ISIR
OSAKA UNIVERSITY

MEMOIRS OF

The Institute of Scientific and Industrial Research

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Foreword

Katsuaki Suganuma
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

Screen-Single-Molecule Analysis

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

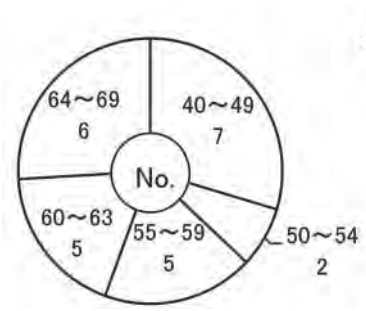
Machine Group
Measurement Group

Administrative Office

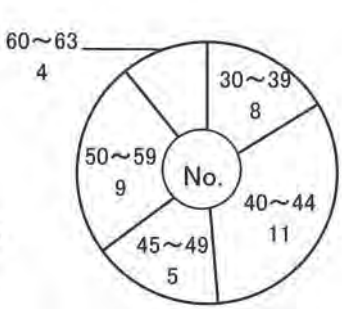
General Affairs Division
Research Cooperation Division

Staffs' Age (years old) –As of Mar.31.2018

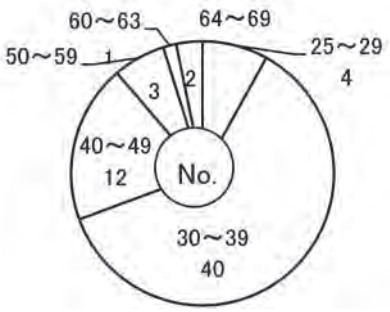
Professors



Associate Professors

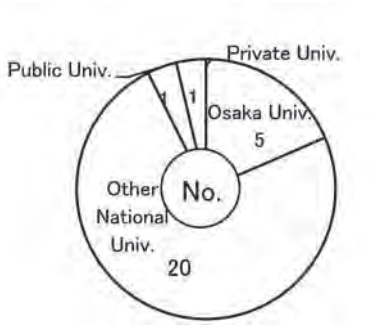


Assistant Professors

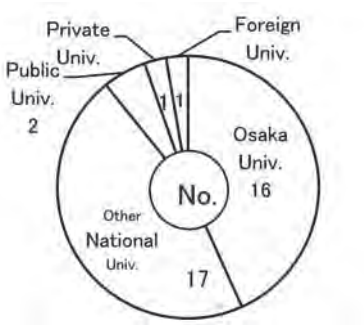


Staffs' Alma Master –As of Mar.31.2018

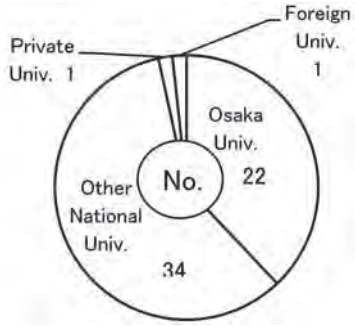
Professors



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.

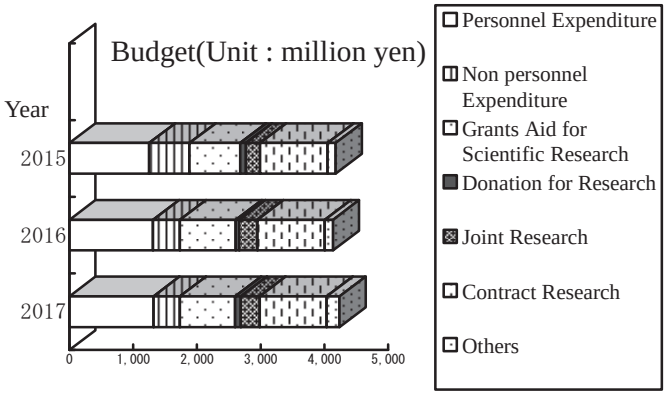
The new organization was highly evaluated, but with change of their structure to National University Agencies in April 2004, our management system needs reshaping. A Board of Directors under the Director has been formed, and Advisory Board has been set up to introduce opinions from outside into the Institute.

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 2017 is 864,007,000yen.

・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
2017	36,300 (7)	26,810 (18)	16,604 (16)	10,000 (3)

Division / Year	Special Projects	Others	Total
2017	1,000 (1)	500 (1)	91,214 (46)

・Cooperative Researches and Contract Researches in the fiscal year 2017 are as follows: Cooperative Researches are carried out with 137 organizations and the budget for the fiscal year 2017 is 292,196,000 yen. The number of Contract Researches is 52 and the budget for the fiscal year 2017 is 1,053,797,000 yen.

4) International Research

Quantum System Electronics	Ruhr University Bochum	Germany	Research on photon-electron spin conversion
	University of Regensburg	Germany	Research on SiGe self-assembled quantum dots

Quantum System Electronics	Max Planck Institute Stuttgart	Germany	Research on photon-electron conversioni transition metal dichalchogenide
Semiconductor Electronics	Oxford University	UK	Liquid-AFM measurementsof glyco-functionalizedgraphene
Advanced Electronic Devices	imec	Belgium The Netherlands	Flexible Electronics
Intelligent Media	Peking University	China	Computer vision
	Drexel University	USA	
	University of Rajshahi	Bangladesh	
	Hanoi University of Science and Technology	Vietnam	
	Vietnam National University of Agriculture	Vietnam	
	Chonnam National University	Korea	
Reasoning for Intelligence	Max-Planck-Institute	Germany	Statistical Causal Inference
	Nanyang Technological University	Singapore	Representative selection with structured sparsity
	Federation University Australia	Australia	Machine Learning
Knowledge Science	Honda Research InstituteUSA, Inc.	USA	Adaptive Information Presentation in Cars
	Carnegie Mellon University	USA	Automatic Tailor-made Spoken Dialogue System for Individual Users
Architecture for Intelligence	imec	Belgium	Brain signal analysis
	Chulalongkorn University	Thailand	Machine Learning
	University of the Philippines Manila	Philippines	
	University of Leuven	Belgium	
	Thammasat University	Thailand	Introductive Logic Programing
	De La Salle University-Manila	Philippines	Empathic Computing

Architecture for Intelligence	University of California, San Diego	USA	Brain signal analysis
Functionalized Natural Materials	Chinese academy of sciences	China	Development of paper photodetector by using perovskite nanowires and nanocellulose
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
	Università di Perugia	Italy	Reaction of hydrogen molecules with hydroxyl radicals
Advanced Hard Materials	Hanyang University	Korea	Academic Exchange in the field of Nanochemical Engineered New Functional Materials
	Korea Institute of Ceramic Engineering and Technology	Korea	Low-powered (<15 mW) smart sensors for multiple gas detection by functionalized nano-structured materials
	Sun Moon University	Korea	Development of Multifunctional Nanomaterials and Processing Technology for Eco-friendly Applications
	Korea Institute of Industrial Technology	Korea	Bulk Fluorescent Ceramic Fabrication Technology and Application with Rare Earth

Advanced Interconnection Materials	Donghua University Ewha Womans University	China Korea	Or anic/inor anic Nanoh brid Platforms for Precision 1¥1mor Ima in and Therapy
Excited Solid-State Dynamics	Peter Grünberg Institut (PGI-3), Forschungszentrum Jülich, Germany	Germany	Phonon physics of graphene and related materials by using newly developed high-resolution electron energy loss spectroscopy
	Ecole Polytechnique, Laboratoire des Solides Irradies, Paris-Saclay University	France	Ultrafast carrier dynamics in semiconductors
Accelerator Science	La Sapienzza Univ, INFN	Italy	Study using THz-far infrared enlectromagnetic wave from SR
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
	University of Science and Technology of China	China	Study on modeing of radiolysis of high temperature water under mixed radiation field.
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
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

	University of Burgundy	France	development of chiral phosphine catalyst and its application to asymmetric catalysis
Synthetic Organic Chemistry	Chung-Ang University	Korea	development of chiral vanadium catalyst
Regulatory Bioorganic Chemistry	University of Toronto	Canada	Regulation of repeat instability using small molecules
	Adam Mickiewicz University	Poland	Binding analysis of CUG repeat-binding molecules
	Polish Academy of Sciences	Poland	Structural analysis of small molecule-nucleic acid complex
	Weizmann Institute of Science	Israel	Regulation of microRNA function using small molecules
Organic Fine Chemicals	Department of Medical Sciences, Thailand	Thailand	Development of PNA device for dengue virus infection
	Eindhoven University of Technology	The Netherlands	Regulation of 14-3-3 functions by use of fusicoccin derivatives
	McGill university	Canada	neurite outgrowth effect of fusiccocin
Biomolecular Science and Reaction	Academia Sinica	Taiwan	Application of ZZ-BNC for novel SPR sensor
Biomolecular Science and Regulation	The University of Hong Kong	Hong Kong	Function of drug efflux systems
	French National Institute for Agricultural Research（INRA）	France	Regulation of drug efflux systems
	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
Biomolecular Science and Engineering	DRVision Technologies LLC	USA	Live-cell fluorescent probes for neurological diseases
	Albert Einstein College of Medicine	USA	Development of near-infrared chemiluminescent protein
	Vanderbilt University	USA	Measurement of Mg2+ dynamics in cyanobacteria with MARIO
	University of Alberta	Canada	Development of genetically encoded FRET-based Ca2+ indicators using novel red chrom-oprotein
Functional Nanomaterials and Nanotechnology	Indian Institue of Technology, Hyderabard	India	Sn oxide-based gas sensors
	Genova University	Italy	Functional Oxide-MEMS
	Purdue University	USA	3D correlated oxide nano-structures for nano-scaling phenomena and electronic phase change memory application.
Nanocharacteri-zation 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
	Harvard University	USA	Analysis and characterization of molecular materials using electron microscopy
	FEI Company	USA	Development of a high resolution environmental TEM
Theoretical Nanotechnology	Uppsala University	Sweden	Materials Design toward Environmental and Energy Issues
	University of Jember	Indonesia	The density functional theory and its computational applications
	Pusan National University	Korea	Electronic states of transition-metal oxides

Theoretical Nanotechnology	CNR	Italy	Electronic structure in transition-metal oxides
Theoretical Nanotechnology	Forschungszentrum Jülich	Germany	Materials design by first-principles calculations
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
Bio-Nanotechnology	Huazhong University of Science and Technology	China	Microfludics
Comprehensive Analysis Center	Carnegie Institution of Washington Geophysical Laboratory,	USA	Structure transition of dielectric substance
	Sichuan University	China	Photochemistry of supramacromolecular complex

5) Symposia, Seminars, Workshops and Lectures

2017/4/14	Seminar on the research of the bacterial drug efflux systems
2017/5/25-5/26	Symposium on Photovoltaic Materials and Technologies
2017/6/1	Lecture on Functional AlN Thin Films and Their Physica Properties
2017/6/12/-6/13	QTech2017
2017/6/15	Research Forum on development of small-molecule drug targeting nucleic acids
2017/6/19	6th imec-Handai international symposium
2017/6/22	Core to core seminar
2017/7/1	45th Kansai Joint Speech Seminar
2017/7/21	Workshop of "Development of beam chemistry using accelerator and elucidation of radiation induced chemical reaction"
2017/8/8	Research Forum on development of small-molecule drug targeting nucleic acids
2017/8/18	Seminar on the Design and Advanced Function of Novel Materials
2017/9/11-9/12	Workshop on Nano Spin Conversion Science 2018
2017/9/29	Joint research meeting: Okada Group (Tokyo Tech) and Komatani Lab (Osaka U)
2017/10/2-2017/10/3	Satellite Workshop of Kanamori Memorial Symposium — Recent Progress in Materials Science for Spintronics and Energy Applications
2017/10/12	Research Forum on development of small-molecule drug targeting nucleic acids

2017/10/17	JST-TU Delft Quantum Technology Workshop
2017/10/27-10/29	12th Korea-Japan Symposium on Frontier Photoscience
2017/11/16-17	The 14th Japan Catechinology
2017/11/26-12/1	Workshop on Innovative Nanodevice and Systems 2017
2017/11/30	H29 Printed Electronics Sympojium/3rd Workshop
2017/12/4-12/5	22nd Physics and Applications of Spin-related Phenomena in Semiconductors (PASPS-22)
2017/12/15	Research Forum on development of small-molecule drug targeting nucleic acids
2017/12/23	日本物理学会大阪支部公開シンポジウム「量子力学 90 年」
2018/1/17	1st SANKEN JSPS Symposium for the Circulation of Talented Researchers “Global Networking on Molecular Technology Research”
2018/1/26	Printed Electronics Association : Public Symposium
2018/2/2	大阪大学物質・材料科学研究推進機構講演会
2018/2/9	Seminar for Young Researchers on SANKEN Nanotechnology Center
2018/2/16	兵庫県マテリアルズ・インフォマティクス講演会
2018/3/9	Seminar on Photochemical Functions of Materials for Biorogical Viewoint
2018/3/16	4th Osaka University-KAERI Workshop on Radiation Research
2018/3/16	Symposium on Frontier Researches of Functional Oxide Devices and Materials
2018/3/18	The 2018 Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry, Symposium
2018/3/19	Seminar on the research of the bacterial drug efflux systems
2018/3/19	The 65th JSAP Spring Meeting
2018/3/20	The 98th CSJ Annual Meeting

Other Lectures and Seminars

2017/4/10	Takashi Okada	Kwansei Gakuin University	Emeritus Prof.	Molecular Graph and data mining
2017/4/14	Masayuki Ohzeki	Tohoku Univ.	Assoc. Prof.	Introduction to the Machine Learning
2017/4/20	Takeo Kawabata	Institute of Chemistry, Kyoto University	Professor	不斉及び位置選択的分子変換の新機軸
2017/5/12	Thierry Epicier	University of Lyon	Professor	Towards Operando and real time 3D analysis of Nanocatalysts in Environmental TEM

2017/5/29	Shigeru Arai	Graduate School and Faculty of Pharmaceutical Sciences, Chiba University	Assoc.Prof.	コプシアアルカロイドの全合成研究
2017/6/1	Padmalochan Panda	Indira Gandhi Centre for Atomic Research (IGCAR)	Ph.D,Student	Deep UV region usable pure and doped AlN thin films and its physical properties
2017/6/2	Radu Orghidan	NTTData Romania	Senior Presales Consultant	Recent topics on computer visions and robotics
2017/6/5	Yasuyuki Kita	Ritsumeikan University	Professor	創薬を志向し、ヨウ素原子の特性を活用したメタルフリーカップリング反応の開拓
2017/6/22	N. Shioda	Gifu Pharmaceutical University	Assoc. Prof.	Drug development toward neurological disorders based on G-Qplex
2017/7/6	Hiroki Funashima	Dept. of Physics, Kobe University	Research Lecturer	Thermoelectric chalcogenide thermoelectric mineral
2017/7/13	Inuzuka Nobuhiro	Nagoya Institute of Technology	Professor	つながりと論理を重視した知識発見アルゴリズム
2017/7/14	Luca Pellegrino	CNR-SPIN and University of Genova	Researcher	VO2: a solid state actuator for micro/nanorobotics
2017/8/8	Vincenzo Aquilanti	Accademia Nazionale dei Lincei, Roma Accademia Nazionale delle Scienze, Università di Perugia	Emeritus Prof.	Orienting molecules: Stereodirectional and Chiral Features of Photo- and Reaction Dynamics
2017/8/18	Toshihiro NAKAMURA	Hosei University	Assoc. Prof.	Random lasing in semiconductor micro/nano-structures
2017/9/20	Koji MORIMOTO	Faculty of Pharmaceutical Sciences, Ritsumeikan University	Assis. Prof.	ヘテロ原子を有する芳香族化合物類の革新的なメタルフリー酸化的結合形成
2017/9/20	Tetsuo NARUMI	Graduate School of Integrated Science and	Assoc.Pprof.	ペプチド結合等価体によるアミロイドペプチドの凝集機構

		Technology, Shizuoka University		解明
2017/9/29	Gang Chen	Nanyang Technological University	Assis. Prof. (PI)	RNA Technology, Basic and Application
2017/10/25	Timothy John Maxwell	SLAC National Accelerator Laboratory	Research Associate	Longitudinal Beam Dynamics and Diagnostics at the LCLS
2017/12/5	Luca Pellegrino	CNR-SPIN and University of Genova	Researcher	Perspectives of VO2 for new applications in micro/nano actuators
2017/12/7	Artoto Arkundato	University of Jember	Lecturer	Study of Liquid Lead Corrosion of Fast Nuclear Reactor and Its Mitigation by Using Molecular Dynamics Method
2017/12/11	Fumitoshi KAKIUCHI	Faculty of Science, Keio University	Professor	Palladium-catalyzed Aromatic C-H Functionalization by Means of Electrochemical Oxidation
2018/1/16	Yasukazu Murakami	Kyushu Univ.	Professor	Toward Ultrahigh Precision of Electron Holography: Imaging of Electromagnetic Field in Nanostructure Materials
2018/1/17	Dimitrios Peroulis	Purdue Univ.	Professor	Multifunctional RF Frontends for High-Frequency AI Sensors
2018/1/18	Michi-To Suzuki	Center for Emergent Matter Science (CEMS), RIKEN	Research Scientist	Cluster multipole theory for macroscopic phenomena in antiferromagnets
2018/1/18	Gustav Bihlmayer	Forschungszentrum Jülich	Scientist	Magnetic topological materials
2018/1/18	Daisuke Okuyama	Institute of Multidisciplinary Research for Advanced Materials, Tohoku Univ.	Assis. Prof.	Observation of crystal and magnetic structures on noncentrosymmetric magnets
2018/1/18	Johannes Daniel Reim	Institute of Multidisciplinary Research for Advanced Materials, Tohoku Univ.	Assis. Prof.	Ferro- and antiferromagnetic skyrmions from a neutron scattering perspective: Two case studies

2018/1/18	Jean-Jacques Toulmé	University of Bordeaux	Prof. (PI)	RNA aptamer, Basic and Application
2018/1/26	Hideo Hosono	Tokyo Institute of Technology	Professor	Transparent oxide semiconductor technologies for organic electronics
2018/1/26	Junichi Takeya	University of Tokyo	Professor	Organic integrated circuits and printed electronics
2018/2/1	Prof. Dr. Christian Ottmann	Eindhoven University of Technology	Assoc. Professor	Small-molecule stabilization of Protein-Protein Interactions
2018/3/9	Taito Itabashi	Towada Municipal Central Hospital	Chief Manager of Orthopedics	Clinical application of optical function and long term antimicrobial expression
2018/3/9	Yukihiro MORIMOTO	Ushio Inc.	Project Manager	Mechanism of photo functionalization inducing Osseo integration
2018/7/14	Daniele Marre	CNR-SPIN and University of Genova	Professor	An overview on the activities at CNR-SPIN and University of Genova in condensed matter physics.

7) Public Information Activity

Public information activity of ISIR in 2017 is as follows:

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

8) Research Reports

The number of scientific and technological papers published in 2017 is 362. The details are described in the part of activity of divisions and facilities.

9) Scientific Awards

2018/3/28	K.KISHI S.TAKIZAWA H.SASAI	Best presentation award of 138th Annual Meeting of the Pharmaceutical Society of Japan (AMPSJ)
2018/3/22	K.FUKUI	Knowledge-based Systems Outstanding Reviewer Award
2018/3/14	T.SEKITANI	JEITA Venture Award
2018/3/13	R.TAKEDA	IPSJ Yamashita SIG Research Award
2018/3/12	K.HAYASHI	ANLP Annual Meeting Excellent Paper
2018/2/16	T.ONO Y.KANAI K.INOUE K.MATSUMOTO	Academic-industrial Alliance Award
2018/2/15	T.NAGAI	The Photobiology Association of Japan award
2017/12/27	T.MATSUMOTO	2018 Albert Nelson Marquis Lifetime Achievement Award
2017/12/25	S.NAGAO T.SUGAHARA K.SUGANUMA	MES2017 best paper award
2017/11/23	T.GOTO	The 33rd International Korea-Japan Seminar on Ceramics, Young Ceramist Best Presentation Award
2017/11/23	Y.ONITSUKA	2nd prize in the Best Young Researcher Contribution Contest
2017/11/22	S.YAMASAKI	Japan Science and Technology Agency, President Award
2017/11/8	K.KAIHATSU	The 15th Award of Kansai Branch, Synthetic Organic Chemistry
2017/11/5	S.YAMASAKI	The 2nd COI Young Innovation Pitch, Best Presenter Award
2017/10/31	Z.XU	2017 National Tsing Hua University -Osaka University Life Science Student Symposium,Outstanding presentation
2017/10/26	M. N.HOSSAIN	20th International Symposium on Calcium Binding Proteins and Calcium Function in Health and Disease (CaBP20), Excellent Poster Award
2017/10/23	H.SHINODA	The 55th Annual Meeting of The Biophysical Society of Japan, Student Presentation Award
2017/10/20	T.SEKITANI	16th Docomo Mobile Science Award, Basic Science, Excellence Award

2017/10/5	A.ARIMA M.TSUTSUI W.TONOMURA K.YOKOTA M.TANIGUCHI	化学とマイクロ・ナノシステム学会 第 36 回研究会優秀研究賞
2017/9/28	N.TAKEMURA	VRSJ Outstanding Paper Award
2017/9/28	M,FUJITSUKA	Japanese Society of Radiation Chemistry Award
2017/9/20	T.SEKINO T.GOTO S.CHO	Session Incentive Award, the 30th Fall Meeting
2017/9/15	M.TANIGUCHI	International Investigator Awards of the Japan Society for Molecular Science
2017/9/13	Y.MAKIHARA	IEICE Contribution award
2017/9/7	H.KOBAYASHI T.MATSUMOTO	Key Scientific Article
2017/9/1	M.SOMIYA	2017 JARI/JSEV Oral Presentation Award
2017/8/9	T.AOKI H.SASAKI S.TAKIZAWA M.SAKO	Kansai blanch of The Society of Synthetic Organic Chemistry, Japan Poster Award
2017/8/9	I.MITSUGAMI	MIRU Reviewer Award
2017/7/24	Y.Zhang	The31st Grand Prize for the Advanced Technology Award The Fujisankei Business i Prize
2017/7/13	H.KOGA	Young Scientist Award of the Cellulose Society of Japan
2017/7/4	M.SAKO H.SASAKI S.TAKIZAWA	GSC Poster Award
2017/6/27	M.SUGIYAMA T.UEMURA S.YOSHIMOTO M.AKIYAMA T.ARAKI T.SEKITANI	9th International Conference on Molecular Electronics and Bioelectronics, Best Poster Award
2017/6/26	M.NUMAO K.FUKUI	JSAI Incentive Award

2017/5/29	M.TANE	Honda Memorial Young Researcher Award
2017/5/16	S.YOSHIMOTO T.ARAKI T.UEMURA S.NEZU T.SEKITANI	Workshop on LSIs and Systems 2017, Best Poster Award (General)
2017/5/16	M.SUGIYAMA T.UEMURA S.YOSHIMOTO M.AKIYAMA T.ARAKI T.SEKITANI	Young Researchers Conference, The Institute of Electronics, Information and Communication Engineers 2017, Best Poster Award
2017/4/21	T.OKAJIMA	Nagase Research Promotion Award

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	43	57	23	0	16	-	139
Doctor Course	24	36	4	3	12	9	88
Total	67	93	27	3	28	9	227

Number of students who had obtained Master's or Doctor's Degree in FY2017 is as follows.

Field / Degree	Science	Engineering	Pharma-ceutical Science	Information Science and Technology	Frontier Biosciences	Total
Master’s Degree	14	20	0	9	-	43
Doctor’s Degree	9	7	1	4	1	22
Total	23	23	1	13	1	65

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)
Chonnam National University
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
Tammasat University
Chungnam National University
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(School of Environmental Science and Engineering / Department of Chemical Engineering)
De La Salle University(College of Computer Studies)
Assiut University
Interuniversitair Micro-Electronica Centrum vzw (IMEC)
University of Bordeaux

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

2) Foreign Researchers and Students

The Number of foreign researchers and students staying in ISIR as of March 31, 2018 is 122 in total. Details are, Assistant Professor(include of specially appointed staffs) (1), Specially Appointed Associate Professor(8), Specially Appointed Researcher(5), Specially Appointed Technical Staff(1), Part-time Employee (19), Graduate Students 68(Doctor Course,44, Master Course,24), Research Students (20).

Their nationalities are; China(54), Korea(19), Thailand(7), Viet Nam(8), Indonesia(4), Bangladesh(7), Egypt(4), The Netherland(1), Philippine(2), Malaysia (2), India(4), Iran(2), Costa Rica(1),Sri Lanka(2), Germany(1), Russia(2), Syrian(1), Taiwan(1), UK(1).

The Number of visiting Research Scholar in 2017 is 51. Their nationalities are; China(13), Thailand(9), U.S.A.(6), Korea(4), Germany(4), Egypt(3), India(2), UK(2), Ireland(1), The Netherlands(1), Sweden(1), France(1), Taiwan(1), Indonesia(1), Norway(1), Mexico(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 356 in total.

Number of ISIR staffs who have been working as committee members of International Conferences or Editorial Board of international academic journals are 146 in total. For more details, see the part of activity of divisions and facilities.

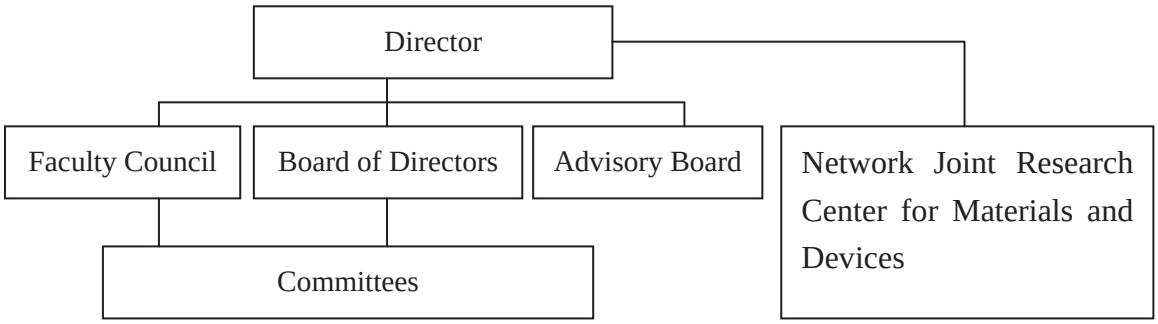
4. Concluding Remarks

(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
Assistant Professor: Takafumi FUJITA (1.8.2017-)
Specially Appointed Researcher: Yuji SAKAI
Guest Researcher: Shuichi EMURA
Postdoctoral Researcher: Yijin ZHANG
Graduate Students: Yoshito SUGETA, Tomohiko ABE, Tomohiro NAKAGAWA, Yuhei KUROKAWA, Masaki TADA, Yumi AOMATSU, Kazutoshi KAWAGUCHI, Seiu HIGASHIDE, Ryo YANAGIDANI, Rio FUKAI, Moe TANAKA, Tomoki CHATANI, Ryota HAYASHI, Takuro KOJIMA
Under Graduate Students: Sanshiro FUJIMORI, Takuya YOSHIHARA
Supporting Staff: Akiko WATANABE

Outline

In our department, we search for and study novel quantum and spintronic devices that control the quantum mechanical properties of light, electrons and especially spins. In particular, single electron spins are a candidate for a suitable quantum bit (qubit), the information unit in quantum computation. In a similar manner, we focus to join the technologies of low-dimensional transport and nano-fabrication for handling the spins in actual devices. Here, we have been developing quantum information processors based on quantum dots and quantum interfaces that convert quantum states between single photons and single electron spins, which is necessitated in long distant quantum communication. Moreover, on the search of unique semiconductor materials, we grow magnetic semiconductors by introducing magnetic materials in non-magnetic semiconductors. As a whole, we study the growth, characterize high quality materials and perform precise quantum transport measurements to be able to explore new phenomena emerging from photon, electron and spin degrees of freedom inside the quantum nano-structures.

Research Projects

Single-electron charge sensing in InAs self-assembled quantum dots

Electron spins in uncapped InAs self-assembled quantum dots (QDs) are a potential candidate of qubits in quantum information processing. A missing technology in self-assembled QDs is a sensitive charge sensing, which has been extensively employed in gate-defined QDs for detecting a single charge and a single spin. Realization of the

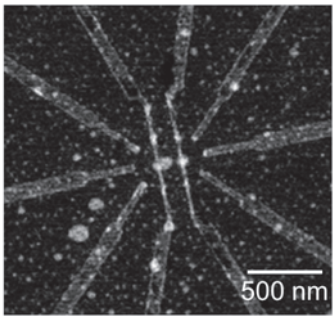


Fig.1 Scanning electron micrograph of the InAs self-assembled quantum dot device

charge sensing in self-assembled QD devices may further facilitate their applications to spintronics and spin-based quantum information processing. In this work, we demonstrate the charge sensing in InAs self-assembled QDs using another adjacent InAs QD as a charge sensor [Fig. 1]. We choose two adjacent QDs, and fabricate source, drain, and side-gate electrodes. At low temperatures, we find that the current through one of the QDs shows distinct changes at Coulomb peaks in the other QD, indicating single-electron charge sensing.

Measuring quantum dots in (110) GaAs and its application for light-spin interfaces

The lack of conversion efficiency is a challenge to be overcome when realizing quantum repeaters that allow long-distant quantum communication. We have prepared a (110) quantum well device that provide the few times higher efficiency heavy-hole band for the quantum conversion, as compared to the conventional (001) wafers that requires the light-hole band excitation. This orientation allows the Zeeman splitting of the heavy hole and its spin resolved photo-excitation. We demonstrated the basic classical conversion from photon circular polarization to electron spin using this heterostructure [Fig. 2] and formed a single quantum dot tuned to the few electron regime. These results assure our progress towards realizing coherent quantum state conversion using a (110) grown wafer.

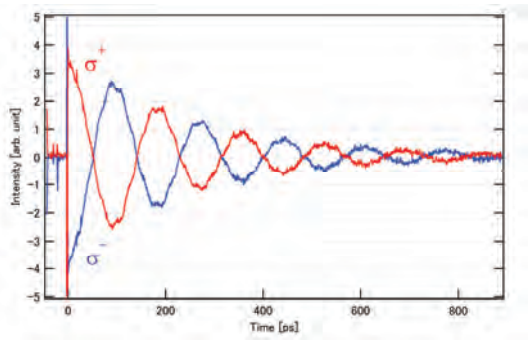


Fig.2 Time-resolved Kerr rotation measurement when exciting the heavy-hole band of a (110) grown GaAs quantum well.

Formation of III-Nitride semiconductor nanorods towards application to spintronic devices

III-Nitride semiconductor is one of the most attractive semiconductor materials for spintronic devices as well as optoelectronic devices since the spin relaxation lifetime in GaN is 1000 times as long as that in GaAs. Moreover, GaN nanorods, one-dimensional nanostructures of GaN, make it possible to reduce the electron spin relaxation by constraining the electrons in low dimensional structures as well as by reducing the defect density. In 2017, firstly, we investigated the formation of isolated GaN nanorods by plasma-assisted molecular beam epitaxy. Then, we fabricated single-nanorod devices with a metal/semiconductor/metal (MSM) structure and characterized their electric properties, as shown in Fig. 3. The devices exhibited S-shaped *I-V* curves reflecting the MSM structure with Schottky barrier contacts (Pd/GaN/Pd). Low photocurrent generation efficiency indicates that the present GaN nanorod devices possess remarkable surface effects on their electronic transport.

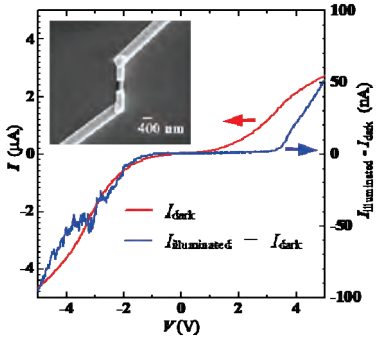


Fig.3 *I-V* characteristics and a SEM image for a single GaN nanorod MSM device

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, Masami TANIOKU, Aki KUROMATSU, Kaori YAMAMOTO
Graduate Students:	Satoshi OKUDA, Ryo OKAZAKI, Takuya KAWATA
Under Graduate Students:	Mitsuru SHIRAI, Takashi YAMANAKA
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

Multifunctional Graphene Biosensors on Piezoelectric Substrates

We have developed and investigated a hybrid device of surface acoustic wave (SAW) sensor with a graphene field-effect transistor (G-FET). The G-FET biosensor was fabricated on a $LiTaO_3$ substrate and beside it interdigital transducers were formed to generate SAW on the surface (Fig. 1). The propagation of SAW induces acoustic current (AC) in graphene, which is monitored as the reference-electrode voltage is varied. A small pool is set on the graphene and filled with an aqueous solution of target biomolecules. This sensor is expected to realize the simultaneous measurement of total charge and total mass of target molecules adsorbed on the graphene. The AC peak is clearly observed in the experiments, and its height depends on the mass while its position indicates the charge.

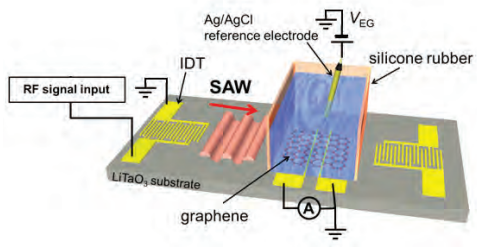


Fig. 1. Schematics of the SAW G-FET sensor

Fabrication of Graphene Devices with Protective Almina Films

Direct resist coating on graphene causes degradation of transfer characteristics of graphene FETs. Here, we have demonstrated a fabrication of graphene FETs without direct resist coating on graphene using AlO_2 deposition on CVD graphene. Figure. 2 (a) shows schematic images of the fabrication process. First, AlO_2 as a protective layer was deposited on CVD graphene synthesized on Cu foils. Then, we transferred graphene from Cu foils to substrates by a conventional method. Graphene was covered with AlO_2 in graphene FET fabrication. After FET fabrication, AlO_2 was etched by sodium hydroxide. Figure. 2 (b) shows transfer characteristics of the graphene FET. The characteristics was improved using AlO_2 deposition process, compared with the conventional process.

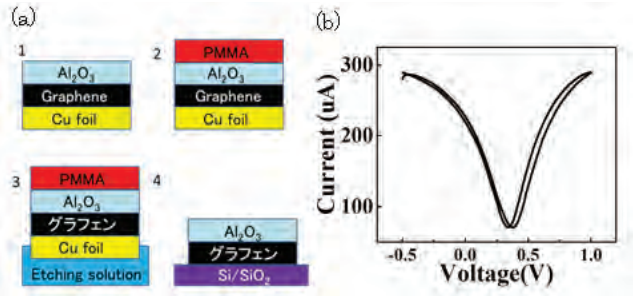


Fig. 2. (a) Schematic image of graphene transfer process with an aluminum protective layer. (1 Aluminum deposition on graphene. 2 Spin coat PMMA. 3 Etching Cu foil. 4 Transfer onto substrate and removal of PMMA.) (b) Transfer characteristics of a graphene FET fabricated with aluminum

Sialoglycan-functionalized graphene FET for detection of human-infectious influenza virus

When avian influenza virus mutates into human-infectious one, it has high pathogenicity and considered to lead to severe pandemic. To discriminate virus's human infectivity with high sensitivity, we functionalized surface of graphene field-effect transistor, which keenly respond to viral surface charge, using sialoglycan, virus receptor on cell surface (Fig.3). Before the experiment, graphene FET surface is blocked to reduce nonspecific binding of virus. As inactivated influenza virus was introduced to graphene FET, transfer characteristics of graphene FET shifted toward positive gate voltage direction, due to the binding of negatively-charged virus particles to graphene. This shift occurred only with human-infectious influenza virus and avian influenza virus hardly changed the transfer characteristics. After the electric measurement, we observed graphene FET surface using AFM and fluorescent microscope with virus staining. Only after introduction of human-infectious virus, there were many fluorescent particles with diameter of virus on graphene. This confirmed that our sensor specifically captured and detected human-infectious influenza virus. Detection limit of the virus concentration was comparable to that in saliva. Therefore, our sensor is suitable for on-site analysis or diagnosis of clinical samples, whereas the conventional discrimination of human infectivity takes a week due to its low sensitivity. Our virus sensor is a promising way to prevent oncoming pandemic.

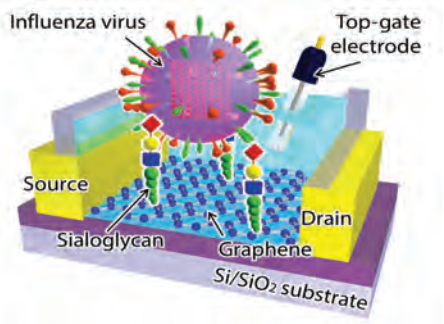


Fig.3. Schematics of influenza virus detection using sialoglycan- functionalized

Department of Advanced Electron Devices

Professor: Tsuyoshi SEKITANI
Assistant Professors: Koichi SUDOH
Specially Appointed Associate Professor: Takafumi UEMURA
Assistant Professor: Teppei ARAKI
Specially Appointed Assistant Professor: Yuki NODA
Guest Associate Professor: Hiroki OHTA
Guest Assistant Professor: Shusuke YOSHIMOTO
Specially Appointed Researcher: Toshikazu NEZU, Afreen AZHARI
Technician: Yuko KASAI, Naoko NANBA, Mihoko AKIYAMA, Hirokazu IIDA, Masaru SHIMIZU, Takako OYAMA, Yumi INOUE, Naoko KURIHIRA, Kazuko IWAKI, Yoshiko HARADA, Takashi INAMI, Hiroshi OHTA, Kazami NABIKA, Yoshiko TAKEMURA, Aki SHIMIZU, Naomi TOYOSHIMA,
Graduate Students: Masaya KONDO, Ashuya TAKEMOTO, Masahiro SHUGIYAMA, Fumika TANABE, Keisuke SAKAGUCHI
Under Graduate Students: Mayuko FUJII, Mizuki MATSUBA
JSPS Postdoctoral Fellowships: Yang YANG
Exchange Students: Ruben MARTEIJN
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

A Sheet-type Wireless electroencephalogram (EEG) Sensor System using Flexible and Stretchable Electronics

A sheet-type wireless electroencephalogram (EEG) sensor system using flexible and stretchable electronics has been successfully developed on flexible substrates. The EEG Ssensor system can be attached to the forehead using biocompatible gel with the stretchable, and bio-compatible electrode sheet and can monitor bioelectric potentials

with less than 1 microvolts. The sensor is compactly designed for 3 cm × 9 cm × 6 mm with weight of 12 g. Results show that the proposed sheet-system demonstrates a promising performance in diagnosing brain- related diseases including the Alzheimer's disease using frequency domain analysis.

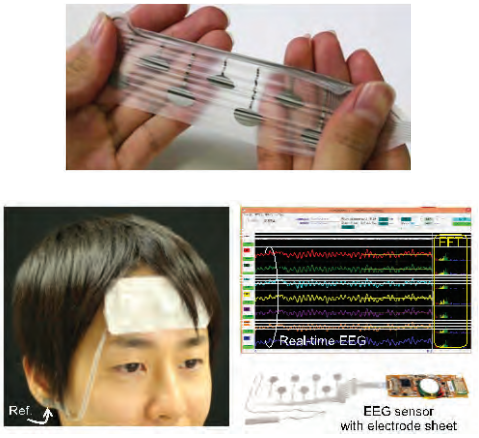


Fig. 1. Strechable electrode, imperceptible EEG sensor mounted on the forehead, wave viewer software connected to the EEG system with a flexible substrate.

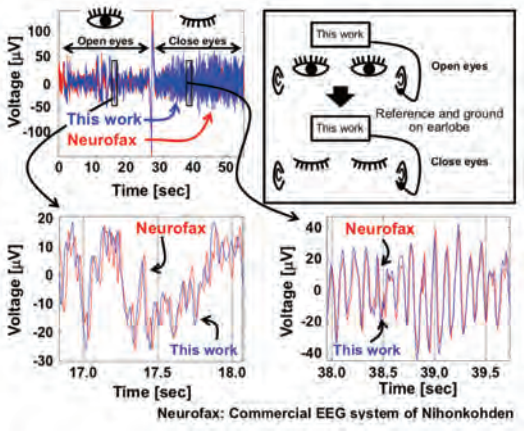


Fig. 2. EEG recorded using a conventional Neurofax (Nihon Kohden) and the proposed EEG system.

A Patch-Type Wireless Forehead Pulse Oximeter for SpO_2 Measurement

A patch-type wireless wearable pulse oximeter system has been developed to measure the heart beat rate and oxygen saturation of blood (SpO_2) in reflective mode from a person's forehead. The system uses light sources of two wavelengths(red,625nm; infrared,865nm) inanopticalsensor, separates photodetecto r signal and transimpedance amplifier output into infrared (IR) and red photoplethysmographic (PPG) signals, and then digitizes and transmits data wirelessly via a Bluetooth module to a remote PC in real time, where the SpO_2 value is calculated. The optical sensor, mounted on a 7 cm × 2 cm flexible sheet, is interfaced with an 8.5 cm × 3.5 cm wireless SpO_2 circuit board. The entire sensor and wireless SpO2 system, which weighs only 15 g, is readily wearable on the forehead, unlike conventional non-wearable wired forehead pulse oximeters. Using our system, the reduction of SpO_2 value was observed from 100% to 89%, under an 80 s breathhold condition, which matched with the simultaneously measured SpO_2 values obtained using commercial pulse oximeters.

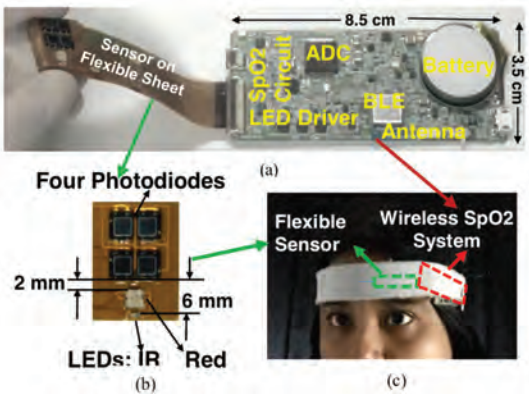


Fig. 3. Proposed forehead reflective type pulse oximeter with wearable sensor and system. (a) Full patch-type POM system on printed circuit board interfaced with sensor. (b) Sensor with photodiodes (PDs) and LEDs mounted on flexible substrate. (c) Full wireless pulse oximeter (sensor and system) set on the forehead under headband.

Department of Intelligent Media

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Outlines

The studies in this lab 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, and intension 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

Joint Intensity and Spatial Metric Learning for Robust Gait Recognition

This paper describes a joint intensity metric learning method to improve the robustness of gait recognition with silhouette-based descriptors such as gait energy images. Because existing methods often use the difference of image intensities between a matching pair to measure a dissimilarity, large intra-subject differences derived from covariate conditions, may wash out subtle inter-subject differences. We therefore introduce a metric on joint intensity to mitigate the large intra-subject differences as well as leverage the subtle inter-subject differences. More specifically, we formulate the joint intensity and spatial metric learning in a unified framework and alternately optimize it by linear or ranking support vector machines. Experiments using the OU-ISIR treadmill data set B with the largest clothing variation and large population data set with bag containing carrying status in the wild demonstrate the effectiveness of the proposed method.

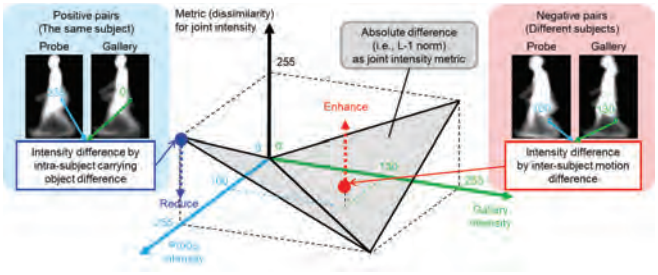

Fig.1 Overview of joint intensity and spatial metric learning

On Input/Output Architectures for Convolutional Neural Network-Based Cross-View Gait Recognition

In this paper, we discuss input/output architectures for convolutional neural network (CNN)- based cross-view gait recognition. For this purpose, we consider two aspects: verification versus identification, and the trade-off between spatial displacement caused by subject difference and view difference. More specifically, we use the Siamese network with a pair of inputs and contrastive loss for verification, and a triplet network with a triplet of inputs and triplet ranking loss for identification. The aforementioned CNN architectures are insensitive to spatial displacement because the difference between a matching pair is calculated at the last layer after passing through the convolution and max pooling layers; hence, they are expected to work relatively well under large view differences. By contrast, because it is better to use the spatial displacement to its best advantage because of the subject difference under small view differences, we also use CNN architectures where the difference between a matching pair is calculated at the input level to make them more sensitive to spatial displacement. We conducted experiments for cross-view gait recognition and con- firmed that the proposed architectures outperformed the state-of-the-art benchmarks in accordance with their suitable situations of verification/identification tasks and view differences.

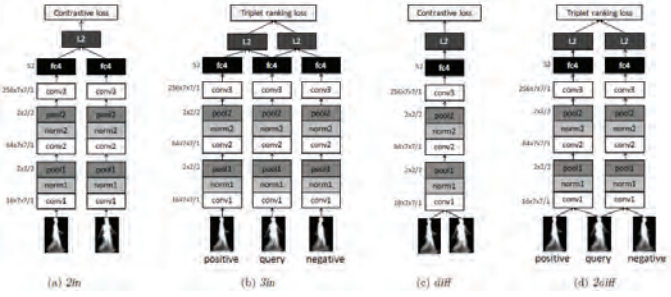

Fig.2 Input/output architectures for cross-view gait recognition

Department of Reasoning for Intelligence

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Outlines

We, humans, extract variety of knowledge from given data by the full use of our reasoning. However, such reasoning ability of humans is so limited that most of the massive and complex data, 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

Measurement Oriented Machine Learning

Along the development of IoT Society, the importance of the information processing for advanced measurement technologies are increasing. Based on this background, we worked on the study of machine learning for the advanced measurements including one molecule measurement, individual virus measurement, super-resolution microscope, and olfactory measurement. In this year, we developed novel principles and methods of the noise reduction in the mixture of objective and noise pulses using pattern recognition of the pulse shapes. Because the objective pulses and the noise pulses cannot be separately acquired while the noise pulses can be independently collected easily in many problems, we developed a method to learn a PU classifier from the labeled noise pulse data and the unlabeled pulse mixture data.

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 prediction based algorithm for searching causal structures governing data sets generated by some non-linear process with arbitrary noise.

Machine learning for operator-theoretic data analysis

We develop novel machine learning methods for operator-theoretic data analysis (OTDA) of dynamic processes. OTDA and its empirical algorithm, named dynamic mode decomposition (DMD), has recently attracted attention in a variety of scientific fields. In this year, we developed algorithms for OTDA based on principles discussed in machine learning such as a probabilistic models DMD and a discriminative algorithm with OTDA for data from nonlinear dynamical systems. Moreover, we applied those to spatiotemporal data from several physical processes such as collective motions in sports, and confirmed its effectiveness in those applications.

Machine Learning Model Enumeration

Use of machine learning techniques is one typical approach for knowledge discovery from data. We first fit a machine learning model to the data so that the model to well explain the data. We then interpret the model to get an insight about the underlying mechanism of the data. This approach, however, has a risk of overlooking some aspects of the data that were not used in the model to explain the data. In this year, to avoid this risk of overlooking, we developed novel algorithms to enumerate several machine learning models that explain the data nearly equally well. In this way, we can obtain several possible explanations of the data, which helps us to get more detailed insights of the data, and to relieve the risk of overlooking.

Department of Knowledge Science

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Associate Professor:	Kouji KOZAKI
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Visiting Researcher:	Julio Vizcarra
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 (neural networks).

We combined deep learning with SSL based on transfer-function model, which resulted in the performance improvement of 3D localization under unseen environment. Acoustic patterns between sound source position and microphone were measured in the anechoic and reverberant rooms to generate training data for deep learning and to analyze acoustics.

We developed a network structure of deep learning that predicts sound class from raw speech signals. The architecture follows and optimizes the process of conventional speech feature extraction. The training of neural networks and the analysis of its behavior using measured acoustic patterns are in progress for the speech recognition robust against reverberation and noises.

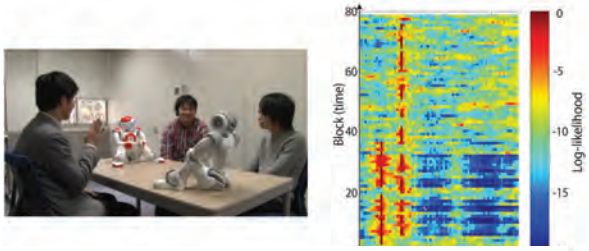

Fig.1 Human-robot interaction (left) and example of sound source localization (right)

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.

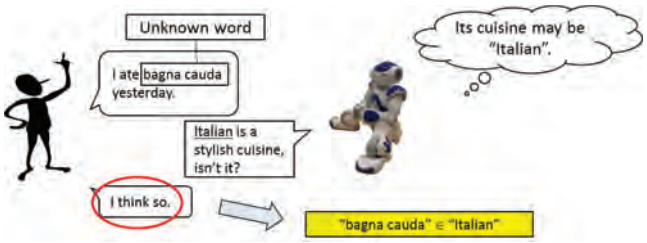

Fig.2 Example of implicit confirmation and acquiring category of unknown word

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 2017, we developed a method to integrate GPS trajectory data with Points of Interest (POI) information collected through some existing open data.

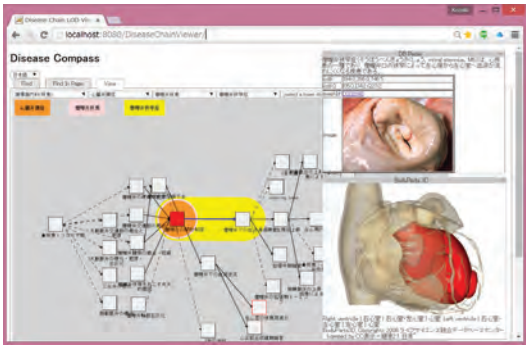

Fig.3 A browsing system for disease ontology based on Linked Data (http://lodc.ed-ontology.jp).

Department of Architecture for Intelligence

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Research Students:	Taweesak EMSAWAS(1.10.2017-), Nat PAVASANT(1.10.2017-)
Supporting Staff:	Megumi TANABE, Mitsuyo OHTSUKA, Akiko YAMAMOTO

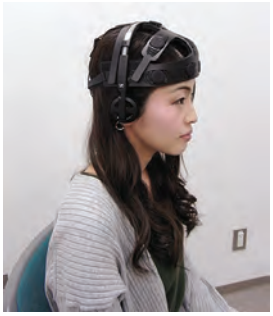
Outlines

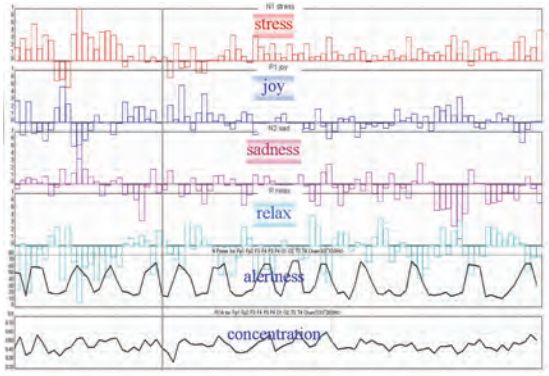
The main research objective is to explore basic technology for computer systems, which support human learning and understanding, beyond conventional artificial intelligence. We particularly focus on the process of human-computer interaction to discover and create architecture of intelligence for such 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

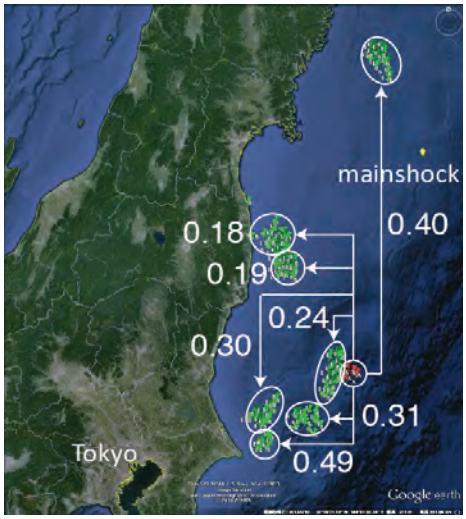
This department is developing a computer with learning ability, for which it researches efficient learning algorithms, acquisition of background knowledge for learning, application to Intelligent Tutoring Systems. These are applied to adaptive user interfaces. The conventional adaptive user interfaces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





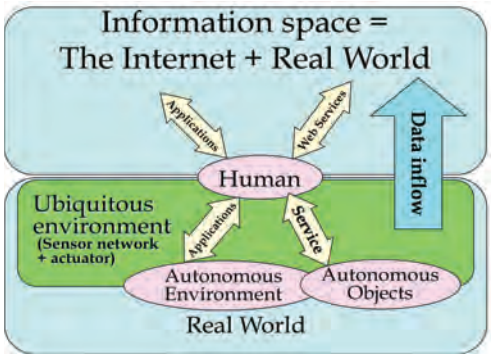
Knowledge Discovery from Event Sequence Data

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: Functionalized Natural 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 and multifunction tuning of ceramic-based materials via nanostructure and hetero-interface design
- Micromechanics-based extraction of single-crystalline elastic constants from polycrystalline samples with crystallographic texture
- 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 Functionalized Natural Materials

Professor: Masaya NOGI
Supporting Staff: Hitomi YAGYU
Yasuko HASHIMOTO (16.11. 2017- 31.3. 2018)

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 (Fig. 1). At present, we are conducting the research and development of flexible nanopaper electronics.

Fig. 1 Transparent nanopaper.

Research Projects

Transparent nanopaper prepared by high-humidity drying (RSC Adv., 8, 1833-1837 (2018))

Conventionally, clearly transparent nanopaper has been prepared from cellulose nanofiber dispersion with quite low concentration: less than 0.5 wt% (Fig. 2c). However, this diluteness accompanies several problems such as huge energy consumption and long operation time for drying. Therefore, the nanopaper should be fabricated from concentrated dispersion (Fig. 2d) to mitigate these problems.

We prepared transparent nanopaper from cellulose nanofiber dispersion with various concentration of 0.24-1.81 wt% to investigate the effect of the concentration of cellulose nanofiber dispersion on resulting nanopaper. Optical experiment revealed that the haze of transparent nanopaper increased monotonically with cellulose nanofiber concentration of dispersion, when cellulose nanofiber dispersion was prepared from holocellulose pulp and conventional over-drying was applied (Fig. 3○).

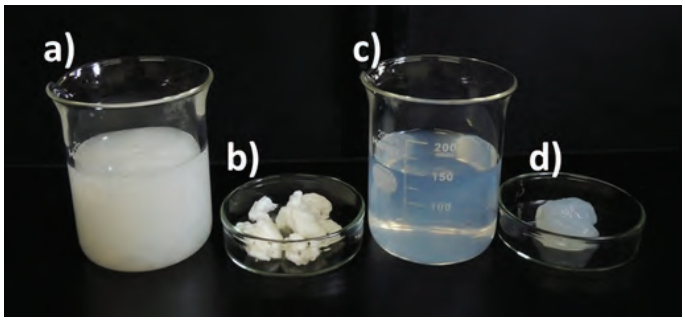


Fig. 2 (a) 2wt% and (b) 27wt% pulp fiber dispersion, (c) 0.2 wt% and (d) 2.3wt% cellulose nanofiber dispersion.

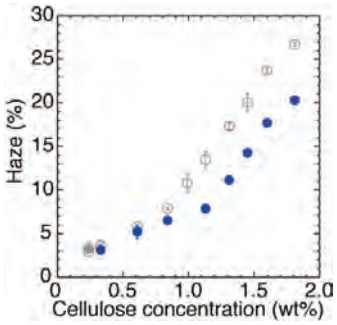


Fig. 3 Dispersion concentration vs haze (○:55°C 25%RH, ●:55°C 80%RH).

To solve the technical hindrance, we developed high-humidity drying, which successfully gave clear transparent nanopaper from concentrated dispersion without prolonged drying time (Fig. 3●, Fig. 4 right). High humidity drying increased water proportion at the surface of dispersion, and then the increased amount of water partially relaxed the nanofiber aggregations in high concentration dispersion, as the conventional dilution protocol did. These achievements will help reduce the production time of nanopaper and encourage the widespread use of future flexible electronics based on nanopaper substrates.

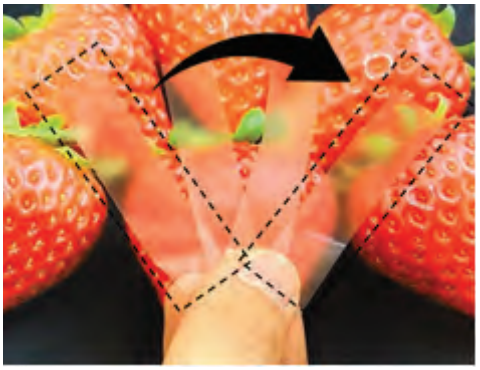


Fig. 4 Transparent nanopaper by high-humidity heating.

Clearly transparent nanopaper prepared using dilution and sonication (Nanomaterials, 8, 104 (2018))

Nanopaper prepared from holocellulose pulp is one of the best substrates for flexible electronics because of its high thermal resistance and highly clear transparency. However, the clearness of nanopaper decreases with increasing concentration of the starting cellulose nanofiber dispersion, with the use of a 2.2 wt% dispersion, for example, resulting in translucent nanopaper with a high haze of 44% (Fig. 5, Fig. 6 left).

