. van Rhee, E. Oksenhendler, E. S. Jaffe, K. S. J. Elenitoba-Johnson and M. S. Lim: Blood, 129 (12) (2017) 1646-1657.

[8]Substitution at the C-3 position of catechins has an influence on the binding affinities against serum albumin, M. Ikeda, M. Ueda-Wakagi, K. Hayashibara, R. Kitano, M. Kawase, K. Kaihatsu, N Kato, Y. Suhara, N. Osakabe and H. Ashida: Molecules, 22 (2) (2017) 314-326.

International Conferences
[1]Neurons without G2 subunit of vacuolar-type proton transporting ATPase: A better source for enzyme structure and Functional studies (poster), N. Kawamura, G. Sun-Wada, Y. Wada: 3rd Novalix conference: Biophysics in Drug Discovery.

[2]Sequence-specific detection and visualization of dengue viral RNA-protein complex by peptide nucleic acid (oral), K. Kaihatsu, Emi Harada, A. Takenaka, H. Matsumura and N. Kato: The 43rd International Symposium on Nucleic Acids Chemistry.

[3]The hydrophobic effect In the protein-protein interaction enhancement of fusicoccin derivatives (poster), Y. Higuchi, N. Kato: The 20th SANKEN International Symposium.

Review Papers
Future perspective of nucleic acid-based detection of dengue virus and its serotypes, K. Kaihatsu, E. Harada, H. Matsumura, A. Takenaka, N. Wichukchinda, A. Sa-Ngasang and N. Kato, J. Antivirals & Antiretrovirals, OMICS International, 8[2] (2016), LXIX-LXXI.

Modulation of 14-3-3 protein function by fusicoccane diterpenoids: Can 14-3-3 protein be a drug target?, Y. Higuchi, N. Kato, Manufacturing & Technology, Association for the Advancement of Manufacturing and Technology, 68[3] (2016), 77-79.

Selective modulation of 14-3-3 protein functions: Small-molecule stabilization of protein-protein interactions, Y. Higuchi, N. Kato, KAGAKU TO SEIBUTSU, The Japan Society for Bioscience, Biotechnology, and Agrochemistry, 54[10] (2016), 732-739.

A reference guide for management of Castleman disease, K. Yoshizaki et al., The Japanese journal of clinical hematology, The Japanese Society of Hematology, 58[2] (2017), 97-107.

Books

[1]Role of autophagy in mammalian embryogenesis: Response to developmental programs(M. A. Hayat) Y. Wada, G. Sun-Wada, "Autophagy: Cancer, Other Pathologies, Inflammation, Immunity, Infection, and Aging", Elsevia, 10 (138-147) 2016.

[2]Visual detection of viral gene by peptide nucleic acid-chromatography(Yodosha Co., Ltd) K. Kaihatsu, "Experimental Medicine", Yodosha Co., Ltd, 34[16] (2688-2688) 2016.

[3]Antiviral mechanisms of catechin derivatives(Technical information institute Co. Ltd.,) K. Kaihatsu, N. Tanaka, "Hygiene products and its application for material development (Case study)", Technical information institute Co. Ltd., 1875 (1-9) 2017.

Patents

[1]G20120074US Production method for epoxy compound using solid catalyst, US20160347763

[2]KB2016004 Heat treated products, P2016-145426A

[3]G20160043WO Tolane derivatives, PCT/JP2016/077597

[4]K20160283 Fusicoccin derivatives, JP2017-015640

Contributions to International Conferences and Journals

K. Kaihatsu J. Antivirals & Antiretrovirals (Editorial Board)

Publications in Domestic Meetings

97th Annual Meeting of the Chemical Society of Japan	1 paper
13th Biooptics Meeting	1 paper
13th Japan Catechinology	1 paper

Academic Degrees

Doctor Degree for Science Y. Inoue	Synthesis, evaluation and analysis of function of inhibitors for RND-family multidrug efflux transporters in Pseudomonas aeruginosa
Master Degree for Science L. Hang	Synthesis and evaluation of 19-functionalized fusicoccin derivatives that have an enhanced stabilizing ability towards protein-protein interactions
Master Degree for Science S. Hirata	Identification of intracellular target protein complex of fusicoccin derivatives

Grant-in-Aid for Scientific Research

N. Kato	Elucidation of intracellular signal transductions by use of point mutated proteins and molecular tools	¥3,510,000
Y. Wada	Microautophagic regulation of tissue morphogenesis	¥5,070,000
Y. Wada	Microautophagy in mammalian early embryogenesis	¥4,550,000
Y. Higuchi	Identification of targets of fusicoccin derivatives utilizing rigid linkers	¥1,690,000
K. Yoshizaki	Detection of prediction bio-markers before therapy to individual patient with rheumatoid arthritis	¥1,430,000
K. Kaihatsu	Establishment of highly sensitive and rapid diagnosis method for dengue virus early infection period	¥5,070,000

K. Kaihatsu	Development of a rapid diagnostic for detecting single base mutation related to viral drug-resistance	¥3,770,000
K. Kaihatsu	Evaluation of virus evolution in H5N1 avian influenza virus epidemic regions and their risks on human pathogenicity	¥520,000
K. Kaihatsu	Effects of catechin-treated masks on the prevention of influenza infection	¥260,000
K. Kaihatsu	Development of sugar-modified three-way junction nucleic acid for capturing any influenza viruses	¥0,000

Entrusted Research

N. Kato	Japan Science and Technology Agency	Design and synthesis of universal inhibitors for bacterial effulux pumps	¥11,570,000
N. Kato	Japan Agency for Medical Research and Development	Synthesis of alkyne-Sph derivatives as molecular tools and exploratory study on seeds and/or leads for the SPNS2 transporter inhibitor	¥1,300,000
K. Yoshizaki	National Institute of Public Health	Epidemiological research on the Castleman's disease	¥803,000
K. Kaihatsu	Japan Agency for Medical Research and Development	Novel Strategic Development of Osaka University and Thailand Research Collaboration on Emerging and Re-emerging Infections	¥2,100,000
K. Kaihatsu	Protectea Co. Ltd.	Evaluation of catechin derivatized products by instrumental analysis	¥1,400,000

Contribution to Research

N. Kato	K. Yoshizaki	¥1,200,000
S. Yamaguchi	S. Yamaguchi	¥250,000
K. Yoshizaki	Aska Corporation Inc.	¥180,000
K. Yoshizaki	The Osaka Medical Research Foundation for Intractable Diseases	¥1,000,000
K. Yoshizaki	Higashihiroshima Memorial Hospital, Yamana medical corporation	¥1,000,000
K. Yoshizaki	K. Yoshizaki	¥3,050,000

Cooperative Research

K. Yoshizaki	Interprotein Co., Ltd.	¥2,000,000
K. Kaihatsu	FujiFilm Co.	¥1,000,000
K. Kaihatsu	Protectea Co. Ltd.	¥0,000
K. Kaihatsu	Toyobo Co. Ltd.	¥0,000
K. Kaihatsu	Teijin Ltd.	¥0,000

Other Research Fund

Y. Higuchi	Japan Agency for Medical Research and Development	¥1,500,000
K. Kaihatsu	Japan Society for the Promotion of Science	¥2,000,000

Department of Biomolecular Science and Reaction

Original Papers

[1]Mutational analysis of hepatitis B virus pre-S1 (9-24) fusogenic peptide., Liu, Q., Somiya, M., Shimada, N., Sakamoto, W, Yoshimoto, N., Iijima, M., Tatematsu, K., Nakai, T., Okajima, T., Maruyama, A., Kuroda, S.: Biochemical and Biophysical Research Communications, 474 (2) (2016) 406-412.

[2]Scaffold protein Enigma Homolog 1 overcomes the repression of myogenesis activation by Inhibitor of DNA binding 2, Nakatani, M., Ito, J., Koyama, R., Iijima, M., Yoshimoto, N., Niimi, T., Kuroda, S., Maturana, A.D.: Biochemical and Biophysical Research Communications, 474 (2) (2016) 413-420.

[3]Bio-nanocapsule-based scaffold improves the sensitivity and ligand-binding capacity of mammalian receptors on the sensor chip, Iijima, M., Yoshimoto, N., Niimi, T., Maturana, A.D., Kuroda, S.: Biotechnology Journal, 11 (6) (2016) 805-813.

[4]RBM20 and RBM24 cooperatively promote the expression of short ENH splice variants, Ito. J., Iijima, M., Yoshimoto, N., Niimi, T., Kuroda, S., Maturana, A.D.: FEBS Letters, 590 (14) (2016) 2262-2274.

[5]Cytokine-dependent activation of the JAK-STAT pathway in Saccharomyces cerevisiae, Yoshimoto, N., Ikeda, Y., Tatematsu, K., Iijima, M., Nakai, T., Okajima, T., Tanizawa, K., Kuroda, S.: Biotechnology and Bioengineering, 113 (8) (2016) 1796-1804.

[6]Cellular uptake of hepatitis B virus envelope L particles is independent of sodium taurocholate cotransporting polypeptide, but dependent on heparan sulfate proteoglycan., Somiya, M., Liu, Q., Yoshimoto, N., Iijima, M., Tatematsu, K., Nakai, T., Okajima, T., Kuroki, K., Ueda, K., Kuroda, S.: Virology, 497 (2016) 23-32.

[7]Release of siRNA from liposomes induced by curcumin, Fujita, K., Hiramatsu, Y., Minematsu, H., Somiya, M., Kuroda, S., Seno, M., Hinuma, S.: Journal of Nanotechnology, 2016 (2016) 7051523.

[8]High efficiency penetration of antibody-immobilized nanoneedle thorough plasma membrane for in situ detection of cytoskeletal proteins in living cells, Kawamura, R., Shimizu, K., Matsumoto, Y., Yamagishi, A., Silberberg, Y.R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K., Nakamura, C.: Journal of Nanobiotechnology, 14 (1) (2016) 74.

[9]Core-fucosylation plays a pivotal role in hepatitis B pseudo virus infection: a possible implication for HBV glyco-therapy, Takamatsu, S., Shimomura, M., Kamada, Y., Maeda, H., Sobajima, T., Hikita, H., Iijima, M., Okamoto, Y., Misaki, R., Fujiyama, K., Nagamori, S., Kanai, Y., Takehara, T., Ueda, K., Kuroda, S., Miyoshi, E.: Glycobiology, 26 (11) (2016) 1180-1189.

[10]Angucycline antibiotic waldiomycin recognizes common structural motif conserved in bacterial histidine kinases, Y. Eguchi*, T. Okajima*, N. Tochio*, Y. Inukai, R. Shimizu, S. Ueda, S Shinya, T. Kigawa, T. Fukamizo, M. Igarashi and R. Utsumi: The Journal of Antibiotics, 70 (3) (2017) 251-258.

[11]Scaffolds for oriented and close-packed immobilization of immunoglobulins, Iijima, M., Kuroda, S.: Biosensors and Bioelectronics, 89 (2) (2017) 810-821.

International Conferences

[1]High efficiency penetration of antibody-immobilized nanoneedle thorough plasma membrane for in situ detection of cytoskeletal proteins in living cells (poster), Shimizu, K., Kawamura, R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K., Nakamura, C.: Biosensors2016, May 25-27, 2016, Gothenburg, Sweden.

[2]Reconstituted ZZ-L particles and planar ZZ-L membrane for the oriented immobilization of Fc-fused molecules on various types of biosensors. (oral), Iijima, M., Kuroda S.: Biosensors2016, May 25-27, 2016, Gothenburg, Sweden.

[3]Angucycline antibiotic waldiomycin recognizes common structural motif conserved in bacterial histidine kinases (poster), Y. Eguchi, T. Okajima, N. Tochio and R. Utsumi: Gordon Research Conference on Microbial Stress Response, South Hadley, MA, USA, July 16-17, 2016.

[4]Analysis of the Catalytic Mechanism of Copper Amine Oxidase from Arthrobacter globiformis (poster), H. Yamaguchi, T. Murakawa, M. Kataoka, Y. Kawano, H. Hayashi, K. Tanizawa and T. Okajima: International Symposium on Diffraction Structural Biology 2016 (ISDSB2016), Knoxville, Tennessee, U.S.A, August 7- 10, 2016.

[5]Mechanism of sequential formation of intrapeptidyl thioether cross-links by the radical SAM enzyme QhpD (oral), T. Nakai, K. Tanizawa, and T. Okajima: Fifth International Conference on Cofactors (ICC-05) & Active Enzyme Molecule 2016, Kurobe, Japan, September 4-8, 2016.

[6]X-ray crystallographic structure of semiquinone radical intermediate formed in bacterial copper amine oxidase (oral), T. Okajima, T. Nakai, K. Tanizawa, T. Murakawa, and H. Hayashi: Fifth International Conference on Cofactors (ICC-05) & Active Enzyme Molecule 2016, Kurobe, Japan, September 4-8, 2016.

[7]Possible involvement of HBV pre-S1 (9–24) fusogenic peptide in uncoating process (poster), Q. Liu, M. Somiya, and S. Kuroda: 2016 International HBV Meeting, Seoul, Korea, September 21-24, 2016.

[8]High efficiency insertion of antibody-immobilized nanoneedle into living cells for in situ detection of cytoskeletal proteins (oral), Nakamura, C., Shimizu, K., Kawamura, R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K.: PRiME2016, October 2-7, 2016, Honolulu, Hawaii.

[9]Reconstituted planar ZZ-L membrane for the oriented immobilization of immunoglobulin G on biosensors (poster), M. Iijima, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[10]Decipherment of olfactory receptor repertoire by using an automated single-cell analysis and isolation system (poster), N. Yoshimoto, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[11]Bio-nanocapsules displaying various immunoglobulins as an active targeting-based drug delivery system (poster), K. Tatematsu, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[12]Nuclear delivery of NF-κB corepressor, MTI-II, by using hepatitis B virus infection machinery (poster), Z. Xu, K. Tatematsu, K. Okamoto, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[13]Elucidation of early infection machinery of hepatitis B virus and bio-nanocapsule (poster), Q. Liu, M. Somiya, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[14]Synthesis and assembly of hepatitis B virus envelope protein-derived particles in Escherichia coli. (poster), H. Li, K. Onbe, Q. Liu, M. Iijima, N. Yoshimoto, T. Nakai, K. Tatematsu, T. Okajima, M. Seno, H. Tada, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[15]Novel antibiotics waldiomycin targets a highly conserved H-box motif of sensor histidine kinases. (poster), T. Okajima, Y. Eguchi, M. Igarashi, and R. Utsumi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[16]Characterization of FAD-dependent monooxygenase involved in quinone cofactor biosynthesis. (poster), T. Oozeki, T. Nakai, K. Tanizawa, and T. Okajima: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[17]Analysis of substrate specificity of intrapeptidyl thioether bond forming radical SAM enzyme QhpD (poster), K. Kozakai, T. Nakai, K. Tanizawa, and T. Okajima: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[18]Reaction mechanism of interpeptidyl thioether cross-links by radical SAM enzyme QhpD (poster), T.

Nakai, K. Tanizawa, and T. Okajima: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

Review Papers

Novel radical SAM enzyme forming intrapeptidyl crosslinks, T. Nakai, K. Tanizawa, T. Okajima, The Journal of Japanese Biochemical Society, 88[4] (2016), 506-510.

Scaffolds for oriented immobilization of bioseinsing molecules, M. Iijima, S. Kuroda, Journal of Bioscience and Bioengineering, The Society for Biotechnology, Japan, 94[8] (2016), 497.