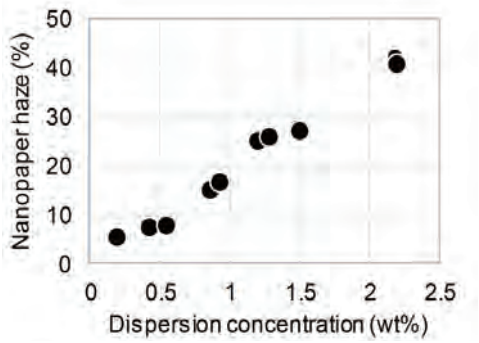


Fig. 5 Dispersion concentration vs haze.

We show that the dilution of this high concentration dispersion with water followed by sonication for 10 s reduces the haze to less than 10%, while maintaining the high thermal resistance of the nanopaper (Fig. 6 right).

Fig. 6 Translucent and transparent nanopaper from high-concentration dispersion.

Transparent nanopaper is one of the promising substrates for flexible transparent conductive films. The transparency of silver-nanowire transparent conductive films depends on the transparency of the substrate and the silver nanowire content. Therefore, when the low-haze nanopaper obtained by drying the diluted and sonicated dispersion was used as the transparent substrate, the high silver nanowire content enhanced the electrical conductivity of the transparent and conductive paper while enabling its high transparency to be maintained (Fig. 7).

Fig. 7 Clearly transparent conductive film.

These achievements will pave the way toward the realization of the mass production of nanofiber-based flexible devices.

Department of Semiconductor Materials and Processes

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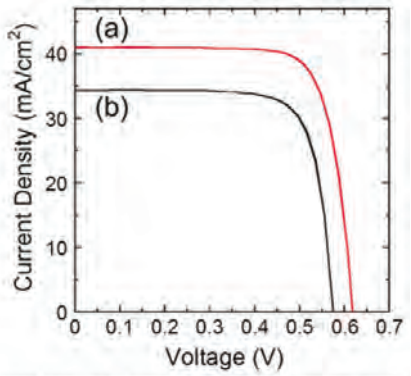
Outlines

The modern society is based on semiconductor technology. Our research aims at development of novel materials for hydrogen generation, improvement of the characteristics of semiconductor products and development of semiconductor devices with new structures with development of new semiconductor chemical processes. For this purpose, we study 1) crystalline Si solar cells to solve energy and environmental problem, 2) application of Si nanopowder produced from Si swarf to batteries and 3) Si composition for hydrogen generation.

Research Projects

Surface nanocrystalline Si structure and its surface passivation for highly efficient black Si solar cells [Original paper 1]

19.5% conversion efficiency crystalline silicon (Si) solar cells having simple structure without antireflection coating have been fabricated using the surface structure chemical transfer method which produces a nanocrystalline Si layer simply by contacting catalytic platinum with Si wafers in hydrogen peroxide plus hydrofluoric acid solutions. The reflectivity becomes less than 3% after the surface structure chemical transfer method due to formation of black Si. Deposition of phosphosilicate glass and heat treatment at 925°C performed for formation of pn-junction effectively passivate the nanocrystalline Si surface. With this phosphosilicate glass passivation plus the hydrogen treatment at 400°C, the internal



	Voc (V)	Jsc (mA/cm^2)	FF	η (%)
(a)	0.618	41.0	0.769	19.5
(b)	0.575	34.4	0.763	15.1

Fig. 1 Current–voltage (I–V) curves under AM 1.5 100mW/ cm^2 irradiation for the <Ag/nanocrystalline Si/n$^+$-Si/p-Si(100)/p$^+$Si/Ag> solar cells: (a) with surface passivation using PSG deposition plus hydrogen treatment at 400°C; (b) without surface passivation.

quantum efficiency is greatly improved and reaches 81% at a wavelength of 400nm. Analysis of ellipsometry data shows that incident light with wavelength shorter than 400nm is almost completely absorbed by the nanocrystalline Si layer. The high internal quantum efficiency for short wavelength light is attributed to effective surface passivation and the nanocrystalline Si layer band-gap energy which decreases with the distance from the top of the network structure of the nanocrystalline Si layer.

Fabrication of Si nanopowder from Si swarf and application to high-capacity and low cost Li-ion batteries [Original paper 4]

Si nanopowder is expected as a high capacity anode active material for Li-ion batteries due to its superior theoretical capacity (~3600 mAh/g), which is one order of magnitude higher than that of graphitic materials. We have succeeded in fabrication of Si nanopowder from swarf using the cost-effective beads milling method. The delithiation capacity higher than 1600 mAh/g after the 100th cycle with the current density of 1800 mA/g is achieved by setting the C/Si ratio at 0.1 and the FEC concentration at 10wt% for the nano-Si electrode.

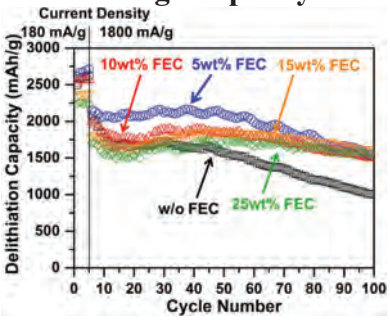


Fig. 2 Delithiation capacity of the Si electrodes in EC/DEC plus FEC solutions with various FEC concentrations.

Hydrogen generation by reaction of Si nanopowder with neutral water [Original paper 3]

Si and its oxide are nonpoisonous materials, and thus, it can be taken for medical effects. We have developed a method of generation of hydrogen by use of reactions of Si composition with water in the neutral pH region. Si composition reacts with water to generate hydrogen even in cases where pH is set at the neutral region between 7.0 and 8.6. The hydrogen generation rate strongly depends on pH and in the case of pH 8.0, ~55 ml/g hydrogen which corresponds to that contained in approximately 3 L saturated hydrogen-rich water is generated in 1 h. The reaction rate for hydrogen generation greatly increases with pH, indicating that the reacting species is hydroxide ions. The change of pH after the hydrogen generation reaction is negligibly low compared with that estimated assuming that hydroxide ions are consumed by the reaction. From these results, we conclude the following reaction mechanism: Si composition reacts with hydroxide ions in the rate-determining reaction to form hydrogen molecules, SiO_2, and electrons in the conduction band. Then, generated electrons are accepted by water molecules, resulting in production of hydrogen molecules and hydroxide ions. The hydrogen generation rate strongly depends on the crystallite size of Si composition, but not on the size of aggregates of Si composition. The present study shows a possibility to use Si composition for hydrogen generation in the body in order to eliminate hydroxyl radicals which cause various diseases.

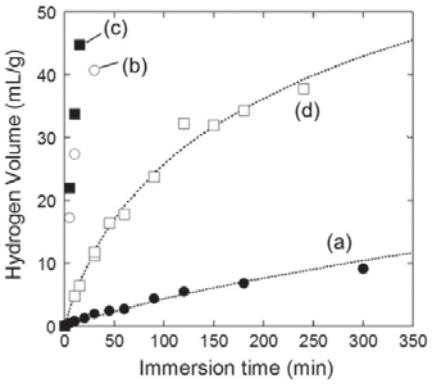


Fig. 3 Generated hydrogen volume vs the immersion time of Si composition in the following solutions: a ultrapure water; b water with pH8.0; c water with pH8.6; d tap water with pH7.1~7.4.Si composition was produced by use of the one-step milling method with 0.5-mm diameter zirconia beads. Si composition was etched with an HF solution to remove silicon oxide before immersion.

Department of Advanced Hard Materials

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Supporting Staff: Mitsuru NISHISAKO

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 as structure components for various devices and instruments, next generation biocompatible, environmental and energy materials, all which are the strongly demanded materials to solve crucial problems arising in our society.

Research Projects

Adsorption and photocatalytic property of TiO_2-modified hydroxyapatite synthesized by hydrothermal treatment

Hydroxyapatite (HAp) is expected as an excellent catalyst support, because it shows the unique adsorption property depending on its crystal morphology and structure. In this study, the adsorption behavior and photocatalytic decoloration of acidic dye on TiO_2- modified HAp were investigated. From the adsorption isotherm, the amount of acidic dye adsorbed on TiO_2-modified HAp with sponge-shaped showed the highest value in all samples. Also, the photocatalytic decoloration of acidic dye by TiO_2-modified HAp with sponge-shaped showed faster reduction rate than that of needle-shaped sample. From the results of elemental analysis and zeta-potential measurement, with increasing the urea concentration of hydrothermal synthesis, TiO_2 content in sample decreased and zeta potential of TiO_2-modied HAp increased. These results suggested that zeta potential of TiO_2-modified HAp, which is caused by TiO_2 content and morphology of HAp, affects the adsorption behavior of acidic dye.

Development of photochemically functionalized titania nanotubes through structure tuning

Titania nanotubes (TNTs) have unique multi-functionality such as synergy of molecular adsorption and photocatalytic properties, which is not found in common TiO_2 nanoparticles. To enhance these functions and to develop practically applicable environmental friendly and/or energy-related materials, materials tuning technology has been attempted to the TNTs. In this study, we have selected ZnO as a structure-modifier, and ZnO-modified TNTs have been prepared by microwave assisted hydrothermal process. It was found that nanotubular titania was synthesized through this process, where the nano-sized ZnO particles were decorated on the TNT surface, showing one-dimensional nano-hybrid structure (Fig. 1). The methylene blue (MB) dye molecular removal performance was investigated, and it was found that the MB adsorption property was enhanced simultaneously with the UV and visible light responsible photocatalytic properties. These results imply that the structure modification for one-dimensional nanostructured oxides is a promising way to tune the advanced environmental-friendly functions for the oxide nanostructures.

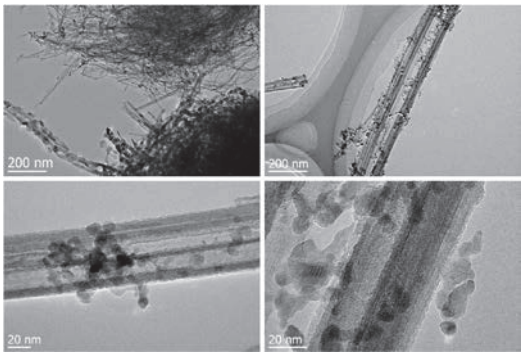

Fig.1. TEM micrographs of different TiO_2-ZnO nanostructures synthesized by microwave assisted hydrothermal process.

Micromechanics-based extraction of single-crystalline elastic constants from polycrystalline samples with crystallographic texture

A micromechanics-based method (inverse self-consistent approximation) that can extract the elastic constants of single crystals from those of polycrystals, taking into account the elastic interaction between the grains, was newly developed. To examine the validity of inverse self-consistent (iSC) approximation, it was applied to Cu polycrystals prepared by a directional solidification method.

Fig. 2 shows the calculated c_{11} components of single-crystalline Cu as a function of the aspect ratio a_3/a_1 of the grains. The calculated c_{11} (iSC) components increased with increasing a_3/a_1, and the difference between the reference value ('Ref.') and iSC approximations decreased for the high a_3/a_1 ratios. This result corresponds to that the elongated grains with high aspect ratios were formed in the Cu polycrystals. Also, it was revealed that the iSC approximation was more accurate than an inverse Voigt-Reuss-Hill (iVRH) approximation which cannot take into account the elastic interaction between the grains in polycrystals.

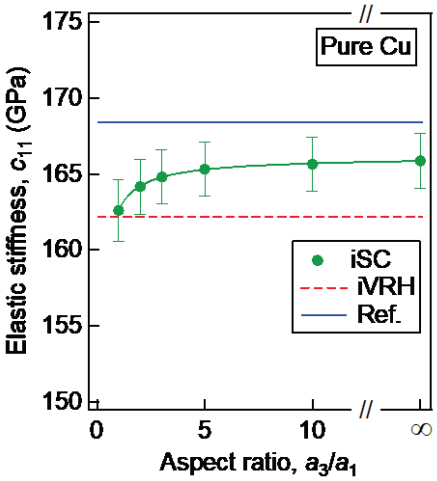

Fig. 2 Elastic stiffness c_{11} of single-crystalline Cu determined using iSC and iVRH approximations.

Department of Advanced Interconnection Materials

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Supporting Staff: Naomi Keenan, Seiyo Okuda, Sachiko Moribe, Noriko Kagami, Yukiko Hirose

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

Macroscale and microscale fracture toughness of microporous sintered Ag for applications in power electronic devices

The application of microporous sintered silver (Ag) as a bonding material to replace conventional die-bonding materials in power electronic devices has attracted considerable interest. Characterization of the mechanical properties of microporous Ag will enable its use in applications such as lead-free solder electronics and provide a fundamental understanding of its design principles. However, the material typically suffers from thermal and mechanical stress during its production fabrication, and service. In this work, we have studied the effect of microporous Ag specimen size on fracture toughness from the microscale to the macroscale. A focused ion beam was used to fabricate 20-, 10- and 5-μm-wide microscale specimens, which were of the same order of magnitude as the pore networks in the microporous Ag. Micro-cantilever bending tests revealed that fracture toughness decreased as the specimen size decreased.

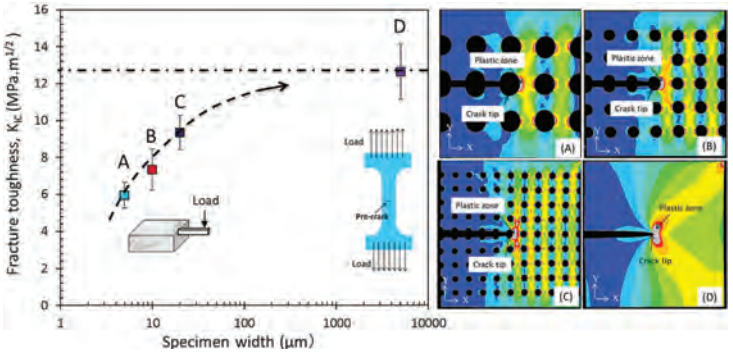

Fig. 1 Relationship between fracture toughness and specimens size, plastic deformation of crack tip of different size with FEM simulation analysis.

Conventional middle-cracked tensile tests were performed to determine the fracture toughness of the macroscale specimens. The microscale and macroscale fracture toughness results showed a clear size effect, which is discussed in terms of both the deformation behavior of crack tip and the influence of pore networks within Ag with different specimen sizes. Finite element model simulations showed that stress at the crack tip increased as the specimen size increased, which led to larger plastic deformation and more energy being consumed when the specimen fractured.

Printable and Flexible Copper−Silver Alloy Electrodes with High Conductivity and Ultrahigh Oxidation Resistance

Printable and flexible Cu−Ag alloy electrodes with high conductivity and ultrahigh oxidation resistance have been successfully fabricated by using a newly developed Cu−Ag hybrid ink and a simple fabrication process consisting of low-temperature precuring followed by rapid photonic sintering (LTRS). A special Ag nanoparticle shell on a Cu core structure is first created in situ by low-temperature precuring. An instantaneous photonic sintering can induce rapid mutual dissolution between the Cu core and the Ag nanoparticle shell so that core−shell structures consisting of a Cu-rich phase in the core and a Ag-rich phase in the shell (Cu−Ag alloy) can be obtained on flexible substrates. The resulting Cu−Ag alloy electrode has high conductivity (3.4 μΩ·cm) and ultrahigh oxidation resistance even up to 180 °C in an air atmosphere; this approach shows huge potential and is a tempting prospect for the fabrication of highly reliable and costeffective printed electronic devices.

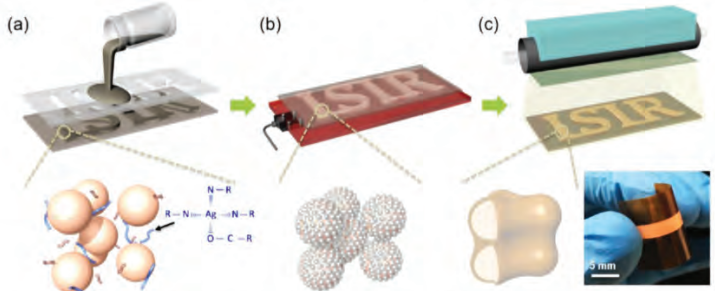

Fig. 2 Schematic diagram(a) Mask printing and fabrication of Cu-Ag electrodes by low-temperature procuring and (c) rapid-sintering (LTRS) under an air atmosphere.

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.

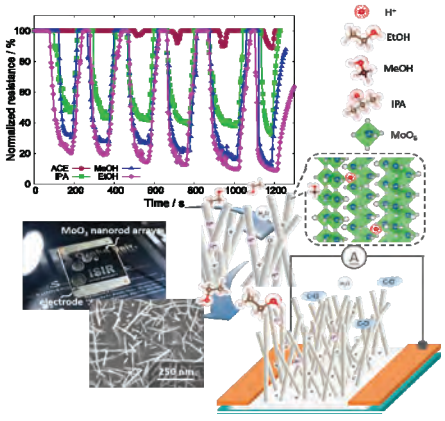

Fig.3 Ceramics nanorods sensor devices by solution process.

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 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. Optical Control of Structural Transitions to Form Nano-scaled Order Phases

Our group discovered a new pathway of non-thermodynamic transformation by optical excitation to form a nano-scaled order phase in graphite. This phase, named as '*diaphite*', includes periodically-formed sp^3-like interlayer bonds, but unresolved issues still remain for the understanding of the excitation-induced processes. Here we demonstrate the primary steps in the phase transformation, and provide a key to the optical control of sp^2-to-sp^3 conversion and the organization with the nano-scaled products in graphene-related materials.

Fig.1 shows the STM images of typical nano-scaled structures. In addition to the *diaphite* (D_C), two smaller structures are observed. The most small-sized structure, D_A, consists of a bright spot on a single atomic site which can be due to a single sp^3-like interlayer bond. D_B-type structure is characterized by a 1 - 5nm sized phase where the original graphite periodic symmetry is preserved. These two structures were formed ahead of D_C. In particular, D_A-type structure was preferentially formed at the early stage of irradiation. Thus, the primary steps are the formation of a single sp_3-like interlayer bond followed by the successive growth of the interlayer-bonded domain.

We also observed the evolution of the surface structures under repeated irradiations with laser pulses of three different photon energies of 1.55, 3.1, and 4.66eV. Total number density of the three-typed products was much larger for 4.66-eV excitation,

while the averaged domain size was enhanced by 1.55-eV excitation. Thus, the growth mode of photo-induced structures strongly depends on the photon energy of laser pulses, and these results are interpreted by different dynamical pathways for the nucleation and growth of interlayer-bonded phase.

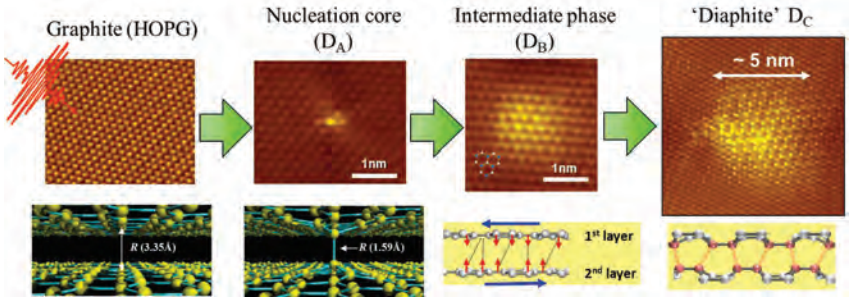

Fig. 1 Three types of nano-scaled structures (D_A, D_B and D_C) formed on the photo-excited graphite surface and their structure models.

2. Investigation of the Phonon Dispersion in Graphite/Graphene by using a newly Developed High-Resolution Electron-Energy Loss Spectroscopy

Phonon is a quantized lattice vibration, and one of the most important properties of the condensed matter. Recently, an apparatus for High-Resolution Electron Energy Loss Spectroscopy (HREELS) has been developed in the PGI-3 in Juelich, Germany, which enables us to achieve the dispersion of the phonon in "one-shot" for solid surfaces and layered materials. We have been carrying out the international co-study with the group (Dr. F. C. Bocquet and Prof. S. F. Tautz), and investigating the phonon and electron-phonon coupling in the layered materials such as graphene/graphite.

Figure 2. shows the HREELS spectra of the single-crystalline graphite and monolayer graphene. The incident electron energy is 110-eV. The phonon dispersion lines are clearly resolved in the second-derivative mode. The detailed analysis will show many important properties, particularly concerning the inter-layer interaction.

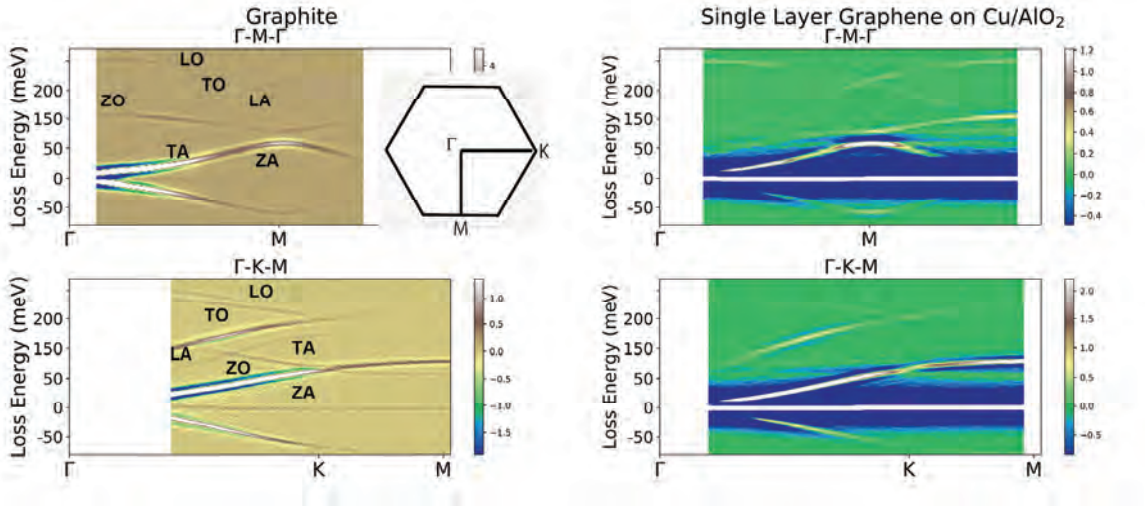

Fig.2 : HREELS spectra in the second-derivative mode of the single-crystalline graphite (left) and monolayer graphene on Cu (right). Identification of the phonon-mode is indicated in the left-hand panels. Inset shows the 2D Brillouin zone within the graphene layer, and the dispersion axis measured.

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

· Irradiation experiments

For the purpose of development of IR laser experiments, we are trying to execute several types of user experiments. Not only limited in ISIR, but also 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 IR FEL has been studied using MIR-FELs and THz-FEL where the wavelength dependence of non-thermal process was discovered. These results are now summarized in an original paper. About THz-FEL in ISIR, the optics and control system are upgraded for the convenience of external users. The time-dependent experiments will be possible by introducing new detectors and programs in near future. We also execute experiments about solid state physics which is one of our theme, and

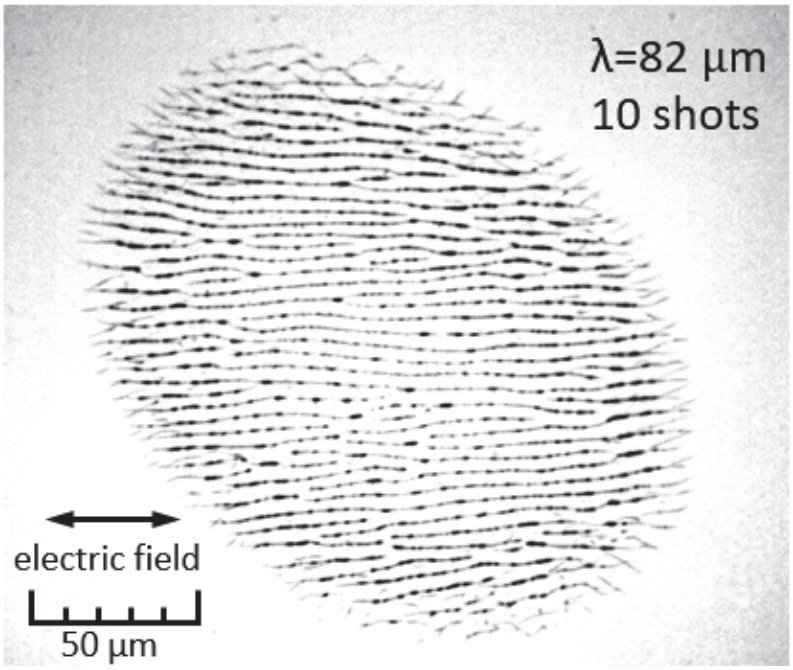

Figure 1 Laser induced periodic surface structure by THz-FEL irradiation.

the new results about laser induced periodic surface structures induced by THz-FEL irradiation are found. These results are reported in an original paper and several invited talks in international conferences. Figure 1 shows the LIPSS constructed on a surface of single crystal Si by irradiation of THz-FEL with the wavelength of 82 μm. The periodicity is quite fine as 3.5 μm compared to the wavelength. The structure is always parallel to the electric field of linear polarized THz-FEL which means this phenomenon is originated in not only thermal effects but non-thermal effects. The dependence of periodicity to the pulse-shot number obeys the power-law, that means this structure is a kind of dissipative structure constructed by self-organization process. This results can propose the universal mechanism of LIPSS generation including different wavelength regions from FIR to NIR.

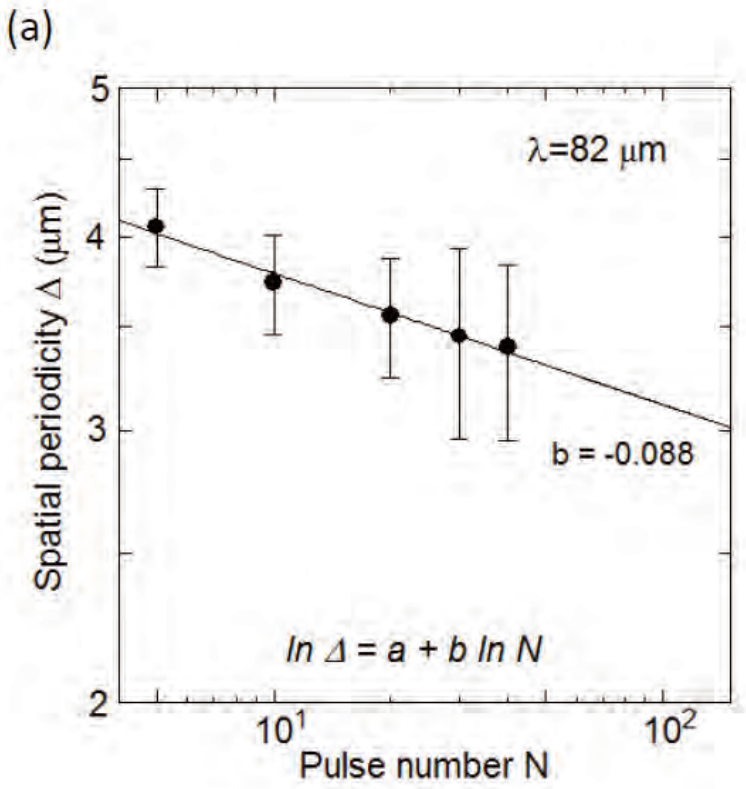

Figure 2 Change of periodicity for irradiation pulse number. Power law dependence is shown by solid line.

Department of Beam Materials Science

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Associate Professor: Yusa MUROYA
Assistant Professor: Kazuo KOBAYASHI
Assistant Professor: Hiroki YAMAMOTO (-29.12.31)
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Supporting Staff: Kinuko WATANABE

Outlines

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

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. In water-cooled reactor, H_2 injection into coolants is known as a powerful technique to suppress oxidative radiolytic species (H_2O_2, O_2) by which adverse effects such as stress corrosion cracking can be significantly mitigated. Although the roles of intermediate species (H, OH etc.) are qualitatively known, quantitative knowledges (reactivity of them) are still poor. In this study, the reaction of H-atom with solvent ($H + H_2O \rightarrow H_2 + OH$) in sub-critical water was studied. Although the rate constant is quite low below 250 ºC ($k < 10^2$), it turned out to increase up to 10^4 at 300 ºC (Fig.1). By applying this rate constant, H_2 injection effect under steady-state irradiation condition was estimated by full-implicit calculation, indicating that higher concentration of H_2 is required than previously believed to control that of H_2O_2 below 10^{-7} (mol/L) (Fig. 2).

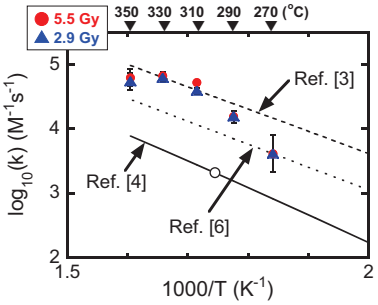


図 1. Arrhenius plot of $k(H+H_2O)$ in sub-critical water.

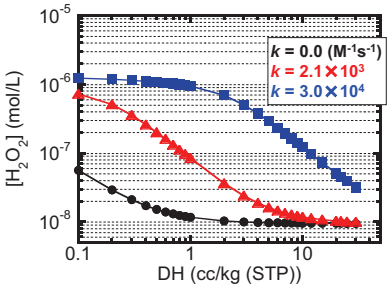


図 2. H_2 injection effect on suppression of H_2O_2 under steady-state radiolysis of water at 300 ºC, dose rate of 1 kGy/sec.

· **Patterning in polystyrene films containing silver nanoparticles induced by electron beam**

Currently, lithography technology continues to be the mainstream technology used in the semiconductor industry for the fabrication of silicon devices at less than 20 nm half-pitch. However, it is very difficult to obtain sub 10 nm feature sizes for mass production by using conventional photolithography techniques. Therefore, ionizing radiations such as extreme ultraviolet (EUV) and electron beam (EB) are the most promising exposure source for next-generation lithographic technology.

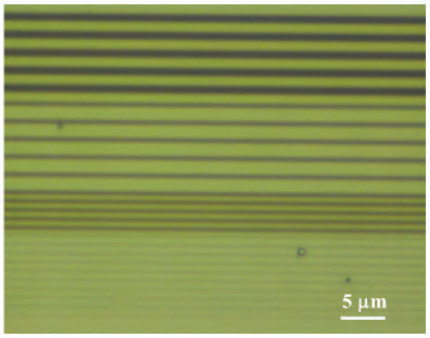
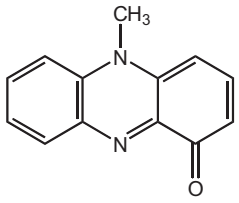


Fig. Photomicrographs of line and space patterns delineated on polystyrene containing Ag nanoparticles.

In this study, we investigate whether radiolytic method makes it possible to both reduce metal ions into particles embedded in a polymer and cross-linked polymer being generated without additives *via* a one-step exposure or not. Although the exposure dose was not optimized, the most highly defined line and space widths on Si were 200 nm and 500 nm, respectively in the case of silver/polystyrene (Ag/PS) films. The mechanisms of this direct-writing process, the properties of the loaded films and the possible patterning were clarified.

Specificity in Mechanism of Transcriptional Factor SoxR

The transcription factor SoxR in bacteria containing a [2Fe-2S] cluster is regulated by redox changes in the [2Fe−2S] cluster. *E. coli* SoxR has transcriptional activity in response to oxidative stress. In contrast, *P. aeruginosa* SoxR, which responds to pyocyanin, controls expression of antibiotic resistance. The two types of SoxR have different mechanisms of the response, despite the homology with 62% amino acid sequence identity. To investigate the specificity of the mechanism of the transcriptional activity, the reactions of SoxR with $O_2^{\bullet -}$ or pyocyanin were examined by pulse radiolysis method. The determinants of SoxR sensitivity to $O_2^{\bullet -}$ have been investigated by mutating several amino acids that are not conserved among SoxR homologues. Replacement of two well-conserved lysine residues, Lys89 and 92, located close to [2Fe-2S] clusters, with alanine residues (K89A/K92A) in *E. coli* SoxR dramatically affected dramatically. The second-order rate constant of the reaction was 3.3×10^7 M^{-1} s^{-1}, which was 10-times smaller than that of wild-type SoxR. From these results, it is evident that lysine is critical for the reaction of $O_2^{\bullet -}$ with the [2Fe-2S] cluster in *E. coli* SoxR. We directly observed the reaction of MV^{2+} with $SoxR_{red}$ using pulse radiolysis, demonstrating a second-order rate constant of 3.0×10^8 M^{-1} s^{-1}. The rate is similar to that observed O_2^-. Similarly, *E. coli* and *P. aerginosa* $SoxR_{red}$ react with nearly all redox-active compounds including pyocyanin, phenazine methosulfate, duroquinone and diquat, a finding consistent with the responsiveness of SoxR to redox-active compounds in vivo.



Pyocyanin

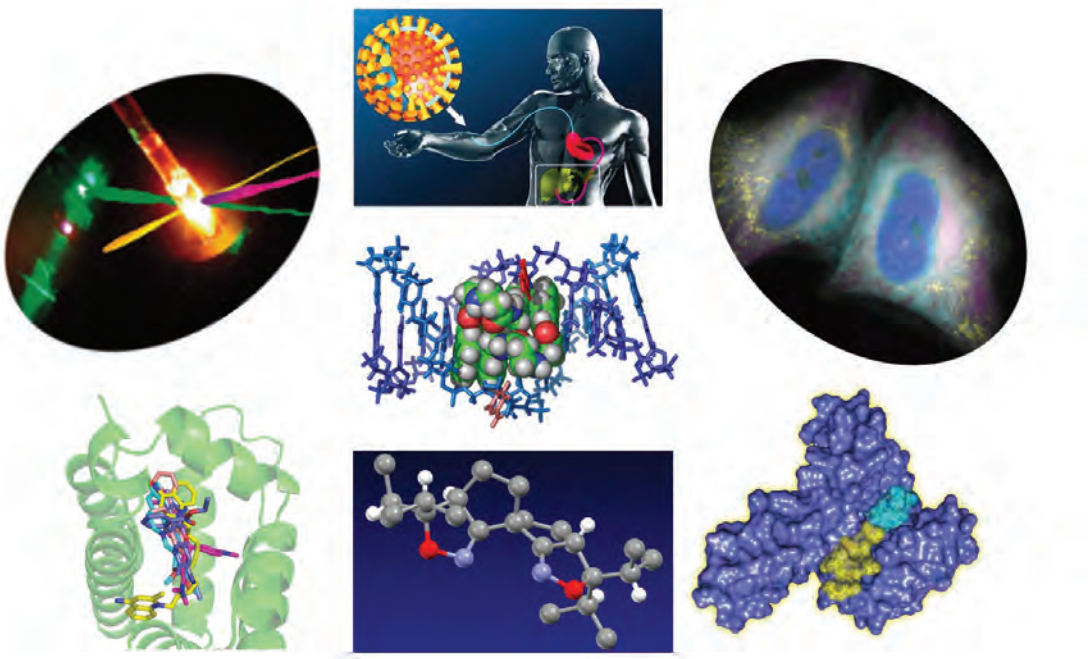
Division of Biological and Molecular Sciences

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
Associate Professors: Mamoru FUJITSUKA, Kiyohiko KAWAI
Assistant Professor: Yasuko OSAKADA (-30.4.2017)
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)
Post-doc Researcher: Peng ZHANG (-30.9.2016)
Graduate Students: Chao LU, Atsushi TANAKA, Osama ELBANNA, Xiaowei SHI, Yuma ICHINOSE, Jie XU, Yang ZHOU, Ryohei SUZUKI, Shunichi MIYAMOTO, Yue WANG (1.10.2016-)
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

"Molecular excitation chemistry" based on photo- and radiation- induced chemistry of organic and inorganic compounds has been investigated from both basic and application points of view. The following research projects are underway with respect to developments of photo- and radiation-controlled chemistry and bioscience, functional materials, ultra-sensitive analytic and diagnostic methods.

1. Generation and reactivity of higher excited states and excited intermediates
2. Single-molecule fluorescence measurements to study dynamic motions and reactions of DNA, RNA, and peptides
3. Kinetic analysis based on the control of fluorescence blinking
4. Bio-imaging using photo-functional nanoparticles using light and radiation
5. Two dimensional polymers for photocatalytic reaction
6. Nanocatalysts for light energy conversion

Research Projects

Chemistry of higher excited states and excited intermediates

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, electron transfer processes in the bis(radical anions) of NDI-PDI dyad ($NDI^{\bullet-}$-$PDI^{\bullet-}$) upon selective laser excitation was investigated by transient absorption measurements. Generation of dianion ($NDI\text{-}PDI^{2-}$) independent of precursor states indicates that excited radical anions can work as both photosensitizing electron donor and photosensitizing electron acceptor. In addition, we investigated the electron transfer from the excited radical anion of C_{70} in the dyad molecules including C_{70} and acceptor. Comparison with the electron transfer process of the excited radical anion of C_{60} revealed the effect of excitation energy on the electron transfer rates.

Single-molecule fluorescence measurement

We developed the **r**edox reaction based **K**inetic **A**nalysis based on the **C**ontrol of fluorescence **B**linking (rKACB method), a general approach to investigating the dynamic motions and association kinetics of molecules at the single-molecule level. By attaching a fluorescent molecule to nucleic acids, we demonstrated that rKACB can be utilized to investigate the structural switching dynamics of nucleic acids (DNA & RNA) between hairpin loop and stem structures. rKACB relies on the kinetics or pattern changes of blinking, which can be triggered by microenvironmental changes around a fluorescent molecule. The more a fluorescent molecule is exposed to the solvent, the faster the blinking pattern becomes. Fast blinking is observed for a fluorescent molecule at the loop, whereas blinking is slow when a fluorescent molecule is buried in a stem. These subtle structural changes in nucleic acids cannot be accessed by conventional single-molecule FRET analysis. rKACB can be applied to single-molecule analysis of dynamic motions and association kinetics in various systems.

Photofunctional molecules and materials toward materials science and biology

Despite intensive research efforts during the last decade, practical microscopy of biological targets using photoswitchable nanoparticles in real time remains challenging. To address this problem, we have developed live macrophage cell imaging and single particle imaging methods, using photoswitchable fluorescent diarylethene-doped polymer nanoparticles (P-dots) under Xe lamp irradiation. To demonstrate the practicality of doped P-dots imaging, we imaged lysosome in a macrophage cell, and observed 11-times slower recovery of the fluorescence from ‘off-state’ to ‘on-state’, indicating their potential for cellular imaging.

Nanocatalysts for light energy conversion

In this year, a binary nano-hybrid (BP/CN) of two-dimensional (2D) black phosphorus (BP) and graphitic carbon nitride (CN) was designed and used as a metal-free photocatalyst for the first time. During irradiation of BP/CN in water with >420 and >780 nm light, solid H_2 gas was generated. The efficient charge transfer due to the interfacial interaction between BP and CN was responsible for the enhanced photocatalytic performance. The efficient charge-trapping and transfer processes were thoroughly investigated with time-resolved diffuse reflectance spectroscopic measurements.

Department of Synthetic Organic Chemistry

Professor: Hiroaki SASAI
Specially Appointed Professor: Yasuyuki KITA
Associate Professor: Shinobu TAKIZAWA
Assistant Professor: Kazuhiro TAKENAKA, Makoto SAKO
Specially Appointed Assistant Professor: Masaru KONDO (1.11.2017-)
Visiting Research Scholar: Lukas SHOBER (10.8.2017-3.10.2017),
Nadine ZUMBRÄGEL (24.10.2017-20.12.2017)
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Takanori AOKI, Miki KUSABA, Akimasa SUGISAKI,
Yasuaki NIIDA, Yuya NOMOTO,
Hettiarachchige Dona Piyumi WATHSALA, Yuki ADACHI,
Kousuke KATAOKA, Tomohiro TAKIISHI, Yuki TAMORI
Under Graduate Student: Hanseok PARK
Research Student: Yuzhao JIANG (1.7.2017-), Qingwen CHEN (1.10.2017-)
Supporting Staff: Ayaka HONDA (-31.8.2017, 1.3.2018-)

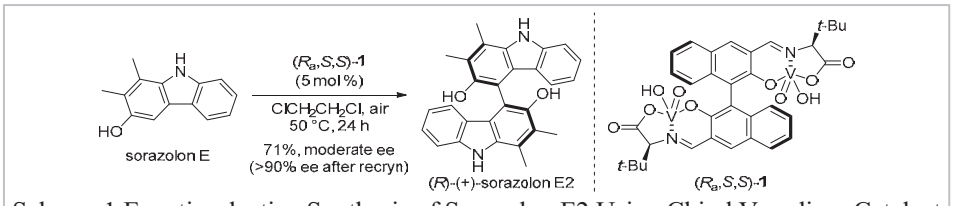
Outlines

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

Chiral Vanadium(V) Complex-catalyzed Enantioselective Oxidative Coupling of 3-Hydroxycarbazoles

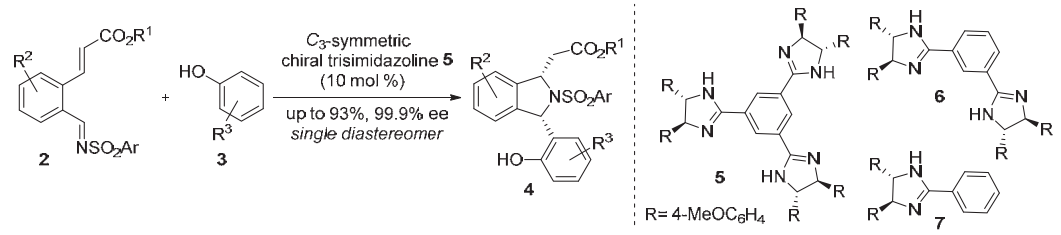
Hydroxycarbazoles and bi(hydroxycarbazole)s have attracted the interest of many research groups because they exhibit a broad range of biological effects. Although several oxidative coupling reactions of hydroxycarbazoles have been reported, there are a few enantioselective examples so far. This time, we found that the oxidative homo-coupling of 3-hydroxycarbazoles with (R_a,*S*,*S*)-**1** under air smoothly proceeded to afford corresponding coupling products in good yields with up to 80% ee. This protocol could be applied to the first enantioselective synthesis of sorazolon E2 (Scheme 1).



Scheme 1 Enantioselective Synthesis of Sorazolon E2 Using Chiral Vanadium Catalyst

Enantio- and Diastereoselective Betti/aza-Michael Sequence: Single Operated Preparation of Chiral 1,3-Disubstituted Isoindolines

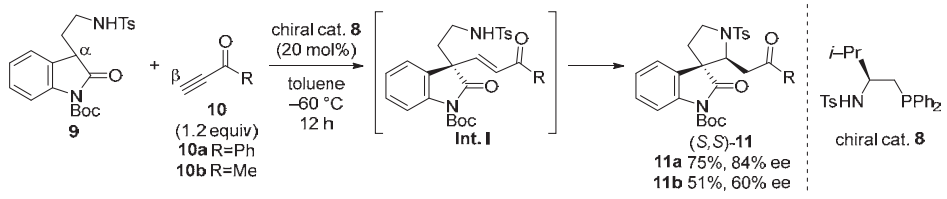
Isoindolines are common substrates in a variety of natural products and pharmaceuticals, such as pagoclone, neuvamine and their functionalized derivatives, and they exhibit various biological activities. Herein, we report the first enantio- and diastereoselective Betti/intramolecular aza-Michael sequence with C_3-symmetric chiral trisimidazoline organocatalyst **5** to afford functionalized 1,3-disubstituted isoindolines **4** bearing two chiral carbon centers as a single diastereomer in high yield with excellent enantioselectivities (Scheme 2). The C_3-symmetric chiral trisimidazoline catalyst bearing electron donating substituent (R= 4-MeOC$_6$H$_4$) gave the best result compared with bis- or monoimidazoline catalyst **6** or **7**. The absolute configuration of optically active 1,3-disubstituted isoindoline 3a was determined by X-ray single crystallography.



Scheme 2 Catalytic and Enantioselective Synthesis of 1,3-Disubstituted Isoindolines Using Betti/aza-Michael Domino Reaction.

Facile synthesis of spirooxindoles via an enantioselective organocatalyzed sequential reaction

Spirooxindole scaffold is found as an important structure in natural products and bioactive compounds. Although there are many synthetic methods to prepare the scaffold, which require many steps, so new efficient methodologies are desired. We envisioned that spirooxindoles **11** could be accessed by the reaction of the α-substituted oxindole **9** bearing two potentially nucleophilic units with ynone **10** *via* sequential addition to the β-position of ynone (Scheme 3). If **10** could be used as a Michael acceptor, the generated intermediate **I** would possess one remaining degree of unsaturation, thereby enabling further incorporation of nucleophiles. We found that the reaction of **9** and **10a** was promoted by Brønsted base acid- Lewis base organocatalyst **8** derived from (*S*)-valine, giving spirooxindole **11a** in 75% yield and 84% ee. The relative configuration **11b**, synthesized by **9** and but-3-yn-2-one (**10b**), was determined by X-ray structure analysis.



Scheme 3 Organocatalyzed Double Michael Reaction for the Enantioselective Synthesis of Spirooxindoes.

Department of Regulatory Bioorganic Chemistry

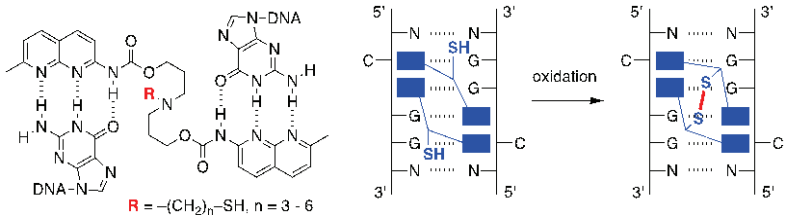
Professor: Kazuhiko NAKATANI
Associate Professor: Chikara DOHNO
Assistant Professor: Asako MURATA
Specially Appointed Assistant Professors: Haruo AIKAWA (-28.2.2018), Takeshi YAMADA, Tomonori SHIBATA
Postdoctral Fellow: Bimolendu DAS,
Guest Researcher: Sanjukta MUKHERJEE
Graduate Students: Norhayati SABANI (-25.9.2017), Nursakinah MOHD ZAIFUDDIN, Jun MATSUMOTO, Yihuan LU, Koichi MIYAGAWA, Kazuaki YAMAUCHI, Shota MIKI, Ayaka YANO, Anisa UL'HUSNA, Russell KOYEAN, Ryo ENOMOTO, Arisa KAWAKITA, Ryo MINAMI, Eitaro MURAKAMI, Yuki YAGI, Naohisa ICHIDA
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. 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.

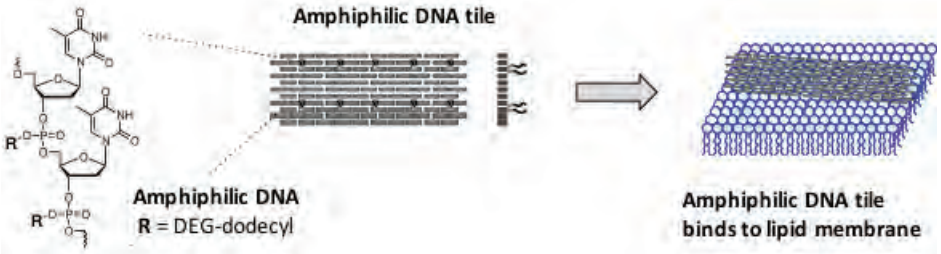
Research Projects

Synthesis of NCD Derivatives Modified with Alkanethiol and Binding Properties of G-G Mismatch DNA



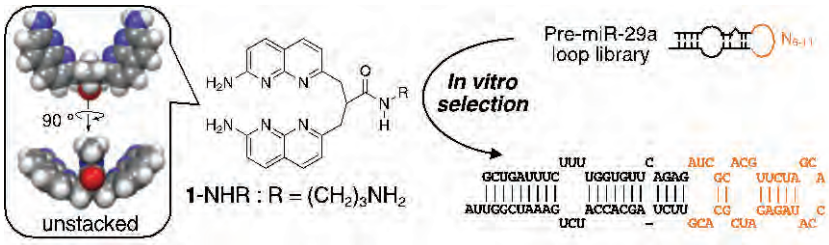
Trinucleotide repeat disease is a group of neurodegenerative disorders, due to excessive elongation of 5'-CNG-3' (N = A, C, G and T) repeat sequences in the genome. We previously developed a small molecule NCD, which bind strongly to GG mismatches in CGG repeats. It is clarified that NCD binds to a GG mismatch with 2 : 1 stoichiometry and high cooperativity. In this paper, we newly developed a series of DNA binding molecules NCD-Cn-SH in which the NCD domain and a thiol moiety are linked via a linker. NCD-Cn-SH oxidatively dimerizes to (NCD-Cn-S)2 under aerobic conditions. The reaction rate of this dimerization was dramatically accelerated in the presence of CGG repeat DNA. These results suggested that NCD-Cn-SH selectively accumulated in CGG repeat DNA, resulting in the formation of a dimer with higher thermal stability, NCD-Cn-SH are attractive for the research focusing on CGG repeat related diseases such as fragile X syndrome.

Amphiphilic DNA Tiles that Bind to Lipid Bilayer Membranes and Modulate the Mechanical Properties



Lipid membrane-associated DNA nanostructures are expected to find applications ranging from synthetic biology to nanomedicine. We have designed and synthesized DNA tiles and modified them by amphiphilic covalent moieties. dod-DEG groups, which consist of a hydrophilic diethylene glycol (DEG) and a hydrophobic dodecyl group, are introduced at the phosphate backbone to create amphiphilic DNA strands which are subsequently introduced into one face of DNA tiles. The tile becomes able to stably bind to lipid membranes by insertion of the hydrophobic groups inside the bilayer core. Our results show that these amphiphilic DNA tiles can bind and assemble into 2D lattices on both gel and fluid lipid bilayers. The binding of the DNA structures to membranes is dependent on the lipid phase of the membrane, the concentration of Mg^{2+} cation, the length of the amphiphilic modifications to the DNA as well as on the density of the modifications within the tile. Atomic force microscopy–based force spectroscopy is used to investigate the effect of the inserted DNA tiles on the mechanical properties of the lipid membranes. The results indicate that the insertion of DNA tiles produces increase of the bilayer breakthrough force.

Development of a Conformationally Restricted Naphthyridine Dimer



One of the important determinants for the efficient molecular interactions is the conformational changes in host and/or guest molecules upon binding. In small-molecule interactions with nucleic acids, conformational changes on both molecules are often involved, especially in intercalating binding. To investigate the effect of conformations of small molecules on binding to DNA and RNA, we have designed and synthesized novel naphthyridine dimers with a short three-atom linker connecting two 2-amino-1,8-naphthyridine heterocycles. One of the dimer molecules we synthesized, 1-NHR, had an exclusively unstacked conformation in both organic and aqueous solutions and showed modest binding affinity towards GX/Y DNA and RNA sequences. In vitro selection of RNA that specifically binds to 1-NHR was performed from pre-miR-29a loop library RNA, and one RNA sequence was enriched and identified. Surface plasmon resonance assay and isothermal titration calorimetry analysis showed the high affinity of 1-NHR to the RNA, and suggested that the binding was likely to proceed in an enthalpy-driven manner.

Department of Organic Fine Chemicals

Assistant Professor: Yusuke HIGUCHI
Specially Appointed Professor: Nobuo KATO
Specially Appointed Associate Professor: Kunihiro KAIHATSU
Specially Appointed Researchers: Hajime NITTA, Emi HARADA
Post-Doctoral Researcher: Katsuya OGATA(1.8.2017-)
Technical Assistants: Kanako AJICHI(-31.7.2017), Hiroyo MATSUMURA, Chika TANAKA(28.8.2017-), Sayaka KAJIKAWA(28.8.2017-), Sakiko HORI(8.9.2017-), Yumi NAKAMURA(16.10.2017-), Etsuka UEDA(16.10.2017-)
Supporting Staff: Misuzu TANNO(-15.10.2017), Yo KAJI(1.10.2017-)

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.

Research Projects

ISIR-050; a cotylenin A mimic derived from fusicoccin A

Fusicoccins (FCs) and cotylenins (CNs) are structurally similar diterpene glycosides, having the fusicoccane (5-8-5 tricyclic ring system) core skeleton linked to functionalized glucose unit and known as stabilizers of protein-protein interactions (PPI) mediated by 14-3-3 proteins. Among them, CN A shows anti-cancer activities not only *in vitro* but also *in vivo*. Thus, although CN A can be a useful anti-cancer drug, the fungal strain producing CNs, an unidentified *Cladosporium* species, has lost its proliferative ability. However, no practical method to produce CN A has been found. Therefore, it is difficult to conduct further biological studies on CN A aimed at drug development.

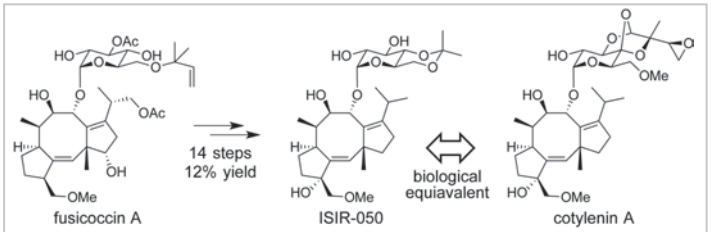


Fig 1. Chemical structure of fusiccocin A, cotylenin A and ISIR-050

To overcome this problem, ISIR-050 was designed as a CN A mimic (Fig 1.). The synthesis was accomplished via a semisynthetic approach starting from fusicoccin A, a major secondary metabolite of *Phomopsis amygdali* that is commercially available, in 12 % (14 steps). ISIR-050 showed interferon-α (IFNα)-dependent growth inhibitory activity and a PPI stabilization effect similar to or slightly better than those of CN A. The biochemical analysis suggested that ISIR-050 and CN A induce the same pharmacological response to IFNα-treated cancer cells and that 14-3-3 proteins play a role in the mode of action.[Original Pater 1]

Department of Biomolecular Science and Reaction

Professor: Shun'ichi KURODA
Associate Professor: Toshihide OKAJIMA, Yoh WADA (1.4.2017-)
Specially Appointed Associate Professors: Masumi IIJIMA (-31.3.2018), Kazuki OKAMOTO (1.4.2017-)
Assistant Professors: Kenji TATEMATSU, Masaharu Somiya (1.6.2017-)
Specially Appointed Assistant Professor: Tomoko YAMAZAKI (16.5.2017-15.11.2017)
Research Students: Qiushi LIU, Fei TENG, Hao LI, Zichang XU (-31.3.2018), Toshinori OOZEKI, Kazuki KOZAKAI (-31.3.2018), Kazuyo FUJITA (1.4.2017-), Masahiro NAGAMORI (1.4.2017-), Kanako SAKAEDA (1.4.2017-), Yuusuke KOBAYASHI (1.4.2017-), Satoshi KANAGAWA (1.4.2017-), Yasushi SASAKI (1.4.2017-), Yuki YAMADA (1.4.2017-), Miyo NAKAMURA (1.4.2017-)
Supporting Staffs: Mayuko MURAI, Yumi YUKAWA, Minami TAKAI

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

Establishment of efficient production method for HBV envelope particles

Hepatitis B virus (HBV) envelope particles have been synthesized in eukaryotic cells as an HB vaccine immunogen and drug delivery system (DDS) nanocarrier. In past three decades, many attempts to synthesize S particles in *E. coli* have been made to establish inexpensive and prompt way of producing HB vaccines. However, even the expression of S protein was extremely low and considered as unstable and deleterious in *E. coli*. Since S protein is predicted to possess at least three transmembrane domains (TM) (Fig. 1), it was considered that these TMs interact with bacterial inner membrane and subsequently interfere with the membrane translocation of S protein. In this study, we generated deletion mutants of HBV envelope L protein containing three transmembrane domains (TM1, TM2, TM3). The ΔNC mutant spanning from TM2 to N-terminal half of TM3 (from 237 aa to 335 aa, Fig. 1) was found as a shortest form showing spontaneous particle formation. After the N-terminal end of ΔNC mutant was optimized by the N-end rule for *E. coli* expression, the modified ΔNC mutant (mΔNC) was efficiently expressed as particles in *E. coli*. The molecular mass of mΔNC particle was approx. 670 kDa, and the diameter was 28.5 ± 6.2 nm. The particle could react with anti-HBV envelope S protein antibody, indicating the particles exhibited S antigenic domain outside as well as HBV envelope particles (Fig. 2) [Original Paper 6]. Taken together, the E. coli-derived mΔNC particle is a hollow nanoparticle, of which the

structure is similar to HB patient-derived HBV envelope particles, and this particle could be utilized as an immunogen of HB vaccine and a DDS nanocarrier.

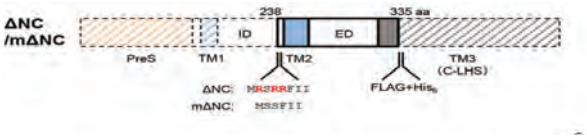


Fig. 1. Structures of ΔNC and mΔNC.
The dotted line shows the full length of L protein.

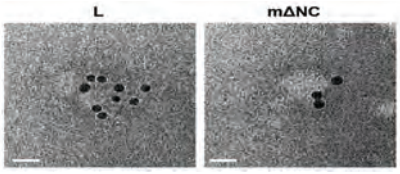


Fig. 2. Immunoelectron microscope images L and mΔNC particles.
Particles were stained with colloidal gold coupled with anti-S IgG.

Preparation of various cyclic peptides by radical SAM enzyme QhpD

In a *qhp* operon coding quinohemoprotein amine dehydrogenase, various genes,involved in modification enzyme for posttranslational modification of the smallest subunit QhpC were encoded without the subunit genes. QhpD, one of the modification enzymes, belongs to a superfamily of a radical *S*-adenosyl methionine (SAM) enzyme that catalyzes chemically-challenging reactions using SAM and Fe-S clusters. QhpD has a activity generating an inter-peptidyl thioether bond formation between Cys and Asp/Glu residues. We have demonstrated that as a result of the thioether bond formation, the peptide region delimited by the crosslinked residues forms loop-out region and that the product peptide has cyclic regions. This study evaluates the ability of QhpD to generate the cyclic peptide having various sequences. We produced a construct of a short version of QhpC (QhpC$_{(-28)-23}$; hereafter designated sQhpC) consists of N-terminal leader (requiring the interaction with QhpD) and the 1st of crosslinked site of QhpC ($\underline{C}^{7}$TTSFDPGW$\underline{E}^{16}$: crosslinked residues are underlined). With the derivatives of sQhpC having various sequence and length of the loop region, the sequence specificity of the sQhpC loop region was analyzed. In the point mutants of sQhpC in which the single residue in the loop region was replaced with Ala residue, all of the sQhpC mutants have been crosslinked by QhpD, although the crosslinking rate of the P13A mutant seems to decrease to 1/10 fold of the wild-type QhpC. We found that size of the residues close to the crosslinked sites significantly affect the crosslinked ability of sQhpC. These data suggest that there is no essential residue for crosslink reaction. Furthermore, we prepared sQhpC mutants that consist of the all-Ala loop region from 1 to 10 residues (Ala X 1 -Ala X10) or lacks the loop region (Ala X 0) and showed that these are again crosslinked by QhpD (Fig. 3). Interestingly, double type QhpC having repeated crosslink region (total 6 crosslinking sites) was also fully crosslinked (Fig. 4). These results support our loop-out model of the QhpC/QhpD complex for the crosslink reaction by QhpD. QhpD would be applicable to prepare the novel peptides containing various sequences and crosslink numbers.

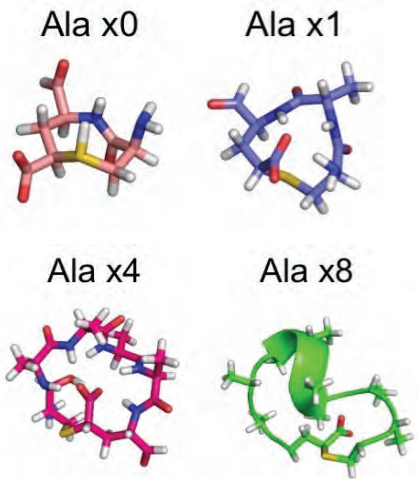


Fig. 3. Presumed structures of Ala-repeated cyclic peptides.

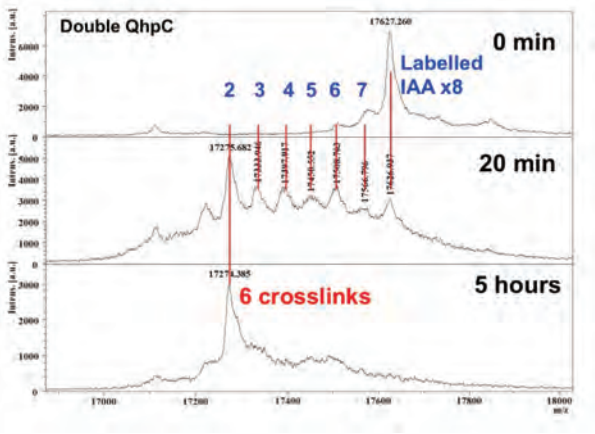


Fig. 4. Sequential crosslink formation of double QhpC.

Department of Biomolecular Science and Regulation

Professor:	Kunihiko NISHINO
Associate Professor:	Tsuyoshi NISHI
Assistant Professors:	Seiji YAMASAKI, Mitsuko HAYASHI-NISHINO
Postdoctoral Fellows:	Shoko NISHI, Katsuhiko HAYASHI
Graduate Students:	Martijn ZWAMA,
Under Graduate Student:	Saki SHIGEYAMA, Kaori NAKAO
Guest Professor:	Yoshimi MATSUMOTO
Supporting Staffs:	Aiko FUKUSHIMA, Sumie MATSUOKA

Outlines

Xenobiotic transporters are widely distributed in living organisms and play important roles in their self-defense mechanisms. Transporters cause a serious chemotherapeutic problem named multidrug resistance in pathogenic bacteria and cancer cells. Recent discoveries also support the notion that some xenobiotic transporters have shown to have important roles in bacterial virulence and signal transduction. We are interested in understanding roles xenobiotic transporters in multidrug resistance and physiological functions. Our knowledge should promote the development of novel inhibitors or strategies that could counteract the contribution of xenobiotic transporters to drug resistance and virulence.

Research Projects

Developing inhibitors of bacterial multidrug efflux pumps

Multidrug efflux pumps contribute to bacterial multidrug resistance by exporting multiple antimicrobial agents from inside to outside of the cells. As a result of post genomic analysis, it was revealed that bacteria possess a number of multidrug efflux pumps. Multidrug efflux systems are an attractive target of new drugs that enable to overcome the problem of bacterial multidrug resistance. In this project, random screening using compound libraries was performed to select candidates of inhibitors of efflux pumps in *Salmonella enterica*, *Escherichia coli* and *Pseudomonas aeruginosa*. Furthermore, we clarify the effect of inhibitors on drug susceptibilities of clinical isolates by using the combination of antibacterial drugs and inhibitors. The purpose of the study is the treatment of infectious diseases with multidrug resistant bacteria.

In this fiscal year, among ten identified pumps (AcrAB, AcrD, AcrEF, MdtABC, MdsABC, MdfA, EmrAB, SmvA, MdtK, MacAB) in Salmonella, we constructed the MacAB-expressing strain because it was previously found that MacAB is related with *Salmonella* virulence. The minimum inhibitory concentration of various antimicrobial agents against this strain was measured and the strain exhibited the highest resistance to erythromycin. Thus, we selected erythromycin to verify the synergistic effect at the screening of inhibitors of MacAB. Two candidates were selected among Osaka University chemical library. Of these, one compound showed the antibacterial activity by itself, in addition to the MacAB inhibitory effect. Another compound did not show antibacterial activity, and when it was used in combination with erythromycin, the

synergetic effect against the MacAB-expressing strain was confirmed. As a result of verifying the synergistic effect with clarithromycin, oleandomycin, and azithromycin, the candidate compound showed synergistic effect with a 14- and 15-membered ring macrolide.

For the screening of *E. coli* drug efflux pump inhibitors, strains expressing AcrAB, MdtABC, AcrD, AcrEF and MdtEF were constructed and the minimum inhibitory concentrations of various drugs against the strains were measured. The strains shows resistance to oxacillin by expressing these pumps (> 256 fold, 8 fold, 32 fold, 128 fold, 32 fold-increase, respectively), it is considered that oxacillin is a first choice drug to verify the synergistic action with the inhibitor candidates.

In addition, we constructed expression strains of drug excretion pumps MexAB and MexXY, which are highly expressed in multidrug-resistant *Pseudomonas aeruginosa*. And we investigatd the synergistic effect with antibiotics recognized by both efflux pumps by using Osaka University compound library for the screening. We select compounds that retain inhibitory effects on MexAB and MexXY, respectively, and also searched candidate compounds that inhibit both pumps simultaneously. In addition, among the candidate compounds, we selected the compounds having antibacterial activity by themselves, and the compounds having no antibacterial activity. We also tested the influence of each compound on the membrane damage and the effect on the bacterial drug efflux activity.

Identification of novel erythrocyte S1P transporter and single-step method for measurement of S1P export activity from erythrocyte.

Sphingosine 1-phosphate (S1P) is an immunomodulating signaling molecule present in blood plasma abundantly (about 1μM). Erythrocytes synthesize and supply about half amount of the plasma S1P that is essential for lymphocyte trafficking. We previously showed that S1P export from erythrocytes is mediated by a glyburide-sensitive S1P transporter. However, the gene encoding the S1P transporter in erythrocytes is not identified. During the search of various cell lines, we found that MEDEP-E14 cells inported extracellular sphingosine, synthesized S1P intracellularly and exported it to the outside of the cells in a time-dependent manner. The S1P export from MEDEP-E14 cells was inhibited by the erythrocyte S1P transporter inhibitor, glyburide. These characteristics are similar to that of the erythrocyte S1P transporter. Because a parental cell of MEDEP-E14, E14TG2a does not release S1P although small amount of S1P was synthesized intracellularly, microarray analysis was performed to find the difference of the transporter gene in these cells. As a result, we identified several transporter genes that is expressing in MEDEP-E14 cells but not in E14TG2a cells. Of these transporters, only MFSD2B showed S1P export activity when MFSD2B was expressed in CHO/SphK cells. S1P export by MFSD2B was time-dependent and inhibited by glyburide. These properties are similar to those in erythrocytes. Moreover, knock-out of *Mfsd2b* gene in MEDEP-E14 cells using CRISPR/Cas9 system abolished S1P export from the cells to both BSA and HDL. These results strongly suggest that MFSD2B is a novel S1P transporter in erythroid cells. The nucleated erythroid cells, MEDEP-E14 may be useful for analyzing function and screening inhibitors of MFSD2B.

Department of Biomolecular Science and Engineering

Professor: Takeharu NAGAI
Associate Professor: Tomoki MATSUDA
Assistant Professors: Yoshiyuki ARAI (-31/7/2017), Masahiro NAKANO
Specially Appointed Associate Professor: Tetsuichi WAZAWA
Specially Appointed Assistant Professors: Megumi IWANO, Tetsuyuki ENTANI, Mitsuru HATTORI (1/5/2017-)
Specially Appointed Researchers: Kunito YOSHIDA, Tomomi KAKU, Satsuki FUJIWARA (-30/9/2017), Takahito Onishi, Lu KAI (16/12/2017-),
JSPS Fellowship Researcher: Michael SHANNON (1/2/2018-)
Visiting Researcher: Syo SATO
Graduate Students: Yuki KUSHIDA, Shigenori INAGAKI, Yemima Dani RIANI, Hajime SHINODA, MD. Nadim HOSSAIN, Quang TRAN, Israt FARHANA, Taichi KIMURA, Masanori TSUJI, Yoshimasa IKE, Syusaku UTO, Yuhei OGAMI, Eunike Priscilla TANIO (1/10/2017-)
Under Graduate Students: Keisuke IDE, Nae SUGIURA, Kousuke NOGUCHI
Research Student: Vu Quang CONG, Zhai LE
Supporting Staffs: Kazuyo SAKAI, Aya HISATOMI, Hiroko INOUE (16/3/2018-)

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

Acid-tolerant monomeric GFP derived from *Olindias Formosa*

Color pallet of fluorescent protein (FP) has made a great contribution to visualize molecular and cellular processes. However, most FPs lose fluorescence at pH lower

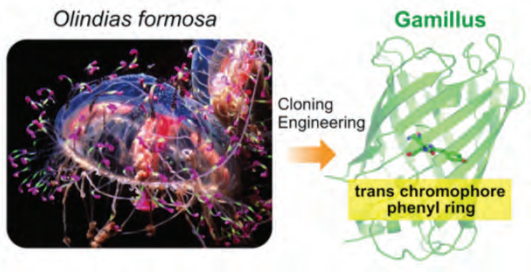


Fig.1 Flower Hat Jellyfish (*Olindias Formosa*) and Gamillus [1].

than their neutral pK_a (≈ 6), and this has hampered their application in acidic organelles such as endosomes, secretory granules, lysosomes and vacuoles (pH ≈ 4.5-6.0). To date, several acid-tolerant FPs are available for cyan and red color, however there is little report of acid-tolerant green FPs (GFPs) practically applicable to bioimaging. Here we developed an acid-tolerant monomeric GFP "Gamillus" from jellyfish *Olindias formosa* with excellent brightness, maturation speed and photostability (Figure 1) [1]. Results of X-ray crystallography and point mutagenesis suggest that the acid-tolerance is attributed to stabilization of deprotonation on chromophore phenyl ring in broad pH range by forming unique trans configuration (Figure 2). We demonstrated that Gamillus serves as a universal molecular tag, suitable for imaging in acidic organelles through autophagy-mediated molecular tracking to lysosomes. Multicolor imaging in combination of Gamillus with reported color pallet of acid-tolerant FPs is expected to unveil physiological phenomena in acidic environments.

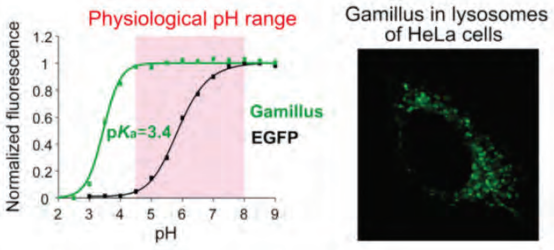


Fig.2 Left; The pH-titration curve for fluorescence emission of Gamillus and EGFP[1]. Right; Fluorescence localization of Gamillus in lysosomes of HeLa cells.

Highly-biocompatible super-resolution imaging by SPoD-ExPAN

Super-resolution microscopy has enabled us to visualize minute details inside cells which were previously invisible by conventional optical microscopy. However, most of the super-resolution imaging techniques require high power density of illumination, which gives rise to phototoxicity to cells and thus hampers time-lapse observation of live cells. Herein we have developed a super-resolution imaging technique that is based on SPoD-ExPAN (Super-resolution by Polarization Demodulation/Excitation Polarization Angle Narrowing) method but provides high biocompatibility [2]. The present technique exploits a fast photoswitchable protein Kohinoor so that the power density of illumination light is several orders of magnitude lower than that used for conventional super-resolution imaging. For the observation Kohinoor we have constructed a SPoD-ExPAN microscope specialized to Kohinoor (Figure 3). With the present technique we have achieved super-resolution observation live cells at a resolution of 70-80 nm. This technique is expected to be extended to visualize dynamic processes in live cells (Figure 4).

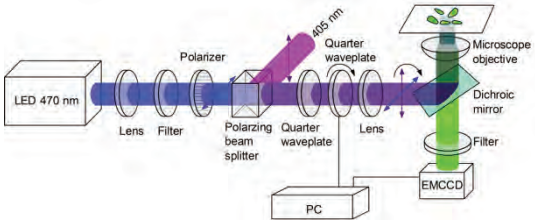


Fig.3 Schematic diagram of SPoD-ExPAN microscope for the observation of Kohinoor.

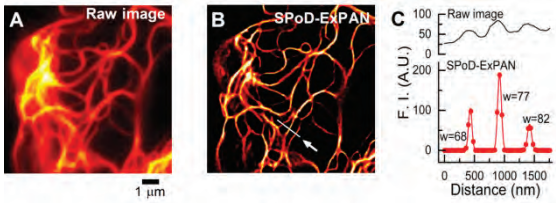


Fig.4 SPoD-ExPAN observation of intermediate filaments in a HeLa cell.

[1] Shinoda et al., Acid-tolerant monomeric GFP from *Olindias formosa*. Int. J. Mol. Sci., 19(6), 1548, 2018
[2] Wazawa et al., Highly biocompatible super-resolution fluorescence imaging using the fast photoswitching fluorescent protein Kohinoor and SPoD-ExPAN with L_p-regularized image reconstruction. Microscopy, 67(2), 89-98, 2018

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 Translational Datability

Incorporate the data-driven research demanded by industry, accelerate the approach to datability, and conduct research on data-driven science.

-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 Katsuaki Suganuma, current director of ISIR) has executed the final 5th year plan of JSPS Core to Core program.

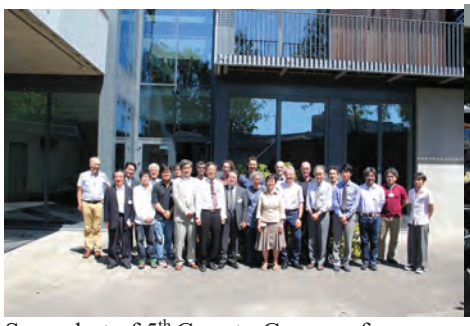
On June 19 5th Conference of SANKEN Core to Core Program and 6th imec Handai Interantional Symposium were held at imec Leuven, Belgium, on June 22 Purdue Seminar held at Birck Nanotechnology Center of Purdue University, West Laffyett USA which is one of core partner, respectively, resultantly whole 15 planned seminar were completely executed.

In pararell, in Osaka univ. COI(Center of Innovation) program, the collaboration agreement were currently contracted between 29 companies and 17 research academia, then " Fostering of super-Nipponjin by human power activation" development has been going well under one roof followed by 6th Handai COI symposium held at Nakanoshima center on October 17.

Research Projects

- **JSPS 5th SANKEN core to core program and 6th imec HandaiInternational conference were held at imec Leuven, Belgium on June 19 last year.**

5th Core to core program is composed of 3 oral session and 1 poster session, at first professor Kazuhiko Matsumoto, the chair person, professor Katsuaki Suganuma, operational committee,and professor Jo De Boeck, imec CTO and eecutive Vice President gave welcome words, then theme R1～R9 presentation were gven. Fruitful discussion were done among 50 participants. As for 6th imec Handai symposium, topics of flexible, organic electronics and bioelectrinics , life science were presented mutually and tight collaboration friendship were shared.



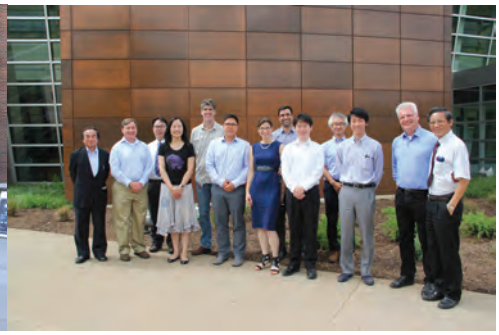
Snap shot of 5th Core to Core conference

Job-well-done party among ISIR professors in Leuven

- **Purdue Seminar was held at Birck Nanotechnology Center, Purdue University**

On June 22 Purdue Seminar was held at Birck Nanotechnology Center Purdue University corresponding to core parter of our Core to Core program, at West Layyette USA, where is quite famous for Captain Nell Armstrong of Applo space ship graduated university. Virus detection and developed devices with nanotechnologies were actively discusssed among 20 participants. Then thanks to professor David Janes, our ISIRdelegation had the clean room window tours of Birck nanotechnology Center.

Bronze image of Captain Armstrong



Snap shot of Purdue Seminar participants

Conference room of Purdue Seminar

Purdue University

Time line	Presentation title	Speaker		Affiliation
10:00-10:10	Welcome word	David Janes	Professor	Purdue Univ.
	Welcome word	Kazuhiko Matsumoto	Professor	Osaka Univ.
10:10-10:50	**Presentations am-1 : Spintronics**			
20min	Spintronics	Zhihong Chen	Professor	ECE Purdue Univ.
20min	Quantum device and spin control	Akira Oiwa	Professor	Osaka Univ.
10:50-11:30	**Presentations am-2 : Materials**			
20min	VO2 Oxide material and device	Hidekazu Tanaka	Professor	Osaka Univ.
20min	2D Materials for Electronics and Optoelectronics	Joerg Appenzeller	Professor	ECE Purdue Univ.
11:30-12:30	**Lunch time & networking coffee break**			
12:30-13:50	**Presentations pm-1 : Virus detection and devices**			
20min	Pathogen detection using graphene device with microreactor	Takao Ono	Assistant Prof.	Osaka Univ.
20min	Graphene-wrapped microparticles for viral detection	Lia Stanciu	Dr.	MSE Purdue Univ.
20min	Biosensors/virus detection	Jacqueline Linnes	Dr.	BME Purdue Univ.
20min	Virus detection by Graphene FET	Kazuhiko Matsumoto	Professor	Osaka Univ.
13:50-14:20	**Networking coffee break**			
14:20-15:00	**Presentations pm : Life science application**			
20min	Implantable sensors and actuators for neurological applications	Hyowon (Hugh) Lee	Dr.	BME Purdue Univ.
20min	Brain wave measurement system	Takafumi Uemura	Associate Prof.	Osaka Univ.
15:00-15:05	Concluding Remarks	David Janes	Professor	Purdue Univ.
15:10-16:40	**Purdue University Tours by Professor Hidekazu Tanaka**			
16:40	**Adjourn**			

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 have continued a consignment study [Developmental study for new element technologies to enable the value adding of natural materials] and a research grant [the Japanese Society of Eucommia / 12th research grant (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 on functional foods

-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, research of the promotion of plant growth, metabolome analysis about functional-food components and developmental study of keeping freshness of fruits were carried out.

New hydroponic-cultivation system using scrap glass was developed, and the technology was practically tested on public road in Umeda area.

We analyzed the effect of the method of drying Eucammia leaves on functional-food components by using metabolome technics.

An academic symposium was held in Dec. 5th, 2017 to introduce the achievements of academia-industry collaboration in functional-food field.

Fig.1 Practical tests of new hydroponic-cultivation

Fig.2 Symposium on functional foods

Laboratory of Cellulose Nanofiber Materials

Specially Appointed Assistant Professor: Hirotaka KOGA
Supporting Staff: Yasuha IZUMI

Outlines

Wood-derived cellulose is the most abundant and renewable bioresources. Among many cellulosic materials, paper is the most common one. Since the invention of paper approximately 2000 years ago, it has been traditionally used on a daily basis for various purposes such as writing, printing, wiping, and packaging applications. The recent trend toward green and sustainable technology has led to a growing emphasis on the development of new functionalized paper materials to extend their use in advanced applications. We aim at functional innovation of cellulose paper by structural, molecular, and material design, i.e., compositing of metal or carbon nanomaterials, chemical modification, control of porous structures from micro to nanoscale, and their combination. This "renovation of paper" strategy opens new doors for the development of advanced functional paper materials to realize green electronics and chemistry.

Research Projects

Electronic paper made of real paper (ACS Appl. Mater. Interfaces, 9, 40914 (2017))
We succeeded in preparing a paper electrolyte by supporting a non-volatile electrolyte (1-butyl-3-methylimidazolium tetrafluoroborate [bmim]BF_4) on the surface of cellulose pulp fibers through hydrogen bonding. Furthermore, we evenly coated conducting polymers with electrochromic (EC) function, poly(3,4-ethylenedioxythiophene) poly (styrenesulfonate) (PEDOT:PSS), onto the entire surface of the transparent paper made from cellulose nanopulp fibers, fabricating a transparent EC paper electrode. By sandwiching the as-prepared $LiClO_4$/[bmim]BF_4@paper electrolyte between EC conductive PEDOT:PSS-coated transparent cellulose nanofiber papers as a transparent EC electrode, we fabricated an EC paper device (Fig. 1).

This EC device is flexible and easily bent because the whole device is paper-based. In addition, a white paper electrolyte with high optical reflectance enhances the visibility of the EC displays. Thus, we have created a new application for paper, which has traditionally acted as a medium on which to display information by writing and printing, as a display using electricity.

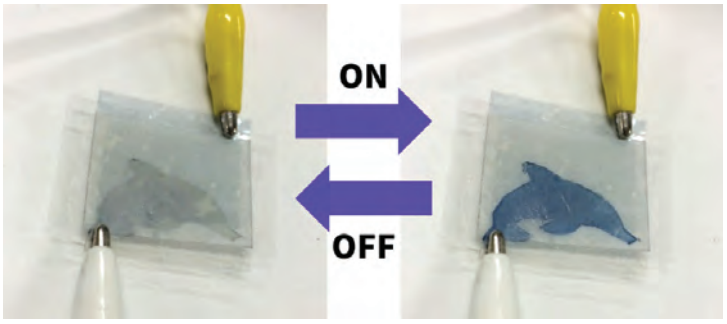


Fig. 1 An electrochromic display based on transparent paper electrodes and a paper electrolyte.

Laboratory of Cell Membrane Structural Biology

Specially Appointed Professor: Akihito YAMAGUCHI
Specially Appointed Associate Professor: Ryosuke NAKASHIMA
Supporting Staff: Kimie KITAGAWA

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.

Research Projects

Multiple entry pathways within the efflux transporter AcrB contribute to multidrug recognition.

AcrB has multiple entry pathways, the membrane surface entrance channel 1 (CH1) and periplasmic entrance channel 2 (CH2), and two multisite drug-binding pocket named the proximal binding pocket (PBP) and the distal binding pocket (DBP). From these channel, drugs can move to a voluminous multisite drug binding pocket within the AcrB monomer, from where the drugs are extruded through a top-open funnel. A glycine-rich swinging loop is located between the PBP and DBP. This loop acts as a swinging valve during the translocation of drugs from the PBP to the DBP by a peristaltic motion. In this year, we reported an additional third channel (CH3) open to the central cavity within the AcrB trimer. The importance of CH1 and CH2 is revealed by site-directed mutagenesis studies, while there was yet no experimental evidence for CH3. It therefore appeared that RND-type exporters have multiple drug-binding pockets as well as multiple drug translocation pathways. However, the significance of the existence of multiple entrances had not been clearly established. We provide evidence for a specific entry channel from the central cavity and show that this channel (CH3) is directly connected to the DBP and bypasses the PBP and the switch-loop. We show that CH3-preferring drugs can be characterized by their chemical structure and are transported non-competitively with the other CH1 and CH2-preferring drugs (Nature Communications, 9(124), 1-9, 2018).

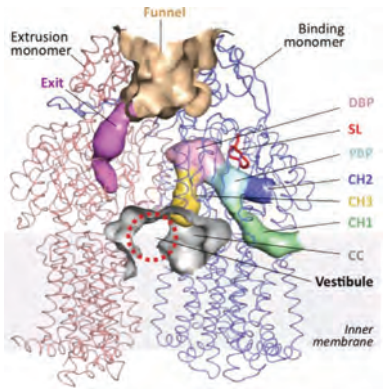


Figure 1. The three main supposed channels for AcrB.

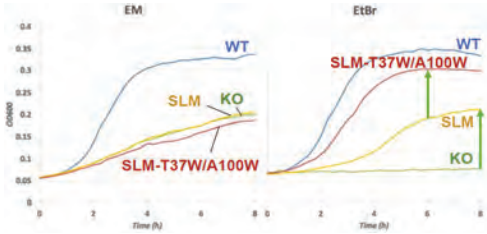


Figure 2. The effect of drugs on the export activity of the switch-loop mutant (SLM).

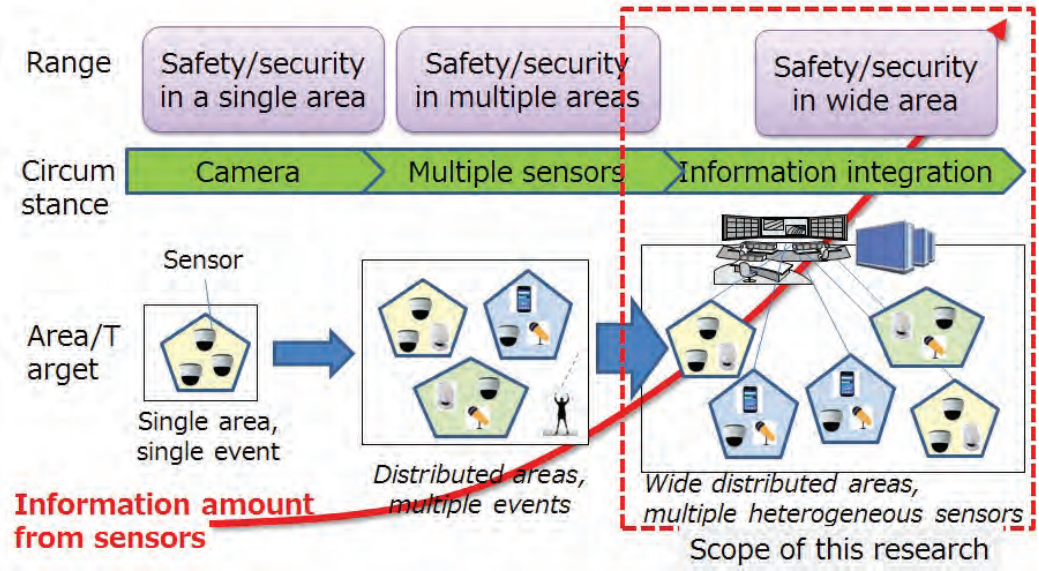
Mitsubishi Electric Collaborative Research Division for Wide-area Security Technology

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

Division of SCREEN Single-Molecule Analysis

Outline

Development of methodology of identifying molecules and/or detecting / monitoring molecular behaviors at the single-molecular level is an important research issue for research field and also for application-fields. The object of this division is to establish a high-throughput single-molecule electrical measurement and analysis methodology by using silicon-based nano-devices, which are fabricated by cutting-edge nanotechnology, and to develop application technology of this single-molecule sensing technology for various social needs. For that purpose, we aim to develop the manufacturing process technology of semiconductor devices which is quality-controlled, measuring equipment adapted to device performance, accompanying measurement, analysis system and so on.

Research Projects

1. Development of device production technology for single-molecular measurement.

The key to semiconductor based devices for one molecule measurement is to keep clean in device and sensing condition. Therefore, it is necessary to prevent various contaminants in the device-manufacturing process. In this fiscal year, we reviewed all process on device fabrication including the film formation process of the gold electrode, and tried to minimize contamination events. As a results, the device-conduction yield was improved by implementing the structural design and fabrication technology of the flow path cover (PDMS), realizing a stable electrophoresis function, resulting in improvement of the measurable yield.

2. Development of measurement system for high-sensitive current measurement.

One of the key technologies for single-molecule sensing is the development of an amplifier for high-speed and high-resolution current measurement. In this fiscal year, we developed high speed, low noise, high sensitive current / voltage amplifier and voltage source to improve signal accuracy. As a result, the developed amplifier characteristics were able to maintain the amplifier characteristics up to the broadband under the measurement system condition, succeeded in reducing the resonance phenomenon due to the parasitic capacitance mismatch. Current single-molecule measurement is carried out by measurement system equipped with this amplifier.

3. Development of single-molecule analysis system

High quality of single-molecule identification and quantification is key for application. We constructed a data-center for single-molecule identification and, currently, accumulated single-molecule data by our device and measurement systems in the center. In this fiscal year, we acquired a large amount of single-molecule electrical measurement data and, based on these data, by using machine learning, develop several algorithms for single-molecule molecule identification.

Activities of Centers

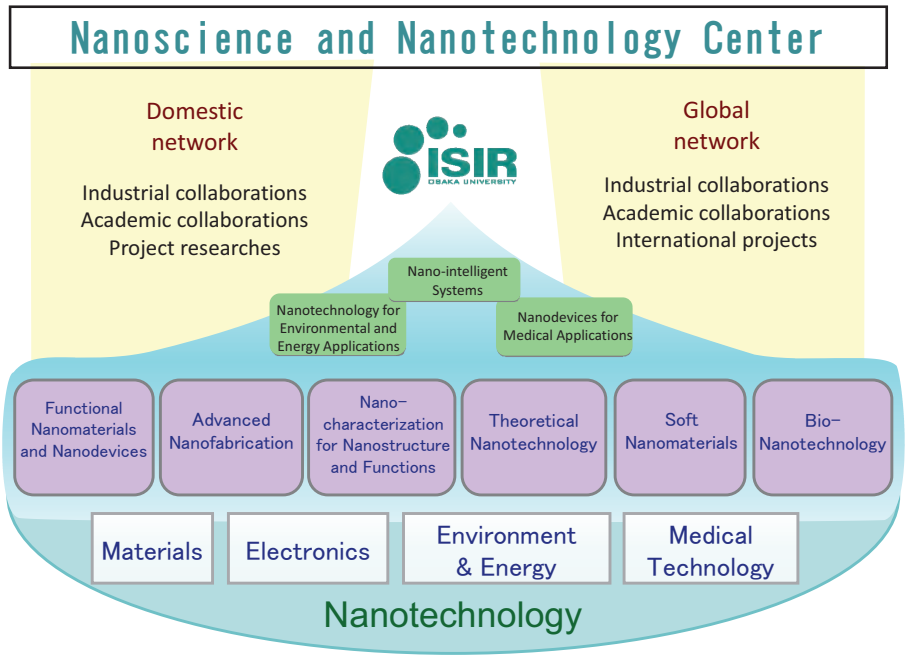
Nanoscience and Nanotechnology Center

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 operates 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
JSPS Foreign Research Fellow:	Alexis BOROWIAK (28.9.2016 - 27.9.2018)
Gest Research Fellow:	Rupali RAKSHIT (1.1.2018 - 31.12.2018)
Graduate Students:	Koutarou SAKAI, Masahi CHIKANARI, Keiichiro HAYASHI, Yoshiyuki HIGUCHI, Yoshihide TSUJI, Daiki KAWAMOTO, Yuto ANZAI, Keita MURAOKA
Under Graduate Students:	Shingo GENCHI, Fumiya ENDO, Toshiki TANIMURA
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 Phase-transition Straintronics.

We demonstrated to control a magnitude of lattice strain in VO_2 freestanding nanowire with planer-type double side-gates by applying various gate-biases. Fig. 1(a) shows the scanning electron microscope (SEM) images of VO_2 freestanding nanowires with planer-type double side-gates in a width of 800 nm, and the NEMS structure with hung side-gates and suspended channel parts can be confirmed. Fig. 1(b) shows resistance switching behavior by applying gate-biases near transition temperature (T=337K). The transport behavior showed abrupt resistance drop, and the on-state resistance was steeply return to the original state as soon as removing gate-biases. The channel resistance was dropped by gate biases regardless of positive or negative polarities. Origin of these volatile switching and the am-bipolar resistance drop can be inferred by an electrostatic attractive force. We revealed the origin of electrical transport modulation,

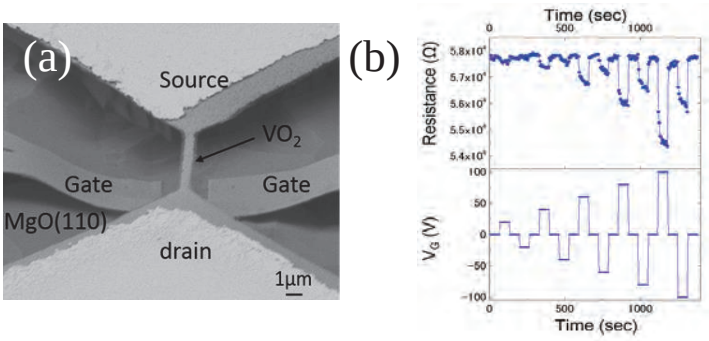


Fig. 1 (a) The scanning electron microscopy (SEM) image of freestanding nanowires with planer type double side-gates in a width of 800nm. (b) Time response of resistance changing the applied gate-biases near transition temperature (T=337K).

which artificially switch metallization and insulation due to compressive and tensile strain of c-axis. Our results pave the way of electrical control of lattice strain in phase transition oxide materials, and this “Phase-Transition straintronics” would provide a new platform for realizing high performance next-generation devices.

Epitaxial Crystallization of Self-assembled Functional Oxide Nano-pillar System

We successfully demonstrated a self-assembled ZnO–NiO nanopillar system with a three-dimensional structure. By designing a three-dimensional epitaxial combination of phase-separated oxide materials and a single-crystal substrate, epitaxial NiO pillars 20–50 nm in diameter and embedded in a ZnO matrix were successfully created. Conductive-atomic force microscopy, piezoresponse force microscopy and TEM measurements revealed a highly doped semiconducting and piezoelectric ZnO matrix and lightly doped semiconducting and non-piezoelectric NiO pillars as shown in Fig. 2. This oxide semiconductor-basednano-heterostru cture is sure to contribute to the future development of electronic devices utilizing heterointerfaces between oxide semiconductors.

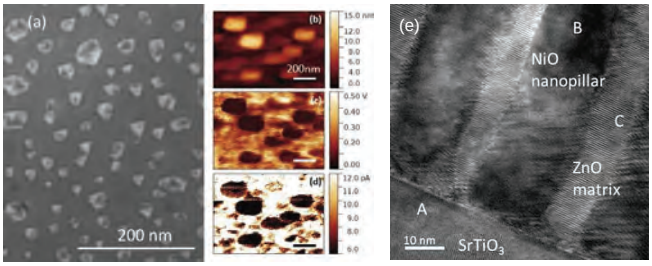


Fig. 2 Nanostructured ZnO–NiO surface observed by (a) SEM image, (b) AFM topography image, (c) PFM amplitude image measured at ±2 V, (d) c-AFM image measured at +5 V, (e) Cross-sectional TEM image.

Transistors Based on 2D Semiconductors/Dielectrics Contacted with the Phase-Change Oxides

Correlated oxides with exotic properties such as metal-insulator transition (MIT) show great potential for electronic applications particularly when integrated with semiconductors. Two-dimensional semiconductors such as transition metal dichalcogenides have also great potential as post-silicon channel materials. To overcome the fundamental limit for the subthreshold swing on semiconductors, we introduce the metal-insulator phase-change VO_2 as a contact electrode in an atomically thin semiconducting WSe_2-based MIS transistor with a gate dielectric of hexagonal boron nitride (h-BN), and demonstrated a three-terminal abrupt switching device. A VO_2 microwire was monolithically integrated with WSe_2 by van der Waals stacking. We fabricated the WSe_2 transistor using the VO_2 wire as the drain contact and titanium as the source contact, and found it shows the ambipolar transport characteristic, with the higher conductivity in the electron branch. The electron current increases continuously with gate voltage below the critical temperature of the MIT of VO_2. Near the critical temperature, the current shows abrupt and discontinuous jump at a given gate voltage, indicating that the MIT in the contacting VO_2 is induced by gate-mediated self-heating. Our results suggest an approach to furnishing VO_2 with the gate tunability, by the van der Waals assembly of an atomically thin semiconductor.

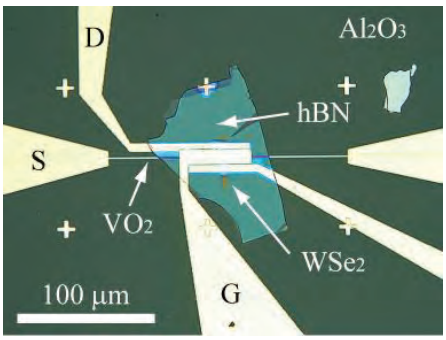


Fig. 3 Optical microscope image of VO_2 contact with WSe_2-*h*BN MIS transistor.

Department of Advanced Nanofabrication

Professor:	Yoichi YOSHIDA
Associate Professor:	Jinfeng YANG
Assistant Professors:	Takafumi KONDOH, Koichi KAN
Specially Appointed Professor:	Seiichi TAGAWA (1.4.2017-)
Specially Appointed Associate Professor:	Shigeki KAWAKAMI
Specially Appointed Researcher:	Masao GOHDO
	Dinh Cong Que(1.4.2017-31.3.2018)
	Kimiaki TANIHATA(1.11.2017-)
Invited Professors:	Masayuki ENDO(-31.3.2018)
	Atsushi OGATA(-31.3.2018)
	Shunichi GONDA,
	Kazumichi NAKAGAWA
	Shigehiro NISHIJIMA(1.4.2017-)
Invited Associate Professors:	Akihiro OHSHIMA
Guest Professor:	Hitoshi KOBAYASHI(-31.3.2018)
Guest Associate Professor:	Hiromi SHIBATA
Graduate Students:	Itta NOZAWA, Ryo ASAKAWA
Under Graduate Students:	Nakaba HIRATA
Supporting Staff:	Yukie TAKAHASHI

Outlines

Our research target is fundamental physicochemical processes induced by electron beam irradiation to materials for the sake of realizing an advanced nanofabrication. To reveal the foundation of the processes, a femto/atto-second pulse radiolysis measurement system and technique has been developing including generation and measurement methods of attosecond electron beam. In addition to the time-resolved spectroscopy, time-resolved electron diffraction and electron microscopic method and apparatus have been developed and studied. Utilizing our ultra-short electron beam, we are exploring novel interaction of the high-density electron beam and materials. Our research is lying to interdisciplinary fields of radiation chemistry, accelerator science and electron microscopy.

Current Research Projects

Feasibility of Single-shot Bunch Length Monitor for Femtosecond Electron Beams

Single-shot bunch length monitor for femtosecond electron beams was studied. Electron beams were generated by a photocathode RF (radio frequency) gun linac and a magnetic bunch compressor. It was found that achromatic conditions shortened bunch length after the compressor by monitoring intensity of coherent transition radiation (CTR) without frequency resolution. In the next step, single-shot bunch length monitor would be realized with comparing the frequency spectra of CTR using interferograms.

Study of the Reaction Mechanism of Cation Radical Formed by Direct Ionization in THF

Direct observation of cation radical was achieved by pulse radiolysis technique in THF which often chosen to observe anion radical for ionizing radiation induced reactions. Because the probability of ionization of solute increase when the concentration of the solute increase, the high concentration solution of THF solution of biphenyl showed transient absorption due to the cation radical of biphenyl. At the same time, transient absorptions due to the excited states and anion radical of biphenyl were observed. It is important to achieve deeper understanding of those reaction system in THF which is one of the most important solvent in radiation chemistry.

Reaction Mechanism Study of One Electron Oxidation Induced Deborylation/Csp^2–Csp^2 Coupling Reactions of Chloroborepins by Pulse Radiolysis

Novel reaction of oxidative deborylation/Csp^2–Csp^2 coupling reaction of borepin was analyzed by pulse radiolysis technique in CH_2Cl_2. Obtained transient absorption and their time course were analyzed using model simulation. The simulation explained the observed kinetics and the reaction mechanism was proposed.

Study of Initial Reactive Species after Ionization in Nonpolar Liquid

This year, in order to observe the excited radical cation in dodecane directly, the ps time resolved spectrum was obtained that it was measured in multiple wavelengths by changing the wavelength using a femtosecond optical parametric amplifier. The ps time resolved spectrum of dodecane was obtained in the wavelength from 750 nm to 400 nm with correcting relative absorbance each wavelength by measuring the standard solution (Ethanol 20% 0.1 M NaOH aqueous solution), but it could not be identified the absorption band of the excited radical cation.

Research and Development of the Time Resolved Electron Microscopy Using a Photocathode rf Gun

Ultrafast electron microscopy (UEM) with femtosecond temporal resolution is a “dream machine” that has been long envisioned for the study of ultrafast structural dynamics in materials. For this purpose, we developed a prototype UEM with relativistic femtosecond electron pulses generated by a radio-frequency (rf) acceleration-based photoemission gun. The rf gun generated 3.1-MeV femtosecond electron pulses with a low-emittance of 0.12 mm-mrad, a charge of 1 pC per pulse and a pulse duration of approximately 100 fs. TEM images of polystyrene latex particles and gold nanoparticles were observed using approximately 100-fs long electron pulses with energies of 3.1 MeV.

Department of Nanocharacterization for Nanostructures and Functions

Professor: Seiji TAKEDA
Associate Professor: Hideto YOSHIDA
Assistant Professor: Naoto KAMIUCHI, Ryotaro ASO
Graduate Students: Takehiro TAMAOKA, Koki HAYANO, Ryo KITAMURA, Wataru KURODA, Tatsuya MIZOBUCHI, Kengo YOSHIMOTO
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

Self-activated Surface Dynamics of Nanoporous Gold Catalysts

Nanoporous gold (NPG) catalyst, which is a type of gold catalysts, exhibits catalytic activity for low temperature CO oxidation reaction. However, the essentially active structure in the reaction environment has remained unclear. Here, we identify the catalytically active and dynamic structure in NPG by environmental transmission electron microscopy (ETEM) equipped with a Cs-corrector and a high-speed camera, combined with *ab initio* energy calculations.

A NPG catalyst was prepared from commercially available Au-Ag alloy leaves (Au/Ag = 40/60 wt.%) by a dealloying method with HNO_3 *aq*. The amount of residual Ag was estimated below 1.0 at.% by quantitative analyses of TEM-energy

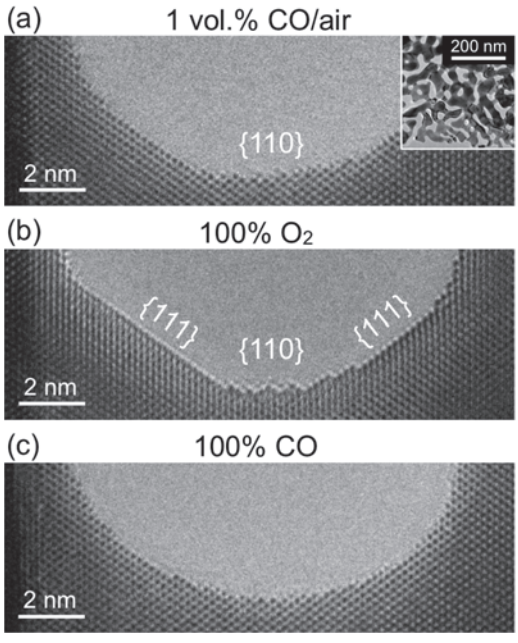


Fig. 1 Drastic changes in surface morphology around a pore. (a) 1 vol.% CO/air, (b) 100% O_2, and (c) 100% CO. Total pressure is 100 Pa. The inset in (a) represents the typical porous structure of the NPG.

dispersive X-ray spectroscopy (EDX) and X-ray photoelectron spectroscopy (XPS) measurements. A representative porous structure with the pore size of 10–100 nm is shown in the inset of Fig. 1(a). The surface morphology drastically changes depending on the various environments of CO oxidation reaction environment, pure O_2 and pure CO, as summarized in Fig. 1. While the surface appears to be smooth and round in pure CO (Fig. 1(c)), the {111} facets are dominant in pure O_2 (Fig. 1(b)) with associated peculiar {100} and {110} nanofacets. The drastic changes in surface morphology indicate that gas molecules of O_2 strongly interact with the surface atoms. We focused on the self-activated surface dynamics on {110} nanofacets under the reaction environment. In the reaction environment, the top atomic column of the nanofacet at t = 0 s, indicated by the white arrow, disappeared at 100 ms, re-appeared from 300–400 ms and then disappeared gradually from 500–900 ms (Fig. 2(a)). On the other hand, the nanofacet is significantly stabilized in pure O_2, as is confirmed in Fig. 2(b). Time-dependent distances between the top atomic column and the atomic column immediately below, D in the reaction environment (Fig. 2(c)) and in pure O_2 (Fig. 2(d)) were evaluated by Gauss fitting for intensity profiles of ETEM images. The dotted bars and shaded areas represent the range of D in pure gold and Au-Ag nanofacet models without oxygen and with oxygen, respectively, which are calculated by *ab initio* energy calculations. The distribution of D for time intervals of 100 ms in the reaction environment and pure O_2 are summarized in Fig. 2(e). By comparing the experimental distances with the calculated results, the essential structure unit for catalytic activity was identified as self-organized nanofacets involving residual silver as well as gold and oxygen atoms. The result unifies experimentally the catalytically active structure of extended gold catalysts such as NPG and Au nanoparticle (AuNP) catalysts into heterogeneous nanostructures of gold and metal oxides.

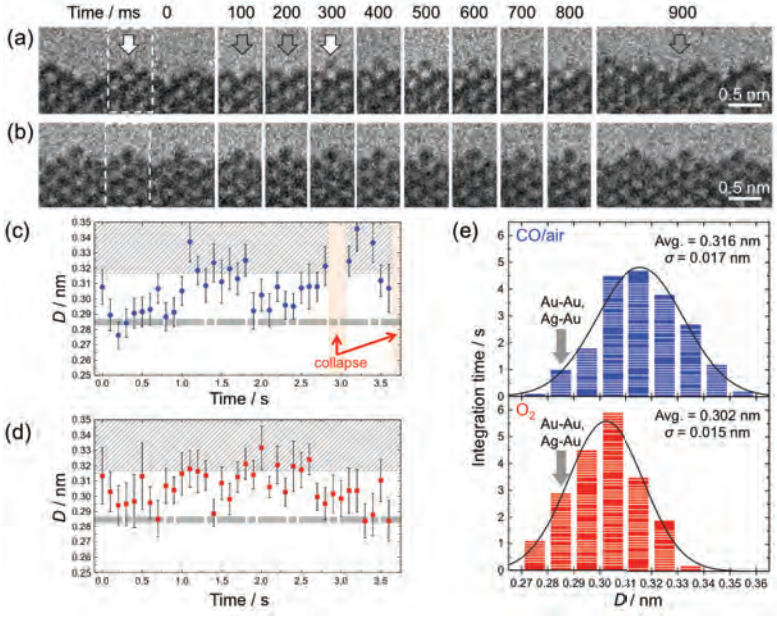


Fig. 2 Dynamic nature of a self-activating nanofacet on {110}. (a) A series of ETEM images of a nanofacet in 1 vol.% CO/air (100 Pa) and (b) in 100% O_2 (100 Pa). (c) Time-dependent distances between the top atomic column and the atomic column immediately below, D in CO/air and (d) in O_2. (e) Distribution of D for time intervals of 100 ms in CO/air and O_2.

Department of Theoretical Nanotechnology

Professor: Tamio OGUCHI
Associate Professor: Koun SHIRAI
Assistant Professors: Kunihiko YAMAUCHI, Hiroyoshi MOMIDA
Specially Appointed Associate Professor: Tetsuya FUKUSHIMA
Guest Professors: Mitsuhiro MOTOKAWA, Takeo JO, Shigemasa SUGA
Visiting Researcher: Tomoki YAMASHITA, Hitoshi FUJII
Joint Research Collaborator: Yukihiro MAKINO
Graduate Students: Naoki UEMURA (gradiated Sept.), Takayoshi FUJIMURA, Masayuki FUKUICHI, Hiroshi KATSUMOTO, Motoyuki HAMAGUCHI, Kei IZUMI, Masaki TAHARA, Masahito KUMAKURA, Thao Thi Phuong NGUYEN, Huyen Thi Ngoc VU, Hung Ba TRAN, Fumiaki KURODA Shinichi KANEHIRA, Yousuke KANDA, Takao KOSAKA Takuro HIRAIWA, Shogo YAMASHITA, Keiya HIRAOKA
Undergraduate Students: Tatsuya TAKAHASHI, Takafumi HAYASHI
Supporting Staff: Chiaki KURIBAYASHI, Mika ASADA

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, we are able to predict material properties with high accuracy. However, to find desirable materials, unbiased searching in a wide range parameter space is needed. Recently, efficiently searching algorithms utilizing data-science methods have been developed. We apply statistical learning methods such as Bayesian optimization and sparse modeling to develop tools for searching desired materials.

Development of Crystal Structure Prediction Method

We propose a crystal structure prediction method based on Bayesian optimization (Fig. 1). Our method is classified as a selection-type algorithm which is different from evolution-type

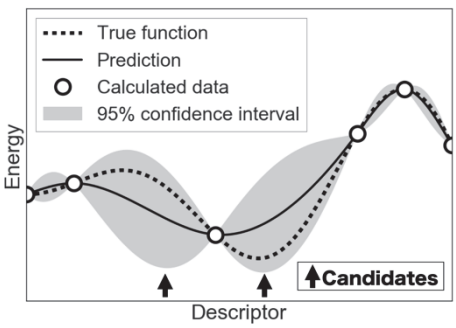


Fig. 1 Structural prediction by Baysian optimization

algorithms. This method can find the most stable structure from a large number of candidates with less numbers of searching trials by using a machine learning technique. The method combined with the random search method was applied to known systems such as NaCl and Y_2Co_{17}. The results demonstrated that Bayesian optimization significantly reduced the number of searching trials to find the global minimum structure by 30–40% in comparison with the random search method alone, indicating an apparent improvement in the efficiency.

Photon-emission of Silicon by a Cu Doping

A Cu complex in silicon exhibits an intense and stable photo emission, which is useful for the optoelectronic application. The structure of this defect complex was not understood well, because of the complex properties of isotope shift. We have recently identified the structure of this Cu complex. It is composed of four Cu atoms forming a tetrahedron centered at a Si vacancy (Fig. 2). This model explains the complex behaviors of this emission, and also explains the formation mechanism of this complex.

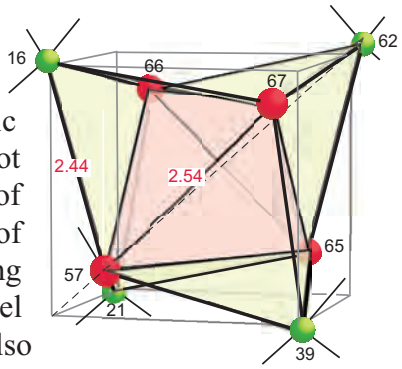


Fig. 2 Cu_4 complex in silicon

Bandstructure Calculation for Topological Matter

Topological matters have attracted much attention recently and developed its research in a wide region of material sciences. In this study, we collaborate with an experimental group of angle-resolved photoemission spectroscopy (ARPES) research in Tohoku University to understand the electronic structure of various topological matters. Recently, we have clarified that a bismuth thin film forms black-phosphorus-type structure on TaS_2 substrate and it shows the peculiar electronic structure caused by proximity effect between the topological and the charge-density-wave properties.

Effects of Lattice Parameters on Piezoelectric Constants of Wurtzite Materials: First-principles and Statistical-learning Calculations

Wurtzite-type piezoelectric materials have been widely used in modern electronic devices. To further enhance the piezoelectricity of wurtzite materials, establishing a guiding principle is needed. We have studied, by first-principles calculations, piezoelectric constants of several wurtzite materials, which are available in structure databases. The calculated piezoelectricity and material parameters have been analyzed by using statistical learning methods, along with elemental, structural, and materials properties (Fig. 3). As a result of the analyses, we find that the wurtzite materials with high piezoelectricity (e_{33}) generally have small ratios of the lattice constant (c/a) higher than about 1.3. This trend is also found for ternary materials such as $Sc_xAl_{1-x}N$. Based on this result, we show that the piezoelectricity of ZnO can be enhanced by a substitution of Zn with Ca.

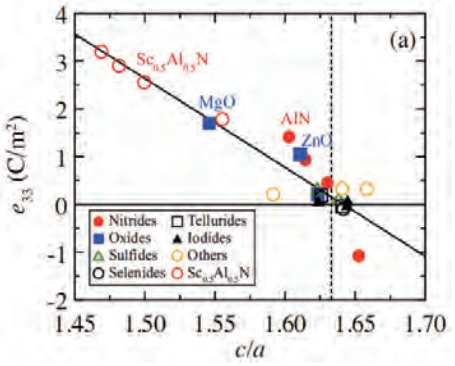


Fig. 3 Calculated piezoelectric constant (e_{33}) and lattice constant ratio (c/a) of wurtzite materials.

Department of Soft Nanomaterials

Professor: Yoshio ASO
Associate Professor: Yutaka IE
Specially Appointed Assistant Professor: Shunsuke TAMBA,
Shreyam CHATTERGEE (16.5.2017-)
Guest Professor: Yoshito TOBE
Guest Associate Professor: Makoto KARAKAWA
Specially Appointed Researcher: Shreyam CHATTERGEE (-15.5.2017)
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Yota KISHIMOTO, Taishi SAKAI
Supporting Staff: Keiko YAMASAKI
Technical Assistant Staff: 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

Development of Organic Photovoltaic Materials

Organic photovoltaics (OPVs) have been intensively investigated over the last decade because of their advantageous such as lightness and flexibility. To improve power conversion efficiencies (PCEs), π-conjugated copolymers should fulfill the following requirements: a reduced band gap to broaden light absorption to the long-wavelength region and a low-lying highest occupied molecular orbital (HOMO) energy level to increase the open-circuit voltage (V_{OC}).

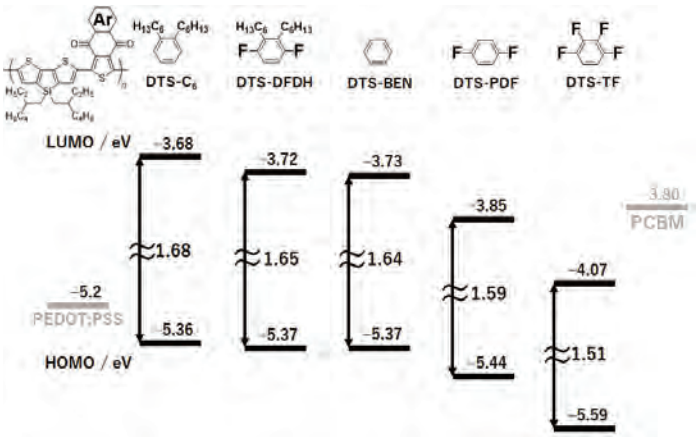


Fig. 1 New D-A copolymers with fluorine-containing naphtho[2,3-*c*]thiophene-4,9-dione as acceptor units.

Therefore, the development of donor-acceptor (D-A) copolymers has become a straightforward approach. However, the effective acceptor unit is still limited. We previously reported that dihexyl-substituted naphtho[2,3-c]thiophene-4,9-dione (C_6) can function effectively as an acceptor unit of D–A type copolymers for bulk-heterojunction OPVs. This result motivated us to modify the chemical structure of C_6 toward stronger electron-accepting nature, which will lead to a decreased HOMO energy level of the copolymers. Furthermore, the increased D–A character will reduce the band gap extending the light absorption to the long-wavelength region. To exemplify this hypothesis, we introduced strongly electron-withdrawing fluorine atoms into the benzene ring of C_6 and designed DFDH, PDF, and TF as new acceptor units (Fig. 1). We also designed BEN as a reference of these units. Target copolymers DTS-DFDH, DTS-PDF, DTS-TF, and DTS-BEN were synthesized via microwave-assisted Stille coupling reaction. All the copolymers showed high molecular weights of more than 30 kg mol^{-1}. As shown in Fig. 1, the D–A characteristics are increased by increasing the number of introduced fluorine atoms and the HOMO and LUMO energy levels of copolymers are fine-tuned depending on the acceptor units. To investigate the photovoltaic characteristics, we fabricated a conventional device structure of glass/ITO/PEDOT:PSS/active layer/Ca/Al. As shown in Fig, 2, all the copolymer-based devices showed typical photovoltaic responses, and the device based on DTS-PDF:$PC_{71}BM$ showed the best performance. Based on these results, we further optimized DTS-PDF:$PC_{71}BM$-based device and found that the MeOH treatment of active layer and the use of Ba thin cathode buffer layer instead of Ca led to 7.30% PCE. However, investigation of the device physics shows that the performance is mainly limited by the hole transport, which provides insight in the direction of material design toward improvement of OPV performance [Original Paper 4].