Development of automated single cell analysis and isolation system and new cell breeding techniques, N. Yoshimoto, S. Kuroda, Bioscience & Industry, 74 (2016), 30-33.

Potential of a non-cationic liposomes-based delivery system for nucleic acid medicines, M. Somiya, S. Kuroda, Drug Delivery Systems, 31 (2016), 35-43.

High-throughput screening of odorant-specific olfactory receptors, N. Yoshimoto, S. Kuroda, Aroma research : Journal of Aroma Science and Technology, 17 (2016), 41-45.

High-throughput analysis of mammalian receptor tyrosine kinase activation in yeast cells, N. Yoshimoto, S. Kuroda, Methods in Molecular Biology, 1478 (2017), 35-52.

Elucidation of the early infection machinery of hepatitis B virus by using bio-nanocapsule, Q. Liu, M. Somiya, S. Kuroda, World Journal of Gastroenterology, 22 (2016), 8489-8496.

Development of drug delivery system nanocarrier by biomimicking technology : Bio-nanocapsule based on Hepatitis B virus early infection machinery, M. Somiya, S. Kuroda, Fine Chemicals, 45 (2016), 18-24.

Scaffolds for oriented and close-packed immobilization of immunoglobulin, M. Iijima, S. Kuroda, Biosensors and Bioelectronics, 89 (2017), 810-821.

Books

[1] Development of olfactory cell array sensor for digitalizing any odorant, N. Yoshimoto, S. Kuroda, “How to utilize human sensory / Perception mechanism for product development”, Technical Information Institute, 2016.

[2] Application of non-cationic liposome for the delivery of nucleic acid therapeutics, M. Somiya, S. Kuroda, “Application of cutting-edge drug delivery systems for drug formulation”, Technnical Information Institute, 2017.

Patents

[1]K20160047 Medicine, 2017-054937

Grant-in-Aid for Scientific Research

S. Kuroda	Development of next-gen DDS carrier by utilizing virus envelope-derived functional domains	¥0,000
S. Kuroda	Development of Neo-bionanocapsule for Various In Vivo Targets	¥34,840,000
T. Okajima	Elucidation of enzyme catalytic mechanism regulating transition state by linking conformational change and fluctuations of the active site	¥9,490,000
T. Okajima	Reaction mechanism of novel tryptophan-hydroxylating enzyme involving in quinone cofactor biogenesis	¥1,430,000
K. Tatematsu	Development of the modified ubiquitin ligase to degrade of a	¥1,430,000

	pathogenic protein	
T. Nakai	Biosynthesis mechanism of multi-step post-translational modification of amine dehydrogenase and its application to development of muti-cyclic peptides	¥1,950,000
N. Yoshimoto	Comprehensive analysis of odorant receptor repertoire by automated single cell analysis and isolation system	¥1,820,000
M. Iijima	Development of scaffold for oriented immobilization of various biomolecules in an ordered manner	¥2,470,000

Entrusted Research

S. Kuroda	Japan Agency for Medical Research and Development	Identification of HBV receptor indispensable for its infection, establishment of HBV infection system, pathological analysis of HBV infection, and development of new anti-HBV drugs	¥13,000,000
S. Kuroda	Japan Agency for Medical Research and Development（P-CRETE）	Development of scaffolding nanoparticle for dramatically enhancing therapeutic efficacy of antibody medicines	¥ 26,730,000

Contribution to Research

S. Kuroda	Yuzuru Morooka	¥1,000,000
S. Kuroda	GLOVACC Co. Ltd., President&Representative Director Mitsuharu Muramatsu	¥3,000,000
S. Kuroda	Kazuki Okamoto	¥230,000

Cooperative Research

S. Kuroda	Rohto Pharmaceutical Co., Ltd.	¥1,000,000
S. Kuroda	Panasonic Corporation	¥540,000
S. Kuroda	Suntory Global Innovation Center Limited	¥2,160,000
S. Kuroda	Kyoto Prefectural Police	¥0,000
S. Kuroda	University of the Ryukyus	¥0,000
S. Kuroda	Katayama Chemical Industries Co., Ltd.	¥0,000
K. Tatematsu	Mitsubishi Tanabe Pharma Corporation	¥2,400,000

Department of Biomolecular Science and Regulation

Original Papers

[1]Phenotype microarray analysis of the drug efflux systems in Salmonella enterica serovar Typhimurium, Seiji Yamasaki, Takuma Fujioka, Katsuhiko Hayashi, Suguru Yamasaki, Mitsuko Hayashi-Nishino, Kunihiko Nishino: Journal of Infection and Chemotherapy, 22 (2016) 780-784.

[2]Fluorescence-based measurement of sphingosine 1-phosphate transport activity in erythrocyte, N. Kobayashi, M. Otsuka, A. Yamaguchi, T. Nishi: J. Lipid Res., 57 (2016) 2088-2094.

[3]Berberine is a novel type efflux inhibitor which attenuates the MexXY-mediated aminoglycoside resistance in Pseudomonas aeruginosa, Yuji Morita, Ken-ichi Nakashima, Kunihiko Nishino, Kenta Kotani, Junko Tomida, Makoto Inoue, Yoshiaki Kawamura: Frontiers in Microbiology, 7 (42587) (2016) 1223(1-10).

International Conferences

[1]Multidrug efflux pumps contribute to Escherichia coli biofilm maintenance , Seiji Yamasaki, Li-Yuan Wang, Takahiro Hirata, Mitsuko Hayashi-Nishino, Kunihiko Nishino: The 15th Awaji International Forum on Infection and Immunity, Hyogo, Japan, September 6-9, 2016.

[2]Improvement of the Gut Flora to Activate Human Power (invited), Seiji Yamasaki, Saki Shigeyama, Aiko Fukushima, Atsushi Kumanogoh, and Kunihiko Nishino: 1st International Conference on COI

Program at Osaka University, Osaka, Japan, December 13, 2016.

[3]Analysis of the dynamics of a multi-drug exporter AcrB in the absence and presence of substrates , Tomoki Matsuda, Seiji Yamasaki, Kunihiko Nishino, Takeharu Nagai, and Akihito Yamaguchi: The Biophysical Society 61st Annual Meeting, Louisiana, United States of America, February 11-15, 2017.

[4]A functional role of sphingosine 1-phosphate transporter, SPNS2 in lymphocyte egress into blood (invited), T. Nishi: 1st Korea-Japan Bioactive lipid Joint Symposium.

[5]Function and regulation of bacterial multidrug efflux pumps (invited), K. Nishino: Symposium on Combatting Antimicrobial Resistance. University of Hong Kong.

[6]Crystal Structure of the Multidrug Resistance Regulator RamR Complexed with Bile Acid (poster), Suguru Yamasaki, Ryosuke Nakashima, Keisuke Sakurai, Sylvie Baucheron, Etienne Giraud, Benoît Doublet, Axel Cloeckaert and Kunihiko Nishino: International Symposium Salmonella and Salmonellosis. 2016/6/6-8. Saint-Malo, France.

[7]Development of Novel Therapeutic Strategies to Tackle Multidrug-Resistant Pathogens (poster), Mitsuko Hayashi-Nishino, Yoshimi Matsumoto and Kunihiko Nishino: International Symposium Salmonella and Salmonellosis. 2016/6/6-8. Saint-Malo, France.

[8]Regulation and Function of Bacterial Multidrug Efflux Systems (invited), Kunihiko Nishino: Seminar at INRA, Tours, France. 2016/6/10.

[9]Regulation and Function of Bacterial Multidrug Efflux Systems (invited), Kunihiko Nishino: Seminar at Tohoku University, Sendai, Japan. 2016/7/19.

[10]Improvement of bacterial flora (invited), Kunihiko Nishino: 2016Artificial Intelligence Seminar for the Group Visiting Japan from Taiwan, Osaka University. 2016/11/29.

[11]Morphological Analysis of Enoxacin-resistant Escherichia coli (poster), Yuna Takeuchi, Mitsuko Hayashi-Nishino, chikara Furusawa, Kunihiko Nishino: The 20th SANKEN International Symposium. Osaka, Japan. 2016/12/13.

[12]Improvement of Gut Flora to Activate Human Power (invited), Kunihiko Nishino: 1st Osaka University COI International Conference, Osaka, Japan. 2016/12/13.

Review Papers

Structural Analysis and New Drug Development against Multidrug EOEux Pumps, Seiji Yamasaki, Ryosuke Nakashima, Keisuke Sakurai, Akihito Yamaguchi, and Kunihiko Nishino, Yakugaku Zasshi, The Pharmaceutical Society of Japan, 137[4] (2017), 377-382.

Lipid mediator exporter is a novel target for drug development, T. Nishi, Y. Hisano, N. Kobayashi, A. Yamaguchi, Experimental Medicine, Yodosha, 34{14} (2016), 2356-2361.

Frontier of pharmaceutical microbiology: To combat-resistant bacterial pathogens, Yuji Morita, Kunihiko Nishino, Yakugaku Zasshi, The Pharmaceutical Society of Japan, 137[4] (2017), 371-372.

Books

[1]For the conquest of drug-resistant bacterial infections(Nakayama Foundation for Human Science) Seiji Yamasaki, “Step of 25 years”, Nakayama Foundation for Human Science, (267-268) 2016.

[2]Screening method for the compounds decreasing bacterial virulence(Fujikin software Co., Ltd.) Seiji Yamasaki, Kunihiko Nishino, Ryosuke Nakashima, Keisuke Sakurai, “New techno-mart information”,

Fujikin Incorporated, 22 (35) 2017.

[3]Antimicrobial drug efflux pumps in Salmonella(Xian-Zhi Li, Christopher A. Elkins, Helen I. Zgurskaya) Kunihiko Nishino, “Efflux-Mediated Drug Resistance in Bacteria: Mechanisms, Regulation and Clinical Implications”, Springer, Chapter 10 (261-279) 2016.

Patents

[1]KB2015003 Inspection method of bacterial or fungal antimicrobial susceptibility and the system to be used to it, 2015-130750

[2]G20120010US Inspection method of bacterial or fungal antimicrobial susceptibility and the system to be used to it, 14/344475

Contributions to International Conferences and Journals

K. Nishino	Frontiers in Micirobiology (Antimicrobials, Resistance and Chemotherapy) (Associate Editor)
K. Nishino	Frontiers in Micirobiology (Ad-Hoc Reviewer)
K. Nishino	PLoS One (Ad-Hoc Reviewer)
K. Nishino	Research in Microbiology (Ad-Hoc Reviewer)
K. Nishino	Scientific Reports (Ad-Hoc Reviewer)

Publications in Domestic Meetings

The Annual Meeting of the Molecular Biology Society of Japan	1 paper
The 16th Annual Meeting of the Protein Science Society of Japan	1 paper
The 64th Annual Meeting of the Japanese Society of Chemotherapy	1 paper
The 68th Annual Meeting of the Japan Society for Cell Biology	1 paper
The 45th Research Meeting of Society for Bacterial Drug Resistance	1 paper
Osaka University innovation fair 2016	1 paper
The 64th Annual Meeting of Western Japan Branch of the Japanese Society of Chemotherapy	1 paper
The 5th nature industry award	1 paper
The 2nd COI2021 meeting	1 paper
The 90th Annual Meeting of Japanese Society for Bacteriology	2 papers
The 137th Annual Meeting of the Pharmaceutical Society of Japan	1 paper
Industrial Research Talk	1 paper
Sanken Techno Salon	1 paper
Alliance kick off meeting	1 paper
Five Star Association · Dynamic Alliance G3 Subcommittee	2 papers

Academic Degrees

Doctor Degree for Pharmaceutical Science Katsuhiko Hayashi	Elucidation of complex and functional structures of RND type multidrug transporters
Master Degree for Pharmaceutical Science Kawashima Keita	Establishment of mass expression system and purification method of hSPNS2
Master Degree for Pharmaceutical Science Takeuchi Yuna	Morphological analysis of enoxacin-resistant strains for development of the automatic discrimination technology of multi-drug resistant bacteria

Grant-in-Aid for Scientific Research

M. Nishino	Regulation of bacterial virulence by ABC-type transporters	¥1,950,000
S. Yamasaki	Establishment of the infectious disease diagnosis control based on the disease-related factor using LC-MS/MS and the nano device	¥1,690,000

Entrusted Research

K. Nishino	Japan Agency for Medical Research and Development	Research on the development of inhibitors of bacterial multi-drug efflux pumps	¥10,000,000
K. Nishino	Ministry of Education, Culture, Sports, Science and Technology	Mechanism of bacterial homeostasis modulated by transportes and development of novel therapeutics	¥5,924,000
K. Nishino	Ministry of Education, Culture, Sports, Science and Technology	Mechanism of bacterial homeostasis modulated by transportes and development of novel therapeutics	¥1,715,000
K. Nishino	Japan Society for the Promotion of Science	Development of new method for intestinal flora control	¥150,000
K. Nishino	Japan Science and Technology Agency	Iimprovement of intestinal flora	¥17,080,000
T. Nishi	Japan Agency for Medical Research and Development	Elucidation of cell migration regulation mechanism by S1P transporter and creation of new drug discovery technology targeting transporters	¥2,600,000
K. Nishino	Japan Science and Technology Agency	Improvement of intestinal flora	¥9,515,000

Contribution to Research

M. Nishino	Mitsuko Nishino (Female researcher research grant)	¥2,000,000
S. Yamasaki	The 64th Annual Meeting of the Japanese Society of Chemotherapy	¥500,000
S. Yamasaki	Seiji Yamasaki (Protein Research Foundation)	¥800,000

Cooperative Research

K. Nishino	Fukoku Co. Ltd.	¥1,351,000
K. Nishino	FINE JAPAN Co. Ltd.	¥895,000
K. Nishino	Aixin Yan (University of Hong Kong)	¥500,000
K. Nishino	Junichi Yamagishi (Nihon Pharmaceutical University)	¥65,000
K. Nishino	Ayano Satoh (Okayama University)	¥65,000
K. Nishino	Yuji Morita (Aichi Gakuin University)	¥0,000
K. Nishino	Corinna Kehrenberg (Tierärztliche Hochschule Hannover)	¥0,000
K. Nishino	Axel Cloeckaert (INRA, France)	¥0,000
K. Nishino	Filip Van Immerseel (Ghent University)	¥0,000
K. Nishino	Cecília Maria Arraiano (Universidade Nova de Lisboa)	¥0,000

Other Research Fund

M. Nishino	The Naito Foundation	¥2,000,000

Department of Biomolecular Science and Engineering

Original Papers

[1]General Anesthetic Conditions Induce Network Synchrony and Disrupt Sensory Processing in the Cortex, Lissek T, Obenhaus HA, Ditzel DA, Nagai T, Miyawaki A, Sprengel R, Hasan MT: Front. Cell. Neurosci., 10 (2016) 64(1-14).

[2]Nontrivial Effect of the Color-Exchange of a Donor/Acceptor Pair in the Engineering of Förster Resonance Energy Transfer (FRET)-Based Indicators., Ohta Y, Kamagata T, Mukai A, Takada S, Nagai T, Horikawa K: ACS Chem Biol., 11 (7) (2016) 1816-1822.

[3]Dysregulation of a potassium channel, THIK-1, targeted by caspase-8 accelerates cell shrinkage., Sakamaki K, Ishii TM, Sakata T, Takemoto K, Takagi C, Takeuchi A, Morishita R, Takahashi H, Nozawa

A, Shinoda H, Chiba K, Sugimoto H, Saito A, Tamate S, Satou Y, Jung SK, Matsuoka S, Koyamada K, Sawasaki T, Nagai T, Ueno N.: Biochim Biophys Acta., 1863 (11) (2016) 2766-2783.