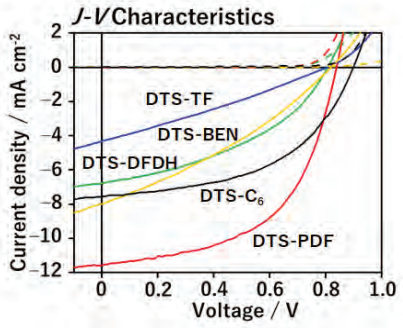
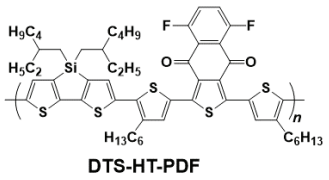


Fig. 2 OPV performance of D-A copolymers.

To enhance the hole-transporting characteristics, a 3-hexylthiophene (HT) spacer unit is integrated into the conjugated backbone of DTS-PDF, resulting in a new D-A type copolymer DTS-HT-PDF (Fig. 3). OPVs based on DTS-HT-PDF and $PC_{71}BM$ show an improved power conversion efficiency of 9.12%. Investigation of the device physics unambiguously reveals that the hole mobility of the copolymer in the blend is increased by an order of magnitude by the introduction of HT, while keeping an amorphous film nature, leading to higher short-circuit current density and fill factor [Original Paper 5].



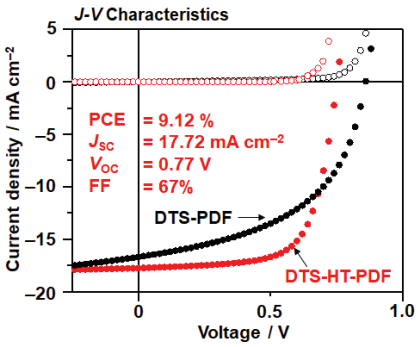


Fig. 3 Chemical structure and OPV performance of DTS-HT-PDF.

Department of Bio-Nanotechnology

Professor: Masateru TANIGUCHI
Associate Professor: Makusu TSUTSUI
Assistant Professor: Hiroyuki TANAKA, Kazumichi YOKOTA (-31.3.2018)
Specially Appointed Professor: Tomoji KAWAI
Specially Appointed Associate Professor: Takahito OHSHIRO (-2017.09.30)
Specially Appointed Assistant Professor: Wataru TONOMURA, Akihide ARIMA
Specially Appointed Researcher: Sanae MURAYAMA, Yuko ESAKI, Hiroko DEGUCHI, Yukari KUBO, Yayoi TSUMOTO
Graduate Students: Takanori MORIKAWA (-31.3.2018), Bo LIU (2.10.2017-), 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

AI-driven Nanopore Analysis for Discriminating Single-bacteria and–viruses

Solid-state nanopore has been used as a useful platform for studying translocation dynamics of single-particles. It measures the ionic current through a micro- or nano-scale hole sculpted in a membrane made of a dielectric material such as SiN and SiO_2. When an object passes through the conduit, it tends to partially block the ion transport in the channel whereby engender a pulse-like change in the current. Here, the pulse pattern contains wealth of information about the fast translocation motions of the analyte in the nano-confined space of nanopore. As the dynamic motions are intimately related to various physical parameters of each particle, we can expect to deduce many properties of each particle detected. This, however, calls for non-conventional data analytics to interrogate the complicated features in the ionic current signals. We therefore employed machine learning approach to examine the pattern analysis. Specifically, we utilized Rotation Forest ensembles to identify the

signal patterns from viewpoints of various feature parameters. Using this AI-driven approach, we demonstrated single-bacteria discriminations with high precision. We are now further extending the research to accomplish digital diagnosis of influenza at very early stage of infections for preemptive medicine.

Remote Heat Dissipation in Atomic Contacts

Heat dissipation is a critical issue in nanoelectronics. In our lab, we have been contributing to this field by studying the fundamental mechanism of local heating in current-carrying nanosystems such as atom-sized metal contacts and molecular tunneling junctions. There, we found that in case of Au nanocontacts, the local heating causes negligible effects on the effective temperature due to the efficient heat conduction to the bulk. This, however, does not mean that there is no energy dissipation in the system. In fact, the field-accelerated electrons should release the kinetic energy to the bath near the contact. In order to shed light on this remote heat dissipation, we fabricated a novel nanosensor consisting of a Au nanobridge and a thermometer. Using this device, we repetitively implemented formation and breaking of Au nanocontacts at room temperature in vacuum and simultaneously measured the local temperature at the thermocouple positioned at micrometer-vicinity of one side of the junction. As a result, we found linear increase in the thermocouple temperature with the input power on the contact, which indicates linear scaling between the power and the Joule heat. Interestingly, the influence of the remote heat dissipation was more pronounced at the current downstream than at the upstream. This was attributed to the electron-hole asymmetry characterized by the negative thermopower of Au nanocontacts. Most importantly, we found very small yet finite influence of the remote heat on the single-atom contact stability corroborating the contributions of the banks acting as efficient heat sinks.

Development of the Prototype Measuring Equipment for Nanopore Devices

In the use of nanopore sensor devices as a ubiquitous system, we developed the potable and common PC-controllable prototype equipment, which is worked by home-type AC100V electric supply (Fig. 1(a)), and verified the performance of that. For validation, we used polystyrene (PS) particles, of which mean particle diameter is 200 nm, produced by the different makers, and SEM images show the difference of the diameter dispersion of those (Fig. 1(b) and (c)). Although the dynamic light scattering (DLS) measurement, which is widely used method, could not distinguish these two samples (Fig. 1(d)), our developed system was clearly detectable the difference of the diameter dispersion.

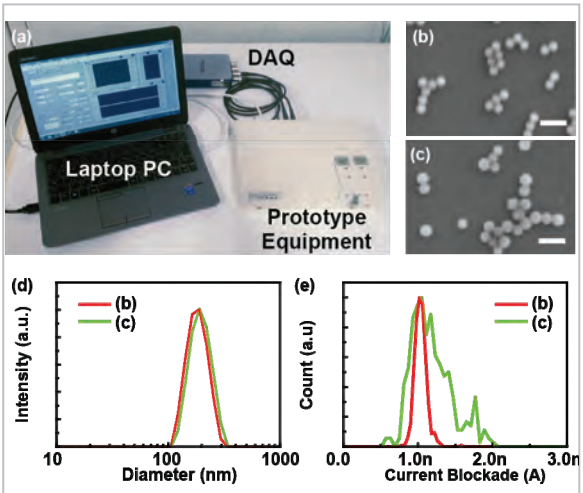


Fig. 1 The developed measurement system for nanopore devices (a), and SEM images for the particles used for the performance validation (b and c). The widely used DLS method cannot distinguish the difference of those (d). Our system can identify those and measured trend is corresponded to SEM observations.

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 Projects

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.

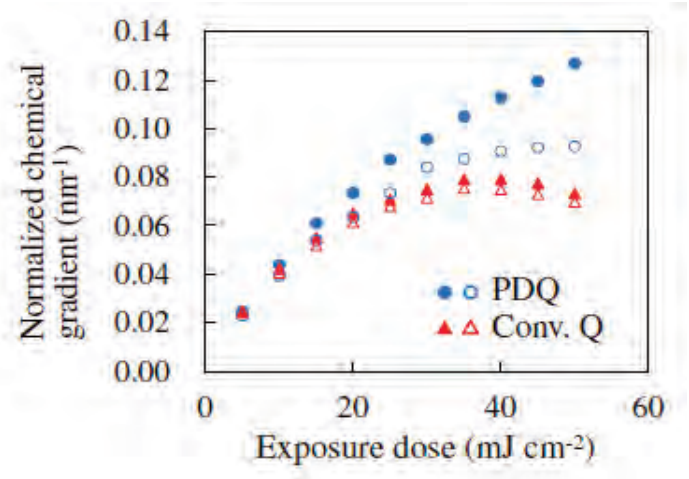


Fig. 1 Relationship between exposure dose (sensitivity) and chemical gradient (an indicator of LER).

Department of Nano-Intelligent Systems

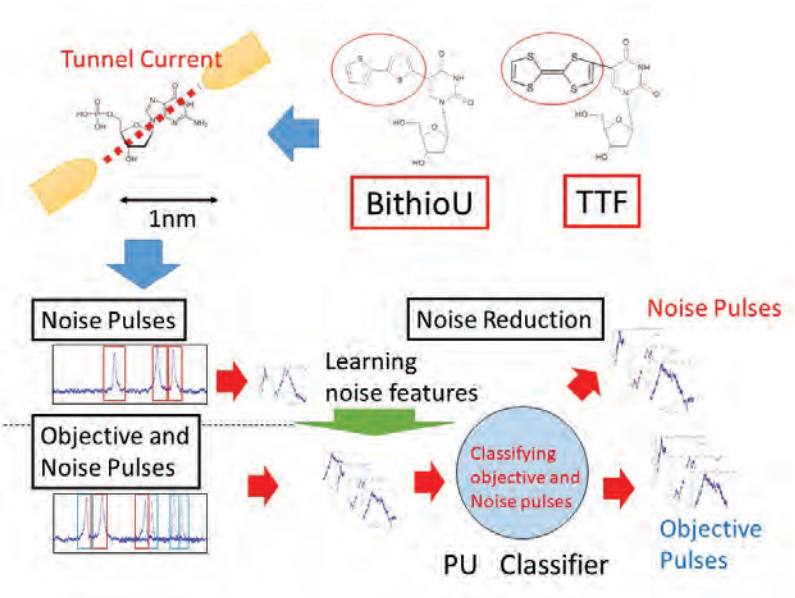
Professor: Takashi WASHIO

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 machine learning method for an accurate monomer molecule classification using a nano-gap device. This is a joint work with the department of bio-nanotechnology. The classification of individual molecule is a promising technology for many important applications including RNA and DNA sequencing and cancer gene detection.

Research Projects

We seeked a principle and a method to reduce noise pulses from measured pulses using machine learning based pattern recognition for the individual molecule classification. Because the objective pulses and the noise pulses cannot be separately acquired while the noise pulses can be independently collected easily in many problems, we developed a method to learn a PU classifier from the labeled noise pulse data and the unlabeled pulse mixture data. The mixture of Di thiophene uracil derivative (BithioU) and TTF uracil derivative (TTF) is measured by the nano-gap with noise pulses, and their pulses are separated into the objective pulses and the noise pulses. The objective pulses are futher classified in to BithioU and TTF. This new technique remarkably increased the final classification accuracy of these two bases from 8% to 100%.



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.

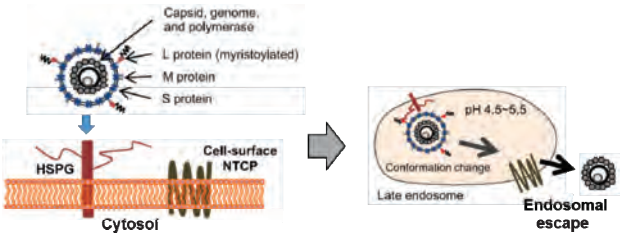


Fig.1 Model of early infection machinery for hepatitis B virus and bio-nanocapsule L in human hepatocytes.

Department of Nanosystem Design

Visiting Professor: Fumitoshi KAKIUCHI (1.4.2017-31.3.2018)

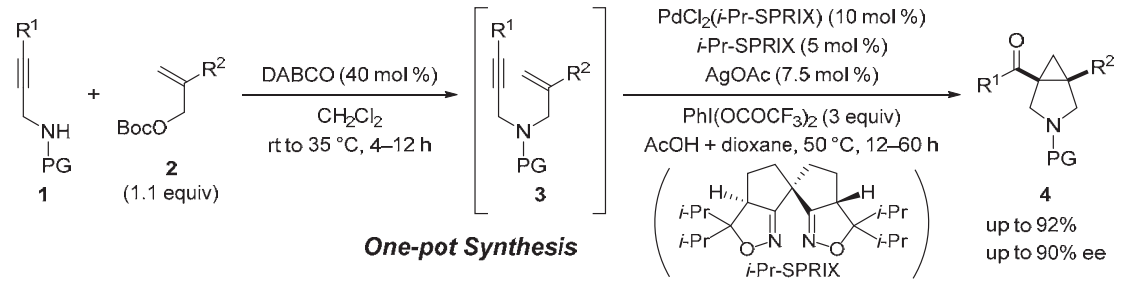
Outlines

Asymmetric catalysis has generally been recognized as the most environmentally benign methodology for the preparation of optically active compounds. In addition to enormous examples of the enantioselective transformation through a Pd(0)/Pd(II) catalytic cycle, Pd(II)/Pd(IV) catalysis has been recently applied to the asymmetric diversification of alkene and alkyne hydrocarbons. Sasai group has successfully developed enantioselective Pd(II)/Pd(IV) catalysis by utilizing a unique chiral ligand *i*-Pr-SPRIX, which efficiently produces optically active molecules. Meanwhile, one-pot methodology is now recognized as a potent synthetic approach to target compounds. Therefore, a combination of the one-pot strategy and the enantioselective Pd(II)/Pd(IV) catalysis would provide a powerful synthetic method of valuable optically active materials.

Research Projects

Enantioselective Synthesis of Bicyclic Pyrrolidine Derivatives *via* One-Pot Organo and Palladium Catalysis

A sequence of catalytic *N*-allylation of propargylamine substrates **1** with allyl carbonates **2** and Pd–*i*-Pr-SPRIX-catalyzed enantioselective oxidative cyclization of the resulting 1,6-enynes **3** was designed to furnish optically active bicyclic pyrrolidine derivatives **4** found in a variety of biologically active compounds. After the screening of reaction conditions, the two catalytic reactions were conducted successively in a single vessel without the isolation of synthetic intermediate **3**. Treatment of **1** with **2** in the presence of 40 mol % of 1,4-diazabicyclo[2.2.2]octane (DABCO) in CH_2Cl_2, followed by removal of the volatiles after the complete consumption of **1** led to the quantitative formation of intermediate **3**. To the flask containing crude **3** were then added Pd–*i*-Pr-SPRIX catalyst, AgOAc as an additive, and 3 equivalents of $PhI(OCOCF_3)_2$ as an oxidant, which was stirred in a mixture of AcOH and dioxane at 50 °C to afford **4** in up to 92% yield with 90% ee (Scheme 1).



Scheme 1. Enantioselective Construction of Bicyclic Pyrrolidine Derivatives Using Organo/Pd–SPRIX Catalysis Sequence

Department of Nanosystem Design

Guest Professor: Shigeki TAKEUCHI (1.4.2017 - 31.3.2018)

Outlines

In order to realize quantum information science using photons, such as quantum computer, quantum network, and quantum metrology, it is important to develop photonic quantum devices for the controlling the nature of the photons. For this purpose, we have studied about nanophotonics devices coupled with single light emitters. In this year, we worked on the development of a nanofiber Bragg cavity, which is a microcavity embedded in an optical nanofiber, using a helium focused ion beam (FIB) system in nanotechnology open facility of Osaka university.

Research Projects

We have used a gallium FIB system to fabricate the nanofiber Bragg cavities. However, the fabrication-resolution of this system was low and also the gallium ions might contaminate the samples during the fabrication. Therefore, in this year, we fabricated the nanofiber Bragg cavities using the helium FIB system with the high resolution of less than a few nanometer and contamination free.

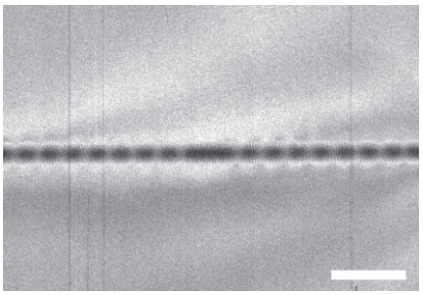


Fig.1 SIM image of the nanofiber Bragg cavity fabricated with the helium FIB system. The length of the white bar is 1 μm.

Figure 1 shows a scanning ion microscope image of the nanofiber Bragg cavity fabricated with the He FIB system. The cavity structure, which is consisted of a defect and the periodical grooves on the nanofiber, is observed.

We also measured a transmission spectrum to confirm the operation as the microcavity. As the result, we observed a resonant peak caused by the cavity structure. The quality (Q) factor estimated from the resonant peak was 450, which was about 1.5 times larger than the sample fabricated with the gallium FIB system.

We will develop the nanofiber Bragg cavities with higher Q factors and realize the coupling with the single light emitters toward the realization of photonic quantum devices.

Department of Nanosystem Design

Guest Associate Professor: Yuta Nishina

Outlines

Chemical manufacturing by continuous-flow catalytic systems has clear advantages over that by conventional batch systems, including high reaction efficiency, safety, and reproducibility. In particular, continuous-flow nanocatalysis based on metal nanoparticle catalyst-anchored flow reactors can serve as an ideal platform for effective conversion of various chemicals. However, there remains the challenge of creating more efficient and truly green sustainable systems; the development of metal nanoparticle-anchored flow reactors with enhanced catalytic efficiency and excellent recyclability is yet to be satisfactorily achieved. In this study, we conducted the research and development of a metal nanoparticle catalysts-anchored wood pulp paper reactor with tailored hierarchically porous channels for highly efficient continuous-flow nanocatalysis with excellent recycling and renewing, by collaboration with Assis. Prof. Hirotaka Koga (Laboratory of Cellulose Nanofiber Materials).

Research Projects

Palladium nanoparticle (PdNP)-anchored paper reactor for continuous-flow cross-coupling reaction (ChemSusChem, 10, 2560-2565 (2017))

Pd is one of the most popular catalysts to produce useful chemicals, such as pharmaceuticals, agrochemicals, and cosmetics, through cross-coupling reactions. A PdNP-anchored paper reactor with micro/nanoscale pores was prepared and used for cross-coupling reaction of aryl iodide with alkyllithium reagent (Fig. 1); it achieved almost 100% conversion of 4-iodotoluene at room temperature with a feed rate of 0.2 mL min^{-1}. Although a similar type of reaction in batch system using a Pd^0 complex with phosphine ligand was recently reported, the PdNP-anchored paper reactor is expected to enable a continuous-flow and heterogeneous analogue of such a cross-coupling reaction without any phosphine ligand.

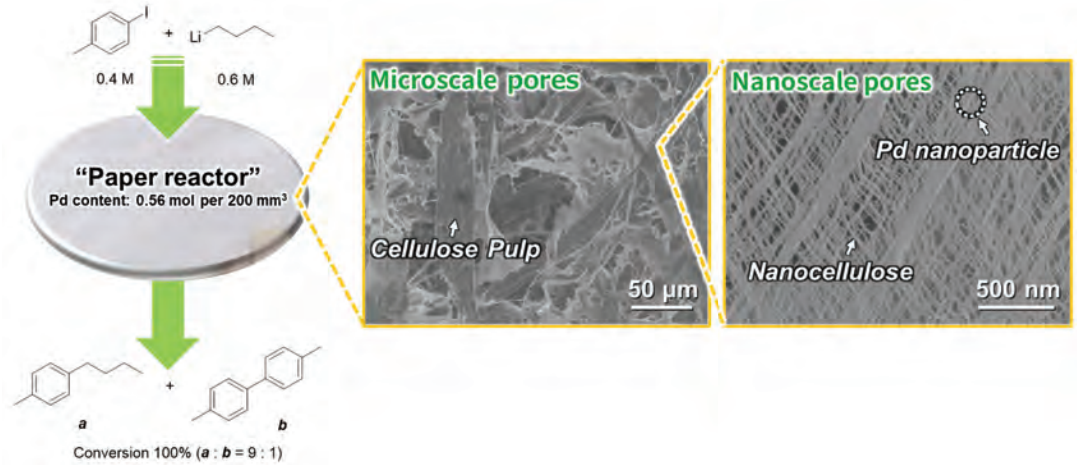


Fig. 1 Schematic of continuous-flow cross-coupling reaction by using PdNP-anchored paper reactor.

Department of Nanosystem Design

Guest Researcher: Kazumasa OKAMOTO (1.4. 2017-31.3. 2018)

Outlines

Lithography utilizing quantum beams such as UV light and ionizing radiation are widely used not only in mass production of semiconductor products but also as processing at the micro/nano scales. With the progress of extreme-ultraviolet (EUV) lithography in recent years, elucidation of the radiation-induced reactions at the molecular level in organic and inorganic resist materials has been very important. Therefore, not only the experimental formation of nanostructures but also the elucidation of their formation mechanism has been studied.

Research Projects

Chemically amplified resists with adding various sulfones were used as sample, and sensitivity curves were obtained after electron beam (EB) and UV light irradiations. The line and space (L&S) patterning was also performed by EB exposure. And the line width and line width roughness (LWR) (3σ) after the development were measured using SEM. In addition, nanosecond pulse radiolysis using a 26 MeV electron beam was carried out at Research laboratory for quantum beam science. The radiation induced reaction of the system containing the additive was analyzed. As a result of the measurement of sensitivity curves, most of the sulfone additives improved resist sensitivity, and the effect of improving resist resolution performance was also shown.

In order to clarify the radiation chemistry of fluorine-based EUV resist materials, the dynamics of radical anion and cation of benzene with one or two 2-hydroxyhexafluoroisopropyl (HFA) groups (HFAB) were also investigated by pulse radiolysis methods. The formation of intermolecular dimer radical cation was observed only HFAB with single HFA in 1,2-dichloroethane. It was found that configurations of HFAB with two HFA groups prevent the overlapping of benzene rings. On the other hand, in the tetrahydrofuran, a characteristic spectral shift of radical anion was shown within a range of several hundred nanoseconds after the EB pulse irradiations. In combination with the results of low temperature matrices spectroscopy and molecular orbital calculation, it was suggested that excess electrons on the HFA group of the radical anion dissociates into neutral radicals.

Submerged photosynthesis of crystallites (SPSC method) that produces nanocrystals only by irradiation of UV light or γ-ray in pure water has been reported recently. By irradiation of γ-ray, short-lived transient species such as radicals and ions were generated in water, and different mechanism from the SPSC method using UV irradiations was occurred to form metal oxide surface nanostructures. Antibacterial activity was shown on the generated structure. The analysis of the formation mechanism of the microstructure was also clarified.

Department of Nanosystem Design

Guest Researcher: Satoshi TSUKUDA (1.4.2017-31.3. 2018)

Outlines

Polymer gels are commonly used as a template and reducing agent for the synthesis of metallic NPs and exhibit a volume phase transition by absorption of a large amount of water or in response to external stimuli. Therefore, the fabrication of a hybrid of polymer gel and Au NPs is expected to be a promising method that realizes control of interparticle distance of Au NPs by the volume phase transition of the gel in response to external stimuli, such as pH, temperature and humidity. Here, we report solution synthesis of hybrids combining both Au NPs and PVP gel film. The PVP gel film was used as a template for fabrication of Au NP assemblies, because PVP has high affinity to surface of metal NPs. The mechanism of the preferential deposition of Au NPs on PVP gel films was discussed in terms of the effect of gel networks inside PVP gel. The optical properties of the hybrids was also evaluated. The shift of the absorption peak of the LSPR of Au NPs was demonstrated, utilizing the change of interparticle distance of Au NPs accompanying the volume change of the swelling and drying gels.

Research Projects

PVP was dissolved in 2-propanol at 1.0 wt %. *N*, *N*-methylenebis(acrylamide) was added to solution as the cross-linking agent at 15 wt % against dissolved PVP. PVP films were prepared on Si substrate by spin-coating. The films were exposed to EB to fabricate gel film. Furthermore, for fabricating Au NPs on PVP films, the samples were immersed in $HAuCl_4$-containing MeOH solutions. After immersing the samples for 10 min, the solutions were irradiated by UV light. Au NPs were successfully formed on PVP gel film by the photoreduction of Au ions. The Au NPs were preferentially and rapidly formed on PVP gel because the films, which consisted of 3-D gel networks, serve as a reduction site and affected particle formation. The Au NP and PVP gel hybrids exhibit visible optical absorption based on localized surface plasmon resonance (LSPR) of the Au NPs. The peak LSPR absorption wavelength under the dry conditions is slightly red-shifted with increasing particle size and number density. In water, the LSPR peak from Au NPs on PVP films is blue-shifted compared to the dry conditions. The absorption peak wavelength shifts reversibly with cycles between in air and water because the distance between Au NPs alters in response to PVP gel volume change during swelling and drying cycles.

Department of Nanosystem Design

Guest Researcher: Kazuki Nagashima

Outlines

The upcoming sensor society leads to a strong demand for making sensors more abundant, affordable, and even disposable. The use of paper in sensor applications would meet this demand, because paper materials are eco-friendly and have been popularized all over the world. In this study, we conducted the research and development of disposable paper sensors consisting of wood-derived nanocellulose and abundant zinc oxide, by collaboration with Assis. Prof. Hirotaka Koga (Laboratory of Cellulose Nanofiber Materials).

Research Projects

Paper sensor for molecular sensing

The paper sensors were fabricated by using wood nanocellulose and zinc oxide (ZnO) nanowires (Fig. 1). First, uniformly connected ZnO nanowire networks were embedded in the surfaces of nanocellulose paper, denoted nanopaper, by using a papermaking process. The as-prepared ZnO nanowire@nanopaper showed an electrical resistivity of 6.5×10^7 Ω with good spatial uniformity, indicating the formation of semiconductive ZnO nanonetworks on the highly insulative nanopaper. Then, platinum electrodes were sputtered on the ZnO nanowire@nanopaper. The resulting paper sensor demonstrated electrical response to H_2 and NO_2, suggesting that redox reaction of the ZnO nanonetworks by molecular adsorption successfully occurred on the nanopaper. Thus, the paper sensor would be expected as a disposable sensing platform towards the future sensor society.

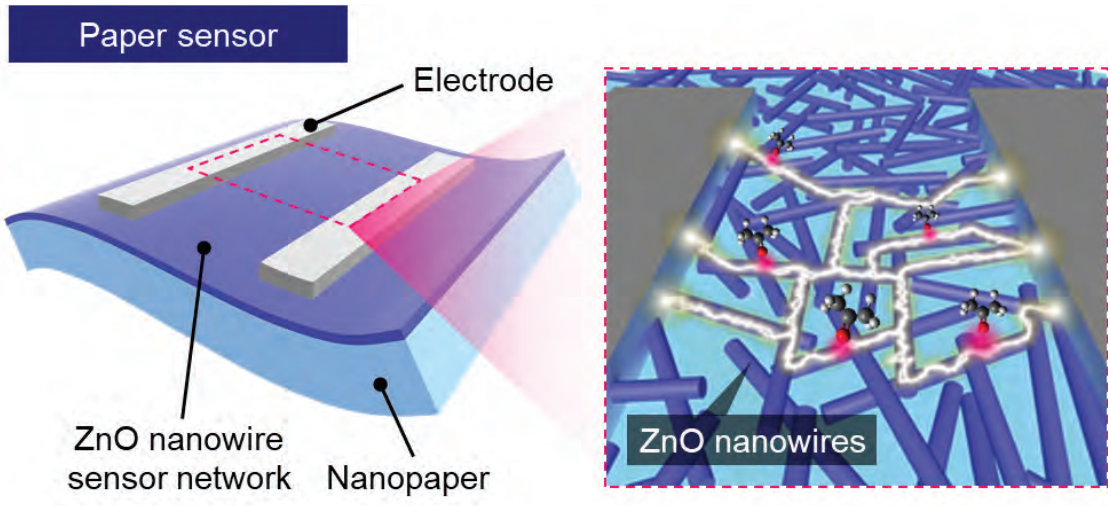


Fig. 1 Schematic of the paper sensor consisting of nanopaper and ZnO nanowires.

Department of Nanosystem Design

Guest Professor: Jun TERAO (10.1.2017-31.3.2018)

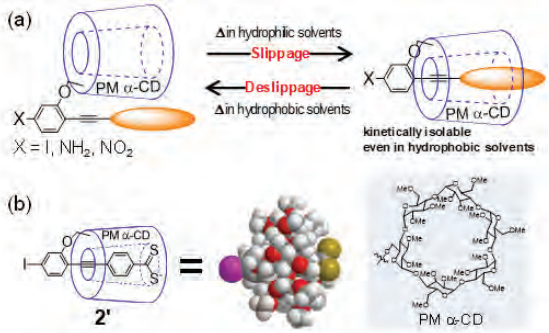
Outlines

Herein, we describe the synthesis of a Ni(II) bis(dithiobenzoate)-type complex three-dimensionally insulated by a [1]rotaxane structure, revealing the importance of ligand insulation. Under cyclic voltammetry conditions, the complex showed stable and reversible redox behavior, in contrast to a non-insulated reference complex, clearly demonstrating the effectiveness of rotaxane-type insulation as a new method of kinetic metal complex stabilization.

Research Projects

Synthesis of insulated Ni(II) bis(dithiobenzoate)-type complex

We designed an insulated ligand comprising a diphenyl(acetylene) backbone, a PM CD as an insulating macrocycle, and a dithiobenzoate moiety (obtained by deprotecting ethyl(trimethylsilyl)- protected precursor). In turn, the synthesis of thus precousor featured the self-inclusion of non-insulated ligand by heating in a hydrophilic solvent via intramolecular slippage process (a). The formation of an insulating structure was confirmed by the low-field shifts of phenyl protons in the corresponding 1H NMR spectrum and the observation of interactions between phenyl and PM CD inner protons. Importantly, insulated Ni(II) bis(dithiobenzoate)-type complex quantitatively maintained its insulating structure at room temperature, even in a hydrophobic solvent ($CHCl_3$, at least three days).



Luminescent color change by ion sensing

we succeeded in synthesizing a Ni(II) bis(dithiobenzoate) complex insulated by a [1]rotaxane structure, which was vital for the efficient synthesis of the above complex and the stabilization of its reduced form. Electrochemical analyses revealed that the prepared complex underwent two-step one-electron reduction. To the best our knowledge, this is the first example of reversible bis(dithiobenzoate) transition metal complex reduction. Thus, the developed strategy based on [1]rotaxane insulation is expected to be generally applicable to the kinetic stabilization of unstable complexes due to allowing the formation of highly insulated species in a wide variety of solvents, including those not suitable for host–guest inclusion.

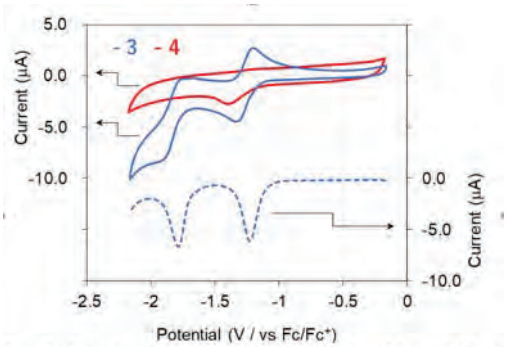


Fig. Cyclic voltammograms of insulated complex (blue solid line) and uninsulated complex (red solid line). Ferrocenium/ferrocene couple was used as the internal standard.

Department of Nanosystem Design

Guest Researcher: Hiroki YAMAMOTO (1.3. 2018-31. 3.2018)

Outlines

Extreme ultraviolet (EUV) lithography is regarded as the most promising next generation lithography technology. The requirements for next generation resist materials in EUV lithography are very challenging. Therefore, the development of new resist materials and processes has been expected to meet strict requirements. Currently, sensitizer molecules containing metal elements of high EUV absorbance can be added to photoresist formulation in order to increase EUV photon absorption. These sensitizers have gained growing attention due to significant sensitivity improvement. However, t the role of metal sensitizers for sensitivity improvement has been still unclear because of the absence of the fundamental study of the metal sensitizer. In this study, we investigated the effect of metal sensitizer in the resist on acid yields using the acid-sensitive dye. In addition, the dissolution behavior of the resists containing metal sensitizer were investigated using Quartz crystal microbalance (QCM).

Research Projects

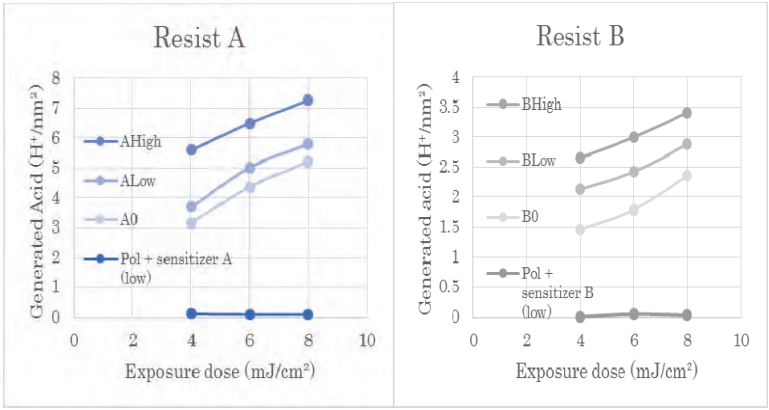


Figure 1 Measured generated acid as a function of the exposure dose, for the two resists.

Two photoresist platforms were used. In the first one, 2 different loading of sensitizer A was added. In the second platform, three different loading of sensitizer B was added. Propylene glycol monomethyl ether acetate (PGMEA) was used as a casting solvent A 100 nm film thickness resist was used for acid yield measurement and QCM in order to absorption measurement and QCM measurement. The films were exposed to EUV (Energetic, EQ-10M). Acid yield measurement were realized using the acid sensitive method. Coumarin 6 (C6, Aldrich Chem.) was used as an indicator to evaluate the acid yield. Dissolution behavior of resist with and without sensitizer was investigated by using the QCM. Figure 1 shows the exposure dose dependence of the acid yield generated in two resist films (Resist A and B) upon EUV exposure. Apart for A_{Low}, these number are in line with the sensitivity improvement observed: higher acid yield is achieved, and the increased acid amount can quantitatively explain the dose-to-size reduction observed. Also, we clarified that the sensitizer is thus not acting as a PAG by itself. In addition, QCM measurement was also carried out on Resist A. The relationship between resist thickness and development time were obtained in photoresist with and without sensitizer. The swelling of the photoresist in unexposed and partially exposed film with very small dose were clearly observed in photoresist with sensitizer.

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 2017. 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.

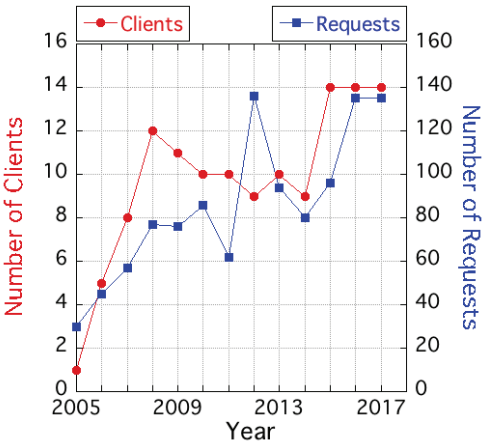


Figure 1 The transit of requests since 2005.

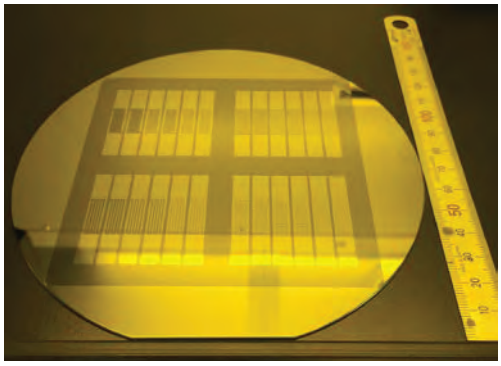


Figure 2 Photoresist pattern on 6-inch silicon wafer.

Though there were not any novel developments, we made the largest patterning ever fabricated at this shop. The photoresist pattern on 6-inch silicon wafer (fig. 2) was made by use of LED lithography equipment belonging to Advanced Nanotechnology Instrument Laboratory. Eleven hours were taken to expose UV light on whole area. A thick photoresist utilized to resist long time dry etching, since silicon trenches of 120 μm in depth were etched in the next stage of the process. The photoresist film tended to peel away easily in the process. It might be cause that there was a long interval time between exposure and cross-linking reaction on hot plate. We tried to improve surface condition of silicon wafer, then the photoresist pattern can be made stably.

Participation in “nanotech 2018”

We demonstrated some samples and devices, showed a panel introducing our activity in the booth of Nanotechnology Center in the international nanotechnology exhibition and conference “nanotech 2018” which was held on 14th to 16th of February in 2018.

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

Advanced Instrument Laboratory assisted nano/micro-fabrication researches using Nanoimprint lithography, Focused ion beam lithography, Electron beam lithography, LED mask-less lithography Instruments, and assisted investigation of thin film properties using X-ray diffraction, ellipsometer, THz spectroscope measurements, and so on.

Nanotechnology Open Facilities

Director, Professor:	Seiji TAKEDA
Professors:	Hidehiro YASUDA
	Hidekazu TANAKA
	Masateru TANIGUCHI
Specially Appointed Professors:	Hirotarou MORI
Assistant Professor:	Keita KOBAYASHI(-31.3.2018)
Specially Appointed Assistant Professors:	Akira KITAJIMA
	Kimihiro NORIZAWA
Specially Appointed Researchers:	Miki KASHIWAKURA
	Kouji HIGUCHI
	Takashi TANIGUCHI
	Kazumi KONDA
	Masanobu YAMAZAKI (1.4. 2017-)
Technical Supporting Staff:	Yoshimi MAEGAWA
Supporting Staff:	Kyoko SHIMOMITSU (-31.3. 2018)
	Keiko ENMI (-31.3. 2018)
	Yukiko Watsuji (17.4. 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 177 research themes in 2017.

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 177 research themes (except for technical consulting and non-publish the fruits) have been supported in the program in 2017. 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:	Takahiro KOZAWA
Associate Professor:	Takeyuki SUZUKI
Assistant Professor:	Da-Yang ZHOU, Kaori ASANO
Assistant Professor:	Kazuhiro TAKENAKA, Makoto SAKO,
(concurrent)	Hideto YOSHIDA, Tomoyo GOTO, Mitsuko NISHINO
Technical Staff:	Takanori TANAKA, Tsuyoshi MATSUZAKI,
	Hitoshi HANEOKA, Yosuke MURAKAMI
Technical assistant Staff:	Takeshi ISHIBASHI
Support Staff:	Miho TAKENAKA, Etsuko TANI

Outlines

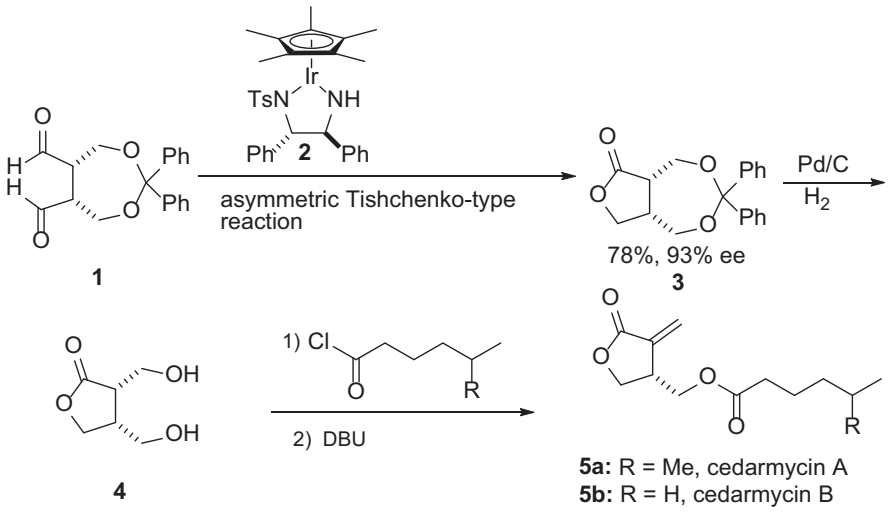
The Comprehensive Analysis Center was founded in 2009, whose project includes (1) analysis of samples provided from other research sections in ISIR and (2) original research for developing novel synthetic methods using a molecular catalyst.

Research Projects

Catalytic asymmetric synthesis of cedarmycins using Tishchenko-type reacrion

Tishchenko reaction is known as the synthetic method of the dimeric ester from the corresponding aldehydes. Recently we have succeeded in the asymmetric synthesis of cedarmycins using the asymmetric Tishchenko-type reaction for the first time.

This time we applied this method for the synthesis of the natural products. Cedarmycins A and B are antibiotic compounds isolated from the cultured broth of the actinomycete Streptomyces sp. TP-A0456 by Frumai. we have succeeded to improve the optical purity of the lactone **3** which is the key intermediate of cedarmycins by recrystallization. After deprotection of diphenylmethylidene acetal, the resulting diol **4** were converted to the diester, and one-pot elimination gave cedarmycins **5**.



Catalytic asymmetric synthesis of cedarmycins using asymmetric Tishchenko-type reaction

Research Laboratory for Quantum Beam Science

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

Current Research Projects

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

The results of operation for all linacs: total score 3,366 hours, 253 days, 34 themes. L-band linac was operated for 227 days except for maintenance use, 2,981 hours (Fig.1). The major troubles happened this year are described as follows. **Electron-Gun:** The cathode of electron-gun was replaced due to exhausted filament after about two years of use. **RF system (Klystron, Modulator):** Commissioning of the new klystron was carried out. While a slight power down relative to the previous klystron was observed, a lack of power was able to be compensated by increasing the seed power of microwave. An RF amplifier of 200 W was purchased. Regardless of the trials so as not to be affected by electric noise, the operation was still unstable, and more efforts will be devoted to improving. **Water circulation system:** A computer-aided power on/off system was equipped for whole water cooling system to make a scheduling of the starting time possible. A leak detection circuit of water was also added to this system. Once a leakage of water detected, the circulation of water is to be automatically stopped. The performance of another parts, such as ducts, valves, flow-switches, etc., were verified and newly added if necessary. **Facilities:** Many parts of no-fuse breakers

(NFBs) in the L-band linac room were replaced, as the terminal in a distribution panel of No.1 irradiation room smoldered due to over-current in spite of the existence of NFB, which meant old NFB would not work well.

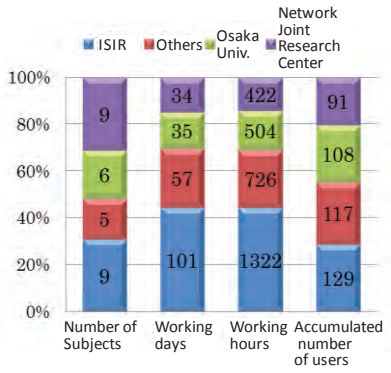


Fig. 1. Results of L-band linac

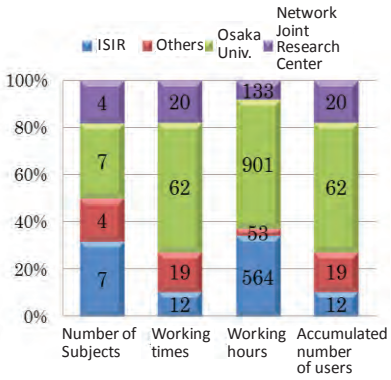


Fig. 2. Results of Co-60 facility

Beam sharing system: A design of a new power control unit of switching magnet based on SiC device and feed-back circuit due to monitored magnetic field as well as controlling current was carried out, aiming at the simultaneous use of an electron beam for multi-user.

RF-gun S-band linac was operated for 74 days, 676 hours.

150 MeV S-band linac was successfully operated, after achieving several replacements such as a pump used for water circulation, the filters for water cooling, a recorder for energy analysis, a cathode in electron gun, and equipping a new injection system of electron beam instead of PCB included old system. The obtained energy spectrum and beam loading curve showed the maximum energy (at zero current) was typically 150 MeV, meaning that a production of slow positron beam can be made without significant change of target of electron beam.

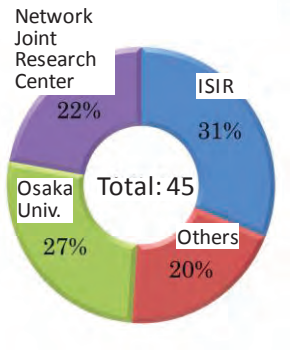


Fig. 3 Accepted subjects

Cobalt-60 facility was used in 113 times, 1,653 hours, for 14 subjects (Fig.2). The annual maintenance was made in March.

Management (Joint use & Radiation safety management)

Accepted subjects were 45 in total (Fig.3). Specially programmed academic meetings were held twice (Dec. 18 2017/ Mar. 16 2018) and the annual debrief session was held on March 15 in 2018. Visitors were more than 197. The training regarding radiation safety management was carried out for the registrants on May 15. The self-inspection was carried out twice a year. Three-year interval official inspection was carried out and no problems were detected.

Formation and structures of thioanisole hydroxyl radical adduct by during Pulse Radiolysis

The formation and structures of thioanisole hydroxyl radical adduct ($ArSCH_3$-$OH^{\bullet}$) were studied by nano-second (ns) transient absorption and ns transient resonance Raman during pulse radiolysis. The main pathway of thioanisole hydroxyl radical ($^{\bullet}OH$)-induced reaction involves the formation of thioanisole radical cation ($ArSCH_3^{\bullet+}$) and thioanisole hydroxyl radical adduct $(ArSCH_3\text{-}OH)^{\bullet}$. The $^{\bullet}OH$ addition leaded to formation of hydroxycyclohexadienyl radical ($ArSCH_3(Ar^{\bullet})$-OH, addition to the aromatic ring).

Center for Collaborative Research Education and Training

Director:	Professor Akira OIWA
Head of Educational Affaires Board:	Professor Masateru TANIGUCHI
Board Members:	Professor Takashi WASHIO
	Associate Professor Shinichiro TANAKA
	Associate Professor Kiyohiko KAWAI
Head of International Affaires Board:	Professor Hiroaki SASAI
Board Members:	Professor Hikaru KOBAYASHI
	Assistant Professor Teppei ARAKI
	Associate Professor Hideto YOSHIDA

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 kinds 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-RPM 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-SEC 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 (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 (CLS: Tokyo Institute of Technology), and Institute for Materials Chemistry and Engineering (IMCE: Kyushu University).

This Five-star Alliance consists of three research groups; "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, for instance through the newly-established "Quantum-beam" and "Time-resolved" Materials and Properties Analysis sub-research groups.

In addition, the alliance has strong correlation with the "Network Joint Research Center (NJRC) 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 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 and CORE Collaboration Center. (Member from ISIR: Director, Prof. K. Nakatani (Director of Operations), Prof. T. Sekino (Chair), Prof. T. Oguchi, Prof. H. Tanaka, and Specially Appointed Prof. H. Asahi (Coordinator)). The group members of ISIR in FY2017 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 (11 members)
Prof. K. Nishino (Sub-leader), 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	Masateru TANIGUCHI
Machine Shop workers:	Technical Staff	Masayoshi OHNISHI, Yuki MATSUSHITA
Glassworks workers:	Technical Staff	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

This year we introduced a 3D printer newly and began to use it to support researchers.
3D printers can quickly make simple parts.
It also helps visual 3D design. (Fig.1)

Number of fabrication request jobs
Machine Shop: 177jobs
Glassworks: 91jobs
Total 268 requests from 34 laboratories.

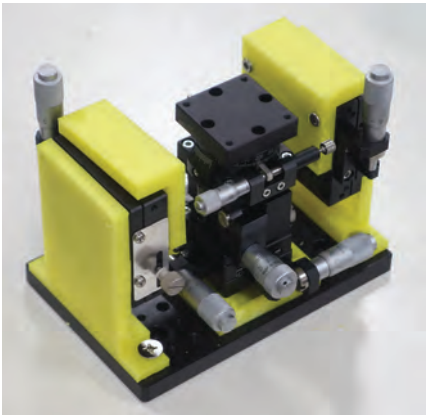


Fig. 1 Assembly test with 3D printer

Anechoic Laboratory

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

Outlines

Anechoic Laboratory was reorganized in 2017 from Electronic Processing Laboratory. The aim of this laboratory is to contribute to various studies in the Institute of Scientific and Industrial Research. This laboratory has an anechoic chamber that can be used for acoustic measurement, psychological experiments, etc. 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.

In the fiscal year of 2017, equipment and systems that have not been used in the former electronic process laboratory were disposed as a part of the reorganization. Maintenance around the anechoic chamber was also performed, e.g., adjusting and stabilizing the inclined floor in the anechoic chamber, and repairing the ventilation equipment of the anechoic chamber's front room. Furthermore, a new web page of the anechoic laboratory was created and linked from the top page of the Institute of Scientific and Industrial Research. The page is now public so that various people can apply for using it.

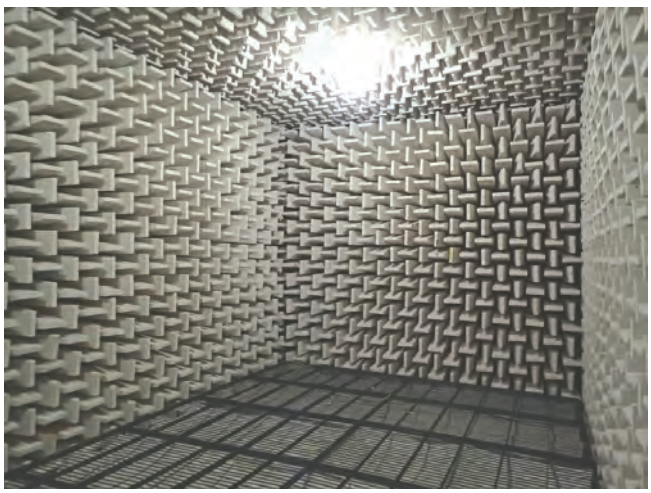


Fig.1 Inside of the anechoic chamber

Library

Professor: Takahiro KOZAWA
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, 2018)

	Number of books	Journals	Newspapers
Japanese	5,077	161 titles	5 titles
Foreign	19,676	493 titles	1 title

Facilities Management Office

Professor: Takahiro KOZAWA
Staff: Kayoko OHASHI

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 2017, the following 12researchers used Nanotech Open Laboratory.

Research Representative	Department
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. Takeharu NAGAI	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
Assoc. Prof. Tsuyoshi KONISHI	Graduate School of Engineering
Prof. Shinichi TAMURA	Graduate School of Medicine

Office of Information Network

Professor, Director:	Akira OIWA
Professor:	Masayuki NUMAO
Professor:	Toru SEKINO
Professor:	Hiroaki SASAI
Professor:	Yoichi YOSHIDA
Associate Professor:	Koji KOZAKI
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 2.

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
1. "Toward Material Innovation" May 12, 2017
2. "Toward Material Innovation II" August 4, 2017
3. "Toward Science Driven Innovation" Nov. 10, 2017
4. "Toward Information Technology Innovation" Feb. 2, 2018

2) "SANKEN Zakkubaran Talk"
7 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.
5 exhibitions and one lecture-meeting

Use of Company Research Park

Number of Use: 25 companies [new use: 5 companies]

Coordination of Joint Research etc.

2 joint researches

Support for New Industry Creation Study Groups

6 study groups

Public Relations Office

Director, Professor:	Akira OIWA
Professors:	Tohru SEKINO (-30.9.2017), Shun'ichi KURODA (-30.9.2017), Takashi WASHIO Tamio OGUCHI, Masaya NOGI (1.10.2017-), Kunihiko NISHINO (1.10.2017-)
Associate Professors:	Taketoshi MATSUMOTO (-30.9.2017), Teruo KANKI (-30.9.2017), Shinobu TAKIZAWA, Yutaka Ie, Kouichi SUDOH (1.10.2017-), Yusa MUROYA (1.10.2017-), Koun SHIRAI (1.10.2017-)
Assistant Professors:	Fumio OKURA (-30.9.2017), Seiji YAMASAKI (-30.9.2017), Masahiro NAKANO (-31.3.2018), Haruki KIYAMA, Akinori IRIZAWA
Staff:	Atsumi ITO
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:	508
The number of visits and visitors:	19 visits and 455 visitors
Press release:	31
Regular press conference:	22
The number of coverages:	443

Publications (Prospectus, Sanken Introduction Brochure, Annual report, Memoirs, Newsletter）
Updates of signboards
Sanken Image Video

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

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 (54 participants).
- Holding craft lecture for children (60 participants).
- Holding joint technical report meeting with Institute for Protein Research and Poster Session of women technical staff in Osaka University (52 participants).

Licenses

Staffs have 81 licenses.

Administrative Office （31-March , 2018）

Director : Yoshikazu TANAKA

General Affairs Division

Staffs: Masahiro KOMAKI
Satoshi KAJIURA
Sachiko YAMAMOTO
Tomoko SAWADA
Mie SHIMOE
Kazumi HAYASHI

Supporting Staffs: Ayano KOMAI
Akiko AKAMATSU
Noriko SASAKAWA

Research Cooperation Division

Staffs: Otoji TANI
Toshihiro YASUDA
Takeshi NAKASHIMA
Mai SHIMURA
Yasuko MUTSUI
Shingo TABATA
Yusuke AKAO
Mayu ESAKA
Momoko SAKAI
Fumiko SHINJO
Emi MIZUGUCHI
Etsuko UNO

Supporting Staffs: Syouko YAMOTO
Yumi WADA
Kazune OTANI
Tokiko NISHIMOTO
Yumi AKUTSU

List of Achievements

Department of Quantum System Electronics

Original Papers

[1]Spin conversion on the nanoscale, Yoshichika Otani, Masashi Shiraishi, Akira Oiwa, Eiji Saitoh, and Shuichi Murakami: Nature Physics, 13 (7) (2017) 829-832.

[2]Gate tunable parallel double quantum dots in InAs double-nanowire devices, S. Baba, S. Matsuo, H. Kamata, R. S. Deacon, A. Oiwa, K. Li, S. Jeppesen, L. Samuelson, H. Q. Xu, and S. Tarucha: Applied Physics Letters, 111 (23) (2017) 233513.

[3]Resonant Hall effect under generation of a self-sustaining mode of spin current in nonmagnetic bipolar conductors with identical characters between holes and electrons, Masamichi Sakai, Hiraku Takao, Tomoyoshi Matsunaga, Makoto Nishimagi, Keitaro Iizasa, Takahito Sakuraba, Koji Higuchi, Akira Kitajima, Shigehiko Hasegawa, Osamu Nakamura, Yuichiro Kurokawa, and Hiroyuki Awano: , 57 (2018) 033001-1 - 033001-13.

[4]Nonlinear and dot-dependent Zeeman splitting in GaAs/AlGaAs quantum dot arrays, V. P. Michal, T. Fujita, T. A. Baart, J. Danon, C. Reichl, W. Wegscheider, L. M. K. Vandersypen and Y. V. Nazarov: Physical Review B, 97 (2018) 035301-1-035301-9.

[5]Single electron-photon pair creation from a single polarization-entangled photon pair, K. Kuroyama, M. Larsson, S. Matsuo, T. Fujita, S. R. Valentin, A. Ludwig, A. D. Wieck, A. Oiwa and S. Tarucha: Scientific Reports, 7 (2017) 16968.

[6]Quantum simulation of a Fermi–Hubbard model using a semiconductor quantum dot array, T. Hensgens, T. Fujita, L. Janssen, Xiao Li, C. J. Van Diepen, C. Reichl, W. Wegscheider, S. Das Sarma and L. M. K. Vandersypen: Nature, 548 (2017) 70–73.

[7]Coherent shuttle of electron-spin states, T. Fujita, T. A. Baart, C. Reichl, W. Wegscheider and L. M. K. Vandersypen: Nature Partner Journal Quantum Information, 3 (2017) 22.

International Conferences

[1]Photon-spin Poincaré interface using electron spins in quantum dots (invited), Akira Oiwa: JSPS Core-to-Core SANKEN Program, The Purdue　Seminar for Sensing Technology by Nano Materials, Birck Nanotechnology Center, Purdue University, West Lafayette, IN, USA, June 22, 2017.

[2]Kondo effect and superconducting transport in SiGe self-assembled quantum dot transistors (invited), Ryoki Shikishima, Kazutoshi Kagawaguchi, Haruki Kiyama, Mario Bamesreiter, Dominique Bougeard, and Akira Oiwa: The second international conference on Quantum Information, Quantum Topological Orders and Emergent Spacetime on Quantum Simulators.

[3]Photon-spin Poincaré interface using electron spins in quantum dots (invited), Akira Oiwa: AEARU Advanced Materials Science Workshop 2017, Osaka University, Nov 1-2, 2017.

[4]Photon-electron spin conversion in gate-defined GaAs quantum dots and developing Poincare interface (oral), Akira Oiwa: JST-TU Delft Quantum Technology workshop.

[5]Electrical Transport Though a SiGe Self--assembled Quantum Dot (oral), R. Shikishima, T. Kagawaguchi, H. Kiyama, M. Bamesreiter, D. Bougeard, and A. Oiwa: 2017 Workshop on Innovative Nanoscale Devicesd Systems (WINDS), Hawaii, November, 2017.

[6]Structural and magnetic properties of Tb-doped GaN grown by plasma-assisted molecular beam epitaxy (poster), R. Yanagidani, S. Hasegawa: Satellite Workshop of Kanamori Memorial Symposium -Recent Progress in Materials Science for Spintronics and Energy Applications-.

[7]Magnetotarnsport in narrow gap semiconductor InSb Quantum Wells (poster), M. Tada, H. Kiyama, K. Akahane, A. Oiwa: SpinTech IX, Fukuoka, Japan, Jun 4-8, 2017.

[8]Design of Surface Plasmon Antennas on Gate-defined Lateral Quantum Dots (poster), R. Fukai, T. Nakagawa, H. Kiyama, and A. Oiwa: SpinTech IX, Fukuoka, Japan, Jun 4-8, 2017.

[9]Kondo effect and superconducting transport in SiGe self-assembled quantum dots (poster), R. Shikishima, T. Kagawaguchi, H. Kiyama, M. Bamesreiter, D. Bougeard, and A. Oiwa: SpinTech IX, Fukuoka, Japan, Jun 4-8, 2017.