[4]Cullin1-P is an Essential Component of Non-Self Recognition System in Self-Incompatibility in Petunia., Kubo KI, Tsukahara M, Fujii S, Murase K, Wada Y, Entani T, Iwano M, Takayama S.: Plant Cell Physiol., 57 (11) (2016) 2403-2416.

[5]A unique intracellular compartment formed during the oligotrophic growth of Rhodococcus erythropolis N9T-4, Yoshida N, Yano T, Kedo K, Fujiyoshi T, Nagai R, Iwano M, Taguchi E, Nishida T, Takagi H.: Appl Microbiol Biotechnol. , 101 (1) (2016) 331-340.

[6]Nonlinear Structured Illumination Using a Fluorescent Protein Activating at the Readout Wavelength., Lu-Walther HW, Hou W, Kielhorn M, Arai Y, Nagai T, Kessels MM, Qualmann B, Heintzmann R.: PLoS One., 11 (10) (2016) e0165148(1-14).

[7]Reversible Monolayer/Spheroid Cell Culture Switching by UCST-Type Thermoresponsive Ureido Polymers., Shimada N, Saito M, Shukuri S, Kuroyanagi S, Kuboki T, Kidoaki S, Nagai T, Maruyama A.: ACS Appl Mater Interfaces., 8 (46) (2016) 31524-31529.

[8]Two Bistable Switches Govern M Phase Entry., Mochida S, Rata S, Hino H, Nagai T, Novák B.: Curr Biol., 26 (24) (2016) 3361-3367.

[9]Optical inactivation of synaptic AMPA receptors erases fear memory., Takemoto K, Iwanari H, Tada H, Suyama K, Sano A, Nagai T, Hamakubo T, Takahashi T.: Nat Biotechnol., 35 (1) (2017) 38-47.

[10]Five colour variants of bright luminescent protein for real-time multicolour bioimaging., Suzuki K, Kimura T, Shinoda H, Bai G, Daniels MJ, Arai Y, Nakano M, Nagai T: Nat Commun., 14 (7) (2016) 13718(1-10).

[11]Simultaneous imaging of multiple cellular events using high-accuracy fluorescence polarization microscopy., Kim SY, Arai Y, Tani T, Takatsuka H, Saito Y, Kawashima T, Kawakami S, Miyawaki A, Nagai T.: Microscopy (Oxf)., 66 (2) (2017) 110-119.

[12]Genetically encoded bioluminescent voltage indicator for multi-purpose use in wide range of bioimaging., Inagaki S, Tsutsui H, Suzuki K, Agetsuma M, Arai Y, Jinno Y, Bai G, Daniels MJ, Okamura Y, Matsuda T, Nagai T.: Sci Rep., 7 (2017) 42398(1-11).

[13]Genetically encoded ratiometric fluorescent thermometer with wide range and rapid response., Nakano M, Arai Y, Kotera I, Okabe K, Kamei Y, Nagai T.: PLoS One., 12 (2) (2017) e0172344(1-14).

[14]Distinct intracellular Ca2+ dynamics regulate apical constriction and differentially contribute to neural tube closure., Suzuki M, Sato M, Koyama H, Hara Y, Hayashi K, Yasue N, Imamura H, Fujimori T, Nagai T, Campbell RE, Ueno N.: Development., 144 (7) (2017) 1307-1316.

International Conferences

[1]Genetically Encoded Bioluminescent Probes for Multi-purpose Use in Wide Range of Bioimaging (invited), Takeharu Nagai: The Fourth Japan-China Symposium on Nanomedicine.

[2]Bioluminescent probes capable of video rate functional imaging at various spatial level ranging from single cell to whole body (oral), Takeharu Nagai: ISBC2016 (19th International Symposium on Bioluminescence & Chemiluminescence).

[3]Development of brilliant light-emitting Marchantia polymorpha for single-cell and whole-plant imaging (oral), Megumi Iwano, Ryuichi Nishihama, Kazushi Suzuki, Sakiko Ishida, Tomomi Kaku,

Takayuki Kohchi, Takeharu Nagai: ISBC2016 (19th International Symposium on Bioluminescence & Chemiluminescence).

[4]Bioluminescent probes capable of video rate functional imaging at various spatial level ranging from single cell to whole body (invited), Takeharu Nagai: FASEB Calcium and Cell Function.

[5]A Spontaneously Switchable Fluorescent Protein for a PALM-Based Easy and Fast Super-Resolution Microscopy (invited), Takeharu Nagai: 2016 Gordon Research Conference (GRC) on Single Molecule Approaches to Biology.

[6]Genetically-encoded chemiluminescent indicator applicable to brain activity recording in freely moving mice (poster), Shigenori Inagaki, Masakazu Agetsuma, Hidekazu Tsutsui, Yoshiyuki Arai, Kazushi Suzuki, Yuka Jinno, Yasushi Okamura, Tomoki Matsuda, Takeharu Nagai: QBiC Symposium 2016 "DECODING ORGANISMS by Quantitative Cell Profiling".

[7]Color pallet of super-duper luminescent proteins for real-time multicolor bioimaging (oral), Kazushi Suzuki, Taichi Kimura, Hajime Shinoda, Yoshiyuki Arai, Masahiro Nakano and Takeharu Nagai: 12th KAIST-OSAKA U Symposium 2016.

[8]Acid resistant monomeric GFP derived from Olindias formosa (oral), Hajime Shinoda, Yuanqing Ma, Ryosuke Nakashima, Keisuke Sakurai, Akihito Yamaguchi, Tomoki Matsuda, Takeharu Nagai: 12th KAIST-OSAKA U Symposium 2016.

[9]Engineering bioluminescent and fluorescent proteins for various bioimaging (invited), Taheharu Nagai: 2016 world life science conference.

[10]Superresolution imaging by spontaneously photoswitchable fluorescent protein (poster), Yoshiyuki Arai, Hiroki Takauchi, Takeharu Nagai: 2016 world life science conference.

[11]Green variant of monomeric photosensitizing fluorescent protein for photo-inducible protein inactivation and cell ablation (poster), Yemima Dani RIANI: RIKEN QBiC Symposium 'Decoding Organism by Quantitative Profiling'.

[12]Five color variants of bright bioluminescent protein and Ca(2+) indicators for real-time multicolor bioimaging (invited), Takeharu Nagai: Janelia Conference　Fluorescent Proteins and Biological Sensors V.

[13]A novel acid resistant GFP derived from flower hat jellyfish (poster), Hajime Shinoda, Yuanqing Ma, Ryosuke Nakashima, Keisuke Sakurai, Akihito Yamaguchi, Tomoki Matsuda, Takeharu Nagai: Janelia Conference; Fluorescent Proteins and Biological Sensors V.

[14]Chemiluminescent voltage indicator applicable to brain activity recording in freely moving mice (poster), Shigenori Inagaki, Masakazu Agetsuma, Tsutsui Hidekazu, Shinya Ohara, Yoshiyuki Arai, Kazushi Suzuki, Yuka Jinno, Tomoki Matsuda, Toshio Iijima, Yasushi Okamura and Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[15]Development of Chemiluminescent Ca2+ Indicators with Expanded Dynamic Range (poster), Mai Ashitani, Kazushi Suzuki, Tomoki Matsuda and Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[16]Superresolution imaging of live cells by fast photoswitching fluorescent protein and improved SPoD-ExPAN microscopy (poster), Tetsuichi Wazawa, Tomoki Matsuda, Yoshiyuki Arai, Hiroki Takauchi, Yoshinobu Kawahara, Takashi Washio, and Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[17]Color pallet of super-duper luminescent proteins for real-time multicolor bioimaging (poster), Kazushi Suzuki, Taichi Kimura, Hajime Shinoda, Guirong Bai, Matthew J. Daniels, Yoshiyuki Arai, Masahiro Nakano and Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[18]Acid resistant monomeric GFP derived from Olindias formosa (poster), Hajime Shinoda , Yuanqing Ma, Ryosuke Nakashima, Keisuke Sakurai, Akihito Yamaguchi, Tomoki Matsuda, Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[19]Development of Bioluminescent Low Affinity Ca2+ Indicators Applicable to Analysis of Ca2+ Dynamics in Endoplasmic Reticulum (poster), Nadim Hossain, Kazushi Suzuki, Megumi Iwano, Tomoki Matsuda and Takeharu Nagai: The 20th ISIR International Symposium “Molecular Technology Frontiers towards IoT World”.

[20]Novel Photoswitchable Fluorescent Proteins for Biocompatible Superresolution Imaging (invited), Yoshiyuki Arai, DK Tiwari, Hiroki Takauchi, Takeharu Nagai: The 17th RIES-HOKUDAI INTERNATIONAL SYMPOSIUM on 柔.

[21]Chemiluminescent voltage indicator applicable to brain activity recording in freely moving mice (poster), Shigenori Inagaki, Masakazu Agetsuma, Hidekazu Tsutsui, Shinya Ohara, Yoshiyuki Arai, Kazushi Suzuki, Yuka Jinno, Tomoki Matsuda, Toshio Iijima, Yasushi Okamura, Takeharu Nagai: Humanware International Symposium 2017.

[22]Super-duper chemiluminescent proteins applicable to wide range of bioimaging (invited), Takeharu Nagai: SPIE. Photonics West 2017, SPIE BiOS.

[23]Analysis of the Dynamics of a Multi-Drug Exporter AcrB in the Absence and Presence of Substrates (poster), Tomoki Matsuda, Seiji Yamasaki, Kunihiko Nishino, Takeharu Nagai, Akihito Yamaguchi: The Biophysical Society 61 th Annual Meeting.

[24]Developing of Heterotrimeric G Protein Based Intramolecular type-FRET Indicator of GPCR Activation (poster), Yuki Kushida, Yoshiyuki Arai, Yoshitsugu Uriu, Ken Shimono, Takeharu Nagai: The Biophysical Society 61 th Annual Meeting.

[25]Genetically encoded bioluminescent probes for multi-purpose use in wide range of bioimaging (plenary), Takeharu Nagai: 8th OCARINA International Symposium.

Review Papers

Current progress in genetically encoded voltage indicators for neural activity recording., Inagaki S, Nagai T., Curr Opin Chem Biol., Elsevier, 33 (2016), 9-5.

Fluorescent protein - Their properties we should know -, Matsuda T., Seibutsu Kogaku Kaishi, The Society for Biotechnology, Japan, 94 (2016), 555-558.

Thermometers for monitoring cellular temperature., Nakano M, Nagai T., J. Photochem. Photobiol. C-Photochem. Rev., Elsevier, 30 (2017), 2-9.

Molecular mechanism and molecular evolution of self-incompatibility in Petunia, Kubo K, Entani T, Takayama S., Regulation of Plant Growth & Development, The Japanese Society for Chemical Regulation of Plants, 51 (2017), 41-47.

Methods for monitoring signaling molecules in cellular compartments., Agetsuma M, Matsuda T, and Nagai T., Cell Calcium., Elsevier, - (-), in press.

Recent progress in expanding the chemiluminescent toolbox for bioimaging., Suzuki K and Nagai T., Curr Opin Biotechnol., Elsevier, - (-), accepted.

Books

[1]Writing original plugin for ImageJ; an automated particle tracking tool as an example(Chapter 5-2)(Miura K, Tsukada Y.) Y. Arai, “Starting biological image analysis with ImageJ”, Gakken Medical Shujunsha, (204-216) 2016.

[2]How to construct single molecule localization microscopy and the observation examples(Okada Y.) Y. Arai, T. Ichimura, “Superresolution imaging. That's even possible for beginners!”, Yodosha, (48-67) 2016.

[3]Types and properties of photoswitchable proteins applicable to superresolution imaging(Okada Y.) T. Mashuda, T. Nagai, “Superresolution imaging. That's even possible for beginners!”, Yodosha, (146-155) 2016.

[4]Principles of RESOLFT, SPoD, and SPoD-ExPAN(Okada Y.) T. Wazawa, T. Nagai, “Superresolution imaging. That's even possible for beginners!”, Yodosha, (242-248) 2016.

[5]Luminescence Imaging: (a) Multicolor Visualization of Ca2+ Dynamics in Different Cellular Compartments and (b) Video-Rate Tumor Detection in a Freely Moving Mouse(Sung-Bae Kim) K. Saito, M. Nakano and T. Nagai, “Bioluminescence Methods and Protocols”, Springer International Publishing, (289-297) 2016.

[6]A look at functions that emerge from small numbers(Nagai T, Togashi Y.) T. Nagai, “Spying minority in biological phenomena”, Nippon Hyoron sha, (1-7) 2017.

Patents

[1]K20160078 Method for detection of bio materials, and chemiluminescent indicator for that purpose, 2017-013463

[2]K20160101 Devices and measurement system, 2017-018773

[3]G20150108WO Fluorescent protein, PCT/JP2016/064132

[4]G20160137WO Fluorescent protein, PCT/JP2017/009759

[5]KP2014063 Optical microscope and auto-focusing device for optical microscope, 2014-548592

Contributions to International Conferences and Journals

T. Nagai	Biophysics and Physicobiology (Editorial Board)
T. Nagai	Microscopy (Editorial Board)
T. Nagai	ACS Sensor (Editorial Board)

Publications in Domestic Meetings

The 39th Annual Meeting of the Japan Neuroscience Society	1 paper
The 54th Annual Meeting of the Biophysical Society of Japan	6 papers
The 39th Annual Meeting of the Molecular Biology Society of Japan	2 papers
137th Annual Meeting of the Pharmaceutical Society of Japan	2 papers

Academic Degrees

Doctor Degree for Engineering K. Suzuki	Multicolor variants of bright luminescent protein for multi-purpose use in wide range of bioimaging
Master Degree for Engineering T. Phanuprayoon	Establishment of easy and high-sensitive detection system for bilirubin by chemiluminescent indicator
Master Degree for	Development of Photoswitchable Fluorescent Calcium Indicators

Engineering J. Trinidad Master Degree for Engineering	Development of chemiluminescent ratiometric Ca2+ indicators with expanded dynamic range	
M. Ahitani Master Degree for Engineering	Exploration of proteins involved in fungal chemi-luminescence	
R. Seto Master Degree for Engineering	Development of cAMP indicators based on the reconstitution of luciferase derived from the light emitting shrimp, Oplophorus gracilirostris	
S. Nawata		

Grant-in-Aid for Scientific Research

T. Nagai	Spying minority in biological phenomena -Toward bridging dynamics between individual and ensemble processes-	¥3,900,000
T. Nagai	Innovation of chemiluminogenetics capable of noninvasive manipulation of biological functions deep inside body	¥9,360,000
T. Nagai	Real time three dimensional imaging of chemiluminescence with Fresnel incoherent correlation holography	¥910,000
T. Matsuda	Visualization and photomanipulation of migrating neuronal cells and surrounded field during the formation of brain tissue	¥26,520,000
Y. Arai	Developlment of optical sectioning microscopy for chemiluminescent imaging	¥0,000
M, Nakano	Development of genetically encoded fluorescent thermometers applicable to living species	¥4,550,000
T. Wazawa	Analyses of the dynamics of actin filaments and myosin by superresolution fluorescence imaging	¥2,730,000
M. Iwano	Analysis of compatible-pollen reception system in Brassicaceae	¥1,690,000
R. Ishida	Development of genetically encoded Mg^{2+} indicators for elucidating intracellular Ca^{2+} dynamics under the control of Mg^{2+}	¥1,950,000
M. Agetsuma	All-optical electrophysiology and investigation of visual cognition system	¥800,000