[10]Kondo effect in a self-assembled SiGe quantum dot (poster), R. Shikishima, T. Kagawaguchi, H. Kiyama, M. Bamesreiter, D. Bougeard, and A. Oiwa: 18th International Conference on Modulated Semiconductor Structures .

[11]Kondo effect in a self-assembled SiGe quantum dot (poster), R. Shikishima, T. Kagawaguchi, H. Kiyama, M. Bamesreiter, D. Bougeard, and A. Oiwa: International Workshop on Silicon Quantum Electronics, Jones Farm Conference Center, Hillsboro, Oregon, Aug 18-21, 2017.

[12]Single-shot ternary readout of electron spin states in a quantum dot coupled to quantum Hall edge states (oral), H. Kiyama: JST-TU Delft Quantum Technology workshop.

[13]Transport and optical properties of (110) GaAs quantum wells for photon-spin quantum state conversion using heavy hole states (poster), Tomohiro Nakagawa, Yuji Sakai, Rio Fukai, Haruki Kiyama, Julian Ritzmann, Arne Ludwig, Andreas D. Wieck, and Akira Oiwa: SpinTech IX, Fukuoka, Japan, Jun 4-8, 2017.

[14]Electrical Transport in Low Dimensional Systems Fabricated in a (110) GaAs Quantum Well (poster), Tomohiro Nakagawa , Rio Fukai, Yuji Sakai, Haruki Kiyama, Julian Ritzmann, Arne Ludwig, Andreas D. Wieck, and Akira Oiwa: International School and Symposium on nanoscale transport and photonics (ISNTT2017), NTT Atsugi R&D Center, Atsugi Kanagawa, JAPAN, Nov 13-17, 2017.

[15]Coherent transfer of spins in a quantum dot array (invited), T. Fujita, T.A. Baart, C. Reichl, W. Wegscheider and L.M.K. Vandersypen: Many paths to interference: a journey between quantum dots and single molecule junctions (mpinqt17) Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.

[16]Coherent spin shuttling through quantum dots (oral), T. Fujita, T.A. Baart, C. Reichl, W. Wegscheider and L.M.K. Vandersypen: SpinTech IX, Fukuoka, Japan, Jun 4-8, 2017.

Contributions to International Conferences and Journals

A. Oiwa	International Conference on Solid State Materials and Devices (SSDM2018) (Program Committee)
A. Oiwa	10th International Conference on Physics and Applications of Spin-related Phenomena (PASPS10) (International Advisory Committee)
A. Oiwa	The 21th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (Edison21) (Program Committee (Chair))

Publications in Domestic Meetings

JPS Meeting 2017 Autumn	5 papers
7th Summer School on Semiconductor/Superconducting Quantum Coherence Effect and Quantum Information	3 papers
JPS Meeting 2018 Spring	4 papers
The 654th JSAP Spring Meeting	3 papers
22nd Symposium on the Physics and Applications of Spin-related Phenomena in Semiconductors	1 paper

The 54th Fall Meeting of JSASS, Kansai&Chubu Branch	1 paper
The 53rd Annual Conference on X-Ray Chemical Analysis	1 paper
VSJ-SSSJ Joint Meeting 2017	2 papers

Academic Degrees

Master Degree for Engineering Y. Kurokawa	Study on Formation of Isolated GaN Nanorods by Plasma-assisted Molecular Beam Epitaxy
Master Degree for Science R. Yanagidani	Growth and Characterization of Dilute Magnetic Semiconductor GaTbN
Master Degree for Science H. Aomatsu	Structural and Magnetic Properties of GaSmN Grown by Plasma-assisted Molecular Beam Epitaxy
Bachelor Degree for Engineering S. Fujimori	Characterization of GaN/GaTbN Superlattices Grown by Plasma-assisted Molecular Beam Epitaxy
Master Degree for Engineering M. Tada	Evaluation of InSb quantum well substrate and fabrication of side gate type quantum point contact
Master Degree for Science K. Kawaguchi	Fabrication and transport measurements of SiGe self-assembled quantum dot devices
Master Degree for Science S. Higashide	Fabrication and measurement of lateral spin valves containing a quantum dot
Master Degree for Engineering R. Fukai	Surface plasmon antennas for efficient conversion from photon to electron using a lateral quantum dot
Bachelor Degree for Engineering T. Yoshihara	Fabrication of a superconductor junction to a GaAs two-dimensional electron system

Grant-in-Aid for Scientific Research

A. Oiwa	Optical spin conversion	¥7,150,000
A. Oiwa	Interconversion of Quantum States Between Photon and Electron Spin Using Electrically Controlled Quantum Dots	¥115,180,000
A. Oiwa	Qunatum state conversion from electron spins to photons in an electricaly-defined quantum dots formed in a lateral p-n junction	¥2,419,000
S. Hasegawa	Controlling spatial distribution of rare-earth elements in III-nitride semiconductors and their magnetic properties	¥6,500,000
S. Hasegawa	Study of optimization methodologies for boron nitride films by controlling an ion-energy distribution function during plasma processing	¥650,000
S. Hasegawa	Complementary accumulation of spin and charge in hydride bipolar conductors	¥260,000
A. Oiwa	Novel solid state phyics via spatial controls of quantum pairs	¥3,185,000
A. Oiwa	Steering committee of spin conversion science	¥1,495,000

Entrusted Research

A.Oiwa	Japan Science and Technology Agency	Creation of a Poincaré interface through the convergence of electronics and photonics	¥25,035,000

Contribution to Research

H.Kiyama	The Murata Science Foundation, Chief Director, Tsuneo Murata	¥1,800,000

Cooperative Research

S. Hasegawa	Hyogo Prefectural Institute of Technology	¥0,000

Department of Semiconductor Electronics

Original Papers

[1]Planar Hall effect from the surface of topological insulators, A. A. Taskin, Henry F. Legg, Fan Yang, Satoshi Sasaki, Yasushi Kanai, Kazuhiko Matsumoto, Achim Rosch & Yoichi Ando: Nature Communications, 8 (1340) (2017) 1－7.

[2]Temperature dependence of universal conductance fluctuation due to development of weak localization in graphene, D.Terasawa A. Fukuda A.Fujimoto Y.Ohno K.Matsumoto: Solid State Communications, 267 (2017) 14-17.

[3]Room-temperature discrete-charge-fluctuation dynamics of a single molecule adsorbed on a carbon nanotube, Agung Setiadi, Hayato Fujii, Seiya Kasai, Ken-ichi Yamashita, Takuji Ogawa, Takashi Ikuta, Yasushi Kanai, Kazuhiko Matsumoto, Yuji Kuwahara and Megumi Akai-Kasaya: , 30 (2017) 10674-10683.

[4]Effects of the plasma process for self-aligned nano-carbon field-effect transistors, T. Kawahara, S. K. Rupesh, Y. Ohno, K. Maehashi, K Matsumoto, K. Okamoto, R. Utsunomiya, T. Matsuba,: ICNF 2017, 1 (7985984) (2017) 1.

[5]Dynamical thermodiffusion model of graphene synthesis on polymer films by laser irradiation and application to strain sensors, Yasushi Kanai1, Yusuke Ishibashi1, Takao Ono1, Koichi Inoue1, Yasuhide Ohno1,2, Kenzo Maehashi1,3 and Kazuhiko Matsumoto: Japanese Journal of Applied Physics, 56 (7) (2017) 075102-1－6.

[6]Zero-bias conductance anomaly in graphene dots, Yasushi Kanai, Mohamed Almokhtar, Takao Ono, Yasuhide Ohno, Kenzo Maehashi, Kouichi Inoue and Kazuhiko Matsumoto: Japanese Journal of Applied Physics, 56 (6) (2017) 06GE07-1－3.

[7]T. Ono, Y. Kanai S. Okuda, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto, Biosensing based on graphene —Lab on a graphene—: The Institute of Electronics, Information and Communication Engineers, C, J100-C (11) (2017) 528-536.

International Conferences

[1]Sugar Chain Modified Graphene FET for Detection of Influenza Virus (invited), K. Matsumoto: The 15th International Conference on Advanced Materials.

[2]Sugar Chain Modified Graphene FET for Detection of Influenza Virus (invited), K. Matsumoto: ICFC International Conference on Functional Carbons.

[3]Sugar Chain Modified Graphene FET for Detection of Influenza Virus (oral), K. Matsumoto, T. Ono, T. Kawata Y. Kanai K. Inoue: imec / Osaka Univ. Symposium.

[4]Sugar Chain Modified Graphene FET for Detection of Influenza Virus (oral), K. Matsumoto, T. Ono, T. Kawata Y. Kanai K. Inoue: JSPS Core-to-Core SANKEN Program, Purdue Seminar “Seminar for Sensing Technology by Nano Materials.

[5]Pathogen detection using graphene device with microreacto (oral), T. Ono, T. Kawata, Y. Kanai, M. Tanioku, K. Inoue, K. Matsumoto: JSPS Core-to-Core SANKEN Program, Purdue Seminar “Seminar for Sensing Technology by Nano Materials.

[6]Measurement of Enzymatic Reaction Using Graphene Field-Effect Transistor and Microwell for

Detection of Helicobacter Pylori (oral), T. Ono, T. Kawata Y. Kanai, M. Tanioku K. Inoue, K. Matsumoto: 59th Electronic Materials Conference.

[7]Influenza Virus Detection System Using Graphene Field-Effect Transistor (oral), T. Kawata, T. Ono, Y. Kanai, M. Tanioku K. Inoue, K. Matsumoto: 59th Electronic Materials Conference.

Books

[1]Lab-on-a-graphene: Functionalized graphene transistors and their application for biosensing(S. Kaneko, P. Mele, T. Endo, T. Tsuchiya, K. Tanaka, M. Yoshimura, D. Hui,) T. Ono, Y. Kanai, Y. Ohno, K. Maehashi, K. Inoue, K. Matsumoto, "Carbon-related Materials in Recognition of Nobel Lectures by Prof. Akira Suzuki in ICCE", Springer, (79-90) 2017.

Grant-in-Aid for Scientific Research

K.Matsumoto	Characteristic Control and Device Application by Modification on the Surface and Interface of New Nanocarbons	¥72,800,000
Y.Kanai	Realization of nanocarbon spin ransistor and developments for quantum devices	¥1,300,000

Entrusted Research

K.Matsumoto	JST	Develop Super Japanese by Human Power Activation/Enhancement of Industrial Competitiveness/Rich Society	¥78,907,000
K.Matsumoto	JST	Construction of two dimensional biological model platform using sugar chain modified graphene	¥35,608,000

Cooperative Research

K.Matsumoto	Murata Manufacturing Co., Ltd	¥1,644,000
K.Matsumoto	TOSHIBA CORPORATION	¥2,616,000
K.Matsumoto	Mitsubishi Electric Corporation	¥500,000
K.Matsumoto	TOSHIBA CORPORATION	¥2,616,000

Other Research Fund

K.Matsumoto	JSPS	¥15,627,000

Department of Advanced Electron Devices

Original Papers

[1]Transmit/Receive 3–20 Ghz 1.2 Mw Packaged Double-Pole-16-Throw Switching Matrix for Radar-Based Target Detection, Afreen Azhari, Yuki Kuwano, Xia Xiao, Takamaro Kikkawa: Jpn. J. Appl. Phys., 57 (2018) 014101.

[2]Enhanced Electronic-Transport Modulation in Single-Crystalline Vo2 Nanowire-Based Solid-State Field-Effect Transistors, Tingting Wei, Teruo Kanki, Masashi Chikanari, Takafumi Uemura, Tsuyoshi Sekitani, Hidekazu Tanaka: Scientific Reports, 7 (2017) 17215.

[3]A Few-Layer Molecular Film on Polymer Substrates to Enhance the Performance of Organic Devices, Tomoyuki Yokota, Takashi Kajitani, Ren Shidachi, Takeyoshi Tokuhara, Martin Kaltenbrunner, Yoshiaki Shoji, Fumitaka Ishiwari, Tsuyoshi Sekitani, Takanori Fukushima, Takao Someya: Nat. Nanotechnol., 13 (2017) 139-144.

[4]Boron-Stabilized Planar Neutral π Radicals with Well-Balanced Ambipolar Charge-Transport Properties, Tomokatsu Kushida, Shusuke Shirai, Naoki Ando, Toshihiro Okamoto, Hiroyuki Ishii, Hiroyuki Matsui, Masakazu Yamagishi, Takafumi Uemura, Junto Tsurumi, Shun Watanabe, Jun Takeya, Shigehiro Yamaguchi: J. Am. Chem. Soc., 139 (2017) 14336-14339.

[5]Growth of Organic Semiconductor Thin Films with Multi-Micron Domain Size and Fabrication of

Organic Transistors Using a Stencil Nanosieve, Pavlo Fesenko,Valentin Flauraud, Shenqi Xie, Enpu Kang, Takafumi Uemura, Jürgen Brugger, Jan Genoe, Paul Heremans, Cédric Rolin: ACS Appl. Mater. Interfaces, 9 (28) (2017) 23314-23318.

[6]12-2: Invited Paper: a Sheet-Type Wireless Electroencephalogram (Eeg) Sensor System Using Flexible and Stretchable Electronics, Tsuyoshi Sekitani, Shusuke Yoshimoto, Teppei Araki, Takafumi Uemura: SID Symposium Digest of Technical Papers, 48 (2017) 143-146.

[7]Antithrombotic Protein Filter Composed of Hybrid Tissue-Fabric Material Has a Long Lifetime, Yusuke Inoue, Tomoyuki Yokota, Tsuyoshi Sekitani, Akiko Kaneko, Taeseong woo, Shingo Kobayashi, Tomokazu Shibuya, Masaru Tanaka, Hiroyuki Kosukegawa, Isturo Saito, Takashi Isoyama, Yusuke Abe, Tomoyuki Yambe, Takao Someya, Masaki Sekino: Annals of Biochemical Engineering, 45 (2017) 1352-1364.

International Conferences

[1]Design of Ultraflexible Organic Differential Amplifier Circuits for Wearable Sensor Technologies (oral), Masaya Kondo, Takafumi Uemura, Mihoko Akiyama, Naoko Namba, Masahiro Sugiyama, Yuki Noda, Teppei Araki, Shusuke Yoshimoto, Tsuyoshi Sekitani: International Conference on Microelectronics Test Structures (ICMTS), M_4_5, Austin, Texas, USA.

[2]Flexible Sensor Sheet for Real-Time Pressure Monitoring in Artificial Knee Joint During Total Knee Arthroplasty (oral), Fumika Tanabe,Shusuke Yoshimoto,Yuki Noda,Teppei Araki,Takafumi Uemura,Yoshinori Takeguchi,Masaharu Imai,Tsuyoshi Sekitani: the IEEE Engineering in Medicine and Biology Society, pp. 1591-1594, Jeju Island, Korea.

[3]Flexible Organic Tft Bio-Signal Amplifier Using Reliable Chip Component Assembly Process with Conductive Adhesive (oral), Shusuke Yoshimoto, Takafumi Uemura, Mihoko Akiyama, Yoshihiro Ihara, Satoshi Otake, Tomoharu Fujii, Teppei Araki, Tsuyoshi Sekitani: the IEEE Engineering in Medicine and Biology Society, pp. 1849 -1852, Jeju Island, Korea.

[4]Micro-Volt Signal Amplification Circuits Based on Organic Thin-Film Transistors for Wireless Bio-Signal Monitoring Systems (invited), Takafumi Uemura, Shusuke Yoshimoto, Teppei Araki, Tsuyoshi Sekitani: The 12th IEEE Nanotechnology Materials and Device Conference (NMDC2017), Holiday Inn Atrium Hotel, Singapore.

[5]Enhanced Electrical Durability and Mechanical Stretchability of Ag Nanowire-Based Transparent Electrodes by Nanometer-Thick Metal Plating (invited), Teppei Araki, Yuki Noda, Ashuya Takemoto, Shusuke Yoshimoto, Takafumi Uemura, Tsuyoshi Sekitani: The 24th International Display Workshops (IDW’17), Electrode Material and Photoresist Technologies, FMC5-1, Sendai, Sendai, 2017.12.8 (Oral, invited).

[6]Ultra-Flexible Organic Amplifier Circuits for Biosignal Monitoring System (invited), Takafumi Uemura Tsuyoshi Sekitani: 27th International Conference on Amorphous and Nanocrystalline Semiconductors (ICANS27), Hoam Faculty House, Seoul National University, Seoul, Korea.

[7]Brain Wave Measurement System (oral), Takafumi Uemura, Masaya Kondo, Teppei Araki, Shusuke Yoshimoto, Tsuyoshi Sekitani: JSPS+M13:M18 Core-to-Core SANKEN Program, Purdue Seminar “Seminar for Sensing Technology by Nano Materials,” Purdue University, West Lafayette, Indiana, USA.

[8]Ultra-Flexible Organic Amplifier Sheet for a Wireless Biosignal Detection (oral), Takafumi Uemura, Masaya Kondo, Teppei Araki, Shusuke Yoshimoto, Tsuyoshi Sekitani: 5th Conference of SANKEN Core to Core Program, imec, Leuven, Belgium.

[9]A Several-Nanometers-Thick Gold Layer on Silver Nanowires Enhancing Migration Durability on

Stretchable Electrodes for Long Therapeutic Bio-Applications (oral), Teppei Araki, Shusuke Yoshimoto, Yuki Noda,Ashuya, Takemoto, Takafumi Uemura, Tsuyoshi Sekitani: 2017 Materials Research Society (MRS) Spring meeting & exhibit, Symposium, SM1.5.08, Phoenix, the United States.

[10]Turn-On-Voltage Control in Organic Transistors by the Gate Electrode Modification and Inverter Circuit Application (poster), Keisuke Sakaguchi, Takafumi Uemura, Masaya Kondo, Teppei Araki, Shusuke Yoshimoto, Yuki Noda, Tsuyoshi Sekitani: 1st SANKEN JSPS Symposium for the Circulation of Talented Researchers “Global Networking on Molecular Technology Research,” ISIR, Osaka University, Japan21st SANKEN International Symposium ”AI Evolution in Science and Technology, ”21st SANKEN International Symposium ”AI Evolution in Science and Technology,” ISIR, Osaka University, Japan.

[11]Development of an Ultra-Flexible Organic Differential Amplifier for Bio-Signal Monitoring (poster), Masahiro Sugiyama, Takafumi Uemura, Shusuke Yoshimoto, Mihoko Akiyama, Teppei Araki, Tsuyoshi Sekitani: 9th International Conference on Molecular Electronics and Bioelectronics (M&BE9), page 250, Kanazawa, Japan.

[12]50-μm-Wide Silver Nanowire Electrodes Patterned on Hydrophilic/Hydrophobic Treated Surface for Transparent Organic Transistors (poster), Ashuya Takemoto, Teppei Araki, Yuki Noda, Shusuke Yoshimoto, Takafumi Uemura, Tsuyoshi Sekitani: 2017 Materials Research Society (MRS) Spring meeting & exhibit, Symposium, SM1.3.24, Phoenix, the United States.

Review Papers
Flexible Electronics for Bio-Signal Monitoring in Implantable Applications, IEICE Electronics Express, 14[20] (2017), 1-12.

溶液塗布による有機半導体単結晶膜の作製と有機トランジスタ応用, 応用物理, 86[8] (2017), 670-672.

イオン液体/ルブレン単結晶界面の周波数変調 AFM による構造解析-界面構造と電気二重層 FET 特性との相関-, 表面科学, 38[8] (2017), 419-424.

Patents
[1]K20160442 透明導電配線パターン、透明導電配線基板及びその製造方法, 2017-081571

[2]K20170103 振動センサおよび圧電素子, 2017-133486

[3]K20170090 配線シート、シート状システム、及び構造物運用支援システム, 2017-142222

[4]K20170033 電極構造体、生体信号計測装置、粘着剤形成用組成物, 2017-146510

[5]K20170105 有機トランジスタの製造方法および電極形成用導電インキ, 2017-177603

[6]K20170097 電極シート、電極シートの製造方法、生体信号取得装置、及び生体信号取得方法, 2017-179041

[7]K20170075 ハイドロゲル, 2017-188524

[8]K20170074 化合物及びその用途, 2017-188525

[9]K20170166 生体信号測定装置及びプログラム, 2017-200831

[10]K20170284 測定装置, 2018-015175

[11]K20170268 ケージ, 2018-059695

[12]G20170012WO 電極シート及びこの電極シートを備える生体信号計測装置, PCT/JP2017/019621

[13]G20170028WO 導電性組成物, PCT/JP2017/022188

[14]G20170021WO 配線シート、シート状システム、及び構造物運用支援システム, PCT/JP2017/026876

[15]G20170007WO 電極シート, PCT/JP2017/029555

[16]G20170036WO 電極シート, PCT/JP2017/035835

[17]G20170069WO 温度センサ, PCT/JP2017/039172

[18]G20170115WO 電極構造体、生体信号計測装置、粘着剤形成用組成物, PCT/JP2017/043172

[19]K20130094 金属パターン形成用インク組成物及び金属パターン形成方法, 2013-144585

Publications in Domestic Meetings

平成 30 年電気学会全国大会, シンポジウム講演 S25-3, 福岡 九州大学伊都キャンパス, 2018.3.14 (口頭, 招待)	1 paper
第 2 回 日本画像学会技術研究会 電子ペーパー/フレキシブル技術研究会「ウェアラブルと電子ペーパーの新展開」, 日本化学会, 東京 千代田区, 2017.10.20 (口頭, 招待)	1 paper
有機エレクトロニクス材料研究会 JOEM Workshop'17, 「デジタルヘルスケア」, 新宿 NS ビル	1 paper
第 1 3 回サマーセミナー, ＳＩＤ日本支部主催, 東京 港区, 2017.8.25 (口頭, 招待)	1 paper
第 12 回有機デバイス・物性院生研究会, 京都大学理学研究科セミナーハウス	1 paper
不老社会実現に向けた進化工学医療ワークショップ, 大阪大学吹田キャンパス	1 paper
ストレッチャブル配線材料, サイエンス&, 品川, 東京	1 paper
第 27 回ファインテックジャパン プリンテッドエレクトロニクスフォーラム, 東京 ビックサイト	1 paper
第 65 回応用物理学会春季学術講演会, 18p-D102-8, 早稲田大学・西早稲田キャンパス	1 paper
人・環境と物質をつなぐイノベーション創出 ダイナミック・アライアンス エレクトロニクス 物質・デバイス（G1） グループ分科会, ホテル常磐, 山口	1 paper
第 27 回マイクロエレクトロニクスシンポジウム, 1C2-4, 中京大学, 愛知	1 paper
M&BE 研究会,「有機分子・バイオエレクトロニクスの最新動向と応用展開」, 北九州, 福岡	1 paper
第 34 回「センサ・マイクロマシンと応用システム」シンポジウム, 広島	2 papers
LSI とシステムのワークシ ョップ 2017 ポスターセッション, 東京	3 papers

Grant-in-Aid for Scientific Research

T.Sekitani	シート型自律神経機能モニタリングシステムの研究開発	¥13,650,000
T.Araki	有機トランジスタの電荷トラップ機構の解明	¥2,990,000
S.Yoshimoto	生体適合電極シートを有するパッチ式ワイヤレス脳波計測システム	¥1,950,000
Y.Noda	印刷法による高次構造の形成とウェアラブル生体信号計測デバイスへ	¥3,510,000

Entrusted Research

T.Sekitani	国立研究開発法人 日本医療研究開発機構	体内埋込型集積回路内蔵フレキシブル超薄膜センサシートを用いたマーモセットの脳信号計測	¥44,920,000

		システムの開発	
T.Sekitani	NICT	大容量体内-体外無線通信技術及び大規模脳情報処理技術の研究開発と BMI への応用	¥3,564,000
T.Sekitani	NEDO	エネルギー・環境新技術先導プログラム／次世代 IoT 社会に必要な、センサーから超微小な主力信号の処理を実現する革新的なノイズ低減・信号増幅等に関するナノテク・材料開発／超微小な出力信号の検出を実現するナノテク材料の研究開発	¥19,999,000
T.Sekitani	NEDO	IoT 推進のための横断技術開発プロジェクト／Field Intelligence 搭載型大面積分散 IoT プラットフォームの研究開発	¥25,000,000
T.Sekitani	NEDO	IoT を活用した新産業モデル創出基盤整備事業／IoT の社会実装推進に向けて解決すべき新規課題に関するシステムの開発／シート型構造物ヘルスケアシステムによる橋梁トリアージへ向けた研究開発	¥20,000,000

Contribution to Research

T.Sekitani	公益財団法人東電記念財団	¥3,000,000
T.Sekitani	一般財団法人テレコム先端技術研究支援センター	¥1,000,000
T.Sekitani	公益財団法人セコム科学技術振興財団	¥24,000,000
T.Sekitani	東電設計株式会社	¥3,000,000
T.Sekitani	プリンテッド・エレクトロニクス研究会	¥3,000,000

Cooperative Research

T.Sekitani	Murata Manufacturing Co., Ltd.	¥0,000
T.Sekitani	Showa Denko K.K.	¥3,750,000
T.Sekitani	Group Corporate Communication Dept., Toyo Ink SC Holdings Co., Ltd.	¥1,000,000
T.Sekitani	Shinko Electric Industries Co., Ltd.	¥0,000
T.Sekitani	Mitsubishi Tanabe Pharma Corporation	¥0,000
T.Sekitani	SCREEN Holdings Co., Ltd.	¥3,000,000
T.Sekitani	PGV Co., Ltd.PGV	¥2,290,000
T.Sekitani	JSR Corporation	¥2,496,000
T.Sekitani	Cemedaine Co,.Ltd	¥2,000,000

Department of Intelligent Media

Original Papers

[1]Comfort/Discomfort Estimation based on Unconscious Reactions to Slight Illuminance Fluctuation, T. Kikuchi, N. Takemura, K. Sato: Transactions of the Institute of Systems, Control and Information Engineers, 30 (4) (2017) 183–190.

[2]Mental Fatigue Estimation Based on the Spatio-Temporal Features of Intensity

Change in Facial Image, R. Kawamura, N. Takemura, K. Sato: IEICE Transactions on Communications (B), J100-B (12) (2017) 1014-1022.

[3]Robust Gait Recognition against Carrying Status Using Joint Intensity Histograms, A. Suzuki, D. Muramatsu, Y. Makihara, Y. Kashimoto, Y. Yagi: IEICE Trans. on Fundamentals (A), J100-A (12) (2017) 444-454.

[4]Pedestrian Group Detection with Gesture Features, H. Habe, T. Hashimoto, I. Mitsugami, K. Sumi, Y. Yagi: Journal of Japan Society for Fuzzy Theory and Intelligent Informatics, 29 (3) (2017) 605-610.

[5]Multi-view Large Population Gait Dataset and Its Performance Evaluation for Cross-view Gait Recognition, N. Takemura, Y. Makihara, D. Muramatsu, T. Echigo, Y. Yagi: IPSJ Transactions on Computer Vision and Applications, 10 (4) (2018) 1-14.

[6]MultiQ: Single sensor-based multi-quality multi-modal large-scale biometric score database and its performance evaluation, M.Z. Uddin, D. Muramatsu, T. Kimura, Y. Makihara, Y. Yagi: IPSJ Transactions on Computer Vision and Applications, 9 (18) (2017) 1-25.

[7]Automatic Image Analysis for Rapid Drug Susceptibility Testing, A. Grushnikov, K. Kikuchi, Y. Matsumoto, T. Kanade, Y. Yagi: Advanced Biomedical Engineering, 6 (2017) 76-82.

[8]3D level set method for blastomere segmentation of preimplantation embryos in fluorescence microscopy images, A. Grushnikov, R. Niwayama, T. Kanade, Y. Yagi: Machine Vision and Applications, 29 (1) (2018) 125-134.

[9]Immersive walking environment for analyzing gaze-gait relations, H. Yamazoe, I. Mitsugami, T. Okada, T. Echigo, Y. Yagi: Transactions of the Virtual Reality Society of Japan, 22 (3) (2017) 435-443.

[10]The OU-ISIR Gait Database Comprising the Large Population Dataset with Age and Performance Evaluation of Age Estimation, C. Xu, Y. Makihara. G. Ogi, X. Li, Y. Yagi, J. Lu: IPSJ Trans. on Computer Vision and Applications, 9 (24) (2017) 1-14.

International Conferences

[1]Age Estimation from Dual-Task Behavior for Comprehensive Growth Assessment of Children, C. Zhou, I. Mitsugami, K. Aoki, F. Okura, Y. Yagi: Prof. of International Workshop on Frontiers of Computer Vision 2018, (P2-1) (2018) 1-2.

[2]A Visual Surveillance System for Person Re-Identification, H. El-Alfy, D. Muramatsu, Y. Teranishi, N. Nishinaga, Y. Makihara, Y. Yagi: Prof. of SPIE, 10338 (2017) 1-7.

[3]Joint Intensity and Spatial Metric Learning for Robust Gait Recognition, Y. Makihara, A. Suzuki, D. Muramatsu, X. Li, Y. Yagi: Proc. of the 30th IEEE Conf. on Computer Vision and Pattern Recognition (CVPR 2017), (2017) 5705-5715.

[4]Spatial and Temporal Segmented Dense Trajectories for Gesture Recognition, K. Yamada, T. Yoshida, K. Sumi, H. Habe, I. Mitsugami: Prof. of SPIE, 10338 (2017) 1-8.

[5]A Geometric View Transformation Model using Free-form Deformation for Cross-view Gait Recognition, H. El-Alfy, C. Xu, Y. Makihara, D. Muramatsu, Y. Yagi: Proc. of the 4th Asian Conf. on Pattern Recognition (ACPR 2017), (2017) 929-934.

[6]Reflectance and Shape Estimation with a Light Field Camera under Natural Illumination, T.T. Ngo, H. Nagahara, K. Nishino, R. Taniguchi, Y. Yagi: Prof. of the 28th British Machine Vision Conference, (2017) 1-13.

[7]Realtime novel view synthesis with eigen-texture regression, Y. Nakashima, F. Okura, N. Kawai, R. Kimura, H. Kawasaki, A. Blanco, K. Ikeuchi: Prof. of the 28th British Machine Vision Conference, (2017) 1-12.

[8]Material Classification Using Frequency- and Depth-dependent Time-of-Flight Distortion, K. Tanaka, Y. Mukaigawa, T. Funatomi, H. Kubo, Y. Matsushita, Y. Yagi: , (2018) .

[9]Exploiting Silhouettes Contours for Human Gait Identification, H. El-Alfy, I. Mitsugami, Y. Yagi: , (2018) .

[10]Reflectance and Shape Estimation with a Light Field Camera under Natural Illumination, T.T. Ngo, H. Nagahara, K. Nishino, R. Taniguchi, Y. Yagi: , (2018) .

[11]Appropriate Network Architecture According to a Situation for Convolutional Neural Network-based Cross-view Gait Recognition, N. Takemura, Y. Makihara, D. Muramatsu, T. Echigo, Y. Yagi: , (2018) .

[12]Joint Intensity and Spatial Metric Learning for Robust Gait Recognition, Y. Makihara, A. Suzuki, D. Muramatsu, X. Li, Y. Yagi: , (2018) .

[13]A Geometric View Transformation Model using Free-form Deformation for Cross-view Gait Recognition, H. El-Alfy, C. Xu, Y. Makihara, D. Muramatsu, Y. Yagi: , (2018) .

[14]MultiQ: Single sensor-based multi-quality multi-modal large-scale biometric score database and its performance evaluation, M.Z. Uddin, D. Muramatsu, T. Kimura, Y. Makihara, Y. Yagi: , (2018) .

[15]3D Level Set Method for Cell Segmentation of Preimplantation Embryos in Fluorescence Microscopy Images, A. Grushnikov, R. Niwayama, T. Kanade, Y. Yagi: , (2018) .

[16]Joint Intensity and Spatial Metric Learning for Robust Gait Recognition, Y. Makihara, A. Suzuki, D. Muramatsu, X. Li, Y. Yagi: , (2018) .

Review Papers

Gait Recognition by Deep Learning, N. Takemura, K. Shiraga, Y. Makihara, D. Muramatsu, T. Echigo, Y. Yagi, Image Lab., JAPAN INDUSTRIAL PUBLISHING CO., LTD., 29[1] (2018), 40-48.

Toward Realization of Video-based Human Behavior Analysis in the Wild Lessons Learned from a Human Video Capturing Experiment at Osaka University, D. Muramatsu, Y. Makihara, Y. Yagi, IEICE Fundamentals Review, IEICE, 11[2] (2017), 93-99.

Books

[1]Behavior Understanding Based on Intention-Gait Model Y. Yagi, I. Mitsugami, S. Shioiri, H. Habe, “Human-Harmonized Information Technology”, Springer, 2 2017.

Contributions to International Conferences and Journals

Y. Makihara	The 4th Asian Conf. on Pattern Recognition (ACPR 2017) (Program co-chair)
Y. Makihara	IEICE Transaction on Information and Systems (Associate Editor)
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	IPSJ Transaction on Computer Vision and Applications (Associate Editor)
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	The 25th ACM Multimedia Conference (MM 2017) (Program Committee Member)
Y. Makihara	The 13th Int. Conf. on Signal Image Technology and Internet based Systems (SITIS 2017) (Program Committee Member)
Y. Makihara	The IEEE Int. Conf. on Identity, Security and Behavior Analysis (ISBA 2018) (Program Committee Member)
Y. Makihara	The 8th Pacific-Rim Symposium on Image and Video Technology (PSIVT 2017) (Program Committee Member)
Y. Makihara	The 31th IEEE Int. Conf. on Computer Vision and Pattern Recognition (CVPR 2018) (Reviewer)
Y. Makihara	The first International conference on Multimedia Analysis and Pattern Recognition (MAPR 2018) (Program Committee Member)
Y. Makihara	2018 ACM Int. Conf. on Multimedia Retrieval (ICMR 2018) (Technical Programm Committee)
Y. Makihara	The 24th Int. Conf. on Pattern Recognition (ICPR 2018) (Technical Committee)
Y. Makihara	The 15th European Conf. on Computer Vision (ECCV 2018) (Reviewer)
Y. Makihara	The 14th Asian Conf. on Computer Vision (ACCV 2018) (Program Committee Member)
Y. Makihara	The 26th ACM Multimedia Conference (MM 2018) (Program Committee Member)
Y. Makihara	The 29th British Machine Vision Conf. (BMVC 2018) (Reviewer)
Y. Makihara	The 10th International Conference on Knowledge and Systems Engineering (KSE-2018) (Program Committee Member)
Y. Makihara	2018 Multimedia Information Processing for Personality & Social Networks Analysis Workshop (Program Committee 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)
D. Muramatsu	The 24th Int. Conf. on Pattern Recognition (ICPR 2018) (Technical 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)
I. Mitsugami	The 16th IEEE International Symposium on Mixed and Augmented Reality (ISMAR 2017) (Reviewer)
I. Mitsugami	The 13th Int. Conf. on Signal Image Technology and Internet based Systems (SITIS 2017) (Program Committee Member)
I. Mitsugami	3D Vision 2017 (3DV 2017) (Reviewer)
K. Aoki	The 24th Int. Conf. on Pattern Recognition (ICPR 2018) (Technical Member)

Publications in Domestic Meetings

Information Processing Society of Japan, Special Interest Group on Computer Vision and Image Media	6 papers
The 20th Meeting on Image Recognition and Understanding	1 paper
The 16th Forum on Information Technology	1 paper
The Institute of Electronics, Information and Communication Engineering, Technical Group on Biometrics	2 papers
The 7th Symposium on Biometrics, Recognition, and Authentication	9 papers
The 105th Robotics Engineering Seminar	1 paper
The 23rd Symposium on Sensing via Image Information	1 paper

INTERNATIONAL TECHNICAL EXHIBITION ON IMAGE TECHNOLOGY AND EQUIPMENT 2017	1 paper
Osaka-Electro Communication University, Institute of Informatics, Seminar on Visual Information	1 paper
Dynamic Alliance, G3 group meeting	1 paper

Academic Degrees

PhD for Information Science K. Sakashita	A study of capturing shapes of moving object by grid-based active stereo
PhD for Information Science GRUSHNIKOV ANDREY	Automatic Image Analysis for Biomedical Research: Rapid Drug Susceptibility Testing and Investigation of Cell Specialization in Early Embryo
Master Degree for Information Science T. Isokane	Three-dimensional Plant Structure Reconstruction using Multiple-view Images
Master Degree for Information Science G. Ogi	Pedestrian Trajectory Extraction using Dynamic Programming with Geometric Constraint for Gait Recognition
Master Degree for Information Science Y. Okinaka	Gaze Estimation from a Low-resolution Surveillance Video
Master Degree for Information Science S. Sunagawa	Hoof Disease Detection by Cow Gait Video Analysis
Master Degree for Information Science S. Hanada	Micro Channel Microscopic Image Analysis for Drug Sustainability Test
Master Degree for Information Science Y. Miyazaki	Endoscopy Image Analysis using Deep Learning - Detection and Segmentation of Desease Region-
Bachelor Degree for Engineering A. Sakata	Confidential
Bachelor Degree for Engineering D. Adachi	Gait Recognition Robust against Posture Change using an Intra-subject Deformation Model
Bachelor Degree for Engineering T. Matsuura	Dimentia Elderly Data Collection with Dual-task Experience System and Its Analysis
Bachelor Degree for Engineering K. Moriwaki	Gait Recognition Considering Human Attributes

Grant-in-Aid for Scientific Research

Y. Yagi	Multi-modal gait recognitoin in the wild and its application to criminal investigation	¥0,000
Y. Yagi	Multi-modal gait recognitoin in the wild and its application to criminal investigation	¥12,220,000
Y. Makihara	Gait-based age estimation and aging process modeling	¥0,000
Y. Makihara	Gait-based age estimation and aging process modeling	¥5,330,000
D. Muramatsu	Person recognition from data pair without common region	¥1,411,000
I. Mitsugami	Motion Extraction for Gait Analysis	¥557,000
F. Okura	Gait analysis of dairy cows focusing long-term transition	¥1,950,000

Entrusted Research

Y. Yagi	NEC Corporation	Research on Video-based Gait Analysis for Person Re-idenitification	¥10,000,000
Y. Yagi	Japan Science and Technology Agency	Novel Health Indices PAMs: Health Management Just from Walking	¥5,200,000
Y. Yagi	SoftBank Corp.	Research on Gait Analysis: Current and Future Perspective	¥1,000,000
Y. Yagi	The Ministry of Education, Culture, Sports, Science and Technology	Promotion of Employment of Excellent Young Researcher	¥2,250,000
Y. Yagi	The Ministry of Education, Culture, Sports, Science and Technology	Start-up Budge for Excellent Young Researcher	¥2,500,000
Y. Makihara	Panasonic Corporation	Smart City Project	¥856,000
Y. Makihara	The Ministry of Education, Culture, Sports, Science and Technology	Program for Promoting Inetrnational Joint Research (type A), International Collaborative Research on Human Sensing	¥5,924,000
F. Okura	Japan Science and Technology Agency	Three-dimensional plant structure modeling and lifelog generation for growth analysis and prediction in future cultivation	¥6,240,000

Cooperative Research

Y. Yagi	Aida Engineering Co. Ltd.	¥1,200,000
Y. Yagi	Information Technology Research and Development Center, Mitsubishi Electric Corporation	¥20,000,000
Y. Yagi	KONICA MINOLTA, INC	¥3,600,000
Y. Yagi	Qoncept, Inc.	¥0,000
Y. Yagi	Rakuno Gakuen	¥0,000
Y. Makihara	the National Institute of Information and Communications Technology	¥0,000
F. Okura	DAIKIN INDUSTRIES, LTD.,	¥7,350,000

Department of Reasoning for Intelligence

Original Papers

[1]Identification of Individual Bacterial Cells through the Intermolecular Interactions with Peptide-Functionalized Solid-State Pores, M. Tsutsui, M. Tanaka, T. Marui, K. Yokota, T. Yoshida, A. Arima, W. Tonomura, M. Taniguch, T. Washio, M. Okochi, and T. Kawai: Analitical Chemistry, 90 (2018) 1511−1515.

[2]Local contrast as an effective means to robust clustering against varying densities, B. Chen, K. M. Ting, T. Washio and Y. Zhu: Machine Learning, 108 (1) (2018) 1-25.

[3]Discriminating single-bacterial shape using low-aspect-ratio pores, M. Tsutsui, T. Yoshida, K. Yokota, H. Yasaki, T. Yasui, A. Arima, W. Tonomura, K. Nagashima, T. Yanagida, N. Kaji, M. Taniguchi, T.Washio, Y. Baba and T. Kawai: Scientific Reports, 7 (1) (2017) 17371.

[4]Error Asymmetry in Causal and Anticausal Regression, P. Bloebaum, T. Washio and S. Shimizu: Behaviormetrika, 44 (2) (2017) 491–512.

[5]Evaluation of Solar Power Generation Output Estimation Using Covariance of Sunlight intensity and

Electric Power flow, K. Yasunami, T. Washio: Transaction on Power and Energy B, 137 (7) (2017) 488-498.

[6]Subspace dynamic mode decomposition for stochastic Koopman analysis, N. Takeishi, Y. Kawahara and T. Yairi: Physical Review E, 96 (2017) 03310.

[7]Discounted average degree density metric and new algorithms for the densest subgraph problem, H. Yanagisawa, S. Hara: Networks, 71 (1) (2018) 3-15.

International Conferences
[1]Machine Learning Independent of Population Distributions for Measurement, T. Washio, G. Imamura and G. Yoshikawa: DSAA2017: 4th IEEE International Conference on Data Science and Advanced Analytics, (2017) .

[2]Bayesian dynamic mode decomposition, N. Takeishi, Y. Kawahara, Y. Tabei and T. Yairi: Proceedings of the 26th International Joint Conference on Artificial Intelligence (IJCAI'17), (2017) 2814-2821.

[3]Sparse Nonnegative Dynamic Mode Decomposition, N. Takeishi, Y. Kawahara, and T. Yairi: Proceedings of the 2017 IEEE International Conference on Image Processing (ICIP'17), (2017) 2682-2686.

[4]Structurally regularized non-negative tensor factorization for spatio-temporal pattern discoveries, K. Takeuchi, Y. Kawahara, and T. Iwata: Proc. of the 2017 European Conf. on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD'17), (2017) 582-598.

[5]Koopman spectral kernels for comparing complex dynamics with application to multiagent in sports, K. Fujii, Y. Inaba and Y. Kawahara: Proc. of the 2017 European Conf. on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD'17), (2017) 127-139.

[6]Learning Koopman invariant subspaces for dynamic mode decomposition, N. Takeishi, Y. Kawahara and T. Yairi: Advances in Neural Information Processing Systems 30, (2017) 1130-1140.

[7]Consistent and Efficient Nonparametric Different-Feature Selection, S. Hara, T. Katsuki, H. Yanagisawa, T. Ono, R. Okamoto and S. Takeuchi: Proceedings of the 20th International Conference on Artificial Intelligence and Statistics, 54 (2017) 130-138.

[8]Approximate and Exact Enumeration of Rule Models, S. Hara, M. Ishihata: Proceedings of the 32th AAAI Conference on Artificial Intelligence, (2018) .

[9]Measurement Oriented Machine Learning for Advanced Sensing Technologies (invited), T. Washio: 4th Asia-Pacific World Congress on Computing Science 2017 (APWC on CSE 2017).

[10]Measurement-oriented Machine Learning for Advanced Sensing (invited), T. Washio: The MANA International Symposium 2018.

[11]Data-driven Modeling of Dynamical Systems (invited), Y. Kawahara: Osaka CTSR - RIKEN iTHES/iTHEMS - Kali IPMU Joint Symposium.

[12]Nonparametric Bayesian learning of Koopman spectrums in nonlinear dynamical systems (invited), Y. Kawahara: The 2017 International Symposium on Nonlinear Theory and Its Applications.

Patents
[1]K20160437 Identification Method, Classification Analysis Method, Identification Instrument, Classification Analysis Instrument and Memory Media, 2017-092075

[2]G20170116WO Identification Method, Classification Analysis Method, Identification Instrument, Classification Analysis Instrument and Memory Media, JP2018-14926

[3]K20150022 EVALUATION INFORMATION PROVIDING SYSTEM AND EVALUATION INFORMATION PROVIDING METHOD, WO2017/069115

[4]K20150023 EVALUATION INFORMATION PROVIDING SYSTEM AND EVALUATION INFORMATION PROVIDING METHOD, WO2017/069116

Contributions to International Conferences and Journals

T. WASHIO	22st ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. WASHIO	Knowledge and Information Systems (KAIS): An International Journal (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 Member)
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 23rd SIGKDD Conference on Knowledge Discovery and Data Mining (2017SIGKDD) Workshop of Causal Discovery (Program Committee)
T. WASHIO	The 21st Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2017) (Senior Program Committee)
T. WASHIO	The 4th IEEE International Conference on Data Science and Advanced Analysis (DSAA2017) (Technical Research Track 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)
T. WASHIO	The SIAM Data Mining Conference 2018 (SDM 2018) (Program Committee)
T. WASHIO	The 22nd Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2018) (Senior Program Committee)
T. WASHIO	24rd ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. WASHIO	ACM Transaction on Knowledge Discovery from Data (TKDD) (Editorial Board Member)
T. WASHIO	The 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (Program Committee)
T. WASHIO	SISAP 2018: 11th International Conference on Similarity Search and Applications (Program Committee)
T. WASHIO	The 2018 IEEE International Conference on Data Mining (ICDM) (Area Program Committee Chair)
T. WASHIO	The 2018 ACM SIGKDD Workshop on Causal Discovery (CD 2018) (Senior Program Committee)
Y. Kawahara	20th International Conference on Artificial Intelligence and Statistics (AISTATS'17) (Program Committee)
Y. Kawahara	21st Pacific Asia Conference on Knowledge Discovery and Data Mining (PAKDD'17) (Program Committee)
Y. Kawahara	26th International Joint Conference on Artificial Intelligence (IJCAI'17) (Program

	Committee)
Y. Kawahara	34th International Conference on Machine Learning(ICML'17) (Program Committee)
Y. Kawahara	21st International Conference on Artificial Intelligence and Statistics (AISTATS'18) (Program Committee)
Y. Kawahara	27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI'18) (Senior Program Committee)
Y. Kawahara	35th International Conference on Machine Learning (ICML'18) (Program Committee)
Y. Kawahara	24th SIGKDD Conference on Knowledge Discovery and Data Mining (KDD'18) (Program Committee)
Y. Kawahara	Neural Networks (Editorial Board)
S. Hara	Neural Information Processing Systems 2017 (Program Committee)
S. Hara	The 32nd AAAI Conference on Artificial Intelligence (Program Committee)
S. Hara	The 6th International Conference on Learning Representations (Program Committee)
S. Hara	SIAM International Conference on Data Mining (Program Committee)
S. Hara	The 27th International Joint Conference on Artificial Intelligence (Program Committee)
S. Hara	The 35th International Conference on Machine Learning (Program Committee)
S. Hara	The 22nd Pacific-Asia Conference on Knowledge Discovery and Data Mining (Program Committee)
S. Hara	ACM SIGKDD International Conference on Knowledge Discovery and Data (Program Committee)

Publications in Domestic Meetings

The 65th JSAP Spring Meeting	1 paper
Research Meeting, The Institute of Electrical Engineers of Japan	1 paper
Fall Meeting, The Opereation Research Society of Japan	1 paper
Fall Meeting, Japan Welding Society	1 paper
The 78th JSAP Fall Meeting	3 papers
Spring Meeting, The Institute of Electrical Engineers of Japan	1 paper
Spring Meeting, Japan Welding Society	1 paper
The 31st Annual Meeting, The Japanese Society for Artificial Intelligence	9 papers

Academic Degrees

Master Degree for Engineering K. Miyazawa	Online Prediction by Predictive-state Machine with Reproducing Kernles
Bacheler Degree for Engineering K. Ikeno	Highlighting Non-contributing Features for Explanation of DNNs
Bacheler Degree for Engineering S. Kido	Super-Resolution Microscopic Image Estimation Using Recursive BC
Bacheler Degree for Engineering M. Hiraoka	Statistical Evaluation in Mode Selection for Sparse Dynamic Mode Decomposition

Grant-in-Aid for Scientific Research

T. Washio	Study on Principles and Methods for Large Scale Causal Inference Based on Nonlinearity	¥1,690,000
Y. Kawahara	The development of meta learning algorithms for structured sparse modeling	¥2,470,000
Y. Kawahara	The development of machine learning algorithms based on discrete convex analysis	¥3,120,000

Entrusted Research

T. Washio	Japan Science and	Extraction of Information	¥13,130,000

	Technology Agency	Characterizing Cell Physiology from Super-High-Resolution Image time Series	
T. Washio	National Cerebral and Cardiovascular Center Hospital	Analysis of Hart Failure Case Big Data Using a Data Mining Method LAMP	¥1,000,000
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	¥22,620,000

Contribution to Research

Y. Kawahara	Fujitsu Laboratories Ltd.	¥500,000

Cooperative Research

T. Washio	Kobe Steel, Ltd	¥1,080,000
T. Washio	National Institue 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	Mizuno Corporation	¥0,000
Y. Kawahara	JFE Steel Corporation	¥2,400,000
Y. Kawahara	University of Tsukuba, Roland Corporation	¥110,000
Y. Kawahara	NTT Communication Science Laboratories	¥0,000
S. Hara	NEC Corporation	¥540,000
S. Hara	Financial Engineering Group, Inc.	¥778,000

Department of Knowledge Systems

Original Papers

[1]Disease Compass -A Navigation System for Disease Knowledge based on Ontology and Linked Data Techniques, Kouji Kozaki, Yuki Yamagata, Riichiro Mizoguchi, Takeshi Imai, Kazuhiko Ohe: Journal of Biomed Sem, 8 (1) (2017) .

[2]A Semi-Automatic Framework to Identify Abnormal States in EHR Narratives, Xiaojun Ma, Takeshi Imai, Emiko Y. Shinohara, Ryota Sakurai, Kouji Kozaki, Kazuhiko Ohe: Stud Health Technol Inform, 245 (2017) 910-914.

[3]Acoustic Model Training based on Node-wise Weight Boundary Model for Fast and Small-footprint Deep Neural Networks, Ryu Takeda, Kazuhiro Nakadai and Kazunori Komatani: Computer Speech & Language, 46 (2017) 461-480.

[4]User-Adaptive A Posteriori Restoration for Incorrectly Segmented Utterances in Spoken Dialogue Systems, Kazunori Komatani, Naoki Hotta, Satoshi Sato, Mikio Nakano: Dialogue and Discourse, 8 (2) (2017) 206-224.

[5]Collection of GPS Trajectory and Transformation of them to LOD using Open Data - Through an Experiment in ISWC2016-, Kouji Kozaki, Teruaki Yokoyama, Fukami Yoshiaki: Journal of Digital Practices, 9 (1) (2018) 138-163.

[6]K-best Iterative Viterbi Parsing, Katsuhiko Hayashi, Masaaki Nagata: IPSJ Journal, 59 (1) (2018) 227-235.

[7]Proposal of Implicit Confirmation toward Lexical Acquisition during Dialogues, Kohei Ono, Ryu Takeda, Eric Nichols, Mikio Nakano, Kazunori Komatani: Transactions of the Japanese Society for Artificial Intelligence, 33 (1) (2018) DSH-E_1-10.

[8]An Ontology Quality Refinement System based on Comparison of Comprihensive Hierarchies following each Property, Takeshi Masuda, Kouji Kozaki, Kazunori Komatani: Transactions of the Japanese Society for Artificial Intelligence, 33 (2) (2018) B-H82_1-10.

International Conferences

[1]K-best Iterative Viterbi Parsing, Katsuhiko Hayashi, Masaaki Nagata: Proceedings of the 15th Conference of the European Chapter of the Association for Computational Linguistics, 2 (2017) 3-7.

[2]Breaking Down Silos: Involving Various Researchers for Driving HCI Research, Arisa Ema, Hirotaka Osawa, Hiromitsu Hattori, Naonori Akiya, Nobutsugu Kanzaki, Ryutaro Ichise, Minao Kukita, Takushi Otani, Akinori Kubo, Kazunori Komatani, Reina Saijo, Mikihito Tanaka, Koziro Honda, Naoki Miyano, Yoshimi Yashiro, Go Yoshizawa: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, (2017) 837-847.

[3]Construction of Linked Urban Problem Data with Causal Relations using Crowdsourcing, Shusaku Egami, Takahiro Kawamura, Kouji Kozaki, Akihiko Ohsuga: The 6th International Congress on Advanced Applied Informatics, (2017) 814-819.

[4]On the Equivalence of Holographic and Complex Embeddings for Link Prediction, Katsuhiko Hayashi, Masashi Shimbo: Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics, (2017) 554-559.

[5]Lexical Acquisition through Implicit Confirmations over Multiple Dialogues, Kohei Ono, Ryu Takeda, Eric Nichols, Mikio Nakano and Kazunori Komatani: Proceedings of the 18th Annual SIGdial Meeting on Discourse and Dialogue, (2017) 50-59.

[6]Node pruning based on Entropy of Weights and Node Activity for Smal-footprint Acoustic Model based on Deep Neural Networks, Ryu Takeda, Kazuhiro Nakadai, Kazunori Komatani: Interspeech-2017, (2017) 1636-1640.

[7]Efficient construction of a new ontology for life sciences by subclassifying related terms in the Japan Science and Technology Agency thesaurus, Tatsuya Kushida, Kouji Kozaki, Yuka Tateisi, Katsutaro Watanabe, Takeshi Masuda, Katsuji Matsumura, Takahiro Kawamura, Toshihisa Takagi: The 8th International Conference on Biomedical Ontology, (2017) .

[8]Hierarchical Word Structure-based Parsing: A Feasibility Study on UD-style Dependency Parsing in Japanese, Takaaki Tanaka, Katsuhiko Hayashi, Masaaki Nagata: Proceedings of the 15th International Conference on Parsing Technologies, (2017) 56-60.

[9]GPS Trajectory Linked Open Data based on Open POI Information -Through an Experiment in ISWC2016-, Kouji Kozaki, Teruaki Yokoyama, Yoshiaki Fukami: Proceedings of the ISWC 2017 Posters & Demonstrations and Industry Tracks co-located with 16th International Semantic Web Conference (ISWC 2017), (2017) .

[10]Linked Urban Open Data Including Social Problems' Causality and Their Costs, Shusaku Egami, Takahiro Kawamura, Kouji Kozaki, Akihiko Ohsuga: Proceedings of the 7th Joint International Semantic Technology Conference, (2017) 334-349.

[11]Semantic Graph Analysis for Federated LOD Surfing in Life Sciences, Atsuko Yamaguchi, Kouji Kozaki, Yasunori Yamamoto, Hiroshi Masuya, Norio Kobayashi: Proceedings of the 7th Joint International Semantic Technology Conference, (2017) 268-276.

[12]Refined JST Thesaurus Extended with Data from Other Open Life Science Data Sources, Tatsuya Kushida, Yuka Tateisi, Takeshi Masuda, Katsutaro Watanabe, Katsuji Matsumura, Takahiro Kawamura,

Kouji Kozaki, Toshihisa Takagi: Proceedings of the 7th Joint International Semantic Technology Conference, (2017) 35-48.

[13]Supervised Attention for Sequence-to-Sequence Constituency Parsing, Hidetaka Kamigaito, Katsuhiko Hayashi, Tsutomu Hirao, Masaaki Nagata, Hiroya Takamura, Manabu Okumura: Proceedings of the 8th International Joint Conference on Natural Language Processing, (2017) 7-12.

[14]Unsupervised Segmentation of Phoneme Sequences based on Pitman-Yor Semi-Markov Model using Phoneme Length Context, Ryu Takeda, Kazunori Komatani: Proceedings of the 8th International Joint Conference on Natural Language Processing, (2017) 243-252.

[15]Extending A Bioscience Ontology Based on Comparison between Sibling Concepts, Takeshi Masuda, Kouji Kozaki, Tatsuya Kushida, Yuka Tateisi, Katsutaro Watanabe, Katsuji Matsumura, Takahiro Kawamura, Kazunori Komatani: The 8th International Conference on Internet Technologies & Society, (2017) .

[16]Urban Problem LOD for Understanding the Problem Structure and Detecting Vicious Cycles, Shusaku Egami, Takahiro Kawamura, Kouji Kozaki and Akihiko Ohsuga: The 12th IEEE International Conference on Semantic Computing, (2018) .

[17]LOD Surfer API: Web API for LOD Surfing Using Class-Class Relationships in Life Sciences, Atsuko Yamaguchi, Kouji Kozaki, Yasunori Yamamoto, Hiroshi Masuya, Norio Kobayashi: Proceedings of the 10th International Conference on Semantic Web Applications and Tools for Health Care and Life Sciences (SWAT4LS 2017), (2017) .

[18]Data-dependent Learning of Symmetric/Antisymmetric Relations for Knowledge Base Completion, Hitoshi Manabe, Katsuhiko Hayashi, Masashi Shimbo: Proceedings of the 32nd AAAI Conference on Artificial Intelligence, (2018) 8.

Review Papers

“Linkages” between Usages of LOD through Community Activities -Thorough LOD Hackathon Kansai as an Example-, K. Kozaki, The Journal of Information Science and Technology Association, Information Science and Technology Association, Japan, 67[12] (2017), 633-638.