Entrusted Research

T. Nagai	Japan Science and Technology Agency (JST)	Development of multi-modal chemiluminescent imaging system	¥13,260,000
T. Nagai	Japan Science and Technology Agency (JST)	Superresolution of "physiological functions" and diagnostics of activity architecture in live cells	¥57,200,000
T. Nagai	Japan Science and Technology Agency (JST)	Development of all-in-one microscopy for chemiluminescence imaging	¥21,489,000
T. Nagai	Ministry of Education, Culture, Sports, Science and Technology - JAPAN (MEXT)	Health care system by using hybrid of fluorescent and chemiluminescent proteins	¥1,000,000
T. Matsuda	Japan Science and Technology Agency (JST)	Analysis of Dynamics of Drug Efflux Transporter and Drug	¥12,480,000

Contribution to Research

T. Nagai	Research Foundation for Opto-Science and Technology	¥1,000,000

Cooperative Research

T. Nagai	Japan Science and Technology Agency (JST)	¥3,751,000
T. Nagai	OPTO-LINE, Inc.	¥7,800,000
T. Nagai	Ono Pharmaceutical Co., Ltd.	¥7,584,000
T. Nagai	Nikon Co.,Ltd.	¥6,840,000

T. Nagai	Panasonic Corporation	¥960,000
T. Nagai	Taiyo Nippon Sanso Corporation	¥0,000
T. Nagai	DRVision Technologies LLC	¥1,127,000
T. Nagai	Olympus Corporation	¥0,000
T. Nagai	Hamamatsu Photonics K.K.	¥0,000
T. Nagai	DRVsion Technologies, Nikon Co.,Ltd.	¥0,000
T. Nagai	NanoScope Technologies, LLC	¥0,000
Other Research Fund		
T. Nagai	Japan Society for the Promotion of Science (JSPS)	¥2,600,000

Department of New Industrial Projection

Original Papers

[1]Experimental Investigation on the Photosynthesis of Arabidopsis Thaliana Under Elevated Pressure, Jun Hayashi, Motoki Yonekura, Hiroyuki Takeishi, Shinya Sawada, Yoshihiro Kimura, Atsushi Okawawa, Takashi Machimura, Akio Kobayashi, and Fumiteru Akamatsu: The Review of Laser Engineering, 44 (11) (2016) 745-749.

Review Papers

Design and Development of Intelligent Plant Growth System that Enables Growth Under Extreme Environmental Conditions, Fumiteru Akamatsu, Jun Hayashi, Hiroyuki Takeishi, Atsushi Okazawa, Yoshihiro Kimura, and Akio Kobayashi, The review of laser engineering, The Laser Society fo Japan, 44[11] (2016), 735-739.

Department of Cellulose Nanofiber Materials

Original Papers

[1]Acetylation of optically transparent cellulose nanopaper for high thermal and moisture resistance in a flexible device substrate, H. Yagyu, S. Ifuku, M. Nogi: Flexible and Printed Electronics, 2 (2017) 014003.

[2]Hazy Transparent Cellulose Nanopaper, M.-C. Hsieh, H. Koga, K. Suganuma, M. Nogi: Scientific Reports, 7 (2017) 41590.

[3]All-Nanocellulose Nonvolatile Resistive Memory, U. Celano, K. Nagashima, H. Koga, M. Nogi, F. Zhuge, G. Meng, Y. He, J. De Boeck, M. Jurczak, W. Vandervorst, T. Yanagida: NPG Asia Materials, 8 (2016) e310.

[4]A High-sensitivity printed antenna prepared by rapid low-temperature sintering of silver ink, H. Koga, T. Inui, I. Miyamoto, T. Sekiguchi, M. Nogi, K. Suganuma: RSC Advances, 6 (87) (2016) 84363-84368.

[5]Stretchable and transparent electrodes based on pattered silver nanowire by laser-induced forward transfer for non-contacted printing technique, T. Araki, R. Mandamparambil, D. van Bragt, J. Jiu, H. Koga, J. van den Brand, T. Sekitani, J. den Toonder, K. Suganuma: Nanotechnology, 27 (2016) 45LT02.

[6]Biaxially stretchable silver nanowire conductive film embedded in a taro leaf-templated PDMS surface, C. Wu, J. Jiu, T. Araki, H. Koga, T. Sekitani, H. Wang, K. Suganuma: Nanotechnology, 28 (2016) 01LT01.

[7]High reliable and high conductive submicron Cu particle patterns fabricated by low temperature heat-welding and subsequent flash light sinter-reinforcement, W. Li, H. Zhang, Y. Gao, J. Jiu,* C.-f. Li, C. Chen, D. Hu, Y. Goya, Y. Wang, H. Koga, S. Nagao, K. Suganuma: Journal of Materials Chemistry C, 5 (2016) 1155-1164.

International Conferences

[1]Deposition of amorphous carbon nitride films on flexible substrates by reactive sputtering (oral), M.

Aono, T. Harata, D. Orihara, H. Miyazak, M. Nogi: ISPlasma2017/IC-PLANET2017.

[2]Paper Composites for Flexible and Disposable Electronics (poster), H. Koga, K. Nagashima, Y. Nishina, T. Yanagida, M. Nogi: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium.
[3]Highly Efficient and Recyclable Flow Reactor Based on Wood Pulp Paper Composites (oral), H. Koga, M. Nogi: ICGC9.

[4]Nano-Ink Development for Wearable Printed Electronics (invited), K. Suganuma, M. Nogi, H. Koga, J. Jiu, T. Sugahara: International Conference on Radiation Curing in Asia.

[5]Reduced Graphene Oxide/Cellulose Paper Composite Electrode Prepared by Papermaking and Flash-Reduction Processes (oral), H. Koga, M. Nogi: ICFPE2016.

[6]Effect of Conductive Nanomaterials on Radio-waves Transmission Performance of Printed Antenna (oral), Y. Goya, H. Koga, M. Nogi, K. Suganuma: IEEE NANO 2016.

[7]Cellulose Nanofibers for Flexible Electronics (plenary), M. Nogi: IPST 2016.

[8]Environment-friendly Disposable Nonvolatile Resistive Switching Memory Composed of Biodegradable Nanocellulose (poster), K. Nagashima, U. Celano, H. Koga, M. Nogi, F. W. Zhuge, G. Meng, Y. He, J. D. Boeck, M. Jurczak, W. Vandervorst and T. Yanagida: 11th Asia-Pacific Microscopy Conference.

[9]Development of low-temperature curable, flexible electrical isotropic conductive adhesive (poster), Y. Okabe, T. Araki, H. Koga, T. Go, K. Suganuma, M. Akimoto: IEEE NANO 2016.

[10]Nanocellulose Based Nonvolatile Resistive Switching Memory (poster), K. Nagashima, U. Celano, H. Koga, M. Nogi, F. W. Zhuge, G. Meng, Y. He, J. D. Boeck, M. Jurczak, W. Vandervorst and T. Yanagida: KJF International Conference on Organic Materials for Electronics and Photonics 2016.

[11]All Nanocellulose Nonvolatile Resistive Switching Memory (oral), K. Nagashima, U. Celano, H. Koga, M. Nogi, F. W. Zhuge, G. Meng, Y. He, J. D. Boeck, M. Jurczak, W. Vandervorst, T. Yanagida: Material Research Society Fall Meeting 2016.

[12]All-nanocellulose Nonvolatile Resistive Switching Memory (poster), K. Nagashima, U. Celano, H. Koga, M. Nogi, F. W. Zhuge, G. Meng, Y. He, J. D. Boeck, M. Jurczak, W. Vandervorst, T. Yanagida: International Symposium on Materials for Chemistry and Engineering.

Review Papers
Development of paper devices based on cellulose nanofibers, M. Nogi, Journal of The Japan Institute of Electronics Packaging, The Japan Institute of Electronics Packaging, 19[4] (2016), 223-227.

Improvement of thermal durability of transparent nanocellulose film, M. Nogi, H. Koga, Material Stage, Technical Information Institute Co. Ltd., 10 (2016), 39-44.

Development of Paper Electronics by Using Paper-Specific Properties, H. Koga, Annals of the High Performance Paper Society, Japan, High Performance Paper Society, Japan, 54 (2015), 37-41.

Advanced Functional Paper Materials, H. Koga, Textile Processing Technology, Seni Co., Ltd., 51 (2016), 344-350.

Paper Electronics Based on Nanocellulose, H. Koga, Journal of the Imaging Society of Japan, The Imaging Society of Japan, 55 (2016), 361-368.

Books

[1]Electronic materials(A. Isogai) M. Nogi, “Preparation and applications of nanocellulose”, CMC Research, (Chapter 4) 2016.

[2]Trasparent conductive paper based on nanocellulose(CMC Publishing Co. Ltd.) H. Koga, M. Nogi, “Technical Data of Cellulose Nanofibers”, CMC Publishing Co. Ltd., (Chapter 19) 2016.

[3]Printed electronics based on cellulose nanofibers(CMC Publishing Co. Ltd.) M. Nogi, “Technical Data of Cellulose Nanofibers”, CMC Publishing Co. Ltd., (Chapter 20) 2016.

[4]Catalytic and electronic applications of nanocellulose(NTS inc.) H. Koga, M. Nogi, “Biomass-derived functional materials”, NTS inc., (Chapter 3・Section 2) 2016.

[5]Recyclable Organic Solar Cell Based on Cellulose Nanocrystal Substrates(Nanocellulose Forum) H. Koga, “Preparation and applications of nanocellulose”, S&T Publishing, (Part III・Chapter 1) 2016.

[6]Applications of nanocellulose for electronic devices(Nanocellulose Forum) M. Nogi, “Preparation and applications of nanocellulose”, S&T Publishing, (Part II・Chapter 4) 2016.

[7]Functionalized paper for electronic applications(K. Fujiwara) H. Koga, M. Nogi, “Recent progress in functionalized paper”, Converting Technical Institute, (Part 1) 2017.

Patents

[1]K110420B1 Metal nanowire transparent conductive film and its ink, 2016-164659

[2]K20160005 Conductive component, 2016-120219

[3]K20160218 Preparation and applications of cell culture substrate, 2016-203818

[4]K20110377 Preparation method of conductive patterns by photo- and microwave-irradiation, 2012-061816

[5]KP2013051 Materials and preparation techniques for copper patterns, 2013-544197

[6]G20120037CN Materials and preparation techniques for copper patterns, 201280055788.5

[7]K20090402 Polyurethan-based substrate and stretchable line, K20090402

Contributions to International Conferences and Journals

M. Nogi	ICFPE2016 (Organaizing Committee)

Publications in Domestic Meetings

83rd Pulp and Paper Research Conference	1 paper
23rd annual meeting of the Cellulose Society of Japan	1 paper
67th meeting of the Japan Wood Research Society	1 paper
28th annual meeting of The Society of Fiber Science and Technology	1 paper
The 97th Annual Meeting 2017 of CSJ	2 papers

Grant-in-Aid for Scientific Research

M. Nogi	Flexible non-volatile memory prepared by using cellulose nanopaper	¥25,870,000
H. Koga	Flexible energy-storage paper based on cellulose nanofiber	¥7,280,000

Cooperative Research

M. Nogi	Uematsu Co., Ltd.	¥800,000
M. Nogi	Nippon Shokubai Co., Ltd.	¥1,050,000

Other Research Fund

H. Koga	Dynamic Alliance for Open Innovation Bridging Human,	¥3,500,000

Laboratory of Cell Membrane Structural Biology

International Conferences

[1]Crystal Structure of the Multidrug Resistance Regulator RamR Complexed with Bile Acids (poster), S. Yamasaki, R. Nakashima, K. Sakurai、 K. Nishino: International Symposium Salmonella and Salmonellosis.

[2]Analysis of the Dynamics of a Multi-drug Exporter AcrB in the Absence and Presence of Substrates.(poster), T. Matsuda、S. Yamasaki、K. Nishino、T. Nagai、A. Yamaguchi: The Biophysical Society 61 th Annual Meeting.

Review Papers

Structural analysis and new drug development against multidrug efflux pumps, S. Yamazaki, R. Nakashima, K. Sakurai, A. Yamaguchi, K. Nishino, Yakugaku Zasshi, The Pharmaceutical Society of Japan, 137[4] (2017), 377-382.

Publications in Domestic Meetings

The 64th Annual Meeting of the Japanese Society of Chemotherapy	1 paper
The 90th Annual Meeting of Japanese Society for Bacteriology	2 papers
The 45th Annual Meeting of the Society for Bacterial Drug Resistance	1 paper
The 16th Annual Meeting of the Protein Society of Japan	1 paper

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	¥53,118,000
R. Nakashima	Japan Agency for Medical Research and Development	Investigation of the structural basis for lipophilic signal transmitter S1P trunsport and inhibitor screening based on the crystal structure of S1P trunsporter.	¥2,600,000

Cooperative Research

A. Yamaguchi	Fine Co., Ltd	¥0,000
A. Yamaguchi、R. Nakashima	Rigaku Corporation	¥0,000

Mitsubishi Electric Collaborative Research Division for Wide-area Security Technology

Grant-in-Aid for Scientific Research

N. Takemura	Active ambient sensing for estimation of user's internal state	¥1,560,000

Department of Functional Nanomaterials and Nanodevices

Original Papers

[1]Local Peltier-effect-induced reversible metal-insulator transition in VO2 nanowires, H. Takami, T. Kanki and H. Tanaka: AIP Advances, 6 (2016) 065118(1-8).

[2]Joule-heat-driven high-efficiency electronic-phase switching in freestanding VO2/TiO2 nanowires, Y. Higuchi, T. Kanki and H. Tanaka: Appl. Phys. Exp., 10 (2017) 033201(1-4).

[3]Enhancements of photoluminescence intensity in high-quality floating-zone Si by thermal annealing in vacuum, K. Kataoka, K. Hattori, A. Yamamoto, A. N. Hattori, T. Hatayama, Y. Kimoto, K. Endo, T. Fuyuki, H. Daimon: Jpn. J. Appl. Phys., 55 (2016) 110308-1-4.

[4]Monitoring thermally induced cylindrical microphase separation of polystyrene-block-poly(methyl

methacrylate) by atomic force microscopy, N. Hiroshiba, R. Okubo, A. N. Hattori, H. Tanaka, M. Nakagawa: J. Photopolym. Sci. Technol., 29 (2016) 659-666.

[5]Methods of creating and observing atomically reconstructed vertical Si{100}, {110}, and {111} side surfaces, A. N. Hattori, S. Takemoto, K. Hattori, H. Daimon, H. Tanaka: Appl. Phys. Express, 9 (2016) 085501-1-4.

[6]Carrier polarity control in α-$MoTe_2$ Schottky junctions based on weak Fermi-level pinning, S. Nakaharai , M. Yamamoto, K. Ueno, K. Tsukagoshi: ACS Appl. Mater. Interfaces, 8 (2016) 14732-14739.

[7]Measuring the complex optical conductivity of graphene by Fabry-Perot reflectance spectroscopy, B. G. Ghamsari, J. Tosado, M. Yamamoto, M. S. Fuhrer, S. M. Anlag: Sci. Rep., 6 (2016) 34166-34166.

International Conferences
[1]Controlling Electronic Phase Changes in Correlated Electron Oxides (plenary), T. Kanki, H. Tanaka: PCOS 2016.

[2]Electric field-induced transport modulation in correlated oxide VO2-FETs with high-k Ta2O5/organic parylene-C hybrid gate (oral), T. Kanki, T. Wei, H. Tanaka: 2016 MRS Fall Meeting.

[3]Electrochemical gating-induced hydrogenation in VO2 nanowires at room temperature (invited), T. Kanki, H. Tanaka: PRiME2016/230th ECS Meeting.

[4]Resistive switching in VO2 nanowires by applying an electric field via air-gap gates (poster), T. Kanki, M. Chikanari, H. Tanaka: 2016 MRS Fall Meeting.

[5]Oxide Nano-Spintronics using Electronic Phase Transition (oral), T. Kanki, H. Tanaka: Spintronics and Core-to-Core Workshop 2017.

[6]Size Dependence of Resistance Switching Efficiency in Freestanding VO2/TiO2 (poster), Y. Higuchi, T. Kanki, L. Pellegrino, N. Manca, D. Marré, H. Tanaka: Symposium on Surface Science & Nanotechnology -25th Anniversary of SSSJ Kansai.

[7]Self-Joule heat-driven high efficient electronic-phase switching in freestanding VO2/TiO2 nanowires (poster), Y. Higuchi, T. Kanki, L. Pellegrino, N. Manca, D. Marré, H. Tanaka: The 20th SANKEN international symposium.

[8]Enhancement of the resistance changing rate in the three dimensionally size controlled VO2 nanowall wire (oral), A. N. Hattori, S. Tsubota, H. Tanaka: 2017 The International Conference on Engineering and Applied Sciences.

[9]Identification of metal-insulator transition properties of electric nanodomains in manganite nanowall wire (oral), A. N. Hattori, H. Nakazawa, T. Nakamura, T. V. A. Ngyuen, H. Tanaka: NANO-SciTech 2017.

[10]Creation of atomically-ordered side-surfaces on the three-dimensionally patterned Si substrate (invited), A. N. Hattori, K. Hattori, S. Takemoto, H. Daimon, H. Tanaka: the 18th International Conference on Crystal Growth and Epitaxy.

[11]Construction of fine VO2 hetero nano-wall wires and their nanoscale transport properties (poster), S. Tsubota, A. N. Hattori, Y. Azuma, Y. Majima, H. Tanaka: the 18th International Conference on Crystal Growth and Epitaxy.

[12]Investigation of nanodomain properties in the phase-separated manganite by probing electron dynamics (oral), A. N. Hattori, T. V. A. Ngyuen, M. Nagai, M. Ichimiya, M. Ashida, H. Tanaka:

International Electrodynamics in Solids, 2016Conference on Low-Energy.

[13]Enhancement of the resistance changing ratio by controlling the number of the electronic domains in VO2 nanowall wire (poster), S. Tsubota, A. N. Hattori, Y. Azuma, Y. Majima, H. Tanaka: The 20th SANKEN international symposium 2016.

[14]Fabrication of electric double layer transistor with (La,Pr,Ca)MnO3 nanowall wire channel (poster), H. Nakazawa, A. N. Hattori, M. Yamamoto, H. Tanaka: The 20th SANKEN international symposium 2016.

[15]Control of conductive properties in the electric double layer transistor with SmNiO3 film channel (poster), D. Kawamoto, A. N. Hattori, M. Yamamoto, H. Tanaka: Symposium on Surface Science and Nanotechnology -25th Anniversary of SSSJ Kansai-.

[16]Fabrication of the three dimensionally nanopatterned TiO2 substrates with vertical flat side-surfaces (poster), T. Yokogawa, A. N. Hattori, H. Tanaka: Symposium on Surface Science and Nanotechnology -25th Anniversary of SSSJ Kansai-.

[17]Creation of atomically reconstructed vertical Si side-surfaces (poster), A. N. Hattori, K. Hattori, S. Takemoto, H. Daimon, H. Tanaka: Symposium on Surface Science and Nanotechnology -25th Anniversary of SSSJ Kansai-.

[18]Room temperature deposition of organic/oxide hybrid gate dielectrics for emergent oxide device (invited), H. Tanaka: 9th International Conference on High Temperature Ceramic Matrix Composites and Global Forum on Advanced Materials and Technologies for Sustainable Development 2016 (GFMAT 2016).

[19]Nanostructured correlated oxides with sensitized phase transition phenomena (invited), H. Tanaka: International Conference on Technologically Advanced Materials and Asian Meeting on Ferroelectricity (ICTAM-AMF10).

[20]Enhancement of electrical transport modulation in epitaxial VO2 nanowire field-effect transistor (oral), H. Tanaka、M. Chikanari , T. kanki: APS March Meeting 2017.

Review Papers
Research Update: Nanoscale electrochemical transistors in correlated oxides, T. Kanki and H. Tanaka, APL Materials, AIP, 5 (2017), 04230(1-11).

Books
[1]Correlated Functional Oxides -Nanocomposits and Heterostructures-(H. Nishikawa, N. Iwata, T. Endo, Y. Takamura, G.-H. Lee, P. Mele) T. Kanki, H. Tanaka, “Chapter 6: Self-assembled Nanocomposite Oxide Films”, Springer, (139-163) 2017.

[2]Raman spectroscopy of transition metal dichalcogenides(K. Ueno, J. Ando, T. Shimada) M. Yamamoto, K. Ueno, K. Tsukagoshi, “Frontier of Layered Chalcogenide Materials Research”, CMC Books, 1 (72-79) 2016.

Patents
[1]G20160025WO Furactural osccilator, signal detector and display, PCT/JP2016/074623

Contributions to International Conferences and Journals

T. Kanki	Symposium on Surface Science & Nanotechnology (Program Committee)
H.Tanaka	ICDS 2017(29th International Conference on Defects in Semiconductors (International Advisory Board)

H.Tanaka	CIMTEC (International Conferences on Modern Materials and Technologies) (Organaizing Committtee)	
H.Tanaka	Scientific Reports (Editorial Board Member)	

Publications in Domestic Meetings

The 64th JSAP Spring Meeting, 2017	8 papers
The 77th JSPS Autumn Meeting, 2016	3 papers
The 4th interdisciplinary meeting for the development of metal oxides research	1 paper
Alliiance G1 baranch meeting	1 paper
The Sanken academic lecture presentations	1 paper
2017 Annual (72th) Meeting	1 paper
The 79th Sanken TechnoSalon	1 paper
Kick-off Symposium for the Center for Spintronics Research Network (CSRN)	1 paper
The 65th SPSJ Annual Meeting	1 paper

Academic Degrees

Doctor of Philosophy in Science T.Wei	Resistance modulation by strongly correlated oxide transistor with high-k Ta2O5/organic parylene-C hybrid gate insulator
Master Degree for Engineering H.Nakazawa	Fabrication of electric-field effect transistor with (La,Pr,Ca)MnO_3 nanowall wire channel
Master Degree for Engineering S.Tsubota	Enhancement of the resistance changes in the three dimensionally size controlled VO_2 nanowall wire
Master Degree for Engineering M.Li	Construction of self-assembled ZnO-NiO nanopillar/matrix structures by the epitaxial thin film growth

Grant-in-Aid for Scientific Research

H.Tanaka	3D correlated oxide nano-structures for nano-scaling phenomena and electronic phase change memory application	¥10,790,000
H.Tanaka	Construction of ferroelectric nano-dot and their size effect investigation by scanning probe microscopy.	¥700,000
H.Tanaka	3D correlated oxide nano-structures for nano-scaling phenomena and electronic phase change memory application()	¥13,780,000
T. Kanki	Dreation of oxide nano-transistor and control of metal-insulator phases in single domain	¥9,100,000
T. Kanki	Proton pump without power due to non-equilibrium ion diffusion by an electric field	¥2,210,000
A. Hattori	Investigation of transition properties for the 10-100 nm size electric domain in the strongly correlated metal oxides	¥17,550,000

Entrusted Research

T. Kanki	Japan Science and Technology Agency (JST)	Desgin of synchronized illuminations mimicing firefly using yuragi oscillators	¥260,000
A. Hattori	Japan Science and Technology Agency (JST)	Realization of the power saving functional phase switching device utilizing nano-confinment effect for the strongly correlated metal oxide	¥24,830,000

Contribution to Research

A. Hattori	The Hattori Hokokai Foundation	¥1,000,000

Cooperative Research

H.Tanaka	Murata Manufacturing Co., Ltd.	¥2,004,000
H.Tanaka	National Institute for Materials Science (NIMS)	¥0,000

Other Research Fund

H.Tanaka	National Institutes of Natural Sciences / Institutes for Molecular Sciences	¥30,910,000

Department of Advanced Nanofabrication

Original Papers

[1]Femtosecond Pulse Radiolysis, T. Kondoh, J. Yang, K. Kan, M. Gohdo, H. Shibata, Y. Yoshida: Electron. Comm. Jpn., 99 (7) (2016) 25-31.

[2]“Generation of Terahertz Waves Using Ultrashort Electron Beams from a Photocathode Radio-Frequency Gun Linac, K. Kan, J. Yang, A. Ogata, T. Kondoh, M. Gohdo, H. Shibata, Y. Yoshida: Electron. Comm. Jpn., 99 (1) (2016) 22-31.

[3]Radiolytic yields of solvated electrons in ionic liquid and its solvation dynamics at low temperature, R. M. Musat, T. Kondoh, M. Gohdo, Y. Yoshida, K. Takahashi: Radiat. Phys. Chem., 124 (2016) 14-18.

[4]Examination of the formation process of pre-solvated and solvated electron in n-alcohol using femtosecond pulse radiolysis, T. Toigawa, M. Gohdo, K. Norizawa, T. Kondoh, K. Kan, J. Yang, Y. Yoshida: Radiat. Phys. Chem., 123 (2016) 73-78.

International Conferences

[1]Time-domain Measurement of Electric Field Emitted from Electron Beam Using Photoconductive Antenna (invited), K. Kan, J. Yang, T. Kondoh, M. Gohdo, I. Nozawa, Y. Yoshida: EMN Meeting on Terahertz 2016.

[2]Ultrafast Electron Microscopy using a 100-femtosecond Relativistic-Energy Electron Beam (invited), J. Yang: 7th International Particle Accelerator Conference.

[3]A Relativistic-energy Femtosecond-pulse Electron Microscopy (invited), J. Yang, Y. Yoshida, K. Tnimura: 11th Asia-Pascific Microscopy Conference.

[4]Photocathode RF gun based ultrafast electron diffraction and imaging (invited), J. Yang: The 8th Asian Forum for Accelerator and Detectors (AFAD2017).

[5]Ultrafast Electron Microscopy using a relativistic-energy femtosecond electron beam (invited), J. Yang: Optics & Photonics International Congress (OPIC’2016).

[6]Ultrafast Electron Diffraction and Microscopy using a femtosecond-pulse electron beam (invited), J. Yang: IX International Workshop on Advanced Generation of THz and Compton X-rays using compact electron accelerator.

[7]Single-shot electron diffraction using relativistic-energy electron pulse (poster), R. Asakawa, J. Yang: 11th Asia-Pascific Microscopy Conference.

[8]Beam Parameter Measurement after Relocation of S-Band Linear Accelerator (poster), I. Nozawa, M. Gohdo, K. Kan, T. Kondoh, J. Yang, Y. Yoshida: 7th International Particle Accelerator Conference (IPAC2016).

[9]Frequency and Time Domain Measurement of Coherent Transition Radiation (poster), K. Kan, M. Gohdo, T. Kondoh, I. Nozawa, J. Yang, Y. Yoshida: 7th International Particle Accelerator Conference (IPAC2016).

[10]Bunch Length Measurement Based on Interferometric Technique by Observing Coherent Transition Radiation (poster), I. Nozawa, M. Gohdo, K. Kan, T. Kondoh, J. Yang, Y. Yoshida: International Beam

Instrumentation Conference (IBIC2016).

[11]Measurement of Femtosecond Electron Beam Based on Frequency and Time Domain Schemes (poster), K. Kan, M. Gohdo, T. Kondoh, I. Nozawa, J. Yang, Y. Yoshida: International Beam Instrumentation Conference (IBIC2016).

[12]Characterization of THz Pulse Emitted from Femtosecond Electron Bunch Using Photoconductive Antenna and Interferometer (oral), K. Kan, J. Yang, M. Gohdo, T. Kondoh, I. Nozawa, Y. Yoshida: IRMMW-THz 2016.

[13]Measurement of Coherent Transition Radiation Using Interferometer and Photoconductive Antenna (oral), K. Kan, J. Yang, M. Gohdo, T. Kondoh, I. Nozawa, Y. Yoshida: NAPAC2016.

[14]Pulse radiolysis study of polystyrene dimer phenyl cation radical in THF (oral), M. Gohdo, T. Kondoh, K. Kan, J. Yang, S. Tagawa, Y. Yoshida: International Conference on Ionizing Processes(ICIP2016).

[15]Geminated ion recombination and charge transfer reaction in alkanes studied by femtosecond pulse radiolysis (poster), T. Kondoh, T. Nishida, M. Gohdo, K. Kan, J. Yang, S. Tagawa, Y. Yoshida: International Conference on Ionizing Processes(ICIP2016).

[16]Femtosecond pulse radiolysis of polar liquids (poster), T. Toigawa, M. Gohdo, T. Kondoh, Y. Yoshida: International Conference on Ionizing Processes(ICIP2016).

[17]Radiolytic Yield of Solvated Electron in Ionic Liquid and its Solvation Dynamics at Low Temperature (poster), R. Musat, T. Kondoh, M. Gohdo, Y. Yoshida, K. Takahashi,: International Conference on Ionizing Processes(ICIP2016).

[18]Femtosecond Pulse Radiolysis Study on Decomposition Processes of Alkanes (oral), Y. Yoshida, S. Nishii, T. Kondoh, M. Gohdo, K. Kan, J. Yang: RadTech Asia2016.

[19]Pulse Radiolysis Study of Reaction Kinetics on Radiation Induced Reaction of Polystyrene (oral), M. Gohdo, T. Kondoh, K. Kan, J. Yang, S. Tagawa, Y. Yoshida: RadTech Asia2016.

[20]Radiation Induced Chemical Reactions in a Model Compound of Polymer-Resist (poster), T. Kondoh, M. Gohdo, K. Kan, J. Yang, Y. Yoshida: RadTech Asia2016.

[21]Ultrafast dynamics of electron solvation in radiation chemistry (oral), Y. Yoshida: 18th International Meeting on Radiation Processing (IMRP2016).

[22]Fabrication and Application of Photoconductive Antenna for Electron Beam Measurement (poster), K. Kan, J. Yang, T. Kondoh, M. Gohdo, I. Nozawa, Y. Yoshida: The 20th SANKEN International Symposium.

[23]Ultrafast Electron Attachment and Picosecond Absorption Spectra of Biphenyl-Dodecane Solution (poster), T. Kondoh, T. Nishida, M. Gohdo, K. Norizawa, K. Kan, J. Yang, S. Tagawa, Y. Yoshida: The 20th SANKEN International Symposium.

[24]Generation of Ultra-short Electron Beam and its Future Application (poster), I. Nozawa, K. Kan, J. Yang, T. Kondoh, M. Gohdo, Y. Yoshida: The 20th SANKEN International Symposium.

Books

[1]Reactions in the magnetics field(Zerong Wang) M. Wakasa, T. Yago, A. Hamasaki, M. Gohdo, “Encyclopedia of Physical Organic Chemistry, 6 Volume Set”, WILEY, 6 2017.