Contributions to International Conferences and Journals

K.Komatani	ACL 2017 (Reviewer)
K.Komatani	Interspeech2017 (Scientific Review Committee)
K.Komatani	EMNLP 2017 (Programme Committee)
K.Komatani	SIGDIAL 2017 (Programme Committee)
K.Komatani	IJCNLP 2017 (Programme Committee)
K.Komatani	IUI 2018 (regular program committee)
K.Komatani	ASRU 2017 (Reviewer)
K.Komatani	DSTC6 (Programme Committee)
K.Komatani	NIPS2017 Workshop on Conversational AI (Reviewer)
K.Kozaki	JIST2017 (Programme Committee)
K.Kozaki	KEOD2017 (Programme Committee)
K. Hayashi	ACL 2017 (Reviewer)
K. Hayashi	EMNLP 2017 (Reviewer)
K. Hayashi	IJCNLP 2017 (Reviewer)

Publications in Domestic Meetings

The 24th Annual Meeting of the Association for Natural Language Processing	5 papers
The 31st Annual Conference of the Japanese Society for Artificial Intelligence, 2017	6 papers
The 16th Forum on Information Technology	1 paper
The 45th Intelligent System Symposium	1 paper

The 43th Meeting of the SIG on Semantic Web and Ontology	2 papers
The 44th Meeting of the SIG on Semantic Web and Ontology	2 papers

Academic Degrees

Master of Engineering K. Ono	Classifying category estimation results for acquiring unknown terms through implicit confirmation and its implementation
Master of Engineering K. Yamabe	Feature design to estimate timing when drivers need navigation
Bachelor of Engineering G. Akai	Estimating response timing using dialogue situations for spoken dialogue systems
Bachelor of Engineering H. Nishimoto	Estimating user's interest levels using multimodal information in dialogues
Bachelor of Engineering Y. Fujioka	Expanding knowledge graph towards dialogue systems replying to unknown queries and its evaluation
Bachelor of Engineering Y. Yamamoto	Polarity Estimation of Words using Linked Open Data and Cooccurrence

Grant-in-Aid for Scientific Research

K. Komatani	Acquiring Domain Knowledge through Dialogues for Dialogue Systems	¥5,330,000
K. Kozaki	An Ontology Framework for Hatmonizing Knowledge Intgration thourgh Domains with Semantic Processing for Deep Knowledge Creation	¥3,055,000
K. Kozaki	A Cross Sectional Analysis Platform for Local Problems based on Integration of Public Information, Open Data and Social Information	¥975,000

Entrusted Research

K. Komatani	DAIKIN INDUSTRIES,LTD	User experience research through anthropomorphism with language	¥1,180,000

Cooperative Research

K. Komatani	Honda Research Institute Japan Co., Ltd.	¥3,600,000
K. Komatani	Honda Research Institute Japan Co., Ltd.	¥600,000
K. Komatani	Honda Research Institute USA, Inc.	¥2,008,000

Department of Architecture for Intelligence

Original Papers

[1]Statistical Sleep Pattern Modelling for Sleep Quality Assessment based on Sound Events, H. Wu, T. Kato, M. Numao and K. Fukui: Health Information Science and Systems, 5 (11) (2017) .

[2]Personal Sleep Pattern Visualization using Sequence-based Kernel Self-Organizing Map on Sound Data, H. Wu, T. Kato, T. Yamada, M. Numao and K. Fukui: Artificial Intelligence in Medicine, 80 (2017) 1-10.

International Conferences

[1]Reinforcement Learning based Distance Metric Filtering Approach in Clustering, B. Ali, K. Fukui, W. Kalintha, K. Moriyama and M. Numao: Proc. 2017 IEEE Symposium Series on Computational Intelligence (SSCI 2017), (2017) 1328-1335.

[2]Concept Drift Detection for Graph-Structured Classifiers under Scarcity of True Labels, N. Sriwatanasakdi, M. Numao, and K. Fukui: Proc. IEEE 29th International Conference on Tools with Artificial Intelligence (ICTAI 2017), (2017) 461-468.

[3]ART-2b: Adapted ART-2a for large scale data clustering on PM2.5 mass spectra, N. Pavasant, H. Furutani, M. Numao and K. Fukui: Proc. 2017 IEEE International Conference on Big Data (IEEE BigData), (2017) 4813-4815.

[4]Explainable Cross-domain Recommendations Through Relational Learning, S. Sopchoke, K. Fukui and M. Numao: Proc. The Thirty-Second AAAI Conference on Artificial Intelligence (AAAI-18), Student Abstract and Poster Program, (2018) .

[5]A System for Composing Music in Collaboration with Musicians, N. Otani, D. Okabe, and M. Numao: Proc. The 5th AAAI Conference on Human Computation and Crowdsourcing (HCOMP 2017), (2017) .

[6]Bisociative Serendipity Music Recommendation (oral), S. Sopchoke, K. Fukui and M. Numao: Workshop on Computation: Theory and Practice (WCTP-2017), Osaka, Japan, Sep. 12-13, 2017.

[7]Multimodal Stability-Sensitive Emotion Recognition based on Brainwave and Physiological Signals (oral), N. Thammasan, J. L. Hagad, K. Fukui and M. Numao: The 5th International Workshop on Context Based Affect Recognition (CBAR2017), Texas, USA, Oct. 23, 2017.

[8]Machine Learning for Distance Metric Learning Systems Improvement (poster), B. Ali, K. Fukui, K. Moriya, W. Kalinta and M. Numao: 21th SANKEN International The 16 SANKEN Nanotechnology Symposium, Osaka, Japan, Jan. 16-17, 2018.

Review Papers

Artificial Intelligence for Sleep Quality Estimation from Sounds, K. Fukui, NIKKEI BigData, Nikkei Business Publications, Inc., 44 (2017), 18.

Proposition of Kernelized Evolutionary Distance Metric Learning for Semi-supervised Clustering, K. Wasin, S. Ono, M. Numao, K. Fukui, Journal of the Japanese Society for Artificial Intelligence, Ohmusha, 33[1] (2018), 60-61.

Patents

[1]K20170050 Sleep Quality Classification System, Sleep Quality Model Creation Program, and Sleep Quality Classification Program, JP2017-158957

[2]K20170100 Supervised Information Creation Method, Machine Learning Method, Supervised Information Creation System and Program, JP2017-162548

[3]K20170297 Defect Detection System, Defect Model Creation Program, and Defect Detection Program, JP2018-036642

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-2017) (Program Committee Member)
K. FUKUI	Workshop on Mathematical Modeling and Problem Solving (PDPTA'17) (Program Committee Member)
K. FUKUI	International Conference on Business Management of Technology (BMOT2017) (Program Committee Member)

K. FUKUI	IEEE International Conference on Systems, Man, and Cybernetics (SMC2017) (Program Committee Member)

Publications in Domestic Meetings

Annual Meeting on Japanese Society for Artificial Intellingece	6 papers
Meeting on Artificial Intelligence and Knowledge Processing, The Institute of Electronics, Information and Communication Engineers	1 paper
Meeting on Kyushu Chapter, Japan Society for Fuzzy Theory and Intelligent Informatics	1 paper
Meeting on Photonics Division, The Japan Society of Applied Physics	1 paper
Fall Meeting on The Meteorological Society of Japan	1 paper
Evolutinary Computation Symposium	1 paper
SIG Mathmatical Modeling and Problem Solving, The Information Processing Society of Japan	1 paper
Intelligent System Symposium, The Society of Instrument and Control Engineers	1 paper
Meeting on The Japanese Society for Evolutinary Computation	1 paper

Academic Degrees

Master Degree for Information Science B. Ali	Reinforcement Learning based Distance Metric Filtering Approach in Clustering
Master Degree for Information Science N. Sriwatanasakdi	Classification in Evolving Data Streams with Concept Drift Detection
Master Degree for Information Science K. Satoh	Extracting Cluster Sequence Pattern with Multiple Correspondence
Doctor Degree for Information Science N. Thammasan	Practical Emotion Recognition using Wearable Brain and Physiological Sensors
Doctor Degree for Information Science H. Wu	Learning Sleep Pattern based on Audio Data

Grant-in-Aid for Scientific Research

K. Fukui	Causality Mining from Event Sequence Data and Its Applications to Causality Discovery in Earthquakes and Damages	¥1,987,000

Entrusted Research

M. Numao	DAIKIN Industries, ltd.	Influence Evaluation of Environmental Factor for Learning Efficiency and Estimation of Learning Efficiency Index Using Multiple Sensors	¥12,213,000

Cooperative Research

M. Numao	AOI Pro. Inc.	¥3,000,000
M. Numao	office FUKUROU and Tokyou City University	¥0,000
K. Fukui	Panasonic	¥4,410,000
K. Fukui	NTN Corporation	¥525,000

Department of Functionalized Natural Materials

Original Papers

[1]Renewable wood pulp paper reactor with hierarchical micro/nanopores for continuous-flow nanocatalysis, H. Koga, N. Namba, T. Takahashi, M. Nogi, Y. Nishina: ChemSusChem, 10 (12) (2017) 2650-2565.

[2]Electrochemical behavior of Zn-xSn high-temperature solder alloys in 0.5M NaCl solution, Z. Wang, C. Chen, J. Jiu, S. Nagao, M. Nogi, H. Koga, H. Zhang, G. Zhang, K. Suganuma: Journal of Alloys and

Compounds, 716 (5) (2017) 231-239.

[3]Ionic liquid-mediated dispersion and support of functional molecules on cellulose fibers for stimuli-responsive chromic paper devices, H. Koga, M. Nogi, A. Isogai: ACS Applied Materials & Interfaces, 9 (46) (2017) 40914-40920.

[4]Clearly transparent nanopaper from highly concentrated cellulose nanofiber dispersion using dilution and sonication, T. Kasuga, N. Isobe, H. Yagyu, H. Koga, M. Nogi: Nanomaterials, 8 (2) (2018) 104.

[5]Deposition of amorphous carbon nitride films on flexible substrates by reactive sputtering for applications in light-driven active devices, M. Aono, T. Harata, T. Odawara, S. Asai, D. Orihara, M. Nogi: Japanese Journal of Applied Physics, 57 (2017) 01AC01.

[6]Clear transparent cellulose nanopaper prepared from a concentrated dispersion by high-humidity drying, N. Isobe, T. Kasuga, M. Nogi: RSC Advances, 8 (4) (2018) 1833-1837.

International Conferences
[1]Nanocellulose Based Flexible, Environment-friendly Nonvolatile Resistive Switching Memory (invited), K. Nagashima, H. Koga, U. Celano, M. Nogi, T. Kitaoka, T. Yanagida: 9th World Congress on Materials Science and Engineering (Materials Congress 2017).

[2]Applications and Developments of Cellulose Nanofiber Materials for Flexible Electronics (invited), M. Nogi: Symposium of SAKURA Science Plan.

[3]Fabrication technique for clearly transparent nanopaper from highly concentrated cellulose nanofiber dispersion (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: 255th ACS National Meeting.

[4]Paper reactor with a cellulose fiber micro/nanoarchitecture for continuous-flow nanocatalysis (poster), H. Koga, Y. Izumi, M. Nogi, Y. Nishina: The 4th International Cellulose Conference (ICC 2017).

[5]The effect of concentration of cellulose nanofiber dispersions on the haze of transparent nanopaper (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: The 4th International Cellulose Conference (ICC 2017).

[6]Two-step fabrication technique for transparent and thermostable nanopaper from highly concentrated cellulose nanofiber dispersion (oral), T. Kasuga, N. Isobe, H. Koga, M. Nogi: A3 Foresight 1st Symposium.

[7]Transparent and thermostable nanopaper from highly concentrated cellulose nanofiber dispersion for foldable transparent conductive films (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: The 21st SANKEN International The 16th SANKEN Nanotechnology Symposium.

[8]Design of hierarchical micro-meso-macro porous structures in a cellulose nanofiber paper for electrode applications (poster), D. Fukushima, H. Koga, M. Nogi: The 21st SANKEN International The 16th SANKEN Nanotechnology Symposium.

Books
[1]Acetylation of transparent nanopaper for improvement of durability against heat and humidity M. Nogi, “Recent development of materials and processes for printed electronics”, Technical Information Institute Co., Ltd. , (Chapter 5・Section 4) 2017.

Patents
[1]G20170079WO Preparation and applications of cell culture substrate, PCT/JP2017/037424

[2]K20110427 Photo-irradiation device and photo-irradiation method, 2012-101052

[3]K20120401 Insulating material, passive element, circuit board, and method of manufacturing an insulating sheet, 2013-145390

[4]K110420B1 Metal nanowire transparent conductive film and its ink, 2016-164659

[5]K20130094 Composition for forming metal pattern and method for forming metal pattern, 2013-144585

[6]G20130122US Insulating material, passive element, circuit board, and method of manufacturing an insulating sheet, 14/311546

[7]G20120091EP Method for manufacturing transparent conductive pattern, 13757358

Publications in Domestic Meetings

84th Pulp and Paper Research Conference	1 paper
The 36th Electronic Materials Symposium	1 paper
2018 Spring Annual Meeting of the Japan Institute of Metals and Materials	1 paper
The 65th JSAP Spring Meeting 2018	1 paper

Grant-in-Aid for Scientific Research

M. Nogi	Flexible non-volatile memory prepared by using cellulose nanopaper	¥15,340,000

Entrusted Research

M. Nogi	NEDO	Characterization of cellulose nanofiber materials for effective utilization of wood biomass	¥15,000,000
M. Nogi	JST	Preparation and evaluation of chemically-functionalized nanofiber films	¥3,900,000

Cooperative Research

M. Nogi	UEMATSU CO., LTD.	¥800,000

Department of Semiconductor Materials and Processes

Original Papers

[1]Surface nanocrystalline Si structure for highly efficient crystalline Si solar cells, K. Imamura, D. Irishika, H. Kobayashi: Prog. Photovolt., 25 (2017) 176-1-9.

[2]Fabrication mechanism of atomically flat n-type 4H-SiC (000-1) surfaces by electrochemical method, T. Akai, K. Imamura, H. Kobayashi: ECS J. Solid State Sci. and Technol., 6 (2017) 265-269.

[3]Hydrogen generation by reaction of Si nanopowder with neutral water, Y. Kobayashi, S. Matsuda, K. Imamura, H. Kobayashi: J. Nanopart. Res., 19 (2017) 176-1-9.

[4]Fabrication of Si nanopowder from Si swarf and application to high-capacity and low cost Li-ion batteries, T. Matsumoto, K. Kimura, H. Nishihara, T. Kasukabe, T. Kyotani, H. Kobayashi: J. Alloys Compd., 720 (2017) 529-540.

[5]Imidazoles-intercalated α-zirconium phosphate as latent thermal initiators in the reaction of glycidyl phenyl ether (GPE) and hexahydro-4-methylphthalic anhydride (MHHPA), O. Shimomura, K. Tokizane, T. Nishisako, S. Yamaguchi, J. Ichihara, M. Kirino, A. Ohtaka, R. Nomura: Catalysts, 7 (2017) 172-1-11.

[6]Improvement of conversion efficiency of silicon solar cells by submicron-textured rear reflector obtained by metal-assisted chemical etching, D. Irishika, Y. Onitsuka, K. Imamura, H. Kobayashi: Solar RRL, 1 (2017) 1700061-1-4.

[7]How to make a simple scientific tool for high school education to clarify the flow-direction of the

cationic ray and its characteristic in vacuum, M. Nishiyama, M. Ishizuka, F. Kaneko, T.: Journal of Science Education in Japan, 40 (2) (2017) 241-251.

[8]Photoluminescence from vibrational excited-states for organic molecules adsorbed on Si nanoparticles, M. Maeda, T. Matsumoto, H. Kobayashi: Phys. Chem. Chem. Phys., 19 (2017) 21856-21861.

[9]Mechanism of low temperature oxidation of 4H-SiC by nitric acid vapor oxidation method at 600°C, T. Matsumoto, H.-S. Joe, H. Kobayashi: ECS J. Solid State Sci. and Technol., 6 (2017) P578-P581.

[10]Reaction of Si nanopowder with water investigated by FT-IR and XPS, K. Imamura, Y. Kobayashi, S. Matsuda, T. Akai, H. Kobayashi: AIP Adv., 7 (2017) 085310-1-10.

[11]Analysis of photoluminescence in the ncSi-DMA system, S. Jurecka, K. Imamura, T. Matsumoto, H. Kobayashi: Commun., 3 (2017) 21-25.

[12]Fabrication of Si nanopowder and application to hydrogen generation and photoluminescent material, Y. Kobayashi, K. Imamura, T. Matsumoto, H. Kobayashi: J. Elect. Eng., 68 (7) (2017) 17-23.

[13]High conversion e cy of crystalline Si solar cells using black−Si fabricated by SSCT method, K. Imamura, Y. Onitsuka, Y. Sakae, H. Kobayashi: J. Elect. Eng., 68 (7) (2017) 37-42.

[14]Investigation of deep defects in nanocrystalline-Si/Si interfaces using acoustic spectroscopy, P. Bury, S. Hardon, H. Kobayashi, K. Imamura: J. Elect. Eng., 68 (7) (2017) 43-47.

[15]Properties of nanocrystalline Si layers embedded in structure of solar cell, S. Jurecka, K. Imamura, T. Matsumoto, H. Kobayashi: J. Elect. Eng., 68 (7) (2017) 48-52.

[16]About complex refractive index of black Si, E. Pincik, R. Brunner, H. Kobayashi, M. Mikula: J. Elect. Eng., 68 (7) (2017) 81-83.

[17]Regarding the optical properties of porous layers prepared on Si substrates, E. Pincik, R. Brunner, H. Kobayashi, P. Vojtek, Z. Zabudla, M. Mikula, J. Gregus and M. Kucera: J. Energy Power Eng., 11 (2017) 687-692.

International Conferences

[1]Hydrogen generation by the reaction of Si nanopowder with water (oral), H. Kobayashi: 13th International Conference of Computational Methods in Sciences and Engineering (ICCMSE 2017).

[2]Fabrication and application of Si nanocrystals and nanopowder for energy devices (invited), H. Kobayashi: EMN Meeting on Surface and interface.

[3]Si nanopowder for internal hydrogen generation materials (invited), H. Kobayashi: 9th World Congress on Materials Science and Engineering.

[4]Highly efficient black Si solar cells fabricated by use of surface structure chemical transfer method (invited), H. Kobayashi: Collaborative Conference on Materials Research (CCMR 2017), International Convention Center (ICC).

[5]High capacity anode with Si nanopwder fabricated from swarf for lithium ion battery (invited), T. Matsumoto, K. Kimura, H. Kobayashi: High capacity anode with Si nanopwder fabricated from swarf for lithium ion battery.

[6]Achievement of 20% conversion efficiency from simple structure crystalline Si solar cells fabricated by use of surface structure chemical transfer method (invited), H. Kobayashi: Taiwan Vacuum Society

2017 (TVS-2017).

[7]Nitric Acid Oxide for Gate Oxide in Thin-Film Transistors and Passivation for Si Solar Cells, and Application of Si Swarf (invited), T. Matsumoto, H. Kobayashi: 7th Annual World Congress of Nano Science and Technology 2017.

[8]Si nanopowder for internal hydrogen generation materials (invited), Y. Kobayashi, H. Kobayashi: The Sixth International Multi-Conference on Engineering and Technology Innovation 2017 (IMETI2017).

[9]Effect of nanostructure for <nanocrystalline Si layer/crystalline Si> solar cells fabricated with surface structure chemical transfer method (poster), T. Sakae, C. Kurosaki, K. Imamura, H. Kobayashi: The Sixth International Multi-Conference on Engineering and Technology Innovation 2017 (IMETI2017).

[10]Surface characteristics of Si nanopowder and its application (invited), H. Kobayashi: Progress in Applied Surface, Interface and Thin Film Science 2017 (SURFINT-SREN V).

[11]High conversion efficiency black Si solar cells formed by use of surface structure chemical transfer (SSCT) method (invited), K. Imamura, H. Kobayashi: Progress in Applied Surface, Interface and Thin Film Science 2017 (SURFINT-SREN V).

[12]Hydrogen generation by reaction of Si nanopowder with neutral water and medical application (invited), Y. Kobayashi, H. Kobayashi: Progress in Applied Surface, Interface and Thin Film Science 2017 (SURFINT-SREN V).

[13]Carrier separation enhancement by graded band-gap structure of nanocrystalline Si layer formed by SSCT method (poster), Y. Onitsuka, K. Imaura, H. Kobayashi: Progress in Applied Surface, Interface and Thin Film Science 2017 (SURFINT-SREN V).

[14]Si Nanopowder for hydrogen generation by reacting with neutral water (poster), Y. Kobayashi, S. Fujie, H. Kobayashi: The 21st SANKEN International Symposium, The 16th SANKEN Nanotechnology International Symposium, The 5th KANSAI Nanoscience and Nanotechnology International Symposium, The 13th Handai Nanoscience and Nanotechnology International Symposium.

[15]Effect of nanocrystalline Si layer of <nanocrystalline Si layer/p-Si> structure on solar cell characteristics (poster), Y. Sakae, C. Kurosaki, K. Imamura, H. Kobayashi: The 21st SANKEN International Symposium, The 16th SANKEN Nanotechnology International Symposium, The 5th KANSAI Nanoscience and Nanotechnology International Symposium, The 13th Handai Nanoscience and Nanotechnology International Symposium.

[16]Surface treatment to fabricate low reflectance and high carrier lifetime multicrystalline wafers produced with fixed abrasive sawing", The 21st SANKEN International Symposium (poster), S. Kunieda, K. Imamura, H. Kobayashi: The 21st SANKEN International Symposium, The 16th SANKEN Nanotechnology International Symposium, The 5th KANSAI Nanoscience and Nanotechnology International Symposium, The 13th Handai Nanoscience and Nanotechnology International Symposium.

[17]Improvement of blue response for nanocrystalline Si layer/crystalline Si solar cells due to graded band structure (poster), Y. Onitsuka, K. Imamura, H. Kobayashi: The 21st SANKEN International Symposium, The 16th SANKEN Nanotechnology International Symposium, The 5th KANSAI Nanoscience and Nanotechnology International Symposium, The 13th Handai Nanoscience and Nanotechnology International Symposium.

[18]High capacity anode with Si nanopowder fabricated from Si swarf in Li ion batteries (poster), J. Choi, K. Kimura, T. Matsumoto, H. Kobayashi: The 21st SANKEN International Symposium, The 16th SANKEN Nanotechnology International Symposium, The 5th KANSAI Nanoscience and

Nanotechnology International Symposium, The 13th Handai Nanoscience and Nanotechnology International Symposium.

[19]Effective phosphosilicate glass passivation for high conversion efficiency black Si solar cells with nanocrystalline Si layer (invited), K. Imamura, H. Kobayashi: Energy Materials and Nanotechnology Meeting on Photovoltaics.

[20]シリコンナノクリスタル層形成によるブラックシリコン太陽電池の短低波長感度向上 (invited), K.Imamura, H.Kobayashi: Japanese session of 4th Annual World Congress of Smart Materials-2018 (WCSM-2018).

[21]Nanostructured Si layer and its effective passivation for high efficiency black Si solar cells (invited), K. Imamura, H. Kobayashi: BIT's 4th Annual Congress of Smart Materials-2018 (WCSM-2018).

[22]シリコン切粉を用いたリチウムイオン電池負極の創製と反応メカニズムの解明 (invited), 松本健俊, 喜村勝矢, 小林光: Japanese session of 4th Annual World Congress of Smart Materials-2018 (WCSM-2018).

[23]High capacity anode of C-Si swarf composite materials for Li ion batteries (invited), T. Matsumoto, H. Kobayashi: BIT's 4th Annual Congress of Smart Materials-2018 (WCSM-2018).

[24]Hydrogen generation from Si nanopowder and its application for medicine (invited), Y. Kobayashi, H. Kobayashi: 14th International Conference of Computational Methods in Science and Engineering (ICCMSE-2018).

[25]S. Kunieda, K. Imamura, H. Kobayashi (poster), Surface Structure Chemical Transfer (SSCT) Method for Fabrication of Low Reflectance and High Carrier Lifetime Textured Multi-Crystalline Silicon: 14th International Conference of Computational Methods in Science and Engineering (ICCMSE-2018).

Review Papers
Fabrication of Si nanopowder from Si swarf and application to anode material in Li ion battery, T. Matsumoto, Automotive technology, Technical Information Institute, 5 (2017), 46-51.

Books
[1]Chapter 7 Development of Si anode materials and supression of cyclability degradation(Technical Information Institute) T. Matsumoto, H. Kobayashi, "Development of electrode materials for secondary batteries in the next generation and technology for high power and stability", Technical Information Institute, (284-294) 2017.

[2]Chapter 3 Development of anodes, 2. Development of Si/C nano-composite electrode materials(T. Sakai) T. matsumoto, "Material development of innovative secondary batteries for post lithium-ion batteries", NTS, (125-132) 2018.

Patents
[1]K20170060 Drug and its preparation, JP2017-145030

[2]KB2016004 Fabrication method of metal silver film, JP2016-092104

[3]G20140061US Fabrication method of epoxy compounds with solid catalysts, US15/038107

[4]K20110051 Method of producing semiconductor manufacturing apparatuses, producing appraruses of semiconductor manufacturing apparatuses, semiconductor manufacturing apparatuses, and materials for surface structure transfer., JP6120172

[5]K20140260 Method of producing Si small powder, and/or its aggregates and materials for hydrogen generation for human bodies and its generation methods, and hydrogen water, its generation methods and generation apparatuses., JP2017-100919

[6]K20160110 Si nanopowder and/or its aggretaes and hydrogen generation materials for human bodied and hydrogen-rich water and its production methods and equipments, JP2017-104848

[7]K20080345 Manufacturing equipment of solar cells, JP6162188

[8]K20160110 Hydrogen-rich water, its generation methods and equipments to generate hydrogen-rich water, and hydrogen generation materials for human bodies, PCT/JP2017/025570

[9]K20170022 Hydrogen generation materials and its generation methods, and hyrogen supply methods., PCT/JP2017/027173

[10]K20100210 Formulation and its generation methods, and supply methods, PCT/JP2017/027174

[11]K20150198 Soild preparation, method of solid preparation, and method of hydrogen generation., WO2017/130709

[12]K20170274 Si solar cell substrates, fabrication methods of substrates of solar cells and solar cells, JP2018-15798

Contributions to International Conferences and Journals

H. Kobayashi	Progress in Applied Surface, Interface and Thin Film Science 2017 (SURFINT-SREN V) (Science Committee Chairman)

Publications in Domestic Meetings

Japan Physics Meeting	7 papers

Academic Degrees

Master of Science T. Ichikawa	Reduction of interface state density for thermal SiO_2/Si substrate and its mechanism
Master of Science T. Osato	Wrapping Si nanopowder with graphite sheets and improvement of cell performance of Li ion battery with Si anode
Master of Science Y. Sakae	Band structure of Si nanocrystal layer formed by the surface structure chemical transfer (SSCT) method and its effect on solar cell characteristics

Grant-in-Aid for Scientific Research

H. Kobayashi	Characterization of Si surface with ultra-low reflectivity by use of the surface structure chmical transfer method	¥8,580,000

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	¥58,486,000

Contribution to Research

T. Matsumoto	Hitachi Metals · Materials Science Foundation	¥800,000
T. Matsumoto	J FE 21st Century Foundation	¥2,000,000
T. Matsumoto	The Sumitomo Foundation	¥4,200,000

Cooperative Research

H. Kobayashi	Nisshin Kasei co., ltd.	¥0,000

Department of Advanced Hard Materials

Original Papers

[1]Insignificant elastic-modulus mismatch and stress partitioning in two-phase Mg–Zn–Y alloys comprised of α-Mg and long-period stacking ordered phases, M. Tane, S. Suzuki, M. Yamasaki, Y. Kawamura, K. Hagihara, H. Kimizuka: Mater. Sci. Eng. A, 710 (2018) 227-239.

[2]Formation of metastable phases in Zr-ion irradiated Al_2O_3 upon thermal annealing, N. Oka, M. Ishimaru, M. Tane, Y. Sina, C. McHargue, K. Sickafus, E. Alves: Microscopy, 66 (2017) 388-396.

[3]Homogeneously bulk porous calcium hexaaluminate (CaAl12O19): Reactive sintering and microstructure development, Kanako Kawaguchi, Yoshikazu Suzuki, Tomoyo Goto, Sung Hun Cho, Tohru Sekino: Ceramics International, 44 (2018) 4462-4466.

[4]Low-temperature hydrothermal synthesis and characterization of SrTiO3 photocatalysts for NOx degradation, Mariko Kobayashi, Yoshikazu Suzuki, Tomoyo Goto, Sung Hun Cho, Tohru Sekino, Yusuke Asakura, Shu Yin: Journal of the Ceramic Society of Japan, 126 (2018) 135-138.

[5]Effect of ultraviolet treatment on bacterial attachment and osteogenic activity to alkali-treated titanium with nanonetwork structures, H. Zhang, S. Komasa, C. Mashimo, T. Sekino, J. Okazaki: International Journal of Nanomedicine, 12 (2017) 4633-4646.

[6]Comparative study on the photocatalytic properties of Ag3PO4 fabricated by different methods, Y.-H. Jo, B. Joshi, T. Sekino, T.-H. Kim, S.-W. Lee: Research on Chemical Intermediates, 43 (9) (2017) 5261-5269.

[7]Room-Temperature H2 Gas Sensing Characterization of Graphene-Doped Porous Silicon via a Facile Solution Dropping Method, Nu Si A. Eom, Hong-Baek Cho, Yoseb Song, Woojin Lee, Tohru Sekino,Yong-Ho Choa: Sensors, 17 (2017) 2750-2757.

[8]Fabrication of Au nanoparticles on poly(vinylpyrrolidone) nanowires exhibiting reversible frequency change of localized surface plasmon resonance, Satoshi Tsukuda, Shu Seki, Masaaki Omichi, Masaki Sugimoto, Akira Idesaki, Tohru Sekino, Takahisa Omata: AIP Advances, 8 (2018) 015314.

[9]The Synthesis and Photocatalytic activity of Carbon Nanotube-mixed TiO2 Nanotubes, Chun Woong Park, Young Do Kim, Tohru Sekino, Se Hoon Kim: Journal of Korean Powder Metallurgy Institute, 24 (4) (2017) 279-284.

[10]Effects of solid lubricant and laser surface texturing on tribological behaviors of atmospheric plasma sprayed Al2O3-ZrO2 composite coatings., Seung-Ho Kim, Sang-Hoon Jeong, Tae-Ho Kim, Jin-Hyuk Choi, Sung-Hun Cho, Bum Sung Kim, Soo Wohn Lee: Ceramics International, 43 (2017) 9200-9206.

[11]Heat transfer control of micro-thermoelectric gas sensor for breath gas monitoring, Tomoyo Goto, Toshio Itoh, Takafumi Akamatsu, Yoshitaka Sasaki, Kazuo Sato, Woosuck Shin: Sensors and Actuators B: Chemical, 249 (2017) 571-580.

[12]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 (2017) 126－131.

[13]Structure and Properties Tunings of Low-dimensional Nanostructured Titania, Tohru Sekino: Journal of the Technical Association of Refractories, Japan, 37 (3) (2017) 160-169.

International Conferences

[1]Sorption of Cs+ on Titania Nanotube Synthesized by Solution Method (oral), T. Goto, S. H. Cho, T. Sekino: The 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim 2017).

[2]Fabrication of low-dimensional carbon and titania nanotube composites via solution chemical process

and their electrical properties (oral), S. Eom, S. H. Cho, T. Goto, T. Sekino: The 12th Pacific Rim Conference on Ceramic and Glass Technology (PacRim 2017).

[3]Fabrication and Multifunctional Properties of Low-dimensional Titania Nanotube-based Nanocomposites (invited), Sunghun Eom, Yuto Yamasaki, Hisataka Nishida, Sung Hun Cho, Tomoyo Goto, Tohru Sekino: The 8th International Conference on Electroceramics (ICE2017).

[4]Thermoelectric Array Sensors with catalyst combustors for breath analysis (invited), Woosuck Shin, Tomoyo Goto, Daisuke Nagai, Toshio Itoh, Takafumi Akamatsu, Kazuo Sato: The 8th International Conference on Electroceramics (ICE2017).

[5]Synthesis and Functions of Visible-light Responsible Photocatalytic Titania Nanotubes (invited), Tohru Sekino: 9th International Conference on Materials for Advanced Technologies (ICMAT 2017).

[6]Synthesis of Titiania Nanotube and Nanostructure Carbon Composites via Solution Chemical Routes and Their Physical Properties (plenary), Sunghun Eom, Tomoyo Goto, Sung Hun Chou, Hisataka Nishida, Tohru Sekino: 2017 China-Japan-Korea Multifunctional Nanomaterials Seminar.

[7]Adsorption Behavior of Acidic Dye on TiO2-Modified Hydroxyapatite as Photocatalyst (invited), Tomoyo Goto, Sung Hun Cho, Tohru Sekino: 2017 China-Japan-Korea Multifunctional Nanomaterials Seminar.

[8]Materials Tuning of Titania Nanotubes for Environmental and Energy Applications (invited), Sung Hun Eom, Yuto Yamasaki, Tomoyo Goto, Sung Hun Cho, Soo Wohn Lee, Tohru Sekino: The 6th Advanced Functional Materials and Devices (AFMD-2017).

[9]Sintering of Ti(III)-doped ZrO2 Ceramics and Their Phase Development (invited), Y. Rikiso, T. Goto, S. H. Cho, H. Nishida, T. Sekino: International Union of Materials Research Society - The 15thInternational Conference on Advanced Materials (IUMRS-ICAM2017).

[10]Effects of crystal morphology and zeta potential of TiO2-modifedHydroxyapatite on adsorption and photocatalytic decoloration of dye (oral), T. GOTO, J. H. SHIN, S.H. CHO, T. SEKINO: International Union of Materials Research Society - The 15thInternational Conference on Advanced Materials (IUMRS-ICAM2017).

[11]Imparting fluorescence color of natural teeth to zirconia material by co-doping Tm-Er (poster), Hisataka Nishida, Tohru Sekino, Takashi Nakamura, Hirofumi Yatani, Kazuyo Yamamoto: The 10th International Federation of Esthetic Dentistry world conference (IFED 2017).

[12]Structure and Function Tuning of Low-dimensional Oxide Nanomaterials for Environmental and Energy Application (invited), Tohru Sekino: JSPS Symposium for the ZIAM/GBB and ISIR/IPR Collaboration.

[13]Materials Tuning of Titania-based Oxide Nanotubes for Energy and Environmental Applications (plenary), Tohru Sekino: The 6th International Symposium on Advanced Ceramics and Technology for Sustainable Energy Applications toward a Low Carbon Society (ACTSEA-2017).

[14]Synthesis and Characterization of TiO2 nanotubes by Microwave Assisted Hydrothermal Method: An effect of process parameters on Nanostructures formation (oral), Sung Hun Cho, Tohru Sekino: A3 Foresight First Symposium on Organic/Inorganic Nanohybrid Platforms for Precision Tumor Imaging and Therapy.

[15]Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials（Five-star Alliance）in Network Joint Research Center for Materials and Devices (oral), Tohru Sekino: A3 Foresight

First Symposium on Organic/Inorganic Nanohybrid Platforms for Precision Tumor Imaging and Therapy.

[16]Various Morphologies of Silicon Nitride Ceramic Fibers Synthesized by Carbothermal Nitridation Process (oral), Sotaro BABA, Tomoyo GOTO, Sung Hun CHO, Tohru SEKINO: A3 Foresight First Symposium on Organic/Inorganic Nanohybrid Platforms for Precision Tumor Imaging and Therapy.

[17]Photocatalyst Property of TiO2-Modified Needle-Shaped Hydroxyapatite Synthesized by Solvothermal Treatment (oral), Tomoyo GOTO, Sung Hun CHO, Chikara OHTSUKI, Tohru SEKINO: The 34th International Japan-Korea Seminar on Ceramics (J-K Ceramics 34).

[18]Titanate nanostructures analysis and characterizations (poster), Cho Sung Hun, Tomoyo Goto, Soo Wohn Lee, Tohru Sekino: The 21th SANKEN International Symposium, Osaka, Japan, January 16-17, 2018.

[19]Elastic properties of two-phase Mg–Zn–Y alloys comprised of α-Mg and long-period stacking ordered phases (poster), M. Tane, S. Suzuki, M. Yamasaki, Y. Kawamura, K. Hagihara, H. Kimizuka: 21st SANKEN International Symposium, Osaka, Japan, January 16-17, 2018.

[20]Synthesis and Multifunctions of Titania Nanotubes-based Low-dimensional Anisotropic Nanocomposites (invited), Tohru Sekino, Sunghun Eom, Yuto Yamasaki, Hisataka Nishida, Sung Hun Cho, Tomoyo Goto: ICACC2018 (The 42nd International Conference & Exposition on Advanced Ceramics & Composites).

[21]The effects of Y_2O_3 and Ti on optimizing mechanical and electrical properties of Al_2O_3 ceramics (oral), Shengfang Shi, Tomoyo Goto, Sung Hun Cho, Tohru Sekino: ICACC2018 (The 42nd International Conference & Exposition on Advanced Ceramics & Composites).

[22]Materials Tuning of Ceramic-based Nanocomposites for Multifunctionalization (plenary), Tohru Sekino: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[23]Fabrication of fine Ti-dispersed alumina composites and their mechanical and electrical properties (invited), Shengfang Shi, Tomoyo Goto, Tohru Sekino: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[24]The Effect of Aluminum Doping on the Morphology of Silicon Nitrides Synthesized by Carbothermal Nitridation Process (oral), Sotaro BABA, Tomoyo GOTO, Sung Hun CHO, Tohru SEKINO: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[25]Preparation of electro-conductive nano-powders based on zinc oxide and application to transparent thin films for eco-windows (poster), Taisei Yamamoto, Akira Senjuh, Kazuo Izumi, Nobuyuki Kuroiwa, Tohru Sekino: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[26]Synthesis and Characterization of Titanate Nanostructure by Alkali Aqueous Solution Process (poster), Sung Hun Cho, Tohru Sekino: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[27]Hydrothermal Synthesis and Self-assembly Behavior of Barium Titanate Nanocubes (poster), Yonghyun CHO, Sung Hun CHO, Tomoyo GOTO, Tohru SEKINO: 19th International Symposium on Eco-materials Processing and Design (ISEPD-2018).

[28]Fabrication of low-dimensional carbons/titanianotube hybrid composites via chemical solution process and their structural and electrical properties (poster), S. Eom, S. H. Cho, T. Goto, J. Hwang, M. Chun, T. Sekino: The 4thInternational Symposium on Hybrid Materials and Processing (HyMaP2017).

[29]Precipitation of Noble Metals on Visible-light Responsible Titania Nanotubes by H2O2 Treatment and their Properties (poster), Yuto Yamasaki, Tomoyo Goto, Sung Hun Cho, Hisataka Nishida, Tohru Sekino: The 4thInternational Symposium on Hybrid Materials and Processing (HyMaP2017).

[30]Removal of Cesium Ion From Aqueous Water Using Titania Nanotube (oral), Tomoyo Goto, Sung Hun Cho, Tohru Sekino: The 4thInternational Symposium on Hybrid Materials and Processing (HyMaP2017).

[31]Materials Tuning of Titania Nanotubes for Environmental and Energy Functions (invited), Tohru Sekino: 2018 IMCE International Symposium.

[32]Structure and Properties Tuning of Titania Nanotubes for Eco-Multifunctionalization (invited), Sunghun Eom, Yuto Yamasaki, Sung Hun Cho, Tomoyo Goto, Myoung Pyo Cun, Soo Wohn Lee, Tohru Sekino: The 6th International Symposium on Advanced Ceramics (ISAC-6).

Review Papers

Extraction of single-crystalline elastic constants from polycrystalline samples with crystallographic texture, M. Tane, Materia Japan, The Japan Institute of Metals and Materials, 56 (2017), 541-545.

Energy abosorption capacity in porous pure iron and carbon steels with directional pores, M. Tane, Y.H. Song, H. Nakajima, Kinzoku, AGNE Gijutsu Center, 87 (2017), 526-532.

Hydrothermal Synthesis and Property Control of Purification Material based on Hydroxyapatite, T. Goto, CERAMICS JAPAN, The Ceramic Society of Japan, 52 (2017), 492－493.

Contributions to International Conferences and Journals

M. Tane	Materials Transactions (Editrial committee)
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	The 4th International Conference on Competitive Materials and Technology Processes (IC-CMTP5) (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)
T. Sekino	The 9th International Symposium on Functional Materials (ISFM2018) (International Advisory Committee)
T. Sekino	The 15thInternational Conference on Advanced Materials (IUMRS-ICAM2017) (Symposiuym Organizer)
T. Sekino	12th International Conference on Ceramic Materials and Components for Energy and Environmental Applications (CMCEE-12) (Symposium Organizer)
T. Sekino	The 6th International Solvothermal and Hydrothermal Association Conference (ISHA2018) (International Advisory Committee)
T. Sekino	The International Symposium on Eco-Materials Processing and Design (ISEPD 2018） (Organizing Committee/Editorial Committee)
T. Sekino	Global Congress & Expo on Mater Sci & Eng (GCEMSE) (Organizers)

Publications in Domestic Meetings

2017 Fall Meeting, The Japan Institute of Metals and Materials	2 papers
2018 Spring Meeting, The Japan Institute of Metals and Materials	2 papers
The Japan Society of Dental Materials and Devices, The 69th General Session	1 paper
Dynamic Alliance, Environment and Energy materials, Device and process/ Group (G2) meeting	1 paper
The Ceramic Society of Japan, The 12th Kansai branch meeting	5 papers
The Japanese Sol-Gel Society, 15th Meeting	1 paper
The 5th Alliance Young Scientists Exchange Meeting	2 papers
6th Young Scientist Seminar on Bulk Ceramics Research	1 paper
The 62nd Chemical Sensor Symposium	1 paper
The Ceramic Society of Japan, The 30th Fall Meeting	4 papers
The Ceramic Society of Japan, Environemtal and Resource Divisiton Seminar	1 paper
The 10th Christmas Lecture	1 paper
2017 meeting, The society of powder technology, Japan	1 paper
The 56th Symposium on Basic Science of Ceramics	1 paper
The Ceramic Society of Japan, Annual Meeting 2018	2 papers
Ceramics Research Symposium 2017	1 paper
Material Processing No. 69 Committee	1 paper

Academic Degrees

Master Degree for Engineering A. Umeda	Kinetics of formation of diffuse ω strusture in metastable Ti alloys with bcc structure
Master Degree for Engineering Y. Yamasaki	Synthesis and properties of noble metal loaded visible light responsible titania nanotubes synthesized by chemical treatment

Grant-in-Aid for Scientific Research

T. Sekino	Physical Photochemical Functionalization of Oxide Nanotubes through Hierarchical Structure Tuning	¥37,856,000
M. Tane	Peculiar phase transformation and mechanical properties in bcc titanium	¥13,000,000
M. Tane	Development of original method for the determination of single-crystalline elastic properties	¥851,000
M. Tane	Elastic properties of Mg alloys and Mg-based intermetallic	¥1,963,000
T. Goto	Hydrothermal synthesis and investigation of Transition metal substituted hydroxyapatite for environmental remediation materials	¥2,582,000

Entrusted Research

T. Sekino	NEDO	Advanced Research Program for Energy and Environmental Technologies / Research & Development for waste heat recovery technology using pyroelectric effect based on	¥29,044,000

temporal temperature variations.

Contribution to Research

T. Sekino	Nikkato Corporation	¥1,000,000
T. Sekino	Inaba Rubber Co. Ltd.	¥1,500,000
M. Tane	Iketani Science and Technology Foundation	¥1,500,000
M. Tane	The Light Metal Educational Foundation, Inc.	¥150,000
M. Tane	Kansai Research Foundation for technology promotion	¥960,000
T. Goto	Izumi Science and Technology Foundation	¥1,000,000
T. Goto	The NAGAI Foundation for Science and Technology	¥100,000

Cooperative Research

T. Sekino	Sun Moon University	¥4,955,000
T. Sekino	Korea Institute of Ceramic Engineering and Technology (KICET)	¥4,995,000
T. Sekino	Daiichi Kigenso Kagaku Kogyo Co., Ltd.	¥1,500,000
T. Sekino	Lotus Alloy Co., Ltd.	¥420,000
M. Tane	TORAY Co.,Ltd	¥1,000,000

Department of Advanced Interconnection Materials

Original Papers

[1]Bonding technology based on solid porous Ag for large area chip, Chuantong Chen, Seungjun Noh, Hao Zhang, Chanyang Choe, Jinting Jiu, Shijo Nagao, Katsuaki Suganuma: Scripta Materialia, 146 (2018) 123–127.

[2]Effect of electroplated Au layer on bonding performance of Ag pastes, Taikun Fan, Hao Zhang, Panju Shang, Caifu Li, Chuantong Chen, Jianxin Wang, Zhiquan Liu, Hao Zhang, and Katsuaki Suganuma: J. Alloys Compd., 731 (2018) 1280-1287.

[3]Highly conductive copper films based on submicron copper particles/copper complex inks for printed electronics: microstructure, resistivity, oxidation resistance, and long-term stability, Wanli Li, Lingying Li, Yue Gao, Dawei Hu, Cai-Fu Li, Hao Zhang, Jinting Jiu, Shijo Nagao, and Katsuaki Suganuma: J. Alloys Compd., 732 (2018) 240-247.

[4]Thermal Stability of Silver Paste Sintering on Coated Copper and Aluminum Substrates, Chun Pei, Chuantong Chen, Guicui Fu, Katsuaki Suganuma: J. Electron. Mater, 47 (2018) 811-819.

[5]Heat-resistant die-attach with cold-rolled Ag sheet, S.J.Noh, C. Choe, C. Chen, K. Suganuma: Appl. Phys. Express, 11 (2017) 016501_1-4.

[6]Thermal Stability of Silver Paste Sintering on Copper and Aluminum Substrates, Chun Pei, Chuantong Chen, Guicui Fu, Katsuaki Suganuma: J. Electron. Mater., 47 (2017) 811-819.

[7]Electrochemical behavior of Zn-xSn high-temperature solder alloys in 0.5M NaCl solution, Z. Wang, C. Chen, J. Jiu, S. Nagao, H. Koga, H. Zhang, G. Zhang, K. Suganuma: J. Alloys Compd., 716 (2017) 231-239.

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Grant-in-Aid for Scientific Research

K.Suganuma	ストレスマイグレーションを利用した構造材接合	¥2,483,000
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	¥2,608,000

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	¥32,957,000
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	¥36,400,000
K.Suganuma	NEDO	ベンチャー企業等による新エネルギー技術革新支援事業／ベンチャー企業等による新エネルギー技術革新支援事業（地熱・熱利用）／再生可能エネルギー排熱利用のための２	¥355,000

		５０　耐熱フレキシブル熱電発電モジュール開発	
K.Suganuma	MEXT	国際共同研究促進プログラム（タイプＡ）グラフェンによる金属ナノワイヤの信頼性向上技術の開発	¥800,000
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Contribution to Research

K.Suganuma	千住金属工業株式会社
K.Suganuma	株式会社ダイセル
K.Suganuma	上村工業株式会社
K.Suganuma	三井金属鉱業株式会社
K.Suganuma	新世代パワー半導体実装技術開発コンソーシアム
K.Suganuma	株式会社富士通研究所　デバイス＆マテリアル研究所
S.Nagao	シエンタオミクロン株式会社

Cooperative Research

K.Suganuma	Showa Denko Co.
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K.Suganuma	Stanley Electtic Co.
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K.Suganuma	Uyemura Inductries Co.
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K.Suganuma	Sumitomo Erectric Co.
K.Suganuma	E Thermogenetech Co.
K.Suganuma	Omuron Co.
K.Suganuma	Asahi Intecc Co.,Ltd.
K.Suganuma	Tokuyama Co.
K.Suganuma	imec
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K.Suganuma	AIST
K.Suganuma	Japan Fine ceramicsAssociation

Other Research Fund

K.Suganuma	JSPS	¥4,400,000

Department of Excited Solid-State Dynamics

Original Papers

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S. Tanaka	High-resolution electron spectroscopic study of atomic layered materlals	¥1,800,000
J. Kanasaki	Development of ultimate spatio-temporal spectroscopy and its aplication to the study of photo-induced phase transformation	¥800,000

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Akinori Irizawa WIRMS2017 Oxford UK (International Advisory Committee)
Grant-in-Aid for Scientific Research
Akinori Irizawa 自由電子レーザーによる LIPSS 発現の研究 ¥1,950,000

Department of Beam Materials Science
Original Papers
[1]Theoretical study on effects of photodecomposable quenchers in line-and-space pattern fabrication with 7 nm quarter-pitch using chemically amplified electron beam resist process, Takahiro Kozawa: Jpn. J. Appl. Phys., Vol. 56 (2017) RP160597 046502.

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[2]Study on Resist Performance of Noria Derivatives Modified with Various Protection Ratios of Acetal Moieties by Means of Extreme Ultraviolet Irradiation (oral), Hiroki Yamamoto, Hiroto Kudo, and Takahiro Kozawa: The 34th International Conference of Photopolymer Science and Technology.

[3]Synthesis and Resist Property of Tellurium-Containing Polymers (oral), Mari Fukunaga , Hiroto Kudo , Hiroki Yamamoto, Takahiro Kozawa ,and Takeo Watanabe: The 34th International Conference of Photopolymer Science and Technology.

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[6]Nanofabrication method for two dimensional controlled array of core-shell nanparticle in large scale fabrication by using self-assembled Au@SiO2 nanoparticle in solvent interface (poster), Hiroki Yamamoto: The 43rd International Conference on Micro and Nanoengineering.

[7]Yusa Muroya, Wataru Kanamori, Shinichi Yamashita, Yosuke Katsumura, Takahiro Kozawa (poster), Yusa Muroya, Wataru Kanamori, Shinichi Yamashita, Yosuke Katsumura, Takahiro Kozawa: The 30th Miller Conference on Radiation Chemistry.

[8]Takahiro Kozawa, Satoshi Ishihara, Hiroki Yamamoto, Julius Joseph Santillan, Toshiro Itani (oral), Takahiro Kozawa, Satoshi Ishihara, Hiroki Yamamoto, Julius Joseph Santillan, Toshiro Itani: SPIE Advanced Lithography.

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Modern Radiation Chemistry (fundamentals) 5　Radiation Chemistry of Water and Aqueous Solutions, Yusa Muroya, RADIOISOTOPES, Japan Radioisotope Association, 66 (2017), 425-435.

Modern Radiation Chemistry (fundamentals) 10 Radiation-Induced Damage in DNA, Kazuo Kobayashi, RADIOISOTOPES, Japan Radioisotope Association, 66 (2017), 479–487.

Contributions to International Conferences and Journals

Takahiro Kozawa	30th International Microprocesses and Nanotechnology Conference (Organaizing Committtee)
Takahiro Kozawa	31st International Microprocesses and Nanotechnology Conference (Organaizing Committtee)
Takahiro Kozawa	30th International Microprocesses and Nanotechnology Conference (Steering Committtee Vice Chair)
Takahiro Kozawa	31st International Microprocesses and Nanotechnology Conference (Steering Chair)
Takahiro Kozawa	2017 International Symposium on Extreme Ultraviolet Lithography (Program Steering Committee)
Hiroki Yamamoto	30 t h International Microprocesses and Nanotechnology Conference (Program Steering Committee)

Publications in Domestic Meetings

2017 Annual meeting of Atomic Energy Society of Japan in Autumn	1 paper
The 60th Meeting of Japanese Society of Radiation Chemistry	1 paper
The 90th Annual Meeting of the Japanese Biochemical Society	2 papers
2018 Annual meeting of Atomic Energy Society of Japan in Spring	2 papers

Academic Degrees

Master Degree for Engineering S. Ishihara	Study on Reaction Mechanism of Zirconia Nanoparticle Resist
Master Degree for Engineering T. Tanaka	Specificity in Mechanism of Transcriptional Factor SoxR Studied by Pulse Radiolysis Method

Grant-in-Aid for Scientific Research

T. Kozawa	Study on nano chemistry induce in nanofabrication materials using combination of quantum beams	¥6,240,000
Y. Muroya	Investigation of radiation-induced reaction process of supercritical water for fundamentals of	¥1,944,000
H. Yamamoto	Development of fine wire for mass production to achieve the precision of less than 1 nm	¥981,080

Entrusted Research

Y. Muroya	Nippon Nuclear Fuel Development Co., Ltd. (NFD)	Practical development of the flexible waste management method enhancing potential of MA P&T technology
Y. Muroya	Central Research Institute of Electric Power Industry	

Cooperative Research

T. Kozawa	Toyo Gosei Co., Ltd
T. Kozawa	NuFlare Technology, Inc.
T. Kozawa	Zeon Corporation

Department of Molecular Excitation Chemistry

Original Papers

[1]Topotactic epitaxy of SrTiO3 mesocrystal superstructures with anisotropic construction for efficient overall water splitting, P. Zhang, T. Ochi, M. Fujitsuka, Y. Kobori, T. Majima, T. Tachikawa: Angew. Chem., Int. Ed., 56 (2017) 5299-5303.

[2]Controllable nanothorns on TiO2 mesocrystals for efficient charge separation in hydrogen evolution, P. Zhang, S. Kim, M. Fujitsuka, T. Majima: Chem. Commun., 53 (2017) 5306-5309.

[3]In situ nitrogen-doped hollow-TiO2/g-C3N4 composite photocatalysts with efficient charge separation boosting water reduction under visible light, X. Shi, M. Fujitsuka, Z. Lou, P. Zhang, T. Majima: J. Mater. Chem. A, 5 (2017) 9671-9681.

[4]Charge separation in a nanostep structured perovskite-type photocatalyst induced by successive surface heterojunctions, X. Cai, L. Mao, J. Zhang, M. Zhu, M. Fujitsuka, T. Majima: J. Mater. Chem. A, 5 (2017) 10442-10449.

[5]Black phosphorus: A promising two dimensional visible and near-infrared-activated photocatalyst for hydrogen evolution, M. Zhu, Y. Osakada, S. Kim, M. Fujitsuka, T. Majima: Appl. Catal. B: Environ., 217 (2017) 285-292.

[6]Radical ions of a π-bowl sumanene: Effects of strained structure on the electronic transitions, M. Fujitsuka, S. Tojo, T. Amaya, T. Hirao, T. Majima: J. Phys. Chem. A, 121 (2017) 4902-4906.

[7]Phase effect of Ni_xP_y hybridized with g-C_3N_4 for photocatalytic hydrogen generation, Z. Sun, M. Zhu, M. Fujitsuka, A. Wang, C. Shi, T. Majima: ACS Appl. Mater. Interfaces, 9 (2017) 30583-30590.

[8]Metal-free photocatalyst for H_2 evolution in visible to near-infrared region: Black phosphorus/graphitic carbon nitride, M. Zhu, S. Kim, L. Mao, M. Fujitsuka, J. Zhang, X. Wang, T. Majima: J. Am. Chem. Soc., 139 (2017) 13234-13242.

[9]g-C_3N_4/TiO_2 mesocrystals composite for H_2 evolution under visible-light irradiation and its charge carrier dynamics, O. Elbanna, M. Fujitsuka, T. Majima: ACS Applied Materials & Interfaces, 9 (2017) 34844-34854.

[10]Live cell imaging using photoswitchable diarylethene-doped fluorescent polymer dots, Y. Osakada, T. Fukaminato, Y. Ichinose, M. Fujitsuka, Y. Harada, T. Majima: Chem. Asian J., 12 (2017) 2660-2665.

[11]Noble metal-free near-infrared-driven photocatalyst for hydrogen production based on 2D hybrid of black Phosphorus/WS_2, M. Zhu, C. Zhai, M. Fujitsuka, T. Majima: Appl. Catal. B: Environ., 221 (2017) 645-651.

[12]Single-molecule monitoring of structural switching dynamics of nucleic acids by controlling fluorescence blinking, K. Kawai, T. Miyata, N. Shimada, S. Ito, H. Miyasaka, A. Maruyama: Angew. Chem. Int. Ed, 56 (48) (2017) 15329-15333.

[13]Au nanorod photosensitized $La_2Ti_2O_7$ nanosteps: Successive surface heterojunctions boosting visible to near-infrared photocatalytic H_2 evolution, X. Cai, M. Zhu, O. A. Elbanna, M. Fujitsuka, S. Kim, L. Mao, J. Zhang, T. Majima: ACS Catal., 8 (2017) 122-133.

[14]Aggregation-induced singlet oxygen generation: Functional fluorophore and anthrylphenylene dyad self-assemblies, S. Kim, Y. Zhou, N. Tohnai, H. Nakatsuji, M. Matsusaki, M. Fujitsuka, M. Miyata, T. Majima: Chem. Eur. J., 24 (2017) 636-645.

[15]Z-scheme photocatalytic water splitting on a 2D heterostructure of black phosphorus/bismuth vanadate using visible light, M. Zhu, Z. Sun, M. Fujitsuka, T. Majima: Angew. Chem., Int. Ed., 57 (2018) 2160-2164.

[16]Faster electron injection and more active sites for efficient photocatalytic H_2 evolution in g-C_3N_4/MoS_2 hybrid, X. Shi, M. Fujitsuka, S. Kim, T. Majima: Small, 14 (2018) 1703277.

[17]Anisotropic Ag_2S-Au triangular nanoprisms with desired configuration for plasmonic photocatalytic hydrogen generation in visible/near-infrared region, Z. Lou, S. Kim, M. Fujitsuka, X. Yang, B. Li, T. Majima: Adv. Funct. Mater., 28 (2018) 1706969.

[18]Fluorescence redox blinking adaptable to structural analysis of nucleic acids, T. Miyata, N. Shimada, A. Maruyama, K. Kawai: Chem. Eur. J, 24 (2018) .

International Conferences
[1]DNA STRUCTURAL CHANGES MONITORED BY CONTROLLING THE FLUORESCENCE BLINKING (oral), K. Kawai, A. Maruyama, T. Majima: The 15th Conference on Methods and Applications in Fluorescence.