Publications in Domestic Meetings

Symposium on Platform for Innovative Food Preservation and Logistics	1 paper
The Japanese Society of Microscopy	1 paper
53th Reserch meeting of radioisotope and radiation	4 papers
The 13th Annual Meeting of Particle Accelerator Society of Japan	4 papers
2016 Fall Meeting of Atomic Energy Society of Japan	4 papers
59th Annual meeting of Japanese Society of Radiation Chemistry	3 papers
23th FEL and High-Power Radiation Meeting and 14th High Brightness and Radio Frequency Electron Gun Meeting	2 papers
The 97th CSJ Annual Meeting	1 paper
2017 Annual Meeting of Atomic Energy Society of Japan	2 papers

Academic Degrees

Bachelor degree for engneering T. Nishida	Study of specific behavior of thermalized electron in alkanes using femtosecond pulse radiolysis

Grant-in-Aid for Scientific Research

Y.Yoshida	Development of attosecond pulse radiolysis	¥7,930,000
J. Yang	Study on femtosecond-time-resolved transmission electron microscope	¥9,750,000
J. Yang	Challenge of electron crystallography using relativistic femtosecond electron pulses	¥2,730,000
T. Kondoh	Radiation induced chemical reactions and decomposition of the saturated hydrocarbone-based polymer	¥1,170,000
K. Kan	Study on attosecond electron beam generation using radially polarized electric field	¥9,360,000

Contribution to Research

Y. Yoshida	Nissan Steel Industry Co. Ltd.	¥500,000
Y. Yoshida	Nissho Chemical Holdings Co. Ltd.	¥200,000

Cooperative Research

Y. Yoshida	Daikin Industries, Ltd.	¥1,575,000

Department of Nanocharacterization for Nanostructures and Functions

Original Papers

[1]On the Superior Activity and Selectivity of PtCo/Nb2O5 Fischer Tropsch Catalysts, Jan Huibert den Otter, Hideto Yoshida, Cristian Ledesma, De Chen, Krijn Pieter de Jong: J. Catal., 340 (2016) 270-275.

[2]Current status and future directions for in situ transmission electron microscopy, Mitra L. Taheri, Eric A. Stach, Ilke Arslan, P. A. Crozier, Bernd C. Kabius, Thomas LaGrange, Andrew M. Minor, Seiji Takeda, Mihaela Tanase, Jakob B. Wagner, Renu Sharma: Ultramicroscopy, 170 (2016) 86-95.

[3]Revealing the heterogeneous contamination process in metal nanoparticulate catalysts in CO gas without purification by in situ environmental transmission electron microscopy, Tetsuya Uchiyama, Hideto Yoshida, Naoto Kamiuchi, Hideo Kohno, and Seiji Takeda: Microscopy, 65 (2016) 522-526.

[4]Recombination Activity of Nickel, Copper, and Oxygen Atoms Segregating at Grain Boundaries in Mono-like Silicon Crystals, Yutaka Ohno, Kentaro Kutsukake, Momoko Deura, Ichiro Yonenaga, Yasuo Shimizu, Naoki Ebisawa, Koji Inoue, Yasuyoshi Nagai, Hideto Yoshida, and Seiji Takeda: Appl. Phys. Lett., 109 (2016) 142105-1-142105-4.

[5]Rational Concept for Reducing Growth Temperature in Vapor-Liquid-Solid Process of Metal Oxide Nanowires, Zetao Zhu, Masaru Suzuki, Kazuki Nagashima, Hideto Yoshida, Masaki Kanai, Gang Meng, Hiroshi Anzai, Fuwei Zhuge, Yong He, Mickael Boudot, Seiji Takeda, and Takeshi Yanagida: Nano Lett., 16 (2016) 7495-7502.

[6]Correlation of catalytic activity with the morphology change of supported Au nanoparticles in gas, Tetsuya Uchiyama, Hideto Yoshida, and Naoto Kamiuchi: Surf. Sci., 659 (2017) 16-19.

[7]Impact of local atomic stress on oxygen segregation at tilt boundaries in silicon, Yutaka Ohno, Kaihei Inoue, Kozo Fujiwara, Kentaro Kutsukake, Momoko Deura, Ichiro Yonenaga, Naoki Ebisawa, Yasuo Shimizu, Koji Inoue, Yasuyoshi Nagai, Hideto Yoshida, Seiji Takeda, Shingo Tanaka, and Masanori Kohyama: Appl. Phys. Lett., 110 (2017) 062105-1--062105-5.

International Conferences

[1]In Situ Environmental TEM study of Materials Processes at the Atomic Scale Using a Cs Corrector (invited), Seiji Takeda, Naoto Kamiuchi, Ryotaro Aso, Kentaro Soma, Hideto Yoshida: MRS Spring meeting 2016, Phoenix, USA、March 28 - April 1, 2016.

[2]Recent Advancement of Environmental TEM for Material Process Characterization (invited), Seiji Takeda, Hideto Yoshida, Tetsuya Uchiyama: Microscopy & Microanalysis 2016 Meeting, Ohio, USA, July 24-28, 2016.

[3]Electron beam-induced etching of carbon nanotubes by environmental transmission electron microscope (poster), Yuto Tomita, Hideto Yoshida, Seiji Takeda: The 16th European Microscopy Congress (EMC2016), Lyon, France, August 28 – September 2, 2016.

[4]Analysis To Reveal Dynamical And Correlated Atomic Displacements On Gold Surfaces Depending On Various Environments. (oral), Ryotaro Aso, Yohei Ogawa, Hideto Yoshida, Seiji Takeda: The 16th European Microscopy Congress (EMC2016), Lyon, France, August 28 – September 2, 2016.

Review Papers

In situ analysis by environmental transmission electron microscopy, N. Kamiuchi, S. Takeda, CHEMISTRY & CHEMICAL INDUSTRY, The Chemical Society of Japan, 69(5) (2016), 388-390.

Publications in Domestic Meetings

The Japanese Society of Microscopy 2016	1 paper
Workshop on Environment-Conscious Catalyst Preparation Based on Element Strategy	1 paper
The 64th Spring Science Lecture Meeting of the Japan Society of Applied Physics	2 papers

Academic Degrees

Doctor Degree for Engineering T. Uchiyama	Environmental Transmission Electron Microscopy Studies on Morphology of Catalytically Active Supported Gold Nanoparticles
Master Degree for Engineering T. Fujimoto	In-situ Observation of Silver Nanogap Electrodes under Applied Voltage in Gas Environments

Grant-in-Aid for Scientific Research

S. Takeda	Analysis of dynamic active structure of gold catalyst	¥32,630,000
R. Aso	Dynamic analysis of adsorption and collision of ionized gas molecules at metal surface	¥1,950,000

Entrusted Research

S. Takeda	Japan Society for the Promotion of Science	Global Networking on Molecular Technology Research	¥25,400,000
H. Yoshida	Japan Science and Technology Agency	Visualization of the atomic structure and the nanoscale temperature distribution in thermoelectric nanomaterials	¥31,330,000

Cooperative Research

S. Takeda	UBE Scientific Analysis Laboratory, Inc	¥205,000
S. Takeda,	Institute for Materials Research (IMR), Tohoku University	¥300,000

H. Yoshida
S. Takeda Osaka Prefecture University ¥205,000

Department of Theoretical Nanotechnology

Original Papers

[1]Strong enhancement of piezoelectric constants in ScxAl1-xN: First-principles calculations, H. Momida, A. Teshigahara, T. Oguchi: AIP Advances, 6 (2016) 065006-1-11.

[2]Polar phase transitions and physical properties in fresnoite A2TiSi2O8 (A = Ba, Sr) by first principles calculations, N. Song, H. Momida, T. Oguchi, B. G. Kim: Journal of Solid State Chemistry, 242 (2016) 136-142.

[3]Selective and Low Temperature Transition Metal Intercalation in Layered Tellurides, Takeshi Yajima, Masaki Koshiko, Yaoqing Zhang, Tamio Oguchi, Wen Yu, Daichi Kato, Yoji Kobayashi, Yuki Orikasa, Takafumi Yamamoto, Yoshiharu Uchimoto, Mark A. Green, Hiroshi Kageyama: Nature Communications, 7 (2016) 13809-1-8.

[4]Strain-engineering for Anion Arrangement in Perovskite Oxynitrides, D. Oka, Y. Hirose, F. Matsui, H. Kamisaka, T. Oguchi, N. Maejima, H. Nishikawa, T. Muro, K. Hayashi, T. Hasegawa: ACS Nano, 11 (2017) .

[5]Influences of Orientation on Magnetoelectric Coupling at La1-xSrxMnO3/BaTiO3 Interface from Ab Initio Calculations, Thuy Trang Nguyen, Kunihiko Yamauchi, Tamio Oguchi, and Nam Nhat Hoang: Journal of Electronic Materials, (2017) .

[6]Band splitting and Weyl nodes in trigonal tellurium studied by angle-resolved photoemission spectroscopy and density functional theory, K. Nakayama, M. Kuno, K. Yamauchi, S. Souma, K. Sugawara, T. Oguchi, T. Sato, and T. Takahash ﾚ ﾍ: Physical Review B, 95 (2017) 125204-1-5.

[7]Topological phase transition coupled with spin-valley physics in ferroelectric oxide heterostructures, Kunihiko Yamauchi, Paolo Barone, and Silvia Picozzi: Physical Review B, 95 (2017) 035146-1-7.

[8]Magnetodielectric detection of magnetic quadrupole order in Ba(TiO)Cu4(PO4)4 with Cu4O12 square cupolas, K. Kimura, P. Babkevich, M. Sera, M. Toyoda, K. Yamauchi, G. S. Tucker, J. Martius, T. Fennell, P. Manuel, D. D. Khalyavin, R. D. Johnson, T. Nakano, Y. Nozue, H. M. Rønnow, and T. Kimura: Nature Communications, 7 (2016) 13039-1-7.

[9]Direct observation of nonequivalent Fermi-arc states of opposite surfaces in the Weyl semimetal NbP noncentrosymmetric Weyl semimetal NbP, S. Souma, Zhiwei Wang, H. Kotaka, T. Sato, K. Nakayama, Y. Tanaka, H. Kimizuka, T. Takahashi, K. Yamauchi, T. Oguchi, Kouji Segawa, Yoichi Ando: Physical Review B, 93 (2016) 16112(R)-1-6.

[10]A new orthorhombic boron phase $B_{51.5\text{-}52}$ obtained by dehydrogenation of “α-tetragonal boron”, E. A. Ekimov, Yu. B. Lebed, N. Uemura, K. Shirai, T.B. Shatalova, V.P. Sirotinkin: J. Mater. Res., 31 (2016) 2773-2779.

[11]Steady distribution structure of point defects near crystal-melt interface under pulling stop of CZ Si crystal, T. Abe, T. Takahashi, K. Shirai: J. Cryst. Growth, 459 (2016) 87-94.

International Conferences

[1]Electronic properties associated with spin-orbit coupling and broken symmetry (plenary), T. Oguchi: Ab Initio Based Modeling on Advanced Materials.

[2]First-Principles Materials Exploration of Piezoelectrics (invited), T. Oguchi: The 8th International

Conference on Multiscale Materials Modeling.

[3]Materials Exploration for Sodium Secondary Batteries (plenary), T. Oguchi: The 1st International Conference on Physical Instrumentation and Advanced Materials.

[4]First-Principles Studies on Sodium Secondary Batteries (invited), T. Oguchi: International Workshop on Advanced Materials and Nanotechnology.

[5]Computational Materials Exploration of Piezoelectrics (invited), T. Oguchi: 2016 International Workshop on Computational Materials in Guangzhou.

[6]Theoretical Study on α-Tetragonal Boron and Phase Diagram of Boron (oral), K. Shirai and N. Uemura: The 17th International Conferene on Hihg pressure in Semiconductors.

[7]Superconductivity in low-carrier-density α-rhombohedral boron at high pressures (poster), H. Dekura , N. Vast , and K. Shirai: The 17th International Conferene on Hihg pressure in Semiconductors.

[8]Effects of strains on the thermoelectric properties of crystals of type XTiO3 (poster), K. Shirai, Y. Saijo, K. Yamauchi, and T. Oguchi: The 26th Annual Meeting of MRS-J International Symposium.

[9]Computational exploration of piezoelectric wurtzite materials (invited), H. Momida, T. Oguchi: EU-JAPAN Workshop on Computational Materials Design and Realization for Spintronics, Moltronics, Quantronics, Superconductivity and Topotronics, Juelich, Germany, September 18-30, 2016.

[10]Ab initio Theoretical Studies on Multiferroicity in Transition Metal Oxide (invited), K. Yamauchi: International Symposium on Magnetism and Magnetic Materials (The Korean Magnetics Soceity).

[11]Spin-Valley Coupling and Topological Phase Transition in Ferroelectric Oxide Heterostructures (invited), K. Yamauchi: 11th Korea-Japan Conference on Ferroelectrics (KJC-FE11).

[12]First Principles Study on Topological-Phase Transition in Ferroelectric Oxides (poster), K. Yamauchi: Americal Physical Society (APS) March Meeting 2017.

Review Papers

Magnetism of A-site Ordered Perovskite Oxides, M. Toyoda, k. Yamauchi, T. Oguchi: Solid state physics, AGNE Gijutsu Center, 51 (2016), 33-40. (in Japanese)

Materials Exploration in the Era of Big-Data –Present Status and Perspective -, T. Oguchi: Material Satge, Technical Information Institute, 4(1) (2016), 1-2. (in Japanese)

Contributions to International Conferences and Journals

T. OGUCHI	The 20th Asian Workshop on First-Principes Electronic Structure Calculations (International Organizing Committee)

Academic Degrees

Master Degree for Science T. Tanaka	Property Prediction by Machine Learning
Master Degree for Science M. Hamaguchi	Electronic Strcuture of Secondary Battery Material Li2MTiO4 (M =V, Mn, Fe, Co, Ni) by Means of First-Principles Calculations
Mater Degree for Engineering H. Katsumoto	Theory of X-ray Natural Circular Dichroism

Grant-in-Aid for Scientific Research

K. Yamauchi	Exploration of Novel Toporogical Materials by First-Principles calculations	¥1,560,000
K. Yamauchi	Band Engineering of Topological Insulators of Transition-Metal Oxides	¥1,170,000

Cooperative Research

T. Oguchi	Sumitomo Electric Industries, Ltd.	¥4,752,000

Department of Soft Nanomaterials

Original Papers

[1]Fine structures of organic photovoltaic thin films probed by frequency-shift electrostatic force microscopy, K. Araki, Y. Ie, Y. Aso, T. Matsumoto: Jpn. J. Appl. Phys., 55 (7) (2016) 070305-1–3.

[2]Synthesis, Properties, and Photovoltaic Performance of a Donor–Acceptor Copolymer Having Pyradinobisthiazole as the Acceptor Unit, Y. Ie, S. Sasada, M. Karakawa, Y. Aso: J. Photopolym. Sci. Technol., 29 (4) (2016) 571–574.

[3]Electron-Accepting π-Conjugated Molecules with Fluorine-Containing Dicyanovinylidene as Terminal Groups: Synthesis, Properties, and Semiconducting Characteristics, Y. Ie, A. Uchida, N. Kawaguchi, M. Nitani, H. Tada, F. Kakiuchi, Y. Aso: Org. Lett., 18 (17) (2016) 4320–4323.