[2]Dual Character of Excited Radical Anions in Aromatic Diimide Bis(Radical Anion)s: Donor or Acceptor? (invited), M. Fujitsuka, L. Chao, T. Majima: 13th Korea-Japan Symposium on Frontier Photoscience.

[3]Radical Ions of a π-Bowl Sumanene: Effects of Strained Structure on the Electronic Transitions (poster), M. Fujitsuka, S. Tojo, T. Amaya, T. Hirao, T. Majima: 13th Korea-Japan Symposium on Frontier Photoscience.

[4]Functional aggregatees of fluorophore and abthrylphenylene dyads (invited), S. Kim, Y. Zhou, N. Tohnai, M. Fujitsuka, M. Miyata, T. Majima: 13th Korea-Japan Symposium on Frontier Photoscience.

[5]Radical ions of highly strained oligomeric molecules (oral), M. Fujitsuka: 2018 SANKEN-KAERI Workshop on Radiation Research.

Review Papers
Recent advances of radiation chemistry by vibration spectroscopy, M. Fujitsuka, T. Majima, Radiation Chemistry, Japanese Society of Radiation Chemistry, 103 (2017), 3-12.

Radiation chemical studies on reaction mechanisms, M. Fujitsuka, T. Majima, Radioisotopes, Japan Radioisotope Association, 66 (2017), 437-449.

蛍光 blinking 制御による生体分子のダイナミクス観測─KACB 法, 川井清彦、丸山厚, 生体の科学, 医学書院, 68[5] (2017), 430-431.

蛍光 blinking 制御による核酸構造分析 ～核酸を 1 分子レベルで調べる～, 川井 清彦, 日本核酸化学会誌, 日本核酸化学会, 1 (2017), 3-7.

Reaction dynamics of excited radical ions revealed by femtosecond flash photolysis, M. Fujitsuka, T. Majima, J. Photochem. Photobiol. C: Photochem. Rev., Elsevier, 35 (2018), 25-37.

The development of functional mesocrystals for energy harvesting, storage, and conversion, P. Zhang, T. Tachikawa, M. Fujitsuka, T. Majima, Chemistry - A European Journal, Wiley-VCH Verlag, 24（24) (2018), 6295-6307.

Patents

[1]K20170101 自己集合体形成化合物及び該化合物を含む一重項酸素産生剤, 2017-164826

[2]KP2016046 蛍光プローブ、一重項酸素検出剤、又は一重項酸素検出方法, 2016-529417

Publications in Domestic Meetings

Annual Meeting of Photochemistry 2017	2 papers
The 60th Meeting of Japanese Society of Radiation Chemistry	2 papers
The 98th CSJ Annual Meeting	3 papers

Academic Degrees

Master Degree for Engineering J. Xu	Preparation of Long-distance DNA Conjugates and Study of Photo-Induced Electron Transfer Dynamics in the Extended Conjugates
Master Degree for Engineering R. Suzuki	Studies on intramoleuclar electron transfer from excited bezoquinone radical anion
Master Degree for Engineering S. Miyamoto	Adenosine oxidation studied by pulse radiolysis-time-resolved resonance Raman spectroscopy
Doctor Degree for Engineering O. A. Elbanna	Studies on photocatalytic activities and charge carriers dynamics on TiO2 mesocrystals composites under solar light irradiation

Grant-in-Aid for Scientific Research

T.Majima	光エネルギー変換系におけるナノ触媒の単一分子化学	¥13,260,000
T.Majima	可視光駆動型燃料電池における高性能プラズモン増強電極触媒酸化の開発	¥780,000
K.Kawai	弱い過渡的相互作用をトリガーとした RNA の 1 分子イメージング	¥5,590,000
K.Kawai	DNA 高次構造転移の 1 分子実時間観測	¥4,420,000
K.Kawai	DNA 超らせんダイナミクスの 1 分子レベル解析	¥779,000
S.Kim	細胞内励起状態の視覚化を目指すレーザー粒子とレーザー発振顕微鏡の	¥1,613,000
M.Fujitsuka	曲面状 π 共役分子の新しい有機化学と材料科学	¥1,560,000

Contribution to Research

K. Kawai	The Canon Foundation	¥1,500,000

Other Research Fund

M. Fujitsuka	Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials	¥350,000

Department of Synthetic Organic Chemistry

Original Papers

[1]Short Syntheses of 4-Deoxycarbazomycin B, Sorazolon E, and (+)-Sorazolon E2, M. Sako, K. Ichinose, S. Takizawa and H. Sasai: Chem. Asian J., 12 (2017) 1305-1308.

[2]Determination of the absolute configuration of compounds bearing chiral quaternary carbon centers using the crystalline sponge method, S. Sairenji, T. Kikuchi, M. A. Abozeid, S. Takizawa, H. Sasai, Y. Ando, K. Ohmatsu, T. Ooi and M. Fujita: Chem. Sci., 8 (2017) 5132-5136.

[3]Multifunctional Catalysis: Stereoselective Construction of α-Methylidene-γ-Lactams via Amidation/Rauhut–Currier Sequence, K. Kishi, F. A. Arteaga, S. Takizawa and H. Sasai: Chem. Commun., 53 (2017) 7724-7727.

[4]Enantioselective Synthesis of Tetrahydrocyclopenta[b]indole Bearing a Chiral Quaternary Carbon Center via Pd(II)-SPRIX-Catalyzed C–H Activation, M. A. Abozeid, S. Sairenji, S. Takizawa, M. Fujita

and H. Sasai: Chem. Commun., 53 (2017) 6887-6890.

[5]Reversal of Enantioselectivity Approach to BINOLs via Single and Dual 2　Naphthol Activation Modes, H. Y. Kim, S. Takizawa, H. Sasai and K. Oh: Org. Lett., 19 (2017) 3867-3870.

[6]Enantio- and Diastereoselective Betti/aza-Michael Sequence: Single Operated Preparation of Chiral 1,3-Disubstituted Isoindolines, S. Takizawa, M. Sako, M. A. Abozeid, K. Kishi, H. D. P. Wathsala, S. Hirata, K. Murai, H. Fujioka and H. Sasai: Org. Lett., 19 (2017) 5426-5429.

[7]Chiral Organocatalyzed Intermolecular Rauhut–Currier Reaction of Nitroalkenes with Ethyl Allenoate, S. Takizawa, M. Sako, K. Kishi, M. Shigenobu, G. Vo-Thanh and H. Sasai: Chem. Pharm. Bull., 65 (2017) 997-999.

[8]Asymmetric Oxidative Coupling of Hydroxycarbazoles: Facile Synthesis of (+)-Bi-2-hydroxy-3-methylcarbazole, M. Sako, A. Sugizaki, S. Takizawa: Bioorg. Med. Chem. Lett., in press (2018) in press.

International Conferences

[1]Oxidative Coupling of Polycyclic Phenols Promoted by a Chiral Vanadium Catalyst (oral), H. Sasai: International Symposium on Green Chemistry 2017 (ISGC-2017), La Rochelle, France, May 16-19, 2017.

[2]Vanadium(V) Complex-catalyzed Enantioselective C-C Bond Forming Reactions (poster), M. Sako, S. Takizawa, H. Sasai: the 19th IUPAC International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS 19), Jeju, Korea, June 25-29, 2017.

[3]Oxidative Coupling of Polycyclic Phenols Promoted by Chiral Vanadium Catalysts (invited), H. Sasai: Chirality 2017, Tokyo, Japan, July 9-12, 2017.

[4]Enantioselective Synthesis of Highly Functionalized Heterocycles via the Chiral Phosphine-catalyzed Domino Reaction (poster), S. Takizawa, K. Kishi, M. Kusaba, H. Sasai: Chirality 2017, Tokyo, Japan, July 9-12, 2017.

[5]Vanadium(V) Complex-catalyzed Enantioselective Oxidative Coupling of Monocyclic Phenol Derivatives (poster), T. Aoki, M. Sako, S. Takizawa, H. Sasai: Chirality 2017, Tokyo, Japan, July 9-12, 2017.

[6]Enantioselective Aza-Wacker-Type Reaction Promoted by Pd-SPRIX Catalyst (poster), A. Sen, K. Takenaka, H. Sasai: Chirality 2017, Tokyo, Japan, July 9-12, 2017.

[7]Highly Enantioselective Oxidative Coupling of Polycyclic Phenols Using a Chiral Vanadium(V) Catalyst (invited), H. Sasai: The 5th International Conference on Catalysis, Guilin, China, August 23-25, 2017.

[8]Oxidative Coupling of Phenol Derivatives Catalyzed by a Chiral Vanadium(V) Complex (oral), H. Sasai: RWTH Aachen Univ.-Osaka Univ. Joint Symposium, September 19-21, 2017.

[9]Enantioselective Synthesis of α-Methylidene-γ-Lactams via Amidation and Rauhut-Currier Reaction Sequence (poster), S. Takizawa, K. Kishi, H. Sasai: The 11th International Symposium on Integrated Synthesis (ISONIS-11), The 3rd International Symposium on Middle Molecular Strategy (ISMMS-3), Awaji Island, Japan, November 15-17, 2017.

[10]Enantioselective Aza-Wacker-Type Reaction Promoted by Pd-SPRIX Catalyst (poster), A. Sen, K. Takenaka, H. Sasai: The 11th International Symposium on Integrated Synthesis (ISONIS-11), The 3rd

International Symposium on Middle Molecular Strategy (ISMMS-3), Awaji Island, Japan, November 15-17, 2017.

[11]Catalytic Enantioselective Sequential C-C Bond Forming Reactions in Flow System (poster), H. D. P. Wathsala, K. Kishi, Q. Chen, M. Sako, S. Takizawa, H. Sasai: 21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, January 16-17, 2018.

[12]Enantioselective Synthesis of Bicyclic Pyrrolidine Derivatives via One-pot Sequential Organo- and Pd-Catalysis (poster), B. M. Chaki, J. Bai, K. Takenaka, S. Takizawa, H. Sasai: 21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium, Osaka, Japan, January 16-17, 2018.

[13]Catalytic Enantioselective Sequential C-C Bond Forming Reactions in Flow System (poster), H. D. P. Wathsala, K. Kishi, Q. Chen, S. Takizawa, H. Sasai: The First International Conference on Automated Flow and Microreactor Synthesis (ICAMS-1), Osaka, Japan, January 18-20, 2018.

[14]Vanadium Complex-catalyzed Enantioselective Synthesis of Oxa[9]helicenes (poster), M. Sako, S. Takizawa, H. Sasai: IRCCS-JST CREST Joint Symposium, Fukuoka, Japan, January 24-26, 2018.

[15]Enantioselective C–C Bond Forming Reactions Catalyzed by a Vanadium Complex (poster), M. Sako, T. Aoki, Y. Tamori, S. Takizawa, H. Sasai: IRCCS-JST CREST Joint Symposium, Fukuoka, Japan, January 24-26, 2018.

[16]Facile Synthesis of Spirooxindoles via Enantioselective Double Michael Reaction (poster), M. Kusaba, K. Kishi, S. Takizawa, J. Bai, H. Sasai: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 13-14, 2018.

[17]Catalytic and Enantioselective Sequential Reaction in Flow System (poster), H. D. P. Wathsala, K. Kishi, Q. Chen, M. Sako, S. Takizawa, H. Sasai: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 13-14, 2018.

[18]Enantioselective Synthesis of Bicyclic Pyrrolidine Derivatives via One-Pot Organo and Palladium Catalysis (poster), B. M. Chaki, J. Bai, K. Takenaka, S. Takizawa, H. Sasai: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 13-14, 2018.

[19]Chiral Vanadium Complex-catalyzed Enantioselective Oxidative Coupling Reactions of Polycyclic Phenol (poster), A. Sugizaki, M. Sako, S. Takizawa, H. Sasai: Biotechnology and Chemistry for Green Growth (JSPS Japanese-German Graduate Externship Program), Awaji Island, Japan, March 13-14, 2018.

Books

[1]Development of Enantioselective Domino Reactions Using Multifunctional Organocatalysts S. Takizawa, H. Sasai, “Chemical Engineering”, Chemical Engineering Co., 68[9] (31-38) 2017.

[2]Development of Environmentally Benign Domino Reactions Using Multifunctional Organocatalysts(T. Akiyama) H. Sasai, S. Takizawa, “Development of Organocatalysts and Their Application to Industry”, CMC Publishing Co., (220-232) 2018.

Patents

[1]K20170117 Thiophene derivatives bearing P-substutent and their polymers; their synthetic methods, 2017-176661

Contributions to International Conferences and Journals

H. SASAI	21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium (Organaizing Committtee (chair))
S. TAKIZAWA	21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium (Organaizing Committtee)
K. TAKENAKA	21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium (Organaizing Committtee)
M. SAKO	21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium (Organaizing Committtee)
M. KONDO	21st SANKEN International Symposium/16th SANKEN Nanotechnology International Symposium/5th Kansai Nanoscience and Nanotechnology International Symposium/13th Handai Nanoscience and Nanotechnology International Symposium (Organaizing Committtee)

Publications in Domestic Meetings

The 111th Symposium on Organic Synthesis	3 papers
The 6th JACI/GSC Symposium	2 papers
The 3rd Noyori-forum Young Training School	1 paper
JSPC 2017 Summer Symposium	4 papers
The 37th Organic Chemistry Junior Researcher's Seminar	4 papers
The 4th Grant-in-Aid for Scientific Research on Innovative Areas "Middle Molecular Strategy: Creation of Higher Bio-Functional Molecules by Integrated Synthesis" Young Researcher's Symposium	1 paper
The 64th Symposium on Organometallic Chemistry	2 papers
The 34th Seminar on Organic Synthetic Chemistry	3 papers
H29 Hokuriku Seminar on Organic Synthetic Chemistry	3 papers
The 67th Kinki Branch Meeting of the Pharmaceutical Society of Japan	2 papers
The 46th Congress of Heterocyclic Chemistry	1 paper
The 43rd Symposium on Progress of Reaction and Synthesis	2 papers
The 9th Symposium on Organocatalysis	1 paper
Grant-in-Aid for Scientific Research on Innovative Areas "Middle Molecular Strategy: Creation of Higher Bio-Functional Molecules by Integrated Synthesis" The 5th Meeting for Progress Report	1 paper
The 98th CSJ Annual Meeting	11 papers
The 138th Meeting of the Pharmaceutical Society of Japan	4 papers

Academic Degrees

Master Degree for Science T. Aoki	Development of Asymmetric Oxidative Coupling of Monocyclic Phenols Using Dinuclear Vanadium Catalyst
Master Degree for Science M. Kusaba	Development of Enantioselective Sequential Reaction Using Organocatalyst
Master Degree for Science A. Sugizaki	Development of Asymmetric Oxidative Coupling of Polycyclic Heterocyclic Phenols Catalyzed by Vanadium Complex
Master Degree for Science	Development of Novel Iron Catalyst Based on Spiro-type Chiral Ligands

Y. Niida	
Master Degree for Science	Development of Catalytic Synthetic Method for α-Amino Carbonyl Compounds Based on Palladium Enolate Umpolung
Y. Nomoto	
Doctor Degree for Science	Enantioselective Synthesis of Highly Functionalized Heterocycles via Organocatalyzed C-C Bond Forming Reactions
K. Kishi	
Doctor Degree for Science	Enantioselective Synthesis and Application of Spiro-type Chiral Ligands
B. M. Chaki	

Grant-in-Aid for Scientific Research

S. Takizawa	Practical Asymmetric Transformation Utilizing Multifunctional Catalysts	¥0,000
S. Takizawa	Stereocontrol of the oxo-Metal-centered Chirality and their Applications to Multifunctional Asymmetric Catalysis	¥2,470,000
S. Takizawa	Development of Visualization Monitoring Technology for Chemical Reactions	¥2,392,000
K. Takenaka	New Synthetic Strategy for Carbonyl Compounds Based on Palladium Enolate Umpolung	¥1,300,000
M. Sako	Development of Base Metal Multifunctional Asymmetric Catalyst and Efficient Asymmetric Molecular transformations	¥780,000

Entrusted Research

H. Sasai	Japan Science and Technology Agency	Practical Transformation Based on Catalytic Asymmetric Domino Reactions	¥3,120,000
H. Sasai	Ministry of Education、Culture、Sports、Science and Technology	Expansion of Recruitment for Outstanding Young Researchers	¥2,400,000
H. Sasai	Ministry of Education、Culture、Sports、Science and Technology	Start-up Expense for Outstanding Young Researchers	¥2,600,000
T. Hirao	Japan Science and Technology Agency	Molecular Transformation Technology Based on Design of Environmental Benign Redox Systems Consisting of Early Transition Metals	¥1,950,000

Contribution to Research

H. Sasai	Nagase ChemteX Corporation	¥600,000
H. Sasai	Kyoto Organic Chemistry lab. LTD.	¥250,000

Cooperative Research

T. Hirao	DAIHACHI CHEMICAL INDUSTRY CO.,LTD.	¥0,000

Department of Regulatory Bioorganic Chemistry

Original Papers

[1]Absorption Characteristics and Quantum Yields of Singlet Oxygen Generation of Thioguanosine Derivatives, S. Miyata, T. Yamada, T. Isozaki, H. Sugimura, Yao-Zhong Xu, T. Suzuki: Photochem. Photobiol., (2018) doi: 10.1111/php.12900.

[2]Acid Dissociation Equilibrium and Singlet Molecular Oxygen Quantum Yield of Acetylated 6,8–Dithioguanosine in Aqueous Buffer Solution, S. Miyata, M. Hoshino, T. Isozaki, T. Yamada, H. Sugimura, Y-Z. Xu T. Suzuki: J. Phys. Chem. B, 122 (11) (2018) 2912-2921.

[3]PCR under Low Ionic Concentration Buffer Conditions, F. Takei, M. Akiyama, K. Nobusawa, N.B. Sabani, H. Han, K. Nakatani, I. Yamashita: Chemistryselect, 3 (3) (2018) 973-976.

[4]Restoration of Ribozyme Tertiary Contact and Function by Using a Molecular Glue for RNA, C. Dohno, M. Kimura, K. Nakatani: Angew. Chem. Int. Ed., 57 (2) (2018) 506-510.

[5]Synthesis of Naphthyridine Dimers with Conformational Restriction and Binding to DNA and RNA, K. Nakatani, N. Natsuhara, Y. Mori, S. Mukherjee, B. Das, A. Murata: Chem. Asian J., 12 (23) (2017) 3077-3087.

[6]Protein-driven RNA nanostructured devices that function in vitro and control mammalian cell fate, T. Shibata, Y. Fujita, H. Ohno, Y. Suzuki, K. Hayashi, K.R. Komatsu, S. Kawasaki, K. Hidaka, S. Yonehara, H. Sugiyama, M. Endo, H. Saito: Nat. Commun., 8 (1) (2017) 540.

[7]Design and Synthesis of Cyclic Mismatch-Binding Ligands (CMBLs) with Variable Linkers by Ring-Closing Metathesis and their Photophysical and DNA Repeat Binding Properties, S. Mukherjee, C. Dohno, K. Nakatani: Chem. Eur. J., 23 (47) (2017) 11385-11396.

[8]Synthesis of Naphthyridine Carbamate Dimer (NCD) Derivatives Modified with Alkanethiol and Binding Properties of G-G Mismatch DNA, T. Yamada, S. Miki, A. Ul'Husna, A. Michikawa, K. Nakatani: Org. Lett., 19 (16) (2017) 4163-4166.

[9]Synthetic ligand promotes gene expression by affecting GC sequence in promoter, S. Matsumoto, K. Iida, A. Murata, M. Denawa, M. Hagiwara, K. Nakatani: Bioorg. Med. Chem. Lett., 27 (15) (2017) 3391-3394.

International Conferences

[1]Synthesis and evaluation of naphthyridine tetramer targeting DNA GGGGCC repeat sequences (poster), Y. Lu, C. Dohno, K. Nakatani: The 21st SANKEN International Symposium.

[2]Novel isoquinoline derivatives that inhibit MBNL1-CUG repeat interaction in Myotonic Dystrophy type1 (poster), J. Matsumoto, J. Li, A. Murata, C. Dohno, K. Nakatani: The 21st SANKEN International Symposium.

[3]Ribozyme switch triggered by synthetic small molecule (oral), C. Dohno, K. Nakatani: 1st SANKEN JSPS Symposium for the Circulation of Talented Researchers “Global Networking on Molecular Technology Research”.

[4]Thiol Modified Naphthyridine Carbamate Dimer Accumulated on CGG Repeat DNA (oral), T. Yamada, S. Miki, K. Nakatani: ISNAC 2017 (The 44th International Symposium on Nucleic Acids Chemistry).

[5]Novel isoquinoline derivatives that inhibit MBNL1-CUG repeat interaction in Myotonic Dystrophy type1 (poster), J. Matsumoto, J. Li, A. Murata, C. Dohno, K. Nakatani: ISNAC 2017 (The 44th International Symposium on Nucleic Acids Chemistry).

[6]Cross-linking behavior of psoralen-conjugated oligonucleotides toward epigenetic DNA modifications (poster), A. Yamayoshi, T. Yamada, Y. Araki, A. Murakami, T. Wada, K. Nakatani, H. Sugiyama: ISNAC 2017 (The 44th International Symposium on Nucleic Acids Chemistry).

[7]Toward discovery of molecules regulating nucleic acids structure and function (oral), K. Nakatani: Kickoff Meeting (JSPS Symposium) for the ZIAM/GBB and ISIR/IPR collaboration.

[8]Synthetic ligand driven RNA switch for regulation of gene expression (poster), C. Dohno: Kickoff Meeting (JSPS Symposium) for the ZIAM/GBB and ISIR/IPR collaboration.

[9]Designing small molecules targeting CUG repeats causing Myotonic Dystrophy type 1 (poster), J. Li, J. Matsumoto, B. Li-Ping, A. Murata, C. Cohno, K. Nakatani: RNA　2017 (The 22nd Annual Meeting of

the RNA Society.

[10]A small molecule that target UGGAA pentanucleotide repeats in spinocerebellar ataxia 31 (poster), T. Shibata, M. Ueyama, Y. Nagai, K. Nakatani: RNA　2017 (The 22nd Annual Meeting of the RNA Society.

Publications in Domestic Meetings

The 98th CSJ Annual Meeting 2018	7 papers
ConBio2017	1 paper
The 12th Annual Meeting of Japanese Society for Chemical Biology	2 papers

Academic Degrees

Doctoral Degree for Science Norhayati SABANI	Studies on Ligand Immobilized Sensors for Polymerase Chain Reaction (PCR) Application
Doctoral Degree for Science Nursakinah MOHD ZAIFUDDIN	Studies on the Effect of Small Molecules on Trinucleotide Repeat Instability during DNA Replication Process
Master Degree for Science Anisa Ul'Husna	Study on Secondary Structure Change of Modified Simian Retrovirus –1 Pseudoknot Motives Induced by Naphthyridine Carbamate Tetramer Series (NCTn)
Master Degree for Science S. Miki	Synthesis and Properties of DNA Mismatch Binding Molecules Modified with Nucleophilic Functional Groups
Master Degree for Science A. Yano	Quantum-chemical Calculations for Small-molecule Ligands Tageting a Bulge Structure in Nucleic Acids
Master Degree for Science K. Yamauchi	Targeting expanded trinucleotide repeats by lipid-membrane-binding and self-assembling small molecule

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	¥70,070,000
A. Murata	Induction of -1 ribosomal frameshifting by a small molecule and its application to protein transport and localization	¥2,649,000
T. Yamada	Development of small molecules which inhibit expansion of a CAG trinucleotide repeat tract	¥3,317,000
T. Yamada	Development of small molecules that selectively hydrolyze excessive elongated RNA repeats	¥2,210,000
T. Shibata	Elucidation of action mechanisms for RNA repeat-binding molecules that show therapeutic effects in SCA31 disease models	¥1,300,000

Entrusted Research

K. Nakatani	Ministry of Education, Culture, Sports, Science and Technology-Japan	Osaka University Grant for Inter-University International Symposia, Joint symposium between the ZIAM/GBB-University of Groningen and the ISIR/IPR-Osaka university	¥1,000,000
K. Nakatani	Ministry of Education, Culture, Sports, Science and Technology-Japan	Employment expansion of excellent young researcher	¥6,180,000

Cooperative Research

K. Nakatani	NITTO KASEI CO., LTD.	¥864,000
K. Nakatani	Yamato Scientific Co. Ltd.	¥3,600,000
K. Nakatani	JT	¥4,032,000
K. Nakatani	Veritas In Silico Inc.	¥1,324,000

Other Research Fund

K. Nakatani	Japan Society for the Promotion of Science (JSPS)	¥2,400,000
K. Nakatani	Japan Society for the Promotion of Science (JSPS)	¥2,400,000

Department of Organic Fine Chemicals

Original Papers

[1]Semisynthesis and biological evaluation of a cotylenin A mimic derived from fusicoccin A., Inoue, T; Higuchi, Y; Yoneyama, T; Lin, B; Nunomura, K; Honma, Y; Kato, N.: Bioorg. Med. Chem. Lett., 28 (4) (2018) 646-650.

[2]Small molecule p300/catenin antagonist enhances hematopoietic recovery after radiation, Zhao, Y; Wu, K; Nguyen, C; Smbatyan, G; Melendez, E; Higuchi, Y; Chen, Y; Kahn, M.: PLoS One, 12 (5) (2017) e0177245.

[3]Design of Tail-Clamp Peptide Nucleic Acid Tethered with Azobenzene Linker for Sequence-Specific Detection of Homopurine DNA., Sawada S, Takao T, Kato N, Kaihatsu K: Molecules, 22 (2017) 1840-1853.

[4]Dual-effect liposomes with increased antitumor effects against 67-kDa laminin receptor-overexpressing tumor cells., : International Journal of Pharmaceutics, 541 (2017) 206-213.

[5]Sialyllactose-Modified Three-Way Junction DNA as Binding Inhibitor of Influenza Virus Hemagglutinin., Bioconjugate Chemistry: , in press (2018) .

Books

[1]The development of highly sensitive diagnostic methods of single nucleotide mutations by chemically-modified nucleic acid(Science Impact) Translating Research To Impact, .

Patents

[1]G20170122WO フシコクシン化合物, PCT/JP2018/002825

[2]G20100018US 抗菌剤, 13/388015

[3]G20160043(PCT) Tolan compound, WO2017047807

Grant-in-Aid for Scientific Research

Y.Higuchi	フシコクシン誘導体の細胞内標的同定 : 低自由度リンカーによるアフィ	¥2,535,000
K.Kaihatsu	デングウイルス感染早期の高感度かつ迅速診断法の確立	¥4,940,000

Entrusted Research

Y.Higuchi	JST	異物排出タンパクに対するユニバーサル阻害剤の分子設計および化学合成	¥11,570,000
K.Kaihatsu	国立研究開発法人 日本医療研究開発機構	大阪大学タイ感染症共同研究拠点の戦略的新展開に係る技術	¥9,430,000

Contribution to Research

Y.Higuchi	開發　邦宏	¥600,000
K.Kaihatsu	株式会社クオルテック 代表取締役　志方　廣一	¥1,900,000
K.Kaihatsu	ＤＳファーマアニマルヘルス株式会社 代表取締役社長　中島　毅	¥1,000,000

Cooperative Research

K.Kaihatsu	プロテクティア株式会社	¥100,000
K.Kaihatsu	富士フイルム株式会社 Ｒ＆Ｄ統括本部 医薬品・ヘルスケア研究所	¥0,000
K.Kaihatsu	株式会社クオルテック	¥500,000

Other Research Fund

K.Kaihatsu	JSPS	¥1,920,000

Department of Biomolecular Science and Reaction

Original Papers

[1]Gene cloning, recombinant expression, purification and characterization of L-methionine decarboxylase from *Streptomyces sp*., M. Hayashi, A. Okada, K. Yamamoto, T. Okugochi, C. Kusaka, D. Kudou, M. Nemoto, J. Inagaki, Y. Hirose, T. Okajima, T. Tamura, K. Soda, and K. Inagaki: The Journal of Biochemistry, 161 (2017) 389-398.

[2]Disruption of small GTPase Rab7 exacerbates the severity of acute pancreatitis in experimental mouse models., K. Takahashi, H. Mashima, K. Miura, D. Maeda, A. Goto, T. Goto, G. H. Sun-Wada, Y. Wada, H. Ohnishi: Scientific Reports, 7 (2017) 2817.

[3]Profiling soil microbial communities with next-generation sequencing: the influence of DNA kit selection and technician technical expertise., T. Soliman, S. Y. Yang, T. Yamazaki, H. Jenke-Kodama: PeerJ, 5 (2017) e4178.

[4]Characterization of H-box region mutants of WalK inert to the action of waldiomycin in *Bacillus subtilis*, A. Kato, S. Ueda, T. Oshima, Y. Inukai, T. Okajima, M. Igarashi, Y. Eguchi, R. Utsumi: The Journal of General and Applied Microbiology, 63 (2017) 212-221.

[5]A new cell separation method based on antibody-immobilized nanoneedle arrays for the detection of intracellular markers, R. Kawamura, M. Miyazaki, K. Shimizu, Y. Matsumoto, Y.R. Silberberg, R.R. Sathuluri, M. Iijima, S. Kuroda, F. Iwata, T. Kobayashi, C. Nakamura: Nano Letters, 17 (2017) 7117-7124.

[6]Synthesis and assembly of hepatitis B virus envelope protein-derived particles in *Escherichia coli*, H. Li, K. Onbe, Q. Liu, M. Iijima, K. Tatematsu, M. Seno, H. Tada, S. Kuroda: Biochemical and Biophysical Research Communications, 490 (2017) 155-160.

[7]Preclinical evaluation of cisplatin-incorporated bio-nanocapsule as chemo-radiotherapy for human hepatocellular carcinoma., S.H. Shin, S.S. Park, J. Choi, J.H. Lee, K.J. Lee, E.J. Ju, J. Park, E.J. Ko, I. Park, J. Jung, S. Kuroda, S.M. Hong, J.J. Hwang, J.S. Lee, S.Y. Song, S.Y. Jeong, E.K. Choi: Oncology Reports, 38 (2017) 2259-2266.

[8]Low immunogenic bio-nanocapsule based on hepatitis B virus escape mutants, J. Jung, M. Somiya, S.Y. Jeong, E.K. Choi, S. Kuroda: Nanomedicine, 14 (2018) 595-600.

[9]Albumin-encapsulated liposomes: A novel drug delivery carrier with hydrophobic drugs encapsulated in the inner aqueous core., Y. Okamoto, K. Taguchi, K. Yamasaki, M. Sakuragi, S. Kuroda, M. Otagiri: J, 107 (2018) 436-445.

[10]Phosphoproteome analysis of synoviocytes from patients with rheumatoi arthritis, M. Katano, M.S. Kurokawa, K. Matsuo, K. Masuko, N. Suematsu, K. Okamoto, T. Kamada, H. Nakamura, T. Kato: International Journal of Rheumatic Diseases, 20 (3) (2017) 708-721.

[11]Serum peptides as putative modulators of inflammation in psoriasis, T. Matsuura, M. Sato, K. Nagai,

T. Sato, M. Arito, K Omoteyama, N. Suematsu, K. Okamoto, T. Kato, Y. Soma, M. S. Kurokawa: Dermatological Science, 87 (7) (2017) 36-49.

[12]Effects of vaccine-acquired polyclonal anti-HBs antibodies on the prevention of HBV infection of non-vaccine genotypes, M. Kato, S. Hamada-Tsutsumi, C. Okuse, A. Sakai, N. Matsumoto, M. Sato, T. Sato, M. Arito, K. Omoteyama, N. Suematsu, K. Okamoto, T. Kato, F. Itoh, R. Sumazaki, Y. Tanaka, H. Yotsuyanagi, T. Kato, M. S. Kurokawa: Journal of Gastroenterology, 52 (9) (2017) 1051-1063.

[13]Biocompatibility of highly purified bovine milk-derived extracellular vesicles, M. Somiya, Y. Yoshioka, T. Ochiya: Journal of Extracellular Vesicles, 7 (2018) 1440132.

International Conferences

[1]Planar membrane displaying IgGs in an oriented immobilization manner for biosensor surface. (poster), M. Iijima, S. Kuroda: 5th International Conference on Bio-Sensing Technology.

[2]Regulation of canonical Wnt pathway via microautophagy in the early mouse embryo. (poster), N. Kawamura, G.H. Sun-Wada, and Y. Wada: The 6th International Symposium on Autophagy.

[3]Specific delivery of the NF-κB corepressor sMPAID to inflammatory region by using early infection machinery of hepatitis B virus. (oral), Z. Xu, K. Tatematsu, K. Okamoto, S. Kuroda: National Tsing Hua Univerisity - Osaka University Life Science Student Symposium.

[4]Multi-step posttranslational modification of a cofactor-containing small subunit constituting quinoenzyme. (poster), T. Okajima: Kickoff Meeting (JSPS Symposium) for the ZIAM/GBB and ISIR/IPR collaboration.

[5]Evaluation of mechanical property of intermediate filament related with stiffness of breast cancer cell by use of nanoneedle and AFM (oral), A. Yamagishi, M. Susaki, U. Takano, M. Iijima, S. Kuroda, T. Okada, A, Nagasaki, C. Nakamura: The 2017 MRS Fall Meeting.

[6]Mechanical Separation of Neural Stem Cell Derived from Human iPS Cell Using Nanoneedle Array (poster), Y. Matsumoto, K. Shimizu, R. Kawamura, A. Yamagishi, M. Iijima, S. Kuroda, C. Nakamura: IGER International Symposium on Cell Surface Structures and Functions 2017.

[7]Development of scaffolding molecule for improving function of biomolecules (poster), M. Iijima, S. Kuroda: 42nd FEBS Congress.

[8]Capsular- and planar-scaffold for clustering and oriented immobilization of sensing molecules. (poster), M. Iijima, S. Kuroda: Nanotech France 2017 Conference and Exhibition.

[9]Bioavailability of bovine milk-derived EVs for drug delivery application. (poster), M. Somiya, Y. Yoshioka, and T. Ochiya: Annual meeting of International Society for Extracellular Vesicles.

[10]Analysis of cell attachment and entry of hepatitis B virus. (oral), Q. Liu, M. Somiya, S. Kuroda: 5th JAPAN-TAIWAN-KOREA HBV Research Symposium 2017.

[11]Novel heparin-binding domain of hepatitis B virus: Application to drug delivery system. (oral), Q. Liu, M. Somiya, S. Kuroda: Biomaterials International 2017.

[12]Establishment of human olfactory receptor-expressing cell lines for high throughput odorant analysis. (poster), M. Nakamura, T. Yamazaki, M. Takai, K. Tatematsu, S. Kuroda: The 21th SANKEN International Symposium.

[13]Role of flavin-containing enzyme in the post-translational modification of quinoheme protein amine

dehydrogenase (poster), T. Oozeki, T. Nakai, K. Tanizawa, T. Okajima: The 21th SANKEN International Symposium.

[14]Creation and application of hepatitis B virus-mimicking nanoparticle for drug delivery. (poster), Q. Liu, M. Somiya, S. Kuroda: The 21th SANKEN International Symposium.

[15]Bio-nanocapsule-based scaffold for clustering and oriented-immobilization of sensing molecules. (poster), Yamada Y, Iijima M, Kuroda S.: The 21th SANKEN International Symposium.

Review Papers
Microautophagic modulation of morphogenetic signaling in mammalian early embryogenesis, Y. Wada, G.H. Sun-Wada, N. Kawamura, Experimental Medicine, Yodosha, 35[15] (2017), 136-143.

Automated single-cell analysis and isolation system : Basics and applications : A paradigm shift in the cell screening system by single-cell isolation robot, K. Tatematsu, S. Kuroda, Kagaku To Seibutsu, The Japan Society for Bioscience, Biotechnology, and Agrochemistry, 55[10] (2017), 684-689.

Technique for oriented immobilization of sensing molecules, M. Iijima, S. Kuroda, Chemical Engineering, Kagaku-Kogyo Sha, 62[11] (2017), 785-791.

Current progress of virus-mimicking nanocarriers for drug delivery, M. Somiya, Q. Liu, S. Kuroda, Nanotheranostics, Ivyspring International Publisher Pty Ltd, 1[4] (2017), 415-429.

Biomimetic strategy for development of pleiotropic DDS carriers, M. Somiya, Drug Delivery System, The Japan Society of Drug Delivery System, 32[2] (2017), 156-157.

Issues in the entrepreneurization and commercialization of academic research-based DDS technology, S. Kuroda, Drug Delivery System, The Japan Society of Drug Delivery System, 32[4] (2017), 251-258.

Books
[1]High-throughput analysis of mammalian receptor tyrosine kinase activation in yeast cells (Jimenez, Gerardo) N. Yoshimoto, S. Kuroda, “ERK Signaling: Methods in Molecular Biology book series”, Springer International Publishing, 1487 (35-52) 2017.

[2]Application of non-cationic liposomes for the delivery of nucleic acid therapeutics (Technical Information Institute) M. Somiya, S. Kuroda, “Cutting-edge DDS technologies for the development of pharmaceuticals”, Technical Information Institute, 1901 (204-209) 2017.

[3]Bionanocapsule: Drug delivery system mimicking virus (K. Kataoka) K. Tatematsu, S. Kuroda, “Future medical care opened by nanotechnologies”, The Canon Foundation, (91-113) 2017.

[4]Development of peptide antii-inflammatory drug with few side-effects (T. Sigawara) K. Okamoto, “Screening, stabilization and formulation technology of peptide pharmaceuticals”, Technical Information Institute, (381-389) 2017.

Patents
[1]G20170157WO Medicine, PCT/JP2018/010791

[2] Method for quantifying odor, cell used for the method, and method for producing the cell, JP2017-157492

Publications in Domestic Meetings
The Japan Society for Bioscience, Biotechnology, and Agrochemistry Kansai Branch 2 papers
the 499st meeting

The 17th Annual Meeting of the Protein Science Society of Japan	3 papers
2017 Enzyme and Cofactor Research Meeting	1 paper
The 69th Annual Meeting of the Society for Biotechnology,	4 papers
Young Reseracher Meeting of the Society for Biotechnology 2017	4 papers
Consortium of Biological Sciences 2017	3 papers
The 11th Symposium on Biorelevant Chemistry	1 paper
The 9th Annual Meeting of the Japanese Association for RNAi	2 papers
The 32nd Japanese Society for the Study of Xenobiotics Annual Meeting	1 paper
LSACJ2017 Meeting	2 papers
The 2018 Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry	6 papers
The 98th Chemical Society of Japan Annual Meeting	1 paper
The 65th Annal Meeting of The Japan Society of Applied Physics	1 paper
The 450th Japanese Research Association for Vitamin B	1 paper

Academic Degrees

Master Degree for Science T. Oozeki	Functional analysis of FAD-dependent oxygenase QhpG involved in quinone cofactor biosynthesis
Master Degree for Science K. Kozakai	Substrate specificity of radical SAM enzyme QhpD forming intra-peptidyl thioether crosslinks
Master Degree for Science Z. Xu	Intracellular Kinetic Analysis of Novel NF-κB Corepressor MTI-II-containing Hepatitis B Virus Infection Mechanism-based Nanocarrier
Master Degree for Frontier Biosciences H. Li	Development of Macrophage-targeting and Phagocytosis-inducible Bio-nanocapsule-based DDS Nanocarrier

Grant-in-Aid for Scientific Research

S. Kuroda	Development of Neo-bionanocapsule for Various In Vivo Targets	¥33,670,000
T. Okajima	Elucidation of enzyme catalytic mechanism regulating transition state by linking conformational change and fluctuations of the active site	¥2,857,000
T. Okajima	Reaction mechanism of novel tryptophan-hydroxylating enzyme involving in quinone cofactor biogenesis	¥1,284,000
Y. Wada	Microautophagic regukation of mammalien embryogenesis	¥4,550,000
K. Tatematsu	Development of the modified ubiquitin ligase to degrade of a pathogenic protein	¥1,390,000
M. Somiya	Tumor-associated macrophage-targeting exosome containing nucleic acid therapeutics for anti-cancer therapy	¥3,486,000
M. Iijima	Development of scaffold for oriented immobilization of various sensing molecules on two-dimensional membrane	¥1,430,000

Entrusted Research

S. Kuroda	Japan Agency for Medical Research and Development	Identification of HBV receptor, establishment of HBV infection model, and development of anti-HBV drugs	¥6,354,000
S. Kuroda	Japan Agency for Medical Research and Development	Development of nanoparticlate scaffold for the enhancement of therapeutic antibodies	¥26,730,000
S. Kuroda	University of Ryukyus	Establishment of human-derived antibody against human T-cell leukemia virus	¥1,994,000
S. Kuroda	University of Ryukyus	Development of human olfactory	¥323,000

	receptor-based sensor for sensing shochu flavors	

Contribution to Research

S. Kuroda	GLOVACC Inc.	¥3,000,000
S. Kuroda	Prof. Shuji Hinuma	¥300,000
T. Okajima	NAGASE Science Technology Foundation	¥2,500,000
M. Somiya	Mishima Kaiun Memorial Foundation	¥1,000,000
M. Iijima	Japan Foundation for Applied Enzymology	¥500,000
K. Okamoto	Research Council for Vitamin B	¥154,000

Cooperative Research

S. Kuroda	Rohto Pharmaceutical Co., Ltd.	¥250,000
S. Kuroda	Suntory Global Innovation Center Limited	¥0,000
S. Kuroda	San-Ei Gen F.F.I., Inc.	¥2,831,000
S. Kuroda	Panasonic. Co.	¥3,756,000
S. Kuroda	Furukawa Electric Co., Ltd.	¥1,200,000
S. Kuroda	Soda Aromatic Co., Ltd.	¥2,399,000
S. Kuroda	Toshiba Co.	¥540,000
S. Kuroda	Kyoto Prefectural Police	¥0,000
S. Kuroda	Ryukyu Univ.	¥0,000
S. Kuroda	Katayama Chemical Industries Co., Ltd.	¥0,000
S. Kuroda	Kyoto Prefectural Police, Kyoto Univ.	¥0,000
S. Kuroda	Ryukyu Univ., Chiome Bioscience Inc.	¥0,000
K. Tatematsu	Mitsubishi Tanabe Pharma Corporation	¥0,000
K. Tatematsu	Komihakko Co.	¥1,872,000
M. Somiya	MEI3 Center, Osaka University	¥1,000,000

Department of Biomolecular Science and Regulation

Original Papers

[1]A rapid fluorescence assay for measuring sphingosine-1-phosphate transporter activity in erythrocytes, N. Kobayashi and T. Nishi: Methods Mol Biol., 1697 (2017) 73-82.

[2]MFSD2B is a sphingosine 1-phosphate transporter in erythroid cells., N. Kobayashi, S. Kawasaki-Nishi, M. Otsuka, Y. Hisano, A. Yamaguchi and T. Nishi: Sci. Rep., 8 (2018) 4969.

[3]Multiple entry pathways within the efflux transporter AcrB contribute to multidrug recognition, M. Zwama, S. Yamasaki, R. Nakashima, K. Sakurai, K. Nishino, and A. Yamaguchi: Nature Communications, 9 (2018) 124.

[4]Hoisting-loop in bacterial multidrug exporter AcrB is a highly flexible hinge that enables the large motion of the subdomains, M. Zwama, K. Hayashi, K. Sakurai, R. Nakashima, K. Kitagawa, K. Nishino, A. Yamaguchi: Front. Microbiol., 8 (2017) 2095.

[5]Regulation of the Expression of Bacterial Multidrug Exporters by Two-Component Signal Transduction Systems, K. Nishino: Methods Mol Biol., 1700 (2018) 239-251.

[6]Large-Scale Femtoliter Droplet Array for Single Cell Efflux Assay of Bacteria, R. Iino, S. Sakakihara, Y. Matsumoto, K. Nishino: Methods Mol Biol., 1700 (2018) 331-341.

International Conferences

[1]Regulation and Funciotn of Multidrug Exporters (oral), K. Nishino: Kickoff Meeting (JSPS Symposium) for the ZIAM/GBB and ISIR/IPR collaboration (at University of Groningen).

[2]Drug Efflux Transporters of Gram Negative Bacteria and Their Role in Multidrug Resistance (invited), K. Nishino: ConBio2017.

Review Papers

Drug Efflux Transporters of Gram Negative Bacteria, S. Yamasaki, K. Hayashi, K. Sakurai, R. Nakashima, A. Yamaguchi, and K. Nishino, The Cell, New Science, 49[11] (2017), 7-11.

Frontier of pharmaceutical microbiology: To combat-resistant bacterial pathogens, Y. Morita, K. Nishino, Yakugaku Zasshi, The Pharmaceutical Society of Japan, 137 (2017), 371-372.

Structural analysis and new drug development against multidrug efflux pumps, S. Yamasaki, R. Nakashima, K. Sakurai, A. Yamaguchi, K. Nishino, Yakugaku Zasshi, The Pharmaceutical Society of Japan, 137 (2017), 377-382.

Books

[1]Role of drug efflux pumps in bacterial drug resistance(K. Tateda) K. Nishino, "Antibiotics & Chemotherapy", Iyaku (Medicine and Drug) Journal Co., Ltd., 33[5] ((1029)79-(1039)89) 2017.

[2]Bacterial Multidrug Exporters-Methods and Protocols(John M. Walker) K. Nishino, A. Yamaguchi, "Bacterial Multidrug Exporters-Methods and Protocols-Methods in Molecular Biology", Springer, 1700 (1-352) 2018.

Patents

[1]G20170122WO Fusicoccin compound, PCT/JP2018/002825

[2]G20120010EP Method for testing antibacterial-drug sensitivity of bacterium or fungus and system used for same, 12832460.5

[3]G20120010CA Method for testing antibacterial-drug sensitivity of bacterium or fungus and system used for same, 2848559

Contributions to International Conferences and Journals

K. NISHINO	Frontiers in Micirobiology (Antimicrobials, Resistance and Chemotherapy) (Associate Editor)
K. NISHINO	Scientific Reports (Ad-Hoc Reviewer)
K. NISHINO	PLoS One (Ad-Hoc Reviewer)
K. NISHINO	PLoS Pathogen (Ad-Hoc Reviewer)
K. NISHINO	Medical Research Council (Reviewer)
K. NISHINO	Methods in Molecular Biology (Editor)

Publications in Domestic Meetings

Information Processing Sciety of Japan, The 207th CVIM Meeting	1 paper
ConBio2017	2 papers
138th Annual Meeting of the Pharmaceutical Society of Japan	3 papers
6th Osaka Univ. COI Symposium	1 paper
AMR Symposium	1 paper
SSH Research Symposium	2 papers
The Annual Meeting of Japanese Society for Bacteriology, Kansai Branch	2 papers
Medical Device Manufacturing Exhibition	1 paper
Subcommittee of 2017 Biological Functional Materials / Device / System Project Group (G3)	1 paper
The 1st COI Young Researcher's Ideathon Training Camp	1 paper
The 5th Alliance ｙoung researcher's exchange meeting	1 paper
JST Fair 2017	1 paper
The 2nd COI2021Workshop	2 papers
The 65th Annual Meeting of Western Japan Branch of the Japanese Society of Chemotherapy	1 paper
Alliance G1 group meeting	1 paper
The 2nd COI Young Researcher's Ideathon Training Camp	1 paper

The 3rd COI2021 meeting		1 paper
Alliance Sub group meeting		1 paper

Academic Degrees

Doctoral Degree for Pharmaceutical Sciences M. Zwama	Function and Mechanism of Multidrug Efflux Transporters
Bachelor Degree for Pharmaceutical Sciences S. Shigeyama	Improvement effect of Yacon on intestinal flora and health condition of mouse eating high-fat diets
Bachelor Degree for Pharmaceutical Sciences K. Nakao	Study on the substrate recognition mechanism of the MexB multidrug efflux transporter in Pseudomonas aeruginosa

Grant-in-Aid for Scientific Research

K. Nishino	Study on mechanisms of bacterial multidrug resistance and pathogenicity modulated by transporters and development of novel therapeutic methods	¥6,370,000
M. Hayashi-Nishino	Development of automatic discrimination technology of multidrug resistant bacteria by machine learning and artificial intelligence	¥1,430,000
M. Hayashi-Nishino	Regulation of bacterial virulence by ABC-type transporters	¥346,000
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
K. Yoshizaki	A marker capable of selecting an effective biologic product individually for patients before treating rheumatoid arthritis	¥952,000

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	Japan Science and Technology Agency	Improvement of intestinal flora	¥24,295,000
T. Nishi	Japan Agency for Medical Research and Development	Elucidation of cell migration regulation mechanism by S1P transporter and creation of new drug discovery fund technology targeting transporters	¥27,976,000
N. Kato	Japan Agency for Medical Research and Development	Elucidation of cell migration regulation mechanism by S1P transporter and creation of new drug discovery fund technology targeting transporters	¥9,100,000
S. Yamasaki	Japan Science & Technology Agency (JST)	Development of a sensor for stagnant toilet water measurement and the elucidation of the relationship between health conditions and feces components in water	¥4,550,000
K. Nishino	Ministry of Education, Culture, Sports, Science and Technology	Mechanism of bacterial homeostasis modulated by transportes and development of novel therapeutics	¥500,000

Contribution to Research

K. Nishino	K. Yoshizaki	¥400,000
K. Nishino	Japan Waxman Foundation, President, Ichiro Kitasato	¥1,000,000

K. Yoshizaki	K. Yoshizaki	¥2,000,000
K. Yoshizaki	K. Yoshizaki	¥400,000
M. Hayashi-Nishino	The Naito Foundation	¥2,000,000

Cooperative Research

K. Nishino	Fukoku Co., Ltd.	¥319,000
K. Nishino	FINE JAPAN CO.,LTD.	¥729,000
K. Nishino	Ayano Satoh (Okayama University)	¥100,000
K. Nishino	Junichi Yamagishi (Nihon Pharmaceutical University)	¥100,000
K. Nishino	Aixin Yan (University of Hong Kong)	¥400,000
K. Nishino	Yuji Morita (Aichi Gakuin University)	¥400,000
K. Nishino	Axel Cloeckaert (INRA, France)	¥0,000

Department of Biomolecular Science and Engineering

Original Papers

[1]Non-invasive phenotyping and drug testing in single cardiomyocytes or beta-cells by calcium imaging and optogenetics, Chang YF, Broyles CN, Brook FA, Davies MJ, Turtle CW, Nagai T, Daniels MJ,: PLoS One., 12 (2017) e0174181.

[2]Fluorescence and Bioluminescence Imaging of Angiogenesis in Flk1-Nano-lantern Transgenic Mice., Matsushita J, Inagaki S, Nishie T, Sakasai T, Tanaka J, Watanabe C, Mizutani KI, Miwa Y, Matsumoto K, Takara K, Naito H, Kidoya H, Takakura N, Nagai T, Takahashi S, Ema M: Sci Rep., 7 (2017) 46597.

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[5]Dynamic Organization of Chromatin Domains Revealed by Super-Resolution Live-Cell Imaging., Nozaki T, Imai R, Tanbo M, Nagashima R, Tamura S, Tani T, Joti Y, Tomita M, Hibino K, Kanemaki MT, Wendt KS, Okada Y, Nagai T, Maeshima K.: Mol Cell., 67 (2017) 282-293.

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[11]Bioluminescent low-affinity Ca2+ indicator for ER with multicolor calcium imaging in single living cells., Nadim H, Suzuki K, Iwano M, Matsuda T and Nagai T.:ACS Chem Biol., 13(7) (2018) 1862-1871.

[12]A Genetic Screen to Discover SUMOylated Proteins in Living mammalian Cells., Komiya M, Ito A, Endo M, Hiruma D, Hattori M, Saito H, Yoshida M and Ozawa T.: Sci Rep., 7 (2017) 17443.

International Conferences
[1]A photoswitchable fluorescent protein with fast spontaneous switching on property and large photon budget able to easy superresolution imaging. (invited), T. Nagai: Janelia Conference Notice: Frontiers in Imaging Science.

[2]Super-Easy Superresolution Imaging by Spontaneously Photoswitchable Fluorescent Protein. (oral), Y. Arai, H. Takauchi, Y. Ohgami, T. Nagai: FOM 2017.

[3]Bioluminescent indicator applicable to membrane voltage recording in various excitable cell types. (plenary), T. Nagai: OPTICS & PHOTONICS International Congress 2017.

[4]Development of techniques for imaging physiological functions toward visualization of minority cells. (invited), T. Nagai: Joint Symposium on Bioimaging between Singapore and Bioimaging Society of Japan.

[5]Development of Chemiluminescent Low Affinity Ca2+ Indicators Applicable to Analysis of Ca2+ Dynamics in Endoplasmic Reticulum. (poster), H. Nadim, K. Suzuki, M. Iwano, T. Matsuda, T. Nagai.: Joint Symposium on Bioimaging between Singapore and Bioimaging Society of Japan.

[6]Green Variant of Monomeric Photosensitizing Fluorescent Protein for Photo-Inducible Protein Inactivation and Cell Ablation. (oral), YD. Riani, T. Matsuda, T. Nagai: the Biophysical Society Thematic Meeting Single-Cell Biophysics: Measurement, Modulation, and Modeling.

[7]Acid Resistant Monomeric GFP for Quantitative Single Cell Analyses. (invited), T. Nagai: the Biophysical Society Thematic Meeting Single-Cell Biophysics: Measurement, Modulation, and Modeling.

[8]Genetically encoded bioluminescent voltage indicator applicable to brain activity recording in freely moving mice (oral), S. Inagaki, M. Agetsuma, S. Ohara, T. Iijima, T. Wazawa, Y. Arai, T. Nagai: 9th Optogenetics Research Society Japan International Symposium.

[9]Multicolor Bioluminescent Calcium Imaging Across Three Orders of [Ca2+] Magnitude in Single Living Cells (oral), H. Nadim, K. Suzuki, M. Iwano, T. Matsuda, T. Nagai: 20th International Symposium on Calcium Binding Proteins and Calcium Function in Health and Disease.

[10]Fluorescent/Bioluminescent Protein-Based Ca2+ Probes and Photo Manipulation for Imaging of Physiological Functions (invited), T. Matsuda, T. Nagai: 20th International Symposium on Calcium Binding Proteins and Calcium Function in Health and Disease.

[11]Bioluminescent probes for multi-purpose use in wide range of bioimaging (invited), T. Nagai: 8th Asia and Oceania Conference on Photobiology.

[12]Various applications of super-duper bioluminescent proteins: From bioimaging to glowing plants (invited), T. Nagai: 29th Annual Meeting of Thai Society for Biotechnology and International Conference.

[13]Toward spatiotemporally-scalable Ca2+ imaging with a bimodal indicator. (poster), I. Farhana, K. Suzuki, T. Matsuda, T. Nagai: 21st SANKEN International Symposium.

[14]In vitro evolution of photoswitchable red fluorescent protein. (poster), M. Tsuji, M. Hattori, Y. Arai, T. Nagai: 21st SANKEN International Symposium.

[15]Green variant of monomeric photosensitizing fluorescent protein for photo-inducible protein inactivation and cell ablation. (poster), YD. Riani, T. Matsuda, T. Nagai: 21st SANKEN International Symposium.

[16]Direct and functional reconstitution of Haloterrigena turkmenica bacteriorhodopsin from polymer-bounded nanodisc into liposome. (poster), K. Yoshida, K. Hayashi, R. Nakashima, A. Yamaguchi, T. Nagai, T. Matsuda: 21st SANKEN International Symposium.

[17]Analysis of the in cell dynabics of a multi-drug exporter AcrB in the absence and presencen of substrates. (poster), T. Matsuda, S. Yamasaki, K. Nishino, T. Nagai, A. Yamaguchi: 21st SANKEN International Symposium.

[18]A novel fiber-free technique for brain activity imaging in multiple freely behaving mice. (oral), S. Inagaki, M. Agetsuma, T. Nagai: SPIE Photonic West BiOS 2018.

[19]Super-duper bioluminescent probes for next generation neuroscience. (plenary), T. Nagai: SPIE Photonic West BiOS 2018.

[20]Cell-cycle heterogeneity in human embryonic stem cells affects mesendoderm lineage determination. (oral), K. Lu, H. Zhong, C. Song, Y. Zhang, W. Liu, G. Chen: 4th Macau Symposium on Biomedical Sciences 2017.

Review Papers
Recent progress in expanding the chemiluminescent toolbox for bioimaging, K. Suzuki, T. Nagai, Curr Opin Biotechnol., Elsevier, 48 (2017), 135-141.

New paradigm from one to infinite, T. Nagai, Experimental Medicine, YODOSHA, 35 (2017), 3184-3189.

Minority regulation in cell population signaling, K. Horikawa, Y. Ota, A. Mukai, Y. Arai, T. Nagai, Experimental Medicine, YODOSHA, 35 (2017), 3204-3210.

Development of chemiluminescent protein with high-intensity and application to life sience, K. Suzuki, T. Nagai, SEIBUTSU BUTSURI, The Biophysical Society of Japan, 57 (2017), 262-264.

Development of brightness chemiluminescent proteins, M. Nakano, T.Nagai, SEITAI NO KAGAKU, Igaku-Syoin, 68 (2017), 462-463.

Super-Resolution Imaging by SPoD-ExPAN, T. Wazawa, Y. Arai, T. Nagai, KENBIKYO, The Japanese Society of Microscopy, 52 (2017), 77-81.

Books
[1]Genetically encoded Ca2+ indicators; expanded affinity range, color hue and compatibility with optogenetics.(K. Mikoshiba) Nagai T, Horikawa K, Saito K, Matsuda T., “Application of Genetically Encoded Indicators to Mammalian Central Nervous System”, Frontiers Media SA, - (38-42) 2017.