[4]Influence of the perfluoroalkyl chain length in buckminsterfullerene derivatives for the field-effect transistor performances, M. Karakawa, T. Nagai, K. Adachi, Y. Ie, Y. Aso: J. Fluoline Chem., 193 (2017) 52-57.

[5]Precise control over reduction potential of fulleropyrrolidines for organic photovoltaic materials, M. Karakawa, T. Nagai, K. Adachi, Y. Ie, Y. Aso: RSC Adv., 7 (12) (2017) 7122-7129.

[6]Three-dimensional π-conjugated compounds as non-fullerene acceptors in organic photovoltaics: the influence of acceptor unit orientation at phase interfaces on photocurrent generation efficiency, S. Jinnai, Y. Ie, Y. Kashimoto, H. Yoshida, M. Karakawa, Y. Aso: J. Mater. Chem. A, 5 (8) (2017) 3932-3141.

[7]Tetraalkoxyphenanthrene-Fused Thiadiazoloquinoxalines: Synthesis, Electronic, Optical, and Electrochemical Properties, and Self-Assembly, S.-i. Kato, K. Watanabe, M. Tamura, M. Ueno, M. Nitani, Y. Ie, Y. Aso, T. Yamanobe, H. Uehara, Y. Nakamura: J. Org. Chem., 82 (6) (2017) 3132-3134.

International Conferences

[1]Synthesis, Properties, and Photovoltaic Performance of Copolymers Having New Electron-Accepting Units (invited), Yutaka Ie: The 33rd International Conference of Photopolymer Science and Technology (ICPST-33).

[2]Synthesis, properties, and photovoltaic characteristics of copolymers having fluorine-containing benzodioxocycloalkene-annelated thiophene as an acceptor unit, Koki Morikawa, Yutaka Ie, Makoto Karakawa, Yoshio Aso: The 2016 KJF International Conference on Organic Materials for Electronics and Photonics.

[3]Development of Nonfullerene Acceptors for Application to Organic Photovoltaics: Chemical Structures-Film Properties-Photovoltaic Characteristics Relationship (invited), Yutaka Ie: Organic Electronics Materials 2016 RIKEN Symposium.

[4]Development of Electron-Transporting π-Conjugated Systems for Organic Semiconducting Materials (invited), Yutaka Ie: International Conference on Flexible and Printed Electronics.

[5]Synthesis, Properties, and n-Type Field-effect Transistor Characteristics of Quinoidal Terthiophenes Based on a Benzothiophen Unit, Keitaro Yamamoto, Yutaka Ie, Masashi Nitani, Fumitoshi Kakiuchi,

Yoshio Aso: International Conference on Flexible and Printed Electronics.

[6]Development of New π-Conjugated Compounds towards Single-molecule Electronics and Thin-film Electronics (invited), Yutaka Ie, Yoshio Aso: IUPAC 12th International Conference on Novel Materials and their Synthesis (NMS-XII).

[7]Development of Novel π-Conjugated Systems for Electronic Application: Chemical Structures-Properties-Function Relationship (invited), Yutaka Ie, Yoshio Aso: The 14th International Conference on Frontiers of Polymers and Advanced Materials.

Review Papers

Development of donor-acceptor copolymers based on dioxocycloalkene-annelated thiophenes as acceptor units for organic photovoltaic materials, Yutaka Ie and Yoshio Aso, Polymer Journal, The Society of Polymer Science, Japan, 49[1] (2017), 13-22.

Development of Organic Semiconductors for High Performance Organic Electronics, Y. Aso, Y. Ie, Manufacturing & Technology, Association for the Advancement of Manufacturing and Technology, 68[4] (2016), 21-27.

Design and Development of New Functional Units towards Single-Molecule Electronics, Y. Ie, Y. Aso, J. Syn. Org. Chem. Jpn., The Society of Synthetic Organic Chenistry, Japan, 74[7] (2016), 676-688.

Design and Development of Nano-scale New Functional Units towards Single-Molecule Electronics, Y. Ie, Ultra Precision, The Japan Society for Precision Engeneering, Ultra Precision, 22[2] (2016), 4-8.

Patents

[1]K20150219 Benzobisthiadiazole compounds and organic thin films and organic semiconductor devices based on them, 2016-086571

[2]K20150346 Fullerene derivatives and n-type semiconductor materials, 2016-118336

[3]K20150347 Fullerene derivatives, semiconductor materials containing them, and semiconductor thin films containing them, 2016-124488

[4]K20160178 Polymer compounds and organic semiconductor materials containing them, 2016-179929

[5]K20160236 Naphtobischalcogenadiazole derivatives, 2016-254341

[6]G20160032WO UV absorbers, PCT/JP2016/085862

[7]G20160046WO Fullerene derivatives and n-type semiconductor materials, PCT/JP2016/079795

[8]K20110283 Nitrogen-containing fused-ring compounds, nitrogen-containing fused-ring polymers, organic thin films and organic thin-film devices, 2012-018596

[9]K20110313 Polymer compounds and organic semiconductor materials, organic transistors and organic solar cells based on them, 2012-051578

[10]K20120025 Polymers and organic thin films and organic thin-film devices using these polymers, 2012-196331

Contributions to International Conferences and Journals

Y. Aso	13th International Conference on the Chemistry of Selenium and Tellurium (Organizing Committee)

Grant-in-Aid for Scientific Research

Y. Ie	Development and investigation of new functional materials for molecular architectonics	¥18,590,000
Y. Ie	Development of high-performance n-type organic semiconductors and establishment of universal design guidelines based on device operation mechanism	¥5,200,000

Entrusted Research

Y. Ie	Japan Science and Technology Agency	Evaluation of organic field-effect tansistor devices	¥4,160,000
Y. Ie	Japan Science and Technology Agency	Development of novel π-electronic molecules based on fused tetrazole units and application to organic semiconducting materials	¥2,600,000

Cooperative Research

Y. Aso	Daikin Industries, Ltd.	¥1,050,000
Y. Aso	TOYOBO Co., Ltd.	¥1,000,000
Y. Aso	Ishihara Sangyo Ksaisha Ltd.	¥5,368,000

Other Research Fund

Y. Aso	JSPS	¥1,040,000

Department of Bio-Nanotechnology

Original Papers

[1]Roles of vacuum tunnelling and contact mechanics in singlemolecule thermopower, M. Tsutsui, K. Yokota, T. Morikawa & M. Taniguchi: Scientific Reports, 7 (11) (2017) 44276(1-9).

[2]Fast and Low-Noise Tunnelling Current Measurements for Single-Molecule Detections in Electrolyte Solution Using Insulator-Protected Nanoelectrodes, T. Morikawa, K. Yokota, M. Tsutsui and M. Taniguchi: Nanoscale, 9 (2017) 4076-4081.

[3]Single crystalline epitaxial platinum film on Al2O3(0001) prepared by oxygen-doped sputtering deposition, H. Tanaka and M. Taniguchi: Jpn. J. Appl. Phys., 56 (2017) 058001-1 - 058001-3.

[4]Electrical trapping mechanism of single-microparticles in a pore sensor, A. Arima, M. Tsutsui, Y. He, S. Ryuzaki and M. Taniguchi: AIP Advances, 6 (11) (2016) 115004-1 - 115004-8.

[5]Single-crystalline epitaxial platinum film on yttrium-stabilized zirconia (111) prepared by sputtering deposition, H. Tanaka and M. Taniguchi: Jpn. J. Appl. Phys., 55 (2016) 120304-1 - 120304-4.

[6]Tailoring particle translocation via dielectrophoresis in pore channels, S. Tanaka, M. Tsutsui, H. Theodore, H.Yuhui, A. Arima, T. Tsuji, K. Doi, S. Kawano, M. Taniguchi & T. Kawai: Scientific Reports, 6 (2016) 31670-1 - 31670-8.

[7]Dipole effects on the formation of molecular junctions, S. Tanimoto, M. Tsutsui, K. Yokota and M. Taniguchi: Nanoscale Horizons, 1 (2016) 399-406.

[8]Atomically flat nickel film grown on synthetic mica, H. Tanaka and M. Taniguchi: Jpn. J. Appl. Phys., 55 (7) (2016) 078003-1 - 078003-3.

[9]Salt-Gradient Approach for Regulating Capture-to-Translocation Dynamics of DNA with Nanochannel Sensors, Y. He, M. Tsutsui, R. H.Scheicher, X. S. Miao, M. Taniguchi: ACS Sensors, 1 (6) (2016) 807-816.

[10]Particle Trajectory-Dependent Ionic Current Blockade in Low-Aspect-Ratio Pores, M. Tsutsui, Y. He,

K. Yokota, A. Arima, S. Hongo, M. Taniguchi, T. Washio, T. Kawai: Acs Nano, 10 (1) (2016) 803-809.

[11]Decoding DNA, RNA and peptides with quantum tunnelling, M. Di Ventra and M. Taniguchi: Nature Nanotechnology, 11 (2) (2016) 117–126.

International Conferences
[1]Nanogap Sequencing for Personalized Medicine and Therapeutics (invited), M. Taniguchi: The 14th International Nanotech Symposium & Nano-Convergence Expo(NANO KOREA 2016).

[2]Development of Single-Molecule Tunnel-Current based Detection For Biopolymer Identification (poster), T. Ohshiro: KJF International Conference on Organic Materials for Electronics and Photonics 2016 (KJF-ICOMEP 2016).

[3]Ionic Current via Adjacent Low-aspect Nanopores (poster), K. Yokota: KJF International Conference on Organic Materials for Electronics and Photonics 2016 (KJF-ICOMEP 2016).

[4]Single-molecule Identification of Biopolymers (invited), M. Taniguchi: International Symposium on Polymer and Related Materials.

[5]Single Particles analysis using a Nanopore Trapping Method (poster), A.Arima, M.Tsutsui, M.Taniguchi, and T.Kawai: The 20th International Conference on Miniaturized Systems for Chemistry and Life Sciences(MicroTAS 2016 Conference).

[6]Recognition Micropores for Detecting Single-Bactria (poster), M.Tsutsui, K.Yokota, T.Yasui, H.Yasaki, M.Okochi, M.Taniguchi, T.Washio, Y.Baba, and T.Kawai: The 20th International Conference on Miniaturized Systems for Chemistry and Life Sciences(MicroTAS 2016 Conference).

[7]Nanogap Sequencing of Biopolymers (invited), M. Taniguchi: Asia NANO 2016.

[8]ナノポアデバイスと機械学習の融合による１細菌・１ウイルス検出 (invited), M. Taniguchi: MNC 2016 技術セミナー「マイクロ・ナノバイオ技術の最前線」 (29th International Microprocesses and Nanotechnology Conference).

[9]Development of Tunnel-Current Biomolecule Structural Measurement towards Single-Biomolecule Function Detection (oral), Takahito Ohshiro, Makusu Tsutsui , Kazumichi Yokota, Masateru Taniguchi: 2016 MRS Fall Meeting & Exhibit.

[10]Single-Molecule Electrical Sequencing of DNA, RNA, and Peptide (invited), M. Taniguchi: Japan-Spain Joint Workshop on Nanomedicine Research.

[11]Nanotechnology for IoT Era: What should we develop? (plenary), T. Kawai: The 20th ISIR International Symposium.

[12]Electrical identifications of single-particles using solid-state micropores (poster), M. Tsutsui, K. Yokota, A. Arima, W. Tonomura, T. Washio, M.Taniguchi: The 20th SANKEN International & the 15th SANKEN Nanotechnology Symposium.

[13]Sequencing of Single-Stranded DNA by STM and Dispersion-Corrected Density Functional Theory (poster), H. Tanaka, M. Taniguchi: 24th International Colloquium on Scanning Probe Microscopy (ICSPM24).

[14]Structural analysis of Ni (111) epitaxially grown on mica substrate (poster), H. Tanaka, M. Taniguchi: Symposium on Surface Science & Nanotechnology -25th Anniversary of SSSJ Kansai-" (SSSN-Kansai).

[15]Smart Biosensing Technologies to Detect Single Bacteria and Viruses (invited), M. Taniguchi: EDTM 2017(Electron Devices Technology and Manufacturing Congerence).

[16]Machine Learning Approach for Resistive-pulse Analvsis in Pore Sensors (invited), M. Tsutsui: New Quantum Materials and Transport Seminar.

[17]Machine Learning Approach for Resistive-pulse Analvsis in Pore Sensors (invited), M. Tsutsui: Academia Sinica Semiar.

[18]Single-particle Analysis Using Low Aspect-ratio Pore Sensors (invited), M. Tsutsui: BIT's 5th Annual Conference of AnalytiX 2017 (AnalytiX-2017).

Review Papers
Progress and Perspective of Single-Molecule Sequencers, M. Taniguchi, kagaku to seibutsu, Japan Society for Bioscience, Biotechnology, and Agrochemistry, 54[6] (2016), 396-402.

Single molecule DNA sequencing technology and its applications, M. Taniguchi, Gendai Kagaku, Tokyo Kagaku Dohjin, 547 (2016), 52-55.

Books
[1]Nanofluidics for Biomolecular Detection(Joshua Edel, Aleksandar Ivanov, MinJun Kim) Yuhui He, Makusu Tsutsui, and Masateru Taniguchi, "Nanofluidics: Edition 2", Royal Chemical Society, Nanoscience and Nanotechnology series (150-189) 2017.

[2]次世代 DNA シークエンサの開発 Y. Baba, M. Taniguchi, T. Kawai, "先端計測 研究を支える機器開発", Kagaku Dohjin, (125-131) 2016.

[3]Nanofluidcs for Biomolecular Detection(J. Edel, M. J. Kim, A. Ivanov) Y. He, M. Tsutsui, M. Taniguchi, "Nanofluidics: Edition 2", Royal Society of Chemistry, (150-189) 2016.

Patents
[1]K20150257 Sample detection device, sample detection device, ion current detection method and sample identification method, 2016-085113

[2]K20160139 Classification analysis method, classification analysis apparatus and storage medium for classification analysis, 2016-244326

[3]K20160199 Sample analysis method and device for sample analysis, 2016-199331

[4]G20150113WO Electric measuring device and electric measuring device, PCT/JP2016/061225

[5]G20160073US 仮 Devices and Methods for Creation and Calibration of a Nanoelectrode Pair, 62/370175

[6]G20160075WO Number analysis method, number analysis apparatus and storage medium for number analysis, PCT/JP2016/087821

[7]G20160119WO Nanowire device, analytical apparatus including the nanowire device, heat treatment method for sample and method for separating sample, PCT/JP2017/007030

[8]K20120047 Method for immobilizing sample, 2012-193566

[9]G20050028EP Thin-Layer Chemical Transistor and Their Manufacture, 5254857.5

[10]KP2015004 Device for nucleic acid extraction and method for manufacturing nuclear device, nucleic acid extraction method and nucleic acid sequence analysis method, KP2015004

[11]KP2016039 Chip for biomolecule extraction and method for producing biomolecule extraction chip, KP2016039

Contributions to International Conferences and Journals

M. Taniguchi	apanese Journal of Applied Physics (Associate Editor)
M. Taniguchi	Nature Publishing Group Scientific Reports (Editorial Boral Member)

Publications in Domestic Meetings

The Japanese Society for Artificial Intelligence	1 paper
The Japan Society of Applied Physics	6 papers
Japan Society for Molecular Science	4 papers
The Japan Society for Analytical Chemistry	1 paper
The Japanese Biochemical Society	5 papers
Joint Symposium of the Surface Science Society of Japan and the Vacuum Society of Japan	1 paper

Academic Degrees

Master Degree for Science	Measurement of monomolecular conductance in water using insulating coated MCBJ	
S. Tanimoto		

Grant-in-Aid for Scientific Research

M. Taniguchi	Single molecular sequencing method by tunnel current	¥32,890,000
M. Tsutsui	Creation of high performance monomolecular thermoelectric materials	¥3,120,000
M. Tsutsui	Creation of single particle shape analysis method using low aspect ratio pore embedded with sandwiching electrode	¥3,770,000
H. Tanaka	Single molecular sequencing using graphene	¥0,000
H. Tanaka	Single molecular sequencing using graphene	¥1,950,000
W. Tonomura	Over gravity loading on cells using centrifuge channel and its application to mechanical stimulation load cell culture system	¥2,340,000
A.Arima	Generation of micro reaction field by electric capture and fusion of nanocarrier using nanopore trap method	¥1,560,000

Entrusted Research

M. Taniguchi	JST	Development of Solid-State Nanogap-Nanopore Devices for 4th Generation DNA Sequencing Technology and Quantitative Analysis at Single-Molecule Resolution	¥13,000,000
T. Kawai	JST	Development of InSECT System Using Nano-Micro Pore	¥222,910,000
M. Taniguchi	JST	The development of a "Super Nippon-jin" with Enhanced Human senses and Capabilities with the Broader Goal to Strengthen the Industrial Competitiveness and Contribute to a More Prosperous Society	¥8,460,000

Contribution to Research

M. Tsutsui	The Asahi Glass Foundation	¥2,500,000

Cooperative Research

M. Taniguchi	Quantum Biosystems	¥2,484,000
M. Taniguchi	FUJIREBIO Inc.	¥2,232,000
M. Taniguchi	Kirin Co., Ltd.	¥600,000

M. Taniguchi TOSHIBA Co. ¥475,000

Other Research Fund

M. Taniguchi National University Corporation, Kyoto University (recommission by MEXT) ¥34,400,000

Department of Nanodevices for Medical Applications

Original Papers

[1]Mutational analysis of hepatitis B virus pre-S1 (9-24) fusogenic peptide., Liu, Q., Somiya, M., Shimada, N., Sakamoto, W, Yoshimoto, N., Iijima, M., Tatematsu, K., Nakai, T., Okajima, T., Maruyama, A., Kuroda, S.: Biochemical and Biophysical Research Communications, 474 (2) (2016) 406-412.

[2]Scaffold protein Enigma Homolog 1 overcomes the repression of myogenesis activation by Inhibitor of DNA binding 2, Nakatani, M., Ito, J., Koyama, R., Iijima, M., Yoshimoto, N., Niimi, T., Kuroda, S., Maturana, A.D.: Biochemical and Biophysical Research Communications, 474 (2) (2016) 413-420.

[3]Bio-nanocapsule-based scaffold improves the sensitivity and ligand-binding capacity of mammalian receptors on the sensor chip, Iijima, M., Yoshimoto, N., Niimi, T., Maturana, A.D., Kuroda, S.: Biotechnology Journal, 11 (6) (2016) 805-813.

[4]RBM20 and RBM24 cooperatively promote the expression of short ENH splice variants, Ito. J., Iijima, M., Yoshimoto, N., Niimi, T., Kuroda, S., Maturana, A.D.: FEBS Letters, 590 (14) (2016) 2262-2274.

[5]Cytokine-dependent activation of the JAK-STAT pathway in Saccharomyces cerevisiae, Yoshimoto, N., Ikeda, Y., Tatematsu, K., Iijima, M., Nakai, T., Okajima, T., Tanizawa, K., Kuroda, S.: Biotechnology and Bioengineering, 113 (8) (2016) 1796-1804.

[6]Cellular uptake of hepatitis B virus envelope L particles is independent of sodium taurocholate cotransporting polypeptide, but dependent on heparan sulfate proteoglycan., Somiya, M., Liu, Q., Yoshimoto, N., Iijima, M., Tatematsu, K., Nakai, T., Okajima, T., Kuroki, K., Ueda, K., Kuroda, S.: Virology, 497 (2016) 23-32.

[7]Release of siRNA from liposomes induced by curcumin, Fujita, K., Hiramatsu, Y., Minematsu, H., Somiya, M., Kuroda, S., Seno, M., Hinuma, S.: Journal of Nanotechnology, 2016 (2016) 7051523.

[8]High efficiency penetration of antibody immobilized nanoneedle thorough plasma membrane for in situ detection of cytoskeletal proteins in living cells, Kawamura, R., Shimizu, K., Matsumoto, Y., Yamagishi, A., Silberberg, Y.R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K., Nakamura, C.: Journal of Nanobiotechnology, 14 (1) (2016) 74.

[9]Core-fucosylation plays a pivotal role in hepatitis B pseudo virus infection: a possible implication for HBV glyco-therapy, Takamatsu, S., Shimomura, M., Kamada, Y., Maeda, H., Sobajima, T., Hikita, H., Iijima, M., Okamoto, Y., Misaki, R., Fujiyama, K., Nagamori, S., Kanai, Y., Takehara, T., Ueda, K., Kuroda, S., Miyoshi, E.: Glycobiology, 26 (11) (2016) 1180-1189.

[10]Scaffolds for oriented and close-packed immobilization of immunoglobulins, Iijima, M., Kuroda, S.: Biosensors and Bioelectronics, 89 (2) (2017) 810-821.

International Conferences

[1]High efficiency penetration of antibody-immobilized nanoneedle thorough plasma membrane for in situ detection of cytoskeletal proteins in living cells (poster), Shimizu, K., Kawamura, R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K., Nakamura, C.: Biosensors2016, May 25-27, 2016, Gothenburg, Sweden.

[2]Reconstituted ZZ-L particles and planar ZZ-L membrane for the oriented immobilization of Fc-fused

molecules on various types of biosensors. (oral), Iijima, M., Kuroda S.: Biosensors2016, May 25-27, 2016, Gothenburg, Sweden.

[3]Possible involvement of HBV pre-S1 (9–24) fusogenic peptide in uncoating process (poster), Q. Liu, M. Somiya, and S. Kuroda: 2016 International HBV Meeting, Seoul, Korea, September 21-24, 2016.

[4]High efficiency insertion of antibody-immobilized nanoneedle into living cells for in situ detection of cytoskeletal proteins (oral), Nakamura, C., Shimizu, K., Kawamura, R., Iijima, M., Kuroda, S., Fukazawa, K., Ishihara, K.: PRiME2016, October 2-7, 2016, Honolulu, Hawaii.

[5]Reconstituted planar ZZ-L membrane for the oriented immobilization of immunoglobulin G on biosensors (poster), M. Iijima, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[6]Decipherment of olfactory receptor repertoire by using an automated single-cell analysis and isolation system (poster), N. Yoshimoto, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[7]Bio-nanocapsules displaying various immunoglobulins as an active targeting-based drug delivery system (poster), K. Tatematsu, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[8]Nuclear delivery of NF-κB corepressor, MTI-II, by using hepatitis B virus infection machinery (poster), Z. Xu, K. Tatematsu, K. Okamoto, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[9]Elucidation of early infection machinery of hepatitis B virus and bio-nanocapsule (poster), Q. Liu, M. Somiya, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

[10] Synthesis and assembly of hepatitis B virus envelope protein-derived particles in Escherichia coli. (poster), H. Li, K. Onbe, Q. Liu, M. Iijima, N. Yoshimoto, T. Nakai, K. Tatematsu, T. Okajima, M. Seno, H. Tada, and S. Kuroda: The 20th SANKEN International The 15th SANKEN Nanotechnology Symposium, Osaka, Japan, Dec. 12-13, 2016.

Review Papers

Scaffolds for oriented immobilization of bioseinsing molecules, M. Iijima, S. Kuroda, Journal of the Society for Biotechnology??, 94[8] (2016), 497.

Development of automated single cell analysis and isolation system and new cell breeding techniques, N. Yoshimoto, S. Kuroda, Bioscience & Industry, 74 (2016), 30-33.

Potential of a non-cationic liposomes-based delivery system for nucleic acid medicines, M. Somiya, S. Kuroda, Drug Delivery Systems, 31 (2016), 35-43.

High-throughput screening of odorant-specific olfactory receptors, N. Yoshimoto, S. Kuroda, Aroma research : Journal of Aroma Science and Technology, 17 (2016), 41-45.

High-throughput analysis of mammalian receptor tyrosine kinase activation in yeast cells, Yoshimoto N., Kuroda, S., Methods in Molecular Biology, 1478 (2017), 35-52.

Elucidation of the early infection machinery of hepatitis B virus by using bio-nanocapsule, Liu Q., Somiya M., and Kuroda S., World Journal of Gastroenterology, 22 (2016), 8489-8496.

Development of drug delivery system nanocarrier by biomimicking technology : Bio-nanocapsule based on Hepatitis B virus early infection machinery, M. Somiya, S. Kuroda, Fine Chemicals, 45 (2016), 18-24.

Scaffolds for oriented and close-packed immobilization of immunoglobulin, Iijima M., and Kuroda S., Biosensors and Bioelectronics, 89 (2017), 810-821.

Books

[1] Development of olfactory cell array sensor for digitalizing any odorant, N. Yoshimoto, S. Kuroda, "How to utilize human sensory / Perception mechanism for product development", Technical Information Institute, 2016.

[2] Application of non-cationic liposome for the delivery of nucleic acid therapeutics, M. Somiya, S. Kuroda, "Application of cutting-edge drug delivery systems for drug formulation", Technical Information Institute, 2017.

Patents

[1]K20160047 Medicine, 2017-054937

Grant-in-Aid for Scientific Research

S. Kuroda	Development of next-gen DDS carrier by utilizing virus envelope-derived functional domains	¥0,000
S. Kuroda	Development of Neo-bionanocapsule for Various In Vivo Targets	¥34,840,000

Entrusted Research

S. Kuroda	Japan Agency for Medical Research and Development	Identification of HBV receptor indispensable for its infection, establishment of HBV infection system, pathological analysis of HBV infection, and development of new anti-HBV drugs	¥13,000,000
S. Kuroda	Japan Agency for Medical Research and Development（P-CRETE）	Development of scaffolding nanoparticle for dramatically enhancing therapeutic efficacy of antibody medicines	¥ 26,730,000

Contribution to Research

S. Kuroda	Yuzuru Morooka	¥1,000,000
S. Kuroda	GLOVACC Co. Ltd., President&Representative Director Mitsuharu Muramatsu	¥3,000,000
S. Kuroda	Kazuki Okamoto	¥230,000

Cooperative Research

S. Kuroda	Rohto Pharmaceutical Co., Ltd.	¥1,000,000
S. Kuroda	Panasonic Corporation	¥540,000
S. Kuroda	Suntory Global Innovation Center Limited	¥2,160,000
S. Kuroda	Kyoto Prefectural Police	¥0,000
S. Kuroda	University of the Ryukyus	¥0,000
S. Kuroda	Katayama Chemical Industries Co., Ltd.	¥0,000

Comprehensive Analysis Center

Original Papers

[1]Nickel-Catalyzed Construction of Chiral 1-[6]Helicenols and Application in the Synthesis of [6]Helicene-Based Phosphinite Ligands, D.Y.Zhou, T.Suzuki: Eur. J. Org. Chem, 2016 (2016) 4948-4952.

[2]A Model for the Active-Site Formation Process in DMSO Reductase Family Molybdenum Enzymes Involving Oxido-Alcoholato and Oxido-Thiolato Molybdenum(VI) Core Structures, H. Sugimoto, K.

Asano, T. Suzuki, S. Itoh,: Inorg. Chem., 55 (2016) 1542-1550.

[3]Palladium(II)-Catalyzed Dehydroboration via Generation of Boron Enolates, T. Amaya, T. Suzuki, T. Hirao: Chem. Eur. J., 22 (2016) 18686-18689.

[4]Supramolecular Photochirogenesis with a Higher-Order Complex: Highly Accelerated Exclusively Head-to-Head Photocyclodimerization of 2-Anthracenecarboxylic Acid via 2:2 Complexation with Prolinol, M. Nishijima, K. Asano, T. Suzuki, Y. Inoue,: J. Am. Chem. Soc, 138 (2016) 12187-12201.

[5]Cyclic mismatch binding ligand CMBL4 binds to the 5 -T-3 /5 -GG-3 site by inducing the flipping out of thymine base, C. Dohno, K. Asano, K. Nakatani: Nucl. Acid., Res., 44 (2016) 7090-7099.

[6]Enhanced head-to-head photodimers in the photocyclodimerization of anthracenecarboxylic acid with a cationic pillar[6]arene, D.Y.Zhou, T.Suzuki: Chin. Chem. Lett., 27 (2016) 1017-1021.

International Conferences

[1]Catalytic Asymmetric Synthesis of Natural Products Using Ir Catalyzed Tishchenko-type Reaction (poster), T.Suzuki, D.Y.Zhou, K.Asano, H.Sasai: Molecular Chirality Asia 2016, Osaka, Japan, April 20-22, 2016.

[2]Ir Catalyzed Asymmetric Tandem Reaction of meso-Diols (poster), T.Suzuki, D.Y.Zhou, K.Asano, H.Sasai: Late Stage Functionalization for Synthesis and Medicines, Oxford, UK, December 5 2016.

[3]Catalytic Asymmetric Synthesis of Natural Products using Ir-Catalyzed Tishchenko-type Reaction (oral), : 27th ICOMC, Melbourne, Australia, July 17-22, 2016.

[4]Catalytic Asymmetric Synthesis of Natural Products using Ir-Catalyzed Tishchenko-type Reaction (oral), T.Suzuki, D.Y.Zhou, K.Asano: JSPS ctc workshop 2016, Dijon, France, September 22, 2016.

[5]Catalytic Asymmetric Synthesis of Natural Products Using Ir Catalyzed Tishchenko-type Reaction (poster), T.Suzuki, D.Y.Zhou, K.Asano, H.Sasai: BOSS XV, Antwerp, Belgium, July 10-15.

Contributions to International Conferences and Journals

T.Suzuki Molecular Chirality Asia 2016 (Organaizing Committtee)

Publications in Domestic Meetings

Japan Chemical Society annual meeting 2 papers

Reserch Laboratory for Quantum Beam Science

Original Papers

[1]Structures of 4-substituted thioanisole radical cations studied by time-resolved resonance Raman spectroscopy during pulse radiolysis and theoretical calculations, Sachiko Tojo, Mamoru Fujitsuka, Tetsuro Majima: RSC Advances, 6 (111) (2016) 109334-109339.

[2]Mesolysis Processes with Benzylic Carbon–Oxygen Bond Cleavage in Radical Anions of Aryl Benzyl Ethers Studied by Electron Pulse Radiolysis in DMF, Yamaji, Minoru; Tojo, Sachiko; Fujitsuka, Mamoru; Sugimoto, Akira; Majima, Tetsuro: Bulletin of the Chemical Society of Japan, 89 (7) (2016) 798-803.

International Conferences

[1]Sudden Increase of the Radiation Chemical Yield for Loss of Carbonate Ester in PADC Detector where the Track Overlapping of 28 MeV Electrons Becomes Significant (poster), T. Kusumoto, Y. Mori, M. Kanasaki, K. Oda, S. Kodaira, Y. Honda, S. Tojo, R. Barillon, and T. Yamauchi: nternational Symposium on Radiation Detectors and Their Uses.