Patents
[1]G20170132WO Devices and measurement system, PCT/JP2018/002591

[2]G20170106WO Method for detection of bio materials, and chemiluminescent indicator for that purpose, PCT/JP2018/002587

[3]G20130052US Optical microscope and auto-focusing device for optical microscope, 14/647401

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

JSAI2017	1 paper
The 69th Annual Meeting of the Japan Society for Cell Biology	1 paper
The 79th JSAP Autumn Meeting 2018	1 paper
The 55th Annual Meeting of the Biophysical Society of Japan	3 papers
Consortium of Biological Sciences 2017	2 papers
The 98th CSJ Annual Meeting	1 paper

Academic Degrees

Doctor Degree for Engineering S. Inagaki	Development of a genetically encoded chemiluminescent voltage indicator and its application to biological research
Master Degree for Engineering M. Tsujii	Development of a red photoswitchable fluorescent protein with high ON-OFF contrast for better super-resolution imaging
Master Degree for Engineering N. MD Hossain	Development of bioluminescent low affinity Ca2+ indicators applicable to analyze Ca2+ dynamics in endoplasmic reticulum
Master Degree for Engineering T. Quang	Generation of bioluminescent Arabidopsis thaliana and Petunia hybrida

Grant-in-Aid for Scientific Research

T. Nagai	Development of constitutive energy biosynthesis system with chemilumino-genetics	¥1,950,000
T. Matsuda	Visualization and photomanipulation of migrating neuronal cells and surrounded field during the formation of brain tissue	¥0,000
T. Matsuda	Visualization and photomanipulation of migrating neuronal cells and surrounded field during the formation of brain tissue	¥14,560,000
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	¥2,279,000
M. Iwano	Analysis of plant reproduction by bioluminescence calcium imaging	¥1,690,000
M. Iwano	Analysis of compatible-pollen reception system in Brassicaceae	¥1,876,000
M. Hattori	Development of new optogenetics system for deep living tissue by longer-wavelength light	¥3,536,000

Entrusted Research

T. Nagai	Japan Science and Technology Agency (JST)	Superresolution of "physiological functions" and diagnostics of activity architecture in live cells	¥39,350,000
T. Nagai	Japan Science and Technology Agency (JST)	Development of all-in-one microscopy for chemiluminescence imaging	¥35,009,000
T. Nagai	Ministry of Education, Culture, Sports, Science and Technology - JAPAN (MEXT)	Support Project for Excellent young researchers	¥2,880,000
T. Nagai	Ministry of Education, Culture, Sports, Science and Technology - JAPAN	Support Project for Excellent young researchers	¥2,500,000

	(MEXT)		
T. Matsuda	Japan Science and Technology Agency (JST)	Analysis of Dynamics of Drug Efflux Transporter and Drug	¥12,480,000
M. Nakano	Japan Science and Technology Agency (JST)	Development of illumination technique using chemiluminescent proteins	¥38,862,000

Cooperative Research

T. Nagai	OPTO-LINE, Inc.	¥1,920,000
T. Nagai	Nikon Co.,Ltd.	¥3,240,000
T. Nagai	DRVision Technologies LLC	¥7,168,000
T. Nagai	Molecular Devices, LLC	¥108,000
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)	¥2,400,000

Department of Intellectual Property Research

Original Papers

[1]Identification of Waters Incorporated in Laguna Lake, Republic of the Philippines, Based on Oxygen and Hydrogen Isotopic Ratios, : Water, 9 (328) (2017) doi:10.3390/w9050328 .

Publications in Domestic Meetings

The Annual Conference 2017 of Japanese Association for Water Resources and Environment	1 paper

Laboratory of Cellulose Nanofiber Materials

Original Papers

[1]Renewable wood pulp paper reactor with hierarchical micro/nanopores for continuous-flow nanocatalysis, H. Koga, N. Namba, T. Takahashi, M. Nogi, Y. Nishina: ChemSusChem, 10 (12) (2017) 2650-2565.

[2]Electrochemical behavior of Zn-xSn high-temperature solder alloys in 0.5M NaCl solution, Z. Wang, C. Chen, J. Jiu, S. Nagao, M. Nogi, H. Koga, H. Zhang, G. Zhang, K. Suganuma: Journal of Alloys and Compounds, 716 (5) (2017) 231-239.

[3]Ionic liquid-mediated dispersion and support of functional molecules on cellulose fibers for stimuli-responsive chromic paper devices, H. Koga, M. Nogi, A. Isogai: ACS Applied Materials & Interfaces, 9 (46) (2017) 40914-40920.

[4]Clearly transparent nanopaper from highly concentrated cellulose nanofiber dispersion using dilution and sonication, T. Kasuga, N. Isobe, H. Yagyu, H. Koga, M. Nogi: Nanomaterials, 8 (2) (2018) 104.

International Conferences

[1]Nanocellulose Based Flexible, Environment-friendly Nonvolatile Resistive Switching Memory (invited), K. Nagashima, H. Koga, U. Celano, M. Nogi, T. Kitaoka, T. Yanagida: 9th World Congress on Materials Science and Engineering (Materials Congress 2017).

[2]Paper-based electronics and sensors fabricated by using printing technology (oral), T. Enomae, Y. Xu, E. Oktavia, M. Morii, H. Koga: Fundamental Research Symposium.

[3]High frequency characteristics of printed silver nanowire transmission line (oral), Y. Kakuya, H. Dawei, H. Koga, K. Suganuma: 12th IEEE Nanotechnology Materials and Devices Conference (NMDC 2017).

[4]Paper reactor with a cellulose fiber micro/nanoarchitecture for continuous-flow nanocatalysis (poster), H. Koga, Y. Izumi, M. Nogi, Y. Nishina: The 4th International Cellulose Conference (ICC 2017).

[5]The effect of concentration of cellulose nanofiber dispersions on the haze of transparent nanopaper (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: The 4th International Cellulose Conference (ICC 2017).

[6]Two-step fabrication technique for transparent and thermostable nanopaper from highly concentrated cellulose nanofiber dispersion (oral), T. Kasuga, N. Isobe, H. Koga, M. Nogi: A3 Foresight 1st Symposium.

[7]Transparent and thermostable nanopaper from highly concentrated cellulose nanofiber dispersion for foldable transparent conductive films (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: The 21st SANKEN International The 16th SANKEN Nanotechnology Symposium.

[8]Design of hierarchical micro-meso-macro porous structures in a cellulose nanofiber paper for electrode applications (poster), D. Fukushima, H. Koga, M. Nogi: The 21st SANKEN International The 16th SANKEN Nanotechnology Symposium.

[9]Structural design of cellulose paper composites for green chemistry and electronics (invited), H. Koga: 255th ACS National Meeting.

[10]Fabrication technique for clearly transparent nanopaper from highly concentrated cellulose nanofiber dispersion (poster), T. Kasuga, N. Isobe, H. Koga, M. Nogi: 255th ACS National Meeting.

Review Papers
Catalytic paper reactor for chemical manufacturing, H. Koga, Chemical engineering, kako-sha, 62[6] (2017), 388-395.

Books
[1]High-sensitivity printed antenna prepared by high-speed and low-temperature sintering of silver precursor ink H. Koga, H. Tonomura, T. Inui, K. Suganuma, I. Miyamoto, T. Sekiguchi, N. Nawa, “Recent development of materials and processes for printed electronics”, Technical Information Institute Co., Ltd., (Chapter 13・Section 4) 2017.

[2]Fine chemical synthesis by using cellulose nanofibers as catalyst support H. Koga, T. Kitaoka, “Production, compositing, and evaluation techniques of cellulose nanofibers”, Johokiko Co. Ltd., (Chapter 2・Section 6) 2018.

[3]Compositing and structural design of metal nanomaterials and cellulose nanofibers for electronic applications H. Koga, “Production, compositing, and evaluation techniques of cellulose nanofibers”, Johokiko Co. Ltd., (Chapter 4・Section 3・Subsection 1) 2018.

Patents
[1]G20170028WO ELECTRICALLY CONDUCTIVE COMPOSITION, PCT/JP2017/022188

[2]K20120401 Insulating material, passive element, circuit board, and method of manufacturing an insulating sheet, 2013-145390

[3]G20130122US Insulating material, passive element, circuit board, and method of manufacturing an insulating sheet, 14/311546

Publications in Domestic Meetings

84th Pulp and Paper Research Conference	1 paper
24th annual meeting of the Cellulose Society of Japan	1 paper

The 36th Electronic Materials Symposium		1 paper
2018 Spring Annual Meeting of the Japan Institute of Metals and Materials		1 paper
The 65th JSAP Spring Meeting 2018		1 paper
The 98th Annual Meeting 2018 of CSJ		1 paper
Grant-in-Aid for Scientific Research		
H. Koga	Flexible energy-storage paper based on cellulose nanofiber	¥4,030,000
H. Koga	Development of wood flow reactors for chemical manufacturing	¥2,990,000
Contribution to Research		
H. Koga	SEKISUI CHEMICAL Co., Ltd.	¥1,000,000
Other Research Fund		
H. Koga	Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials	¥3,000,000

Laboratory of Cell Membrane Structural Biology

Original Papers

[1]Multiple Entrances of the Efflux Transporter AcrB Contribute to Multidrug Recognition, Seiji Yamasaki, Ryosuke Nakashima, Keisuke Sakurai, Kunihiko Nishino and Akihito Yamaguchi: Nature Communications, 9 (124) (2018) 1-9.

[2]Hoisting-loop in bacterial multidrug exporter AcrB is a highly flexible hinge that enables the large motion of the subdomains, Keisuke Sakurai, Ryosuke Nakashima, Kunihiko Nishino, Akihito Yamaguchi: Frontiers in Microbiology, 8 (2095) (2017) 1-8.

International Conferences

[1]Multiple Channels in Multidrug Exporter AcrB Contribute to Multidrug Recognitio (poster), M. Zwama, S. Yamasaki, R. Nakashima, K. Sakurai, K. Nishino, A. Yamaguchi: Kick-off Meeting(JSPS Symposium) for the ZIAM/GBB and ISIR/IPR Collaboration.

[2]Novel insights about the substrate recognition by MexB, multidrug efflux protein in P. aeruginosa (poster), K. NAKAO, K. SAKURAI, S. YAMASAKI, K. NISHINO, A. YAMAGUCHI, R. NAKASHIMA: The 21st SANKEN International Symposium.

Review Papers

Crystallographic Analysis of Drug and Inhibitor-Binding Structure of RND-type Multidrug Exporter AcrB in Physiologically-Relevant Asymmetric Crystals, R. Nakashima, K. Sakurai, A. Yamaguchi, Methods Mol. Biol., Springer, 1700 (2018), 25-36.

Drug Efflux Transporters of Gram Negative Bacteria, S. Yamasaki, K. Sakurai, R. Nakashima, A. Yamaguchi, K. Nishino, The CELL, NEW SCIENCE co., ltd., 49(11) (2017), 533-537.

Structural Analysis and New Drug Development against Multidrug EŒux Pumps, S. Yamasaki, R. Nakashima, K. Sakurai, A. Yamaguchi, K. Nishino, YAKUGAKU ZASSHI, The Pharmaceutical Society of Japan, 137(4) (2017), 377-382.

Patents

[1]G20120010EP 細菌または真菌の抗菌薬感受性の検査方法およびそれに用いるシステム, 12832460.5

[2]G20120010CA 細菌または真菌の抗菌薬感受性の検査方法およびそれに用いるシステム, 2848559

Publications in Domestic Meetings

日本生体エネルギー研究会/第４３回討論会	1 paper
1. 林克彦, 櫻井啓介, 中島良介, 西野邦彦, 山口明人, 排出機能を持つ緑膿菌	papers

の多剤排出トランスポーターMexB-MexY、MexA-MexX キメラ複合体, 2017 年度生命科学系学会合同年次大会(ConBio2017), 2017 年 12 月 6-9 日

The 43th Annual Meeting of Japan Bioenergetics Group 1 paper

Consortium of Biological Science 2017 1 paper

The 70th Annual Meeting of Japanese Society for Bacteriology, Kansai Branch 2 papers

Entrusted Research

A. Yamaguchi	JST Strategic Basic Research Programs, CREST	Studies on the structural basis of multidrug efflux transport and the development of multidrug transporter inhibitors	¥54,418,000
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.	¥10,400,000

Cooperative Research

A.Yamaguchi	株式会社ファイン	¥720,000
A.Yamaguchi	富山化学工業株式会社→ 富士フイルム株式会社	¥2,000,000

Mitsubishi Electric Collaborative Research Division for Wide-area Security Technolog

Publications in Domestic Meetings

Information Processing Society of Japan, Special Interest Group on Computer Vision and Image Media 1 paper

Institute for Advanced Co-Creation Studies

Original Papers

[1]Single-particle tracking reveals a dynamic role of actin filaments in assisting long-range axonal transport in neurons., Osakada Y, Zhang K.: Bull. Chem. Soc. Jpn., 90 (2017) 714-719.

[2]Live cell imaging using photoswitchable diarylethene-doped fluorescent polymer dots., Osakada Y, Fukaminato T, Ichinose Y, Fujitsuka M, Harada Y, Majima T.: Chemistry - An Asian Journal, 12 (2017) 2660-2665.

[3]Black phosphorus: A promising two dimensional visible and near-infrared-activated photocatalyst for hydrogen evolution., Zhu M, Osakada Y, Kim S, Fujitsuka M, Majima T.: Appl. Catal., B, 217 (2017) 285-292.

Publications in Domestic Meetings

Annual meeting on photochemistry 2017 1 paper

Grant-in-Aid for Scientific Research

Y.Osakada	The development of optogenetic method using hybrid materials	¥4,030,000
Y.Osakada	The development of luminescent nano materials for XEOL for CT imaging beyond 1000 nm light emission	¥58,000
Y.Osakada	The development of XEOL nanomaterials toward braking emitted photon irradiation for effective radiation therapy	¥3,510,000

Entrusted Research

Y. Osakada	Kato Foundation for promotion of science	¥1,000,000

Other Research Fund

Y. Osakada	2016-2021 Ministry of education, culture, sports, science and technology (MEXT), Initiative for realizing diversity in the research envronment (collaboration type)	¥1,440,000

Department of Functional Nanomaterials and Nanodevices

Original Papers

[1]Enhancement of discrete changes in resistance in engineered VO2 heterointerface nanowall wire, S. Tsubota, A. N. Hattori, T. Nakamura, Y. Azuma, Y. Majima, H. Tanaka: Appl. Phys. Express, 10 (2017) 115001-1-4.

[2]Direct observation for atomically flat and ordered vertical 111 side-surfaces on three-dimensionally figured Si(110) substrate using scanning tunneling microscopy, H. Yang, A. N. Hattori, A. Ohata, S. Takemoto, K. Hattori, H. Daimon, H. Tanaka: Jpn. J. Appl. Phys., 56 (2017) 111301-1-4.

[3]Epitaxial crystallization of self-assembled ZnO–NiO nanopillar system, O. Nakagawara, K. Okada, A. S. Borowiak, A. N. Hattori, K. Murayama, N. Tanaka, H. Tanaka,: Appl. Phys. Express, 10 (2017) 0075501-1-4.

[4]Selective High-Frequency Mechanical Actuation Driven by the VO2 Electronic Instability, : Adv.Mater., 29 (2017) 1701618-1-6.

[5]Enhanced electronic-transport modulation in single-crystalline VO2 nanowire-based solid-state field-effect transistors, : Sci. Rep., 7 (2017) 17215-1-7.

[6]VO2: A Phase Change Material for Micromechanics VO2: A Phase Change Material for Micromechanics VO2: A Phase Change Material for Micromechanics, : MDPI Proceedings, 1 (2017) 294-1-4.

[7]Morphology of phase-separated VO2 films deposited on TiO2(001) substrate, Y. Cho, S. Aritomi, T. Kanki, K. Kinoshita, N. Endo, Y. Kondo, D. Shindo, H. Tanaka, Y. Murakami: Mater. Res. Bull., 102 (2018) 289-293.

[8]Virtual substrate method for nanomaterials characterization, Bo Da, Jiangwei Liu, Mahito Yamamoto, Yoshihiro Ueda, Kazuyuki Watanabe, Nguyen Thanh Cuong, Songlin Li, Kazuhito Tsukagoshi, Hideki Yoshikawa, Hideo Iwai, Shigeo Tanuma, Hongxuan Guo, Zhaoshun Gao, Xia Sun, Zejun Ding: Nat. Comm., 8 (2017) 15629.

International Conferences

[1]Modulation of magneto-transport properties in a field effect device accompanying Redox processes in ferrite thin films (poster), H. Tanaka: 29th International Conference on Defects in Semiconductors.

[2]Nanoscale electrostatic and electrochemical transistors in correlated oxides (invited), H. Tanaka,T. Kanki: Yamada Science Foundation Junjiro KanamoriMemorial International Symposium.

[3]Electrochemical conductance modulation in Ionic Liquid gating on perovskite nickelates (oral), H. Tanaka,T. Kanki,A. N. Hattori: Junjiro KanamoriMemorial International Symposium Satellite workshop.

[4]Nanoimprint Technology for Functional Oxide Electronics (invited), H. Tanaka,T. Kanki,A. N. Hattori: The 16th International Conference on Nanoimprint and Nanoprint Technology.

[5]Enhancement Factors of Electrochemical Conductance Modulation in Ionic Liquid Gating on Correlated Oxide Micro/Nanostructures (invited), H. Tanaka: 2017 MRS Fall Meeting & Exhibit.

[6]Electrochemical Gating-Induced Hydrogenation in VO2 Nano-Patterned Devices (oral), H. Tanaka,T. Kanki: 2017 MRS Fall Meeting & Exhibit.

[7]Electric field-induced hydrogen doping into VO2 nanowires at room temperature (invited), T. Kanki, H. Tanaka: 2017 Collaborative Conference on Materials Research.

[8]Nano-spintronics using phase transition in functional oxides (poster), T. Kanki, H. Tanaka: 29th

International Conference on Defects in Semiconductors.

[9]Resistance Modulation and Memory Effect in VO2 Nanowires by Electrochemical Gating-Induced Hydrogenation (invited), T. Kanki, H. Tanaka: lnternational Workshop on Advanced Materials and Device Technology (IWAMDT-2017).

[10]Noise-Driven Signal Transmitter Using Nonlinear Effect of Functional Oxides (oral), T. Kanki, H. Tanaka: 2017 MRS Fall Meeting.

[11]Enhancement of Electronic Transport Modulation in Single Crystalline VO2 Nanowire-Based Solid State-Field-Effect Transistor (poster), T. Kanki, H. Tanaka: 2017 MRS Fall Meeting.

[12]The enhancement of electronic phase switching efficiency in VO2 freestanding nanowires (poster), Y. Higuchi, T. Kanki, and H.Tanaka: 2017 MRS Fall Meeting.

[13]Strain-Electronics Driven by Electrostatic Actuation in Single-crystal VO2 (poster), Y. Higuchi, T. Kanki, L. Pellegrino, N. Manca, D. Marré, H. Tanaka: The 21st SANKEN International Symposium.

[14]Colossal resistance modulation of single crystal VO2 thin films on TiO2(001) substrates by hydrogen doping using catalytic effect using catalytic effect (poster), K. Muraoka, T. Kanki, H. Tanaka: The 21st SANKEN International Symposium.

[15]Colossal resistive jump due to metal-insulator transition in single crystal VO2 nanowires on TiO2(001) substrates with nano-electrode gap (poster), Y. Tsuji, T. Kanki, H. Tanaka: The 21st SANKEN International Symposium.

[16]Fabrication of the Electric Double Layer Transistor with (La,Pr,Ca)MnO3 Nanowall Wire Channel (oral), A. N. Hattori, H. Nakazawa, T. Nakamura, H. Tanaka: 2018 3rd International Conference on Materials Science and Nanotechnology.

[17]Metal-insulator transition properties of electric nanodomains in the strongly electron correlated metal oxide nanowall wire (invited), A. N. Hattori, H. Tanaka: BIT's Annual World Congress of Nano Science & Technology-2017.

[18]Ferromagnetic metal nanodomain structure in the manganite nanowall wire through metal-insulator transition (oral), A. N. Hattori, T. Nakamura, H. Nakazawa , T. V. A. Nguyen, H. Tanaka: 29th International Conference on Defects in Semiconductors.

[19]Wide-range nonvolatile multistate resistance modulation in SmNiO3 film EDLT (poster), D. Kawamoto, A. N. Hattori, M. Yamamoto, H. Tanaka: The 21st SANKEN International Symposium.

[20]Quantitative estimation of the doped width and resistivity after hydrogenation for the ReNiO3 device with the designed micro meter electrode gap (poster), T. Tanimura, A. N. Hattori, H. Tanaka: The 21st SANKEN International Symposium.

[21]Effective resistance modulation in VO2 by gating through hexagonal boron nitride (poster), Y. Anzai, M. Yamamoto, T. Kanki, K. Watanabe, T. Taniguchi, K. Matsumoto, H. Tanaka: The 21st SANKEN International Symposium.

[22]Growth and characterization of VO2 on hexagonal boron nitride (poster), S. Genchi, M. Yamamoto, T. Kanki, K. Watanabe, T. Taniguchi, H. Tanaka: The 21st SANKEN International Symposium.

[23]Non-Thermionic Switching in an Atomically Thin WSe2 Transistor with the Phase-Change Material VO2 Contact (oral), M. Yamamoto, T. Kanki, A. N. Hattori, R. Nouchi, K. Watanabe, T. Taniguchi, K.

Ueno, H. Tanaka: APS Marchi Meeting 2018.

Review Papers

Do you truly care for your daily choice?, T. Kanki, the Advancement of Manufacturing and Technology, Association for the Advancement of Manufacturing and Technology, 70 (2018), 77-79.

Novel oxides/atomically thin materials hybrid devices, M. Yamamoto, H. Tanaka, Kinzoku, AGNE Gijutsu Center, 88 (2018), 112-117.

Patents

[1]K20140224 THIN-FILM STRUCTURAL BODY, METHOD FOR MANUFACTURING THIN-FILM STRUCTURAL BODY, AND SEMICONDUCTOR DEVICE, WO2016/152462 A1

Contributions to International Conferences and Journals

H.TANAKA	CIMTEC (International Conferences on Modern Materials and Technologies) (Organaizing Committtee)
H.TANAKA	Scientific Reports (Editorial Board Member)
H. TANAKA	Symposium on Frontier Researches of Functional Oxide Devices and Materials (Organaizing Committtee)

Publications in Domestic Meetings

Workshop on Single-Nanometer Figuration and the Structure-Induced Property	2 papers
The Sanken academic lecture presentations	2 papers
PASPS-22	1 paper
Workshop on Quantum Beam Science,	1 paper
Seminor on functionl surfaces and devices	2 papers
The 78th JSPS Autumn Meeting, 2017	4 papers
The 2017 Autumn Meeting	2 papers
The 3rd material science week	2 papers
Strategy meeting for new novel functional materials research	1 paper
The 65th JSAP Spring Meeting, 2017	5 papers
2018/5 Annual (73th) Meeting	2 papers

Academic Degrees

Master Degree for Engineering K. Sakai	Study on nanoscopic metal-insulator transition on VO2 single crystalline film
Master Degree for Engineering K. Hayashi	Study on perovskite Ni oxide nanowire and their electro-transport properties.
Master Degree for Engineering Y. Higuchi	Electrical manipulation of Metal-Insulator transition in VO2 Nano Electro-Mechanical Systems
Bachelor degree for Engineering T. Tanimura	Quantitative estimation of the doped width and resistivity after hydrogenation for the ReNiO3 device with the designed micro meter electrode gap
Bachelor degree for Engineering S. Genchi	Fabrication of nanowire structures for perovskite nickelates and study for their transport properties
Bachelor degree for Engineering F.Endou	Fabrication of Singl crystal VO2 Nano Electro-Mechanical Systems and Electrical Mnipulation through electrostatic force

Grant-in-Aid for Scientific Research

H.Tanaka	3 D correlated oxide nano-structures for electronic phase change memory application	¥16,120,000
H.Tanaka	Construction of ferroelectric nano-dot and their size effect investigation by scanning probe microscopy.	¥1,430,000

H.Tanaka	３D correlated oxide nano-structures for nano-scaling phenomena and electronic phase change memory application()	¥4,727,000
T. Kanki	Dreation of oxide nano-transistor and control of metal-insulator phases in single domain	¥4,290,000
T. Kanki	Proton pump without power due to non-equilibrium ion diffusion by an electric field	¥2,160,000
A. Hattori	Investigation of transition properties for the 10-100 nm size electric domain in the strongly correlated metal oxides	¥5,850,000
M.Yamamoto	Correlated oxides/atomically thin semiconductors heterostructures for steep-slope transistors applications	¥3,640,000

Entrusted Research

H.Tanaka	Ministry of Education, Culture, Sports, Science and Technology	Constructions of hybrid oxide nanodevices and their application	¥500,000
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	¥6,500,000

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	¥29,700,000
T. Kanki	Osaka University	¥2,200,000
M. Yamamoto	Yazaki Memorial Fundation for Science and Technology	¥1,000,000

Department of Advanced Nanofabrication

International Conferences

[1]Recent progress on primary processes of radiation chemistry studied by femtosecond pulse radiolysis (oral), Yoichi Yoshida, Takafumi Kondoh, Masao Gohdo, Koichi Kan, Jinfeng Yang, Seiichi Tagawa: 30th Miller Conference on Radiation Chemistry.

[2]The study of the excess electron dynamics in alkanes using a femtosecond pulse radiolysis (oral), Takafumi Kondoh, Masao Gohdo, Kimihiro Norizawa, Koichi Kan, Jinfeng Yang, Seiichi Tagawa, Yoichi Yoshida: 30th Miller Conference on Radiation Chemistry.

[3]Pre-solvated electrons in alcohols and their precursors: formation kinetics and reactions with scavengers (oral), Masao Gohdo, Takafumi Kondoh, Tomohiro Toigawa, Kiminori Norizawa, Koichi Kan, Jinfeng Yang, Seiichi Tagawa, Yoichi Yoshida: 30th Miller Conference on Radiation Chemistry.

[4]Ultrafast Electron Diffraction and Microscopy using a Femtosecond-pulse Electron Beams (invited), Jinfeng Yang: OPTICS & PHOTONICS International Congress 2017 (OPIC 2017), 6th High Energy Density Sciences (HEDS 2017).

[5]Ultrafast relativistic-energy electron microscopy (invited), Jinfeng Yang: Interantional Particle Accelertors 2017 (IPAC 2017).

[6]A Relativistic-energy Femtosecond-pulse Electron Microscopy (invited), Jinfeng Yang, Yoichi Yoshida, Katsumi Tnimura: 11th Asia-Pascific Microscopy Conference.

[7]Single-shot electron diffraction using relativistic-energy electron pulse (poster), Ryo Asakawa, Jinfeng Yang: 11th Asia-Pascific Microscopy Conference.

[8]Ultrafast Electron Microscopy using a MeV-energy Femtosecond-pulse Electron Beam (invited), Jinfeng Yang: Femtosecond Electron Imaging and Spectroscopy Workshop 2017 (FEIS 2017).

[9]Study of primary process of radiation chemistry by femtosecond pulse radiolysis (invited), Yoichi Yoshida: 4th Asian Congress of Radiation Research (ACRR2017).

[10]Ultrafast Electron Microscopy using Femtosecond Relativistic-energy Electron Pulses (poster), Jinfeng YANG, Yoichi YOSHIDA, Hidehiro YASUDA: The 20th SANKEN International Symposium.

[11]Ultrafast electron transport in n-alkanes studied by a femtosecond pulse radiolysis (poster), Takafumi Kondoh, Masao Gohdo, Kimihiro Norizawa, Koichi Kan, Jinfeng Yang, Seiichi Tagawa, Yoichi Yoshida: The 21st SANKEN International Symposium.

[12]Decompostion process of alkanes studied by femtosecond pulse radioysis (invited), Takafumi Kondoh, Masao Gohdo, Koichi Kan, Jinfeng Yang, Yoshida Yoshida: Trombay Symposium on Radiation & Photochemistry (TSRP-2018).

[13]Fundamental aspects of Photosensitized chemically amplified resist (PSCAR) and CAR: How to overcome RLS trade-off and photon shot noise problems (invited), [Seiichi Tagawa]: 2017 Extreme UltraViolet Lithography Workshop (EUVL Workshop 2017).

Review Papers
Geminate Ion Recombination in Condensed Matter, T. Kondoh, RADIOISOTOPES, Japan Radioisotope Association, 66 (2017), 451-458.

Ultrafast Pulse Radiolysis for Observation of Short-lived Intermediate Species in Radiation Chemistry, J. Yang, RADIOISOTOPES, Japan Radioisotope Association, 66 (2017), 395-406.

Radiation Chemistry in Space, H. Shibata, RADIOISOTOPES, Japan Radioisotope Association, 66 (2017), 617-623.

Books
[1]“Reactions in the magnetics field” in Encyclopedia of physical organic chemistry(Z. Wang) Masanobu Wakasa, Tomoaki Yago, Atom Hamasaki, Masao Gohdo, ““Reactions in the magnetics field” in Encyclopedia of physical organic chemistry”, Wiley, 2017.

Patents
[1]K140298B1, Photosensitization chemical-amplification type resist material, method for forming pattern using same, semiconductor device, mask for lithography, and template for nanoimprinting 2018-007351

[2]G20130085KRDIV Method of forming resist pattern, device for forming resist latent image, device for forming resist pattern, and resist material, 10-2017-7025563

[3]G20130085KR Resist-pattern formation method and resist material, 10-2015-7025652

[4]G20140054TW Photosensitization chemical-amplification type resist material, method for forming pattern using same, semiconductor device, mask for lithography, and template for nanoimprinting, 104105771

[5]G20140033TW Substrate processing system, 103145282

Publications in Domestic Meetings

Annual/fall Meetings of Atomic Energy Society Japan	6 papers
Annual Meeting of the Japanese Society of Radiation Chemistry	3 papers

Annual Meeting of Particle Acceleratior Society Japan	5 papers
Annual Meeting of the Chemical Society Japan	1 paper
Annual Meeting of Japan Society for Molecular Science	1 paper
Annual Meeting of RadioIsotope and Radiation Research	1 paper
Workshop of UV/EB lithography	1 paper
Annual Meeting of The Japanese Society of Microscope	2 papers

Academic Degrees

Doctor of Engeneering I. Nozawa	Study of Generation and Measurement of Ultra-Short Electron Beams
Master of Engeneering R. Asakawa	Development of ultrafast electron diffraction using femtosecond electron beam
Bachelor of Engeneering N. Hirata	Research for the excited radical cation of dodecane using femtosecond pulse radiolysis

Grant-in-Aid for Scientific Research

Y. Yoshida	Study of thermalization and relaxation process after ionization using attosecond pulse radiolysis	¥15,600,000
J. Yang	Electron crystallography using femtosecond electron pulses	¥18,590,000
J. Yang	Challenge of electron crystallography using relativistic femtosecond electron pulses	¥1,040,000
T. Kondoh	Study of initial process of radiation chemistry and radiolysis in hydrocarbon-based polymers	¥1,195,000
K. Kan	Study on attosecond electron beam generation using radially polarized electric field	¥7,280,000

Entrusted Research

S. Tagawa	Tokyo Electron Limited	Newly extended TEchnology transfer Program(NexTEP)	¥14,000,000

Contribution to Research

Y. Yoshida	Tokyo Electron Kyushu Limited CEO Masami Akimoto	¥12,000,000
S. Tagawa	Tokyo Electron Kyushu Limited CEO Masami Akimoto	¥4,000,000

Cooperative Research

Y. Yoshida	Japan Atomin Energy Agency	¥0,000
S. Tagawa	Tokyo Electron Limited・JSR Corporation	¥0,000
S. Kawakami	NISSIN GIKEN Co., LTD.	¥435,000
S. Kawakami	Meiwa Sangyo Co. Ltd.	¥12,000,000
S. Kawakami	Meiwa Sangyo Co. Ltd.	¥5,000,000
S. Kawakami	NISSIN GIKEN Co., LTD CEO Shinichi Yamamoto ・ Sosei World Co. Ltd. CEO Toshiharu Fukaki	¥0,000
Y. Yoshida	Daikin Industries, Ltd.	¥1,500,000

Department of Nanocharacterization for Nanostructures and Functions

Original Papers

[1]Electron beam induced etching of carbon nanotubes enhanced by secondary electrons in oxygen, Hideto Yoshida, Yuto Tomita, Kentaro Soma and Seiji Takeda: Nanotechnology, 28 (2017) 195301-1-195301-5.

[2]Detecting dynamic responses of materials and devices under an alternating electric potential by phase-locked transmission electron microscopy, Kentaro Soma, Stan Konings, Ryotaro Aso, Naoto Kamiuchi, Genki Kobayashi, Hideto Yoshida and Seiji Takeda: Ultramicroscopy, 181 (2017) 27-41.

[3]Reaction Mechanism of the Low-Temperature Water-Gas Shift Reaction on Au/TiO_2 Catalysts, Keju Sun, Masanori Kohyama, Shingo Tanaka and Seiji Takeda: The Journarl of Physical Chemistry C, 121

(22) (2017) 12178-12187.

[4]Nanoscopic analysis of oxygen segregation at tilt boundaries in silicon ingots using atom probe tomography combined with TEM and ab initio calculations, Y. Ohno, K. Inoue, K. Fujiwara, K. Kutsukake, M. Deura, I. Yonenaga, N. Ebisawa, Y. Shimizu, K. Inoue, Y. Nagai, H. Yoshida, S. Takeda, S. Tanaka and M. Kohyama: Journal of Microscopy, 268 (2017) 230-238.

[5]Intrinsic microstructure of Si/GaAs heterointerfaces fabricated by surface-activated bonding at room temperature, Y. Ohno, H. Yoshida, S. Takeda, J. Liang and N. Shigekawa: Japanese Journal of Applied Physics, 57 (2018) 02BA01-1-02BA01-3.

International Conferences

[1]New aspects of environmental TEM in catalyst chemistry (invited), S. Takeda, R. Aso, N. Kamiuchi, H. Yoshida, K. Soma: American Chemical Society.

[2]New Aspects in Applying Environmental TEM to Catalyst Chemistry (invited), S. Takeda: MRS Spring Meeting.

[3]In-situ observation of gold electrode surfaces under gas environments using environmental TEM (oral), R. Aso, Y. Ogawa, H. Yoshida, S. Takeda: The 8th International Symposium on Surface Science (ISSS-8).

[4]In-situ observation of the surface of working gold electrodes by environmental TEM (oral), R. Aso, Y. Ogawa, H. Yoshida, S. Takeda: The 2017 MRS Fall Meeting.

Publications in Domestic Meetings

The 73rd Annual Meeting of The Japanese Society of Microscopy	1 paper
The 55th Workshop of catalyst research	1 paper
The 33rd Analytical Electron Microscopy Meeting	1 paper
The 168th meeting of microbeam analysis	1 paper

Academic Degrees

Master Degree for Engineering K. Hayano	Surface structural changes of shape-controlled Pt nanoparticulate catalyst under the reaction atmosphere of CO oxidation
Master Degree for Engineering R. Kitamura	Structure and thermoelectric properties of Bi_2Te_3 nanobelts
Master Degree for Engineering W. Kuroda	Formation of Au/TiO_2 heterostructure in electric evaporation under gas

Grant-in-Aid for Scientific Research

S. Takeda	Analysis of dynamic active structure of gold catalyst	¥6,370,000

Entrusted Research

S. Takeda	Japan Society for the Promotion of Science	Global Networking on Molecular Technology Research	¥37,470,000
H. Yoshida	Japan Science and Technology Agency	Visualization of the atomic structure and the nanoscale temperature distribution in thermoelectric nanomaterials	¥9,620,000

Cooperative Research

H. Yoshida	Institute for Materials Chemistry and Engineering, Kyushu University	¥350,000
S. Takeda, H. Yoshida	Institute for Materials Research (IMR), Tohoku University	¥200,000
R. Aso, S. Takeda	Institute of Multidisciplinary Research for Advanced Materials, Tohoku University	¥1,000,000

Department of Theoretical Nanotechnology

Original Papers

[1] Electronic structure and phase transition in polar ScFeO3 from First Principles Calculations, B. G. Kim, M. Toyoda, J. Park, and T. Oguchi: J. Alloys Compd., 713 (2017) 187-193.

[2] Cathode properties of perovskite-type NaMF3 (M = Fe, Mn, and Co) prepared by mechanical ball milling for sodium-ion battery, A. Kitajou, Y. Ishado, T. Yamashita, H. Momida, T. Oguchi, and S. Okada: Electrochimica Acta, 245 (2017) 424-429.

[3] Scaled effective on-site Coulomb interaction in the DFT+U method for correlated materials, K. Nawa, T. Akiyama, T. Ito, K. Nakamura, T. Oguchi, and M. Weinert,: Phys. Rev. B, 97 (2018) 035117/1-7.

[4] Crystal structure prediction accelerated by Bayesian optimization, T. Yamashita, N. Sato, H. Kino, T. Miyake, K. Tsuda, and T. Oguchi: Phys. Rev. Materials, 2 (2018) 013803/1-6.

[5] Topological interface states in the natural heterostructure (PbSe)5(Bi2Se3)6 with Bi_Pb defects, H. Momida, G. Bihlmayer, S. Blugel, K. Segawa, Y. Ando, and T. Oguchi: Phys. Rev. B, 97 (2018) 035113/1-6.

[6] Electronic structure and magnetic properties of the half-metallic ferrimagnet Mn2VAl probed by soft x-ray spectroscopies, K. Nagai, H. Fujiwara, H. Aratani, S. Fujioka, H. Yomosa, Y. Nakatani, T. Kiss, A. Sekiyama, F. Kuroda, H. Fujii, T. Oguchi, A. Tanaka, J. Miyawaki, Y. Harada, Y. Takeda, Y. Saitoh, S. Suga, and R. Y. Umetsu: Phys. Rev. B, 97 (2018) 035143/1-8.

[7] Anomalous Hall conductivity and electronic structures of Si-substituted Mn2CoAl epitaxial films, K. Arima, F. Kuroda, S. Yamada, T. Fukushima, T. Oguchi, and K. Hamaya: Phys. Rev. B, 97 (2018) 054427/1-8.

[8] Effects of lattice parameters on piezoelectric constants in wurtzite materials: A theoretical study using first-principles and statistical-learning methods, H. Momida and T. Oguchi: Appl. Phys. Express, 11 (2018) 041201/1-4.

[9] First-principles calculations on the origin of mechanical properties and electronic structures of 5d transition metal monocarbides MC (M = Hf, Ta, W, Re, Os, Ir, and Pt), M. Fukuichi, H. Momida, M. Geshi, M. Michiuchi, K. Sogabe and T. Oguchi: J. Phys. Soc. Jpn., 87 (2018) 044602/1-8.

[10] Role of square planar coordination in the magnetic properties of Na4IrO4, Xing Ming, Carmine Autieri, Kunihiko Yamauchi, Silvia Picozzi: Physical Review B, 96 (2017) 205158-1-11.

[11] Structure and stability of pseudo-cubic tetragonal boron, K. Shirai, N. Uemura, and H. Dekura: Jpn. J. Appl. Phys., 56 (2017) 05FB05 (7p.).

[12] Phase diagram of boron crystals, K. Shirai: Jpn. J. Appl. Phys., 56 (2017) 05FA06 (21p.).

International Conferences

[1] Crystal Structure Search for Materials Discovery (invited), T. Oguchi: 14th International Conference of Computational Methods in Sciences and Engineering.

[2] Interplay between ferroelectricity, spin texture, and topological properties in transition-metal oxides (invited), K. Yamauchi: CECAM conference Ab initio Spin-orbitronics, Montesilvano, Pescara (Italy).

[3] DFT calculations on spin-valley coupling and topological property in ferroelectric transition-metal oxides (oral), K. Yamauchi: The 9th APCTP Workshop on Multiferroics, RIKEN CEMS, Tokyo.

[4] Impact of Ferroelectric Distortion upon Spin-Valley Coupling and Topological Phase in Transition-Metal Oxides (poster), K. Yamauchi: International Conference on Topological Materials Science 2017 (TopoMat2017), Tokyo.

[5] First-Principles Materials Design of Spin-Valley Topological Oxides (poster), K. Yamauchi, P. Barone, and S. Picozzi: SpinTECH IX, Fukuoka.
[6] Spin-Valley Coupling and Topological-Phase Transition in Ferroelectric Transition-Metal Oxides (poster), K. Yamauchi, P. Barone, and S. Picozzi: International Conference on Strongly Correlated Electron Systems, SCES 2017, Prague (the Czech Republic).

[7] Topological interface states in the natural heterostructure (PbSe)5(Bi2Se3)6 with Bi antisite defects (poster), H. Momida, G. Bihlmayer, S. Bluegel and T. Oguchi: CECAM Workshop: Ab Initio Spin-Orbitronics, Montesilvano, Italy, September 25-29, 2017.

[8] First-principles calculation of discharge reaction products in Na/SnS batteries (poster), H. Kotaka, T. Oguchi, H. Momida, A. Kitajou and S. Okada: American Physical Society: APS March Meeting 2018, Los Angeles, USA, March 5-9, 2018.

[9] Reaction of hydrogen to CuPL center in silicon (poster), Koun Shirai and Takayoshi Fujimura: 29th International Conference on Defects in Semiconductors.

[10] Problems of tetragonal boron and phase diagram of boron (oral), Koun Shirai and Naoki Uemura: 19th International Symposium on Boron, Borides & Related Materials, 3-8 Sep. 2017, Freiberg (Germany).

Contributions to International Conferences and Journals

T. OGUCHI	The 20th Asian Workshop of First-Principles Electronic Structure Calculations (International Organizing Committee)

Publications in Domestic Meetings

The Japan Institute of Metals and Materials	1 paper
The Japan Society of Applied Physics	2 papers
The Physical Society of Japan	4 papers
The Electrochemical Society of Japan	1 paper
Workshop Toward Innovation of Oxide Research	1 paper
Physics and Applications of Spin-related Phenomena in Semiconductors (PASPS-22)	1 paper
Premier Research Institute for Ultrahigh-pressure Science at Ehime Univ	1 paper

Academic Degrees

Doctor Degree for Science N. Uemura	First-principles study on α-tetragonal boron
Doctor Degree for Science T. Fujimura	Cu_4 Complex in Silicon and Its Impurity Reactions with Hydrogen
Master Degree for Science K. Izumi	Theoretical study on lattice distortion and spin states in LaCoO3
Master Degree for Science M. Tahara	First-Principles Analysis on Magnetism of Mn3XN (X=V, Cr, Mn, Fe, Co, Ni)

Grant-in-Aid for Scientific Research

K. Yamauchi	Exploration of novel topological matter by using first-principles calculation	¥1,560,000
H. Momida	Design of Piezoelectric Device Materials by Controlling	¥1,820,000

Nanostructures: First-Principles Calculations

Entrusted Research

T. Oguchi	Daikin Kogyo Co.	Devolopment of Materials Search for Thermoelectric and Magnetic Cooling by Machine Leanging	¥7,265,000
T. Oguchi	MIXT	Promotion of International Collaboration (B): Materials Design for the Environment and Energy Concerns	¥500,000

Cooperative Research

T. Oguchi	Sumitomo Denkikogyo Co.	¥0,000
T. Oguchi	Sumitomo Denkikogyo Co.	¥2,835,000
T. Oguchi	Nitto Kogyo Co.	¥438,000
K. Shirai	PRIUS of Ehime Univ	¥0,000

Other Research Fund

T. Oguchi	Kyoto University	¥5,500,000
T. Oguchi	NIMS	¥17,600,000

Department of Soft Nanomaterials

Original Papers

[1]Tetraalkoxyphenanthrene-Fused Hexadecadehydro[20]- and Tetracosadehydro[30]annulenes: Syntheses, Aromaticity/Antiaromaticity, Electronic Properties, and Self-Assembly, N. Takahashi, S.-i. Kato, M. Yamai, M. Ueno, R. Iwabuchi, Y. Shimizu, M. Nitani, Y. Ie, Y. Aso, T. Yamanobe, H. Uehara, Y. Nakamura: J. Org. Chem., 82 (17) (2017) 8882-8896.

[2]Influence of Terminal Imide Units on Properties and Photovoltaic Characteristics for Benzothiadiazole-based Nonfullerene Acceptors, IS. Chatterjee, Y. Ie, Y. Aso: J. Photopolym. Sci. Technol., 30 (5) (2017) 557-560.

[3]Synthesis of Dibenzo[h,rst]pentaphenes and Dibenzo[fg,qr]pentacenes by the Chemoselective C−O Arylation of Dimethoxyanthraquinones, IY. Suzuki, K. Yamada, K. Watanabe, T. Kochi, Y. Ie, Y. Aso, F. Kakiuchi: Org. Lett., 19 (14) (2017) 3791-3794.

[4]Synthesis, properties, and photovoltaic characteristics of p-type donor copolymers having fluorine-substituted benzodioxocyclohexene-annelated thiophene, : J. Mater. Chem. A, 5 (37) (2017) 19773-19780.

[5]Enhanced Photovoltaic Performance of Amorphous Donor-Acceptor Copolymers Based on Fluorine-Substituted Benzodioxocyclohexene-Annelated Thiophene, Y. Ie, K. Morikawa, W. Zajazkowski, W. Pisula, N. B. Kotadiya, G.-J. A. H. Wetzelaer, P. W. M. Blom, Y. Aso: Adv. Energy Mater., (2017) 1702506.

[6]Universal Strategy for Ohmic hole injection into organic semiconductors with high ionization energies, N. B. Kotadiya, H. Lu, A. Mondal, Y. Ie, D. Andrienko, P. W. M. Blom, G.-J. A. H. Wetzelaer: Nat. Mater., 17 (2018) 329-334.

[7]Influence of molecular distortion on the exciton quenching for quaterthiophene-terminated self-assembled monolayers on Au(111), H. S. Kato, Y. Murakami, R. Saitoh, Y. Osumi, D. Okaue, Y. Kiriyama, T. Ueba, T. Yamada, Y. Ie, Y. Aso, T. Munakata: Surf. Sci., 669 (2018) 160-168.

[8]Silver Nanowire Networks as a Transparent Printable Electrode for Organic Photovoltaic Cells, M.

Karakawa, T. Tokuno, M. Nogi, Y. Aso, K. Suganuma: Electrochemistry, 85 (5) (2017) 245-248.

[9]A Saturn-like Complex Composed of Macrocyclic Oligothiophene and [60]Fullerene: Structure, Stability, and Photophysical Properties in Solution and the Solid State, H. Shimizu, K. H. Park, H. Otani, S. Aoyagi, T. Nishinaga, Y. Aso, D. Kim, M. Iyoda: Chem. Eur. J., 24 (15) (2018) 3793-3801.

International Conferences
[1]Encapsulated Oligothiophenes: Synthesis and Single-Molecule Conductance (poster), Yoshio Aso,Yutaka Ie, Takuya Inoue, Yuji Okamoto, See K. Lee, Tatsuhiko Ohto, Ryo Yamada, Hirokazu Tada: 17th International Symposium on Novel Aromatic Compound (ISNA17).

[2]Highly Electron-Accepting π-Conjugated Compounds for Organic Electronics (invited), Yoshio Aso: 8th East Asia Symposium on Functional Dyes and Advanced Materials (EAS8).

[3]Development of Electron-Accepting π-Conjugated Units for Organic Electronics (oral), Yutaka Ie, Makoto Karakawa, Masashi Nitani, Yoshio Aso: 2017 Workshop on Innovative Nanoscale Devices and Systems (WINDS2017).

[4]Non-fullerene Acceptors for Application to Organic Photovoltaics: Structures-Thin-film Properties-Photovoltaic Characteristics Relationship (invited), Y. Ie: 13th International Conference of Computational Methods in Science and Engineering, (4/23), The MET Hotel, Thessaloniki.

[5]Development of New pi-Conjugated Systems towards Electronic Device Applications (invited), Y. Ie: ISPAC 2017 International Symposium on Pure & Applied Chemistry 2017.

[6]Non-fullerene Acceptors for Organic Photovoltaics: Structures-Film Properties-Photovoltaic Characteristics Relationship (invited), Y. Ie: ICMAT2017 9th International Conference on Materials for Advanced Technologies.

[7]Novel pi-Conjugated Systems for Organic Semiconducting Materials (invited), Y. Ie: 81st Prague Meeting on Macromolecules.

[8]Development of donor-acceptor copolymers based on fluorine-substituted benzodioxocyclohexene-annelated thiophene (invited), Y. Ie: 1st SANKEN JSPS Symposium for the Circulation of Talented Researchers “Global Networking on Molecular Technology Research.

[9]Development of novel units for single-molecule-based electronics (invited), Y. Ie: International workshop on molecular workshop.

[10]Naphthobisthiadiazole-based Non-fullerene Electron Acceptors: Effect of Substituents in the Thiophene Unit on Properties and Photovoltaic Characteristics (poster), S. Chatterjee, Y. Ie, Y. Aso: The 21th SANKEN International The 16th SANKEN Nanotechnology Symposium.

[11]A Universal Synthetic Methodology for Long Polythiophenes End-functionalized with Anchor Groups (poster), S. Tamba, Y. Ie, Y. Aso: The 21th SANKEN International The 16th SANKEN Nanotechnology Symposium.

Books
[1]Synthesis and Properties of Novel Organic Components Toward Molecular Architectonics(T. Ogawa) Y. Ie, Y. Aso, “Molecular Architectonics”, Springer, (513-539) 2017.

Patents
[1]KB2017003 フラーレン誘導体、及びｎ型半導体材料, 2017-091375

[2]KB2017005 フラーレン誘導体、及びｎ型半導体材料, 2017-117205

[3]K20170109 高分子化合物及びそれを含む有機半導体材料並びにそれを含む有機太陽電池, 2017-159899

[4]K20170157 化合物、及びこれを含む有機半導体材料, 2017-176221

[5]K20170153 化合物、有機半導体材料、有機半導体素子、有機太陽電池及び有機トランジスタ, 2017-199989

[6]K20170158 化合物またはその結合物、及び有機半導体材料, 2017-202189

[7]K20170240 ｎ型有機半導体材料及びそれを含有する有機半導体膜並びに有機薄膜トランジスタ, 2018-049712

[8]K20170376 化合物、化合物の前駆体、化合物を含む有機半導体材料、および有機半導体材料を含む有機電子デバイス, 2018-054583

[9]K20170377 高分子化合物、高分子化合物を含む有機半導体材料、および有機半導体材料を含む有機電子デバイス, 2018-054584

[10]G20160139WO フラーレン誘導体、及びｎ型半導体材料, PCT/JP2017/021933

[11]G20160140WO フラーレン誘導体、およびそれを含有する半導体材料、およびそれを含有する半導体薄膜, PCT/JP2017/023231

[12]G20160117WO 高分子化合物、及びこれを含む有機半導体材料, PCT/JP2017/032863

[13]G20170074WO ナフトビスカルコゲナジアゾール誘導体及びその製造方法, PCT/JP2017/037201

[14]KP2014064 フラーレン誘導体、及びｎ型半導体材料, 2015-517151

Grant-in-Aid for Scientific Research

Y.Ie	分子アーキテクトニクスに向けた機能性分子合成と構造物性相関解明	¥13,910,000
Y.Ie	デバイス駆動メカニズムに基づく高性能 n 型有機半導体の創出と普遍的設	¥1,560,000

Cooperative Research

Y.Aso	東洋紡株式会社	¥1,000,000
Y.Aso	石原産業株式会社	¥2,684,000

Other Research Fund

Y.Aso	JST	¥4,160,000

Department of Bio-Nanotechnology

Original Papers

[1]Identification of Individual Bacterial Cells through the Intermolecular Interactions with Peptide-Functionalized Solid-State Pores, Makusu Tsutsui, Masayoshi Tanaka, Takahiro Marui, Kazumichi Yokota, Takeshi Yoshida, Akihide Arima, Wataru Tonomura, Masateru Taniguchi, Takashi Washio, Mina Okochi, Tomoji Kawai: Anal. Chem., 90 (3) (2018) 1511-1515.

[2]Atomically flat platinum films grown on synthetic mica, Hiroyuki Tanaka、Masateru Taniguchi: Jpn. J. Appl. Phys., 57 (2018) 048001(1-2).

[3]The impact of membrane surface charges on the ion transport in MoS2 nanopore power generators, Zhuo Huang, Yan Zhang, Tomoki Hayashida, Ziwei Ji, Yuhui He, Makusu Tsutsui, Xiang Shui Miao, and Masateru Taniguchi: Appl. Phys. Lett, 111 (2017) 263104 -263107.

[4]Discriminating single-bacterial shape using low-aspect-ratio pores, Makusu Tsutsui, Takeshi Yoshida, Kazumichi Yokota, Hirotoshi Yasaki, Takao Yasui, Akihide Arima, Wataru Tonomura, Kazuki Nagashima, Takeshi Yanagida, Noritada Kaji 、 Masateru Taniguchi、 Takashi Washio、 Yoshinobu Baba、Tomoji Kawai: Scientific Reports, 7 (2017) 17371(1-9).

[5]Single-Molecule Analysis Methods Using Nanogap Electrodes and Their Application to DNA Sequencing Technologies, Masateru Taniguchi: Bulletin of The Chemical Society of Japan, 90 (11) (2017) 1189-1210.

[6]Electrokinetic Analysis of Energy Harvest from Natural Salt Gradients in Nanochannels, Makusu Tsutsui、Masateru Taniguchi: Scientific Reports, 7 (2017) 13156(1-15).

[7]Sequencing of adenine in DNA by scanning tunneling microscopy, Hiroyuki Tanaka、Masateru Taniguchi: Jpn. J. Appl. Phys., 56 (2017) 08LB02(1-3).

[8]Stretching-induced conductance variations as fingerprints of contact configurations in single-molecule junctions, Makusu Tsutsu、Tomoji Kawai: J. Am. Chem. Soc., 139 (2017) 8286-8294.

[9]Single crystalline epitaxial platinum film on Al2O3(0001) prepared by oxygen-doped sputtering deposition, Hiroyuki Tanaka、Masateru Taniguchi: Jpn. J. Appl. Phys., 56 (2017) 058001(1-3).

[10]Short channel effects on electrokinetic energy conversion in solid-state nanopores, Makusu Tsutsui、Masateru Taniguchi: Scientific Reports, 7 (2017) 46661(1-14).

[11]Detecting Single-Nucleotides by Tunneling Current Measurements at Sub-MHz Temporal Resolution, Takanori Morikawa, Kazumichi Yokota, Sachie Tanimoto, Makusu Tsutsui, Masateru Taniguchi: Sensors, 17 (4) (2017) 885(1-9).

International Conferences

[1]Singl-molecule tunnel-current detection towards identification of biopolymer (poster), Takahito Ohshiro: 9th International Conference on Molecular Electronics and Bioelectronics (JSAP M&BE9 2017).

[2]DEVELOPMENT OF SINGLE-MOLECULE DETECTION AND TRANSLOCATION CONTROL BY ELECTROPHORESIS OF NANO-FLUID TOWARDS BIOPOLYMER SEQUENCING (poster), T. Ohshiro, M. Tsutsui, K. Yokota, T. Kawai, and M. Taniguchi: The 21st International Conference on Miniaturized Systems for Chemistry and Life Sciences(MicroTAS 2017).

[3]DUAL-HEIGHT FLUIDIC-CHANNEL-INTEGRATED MICROPORE SENSOR FOR HIGH-THROUGHPUT SINGLE-PARTICLE DETECTIONS (poster), W. Tonomura, M. Tsutsui, K. Yokota, A. Arima, M. Taniguchi, and T. Kawai: The 21st International Conference on Miniaturized Systems for Chemistry and Life Sciences(MicroTAS 2017).

[4]SPM imaging of DNA on Graphene surface (poster), Hiroyuki Tanaka、Masateru Taniguchi: ALC ’17(11th International Symposium on Atomic Level Characterizations for New Materials and Devices ’17).

[5]Scanning Probe Microscope Imaging of DNA Molecules on Graphene Surface (poster), Hiroyuki Tanaka、Masateru Taniguchi: 25th International Colloquium on Scanning Probe Microscopy (ICSPM25).

[6]Development of Quadruple-Electrode integrated Nanopore Devices Toward a Single Biomolecule Detection and Manipulation by electrophoresis (poster), T. Hayashida, T. Ohshiro, M. Tsutsui, K. Yokota and M. Taniguchi: The 8th International Symposium on Surface Science (ISSS-8).

[7]Development of Single-Molecule Electrophoretic Control Method For Single-Molecule Tunnel-Current based Nucleotide Identification by Nano-fluid integrated Nano-gap Devices (poster), Takahito Ohshiro , Makusu Tsutsui , Kazumichi Yokota , Masateru Taniguchi: APS March Meeting 2018.

[8]Development of Single Particle Manipulation and Detection using Quadrupole-Electrode Integtrated Nanopore Devices by Dielectrophoresis (poster), Tomoki Hayashida , Takahito Ohshiro , Makusu Tsutsui , Masateru Taniguchi: APS March Meeting 2018.

[9]Single-Molecule Sequencing Technology , M. Taniguchi: International Workshop on Life Detection Technology: For Mars, Enceladus and Beyond.

[10]Single-Molecule Electrical Sequencing , M. Taniguchi: Japanese-German Workshop, Single-Molecule Science and Technology.

[11]Smart Nanopores to Detect Single Viruses and Bactria , M. Taniguchi: 1st SANKEN JSPS Symposium for Circulation of Talented Researchers.

Review Papers
Single-Molecule Analysis Methods Using Nanogap Electrodes and Their Application to DNA Sequencing Technologies, M. Taniguchi, Bull. Chem. Soc. Jpn., 日本化学会, 90 (2017), 1189-1210.

Patents
[1]K20160437 Identification method, classification analysis method, identification apparatus, classification analysis apparatus and storage medium, 2017-092075

[2]K20160454 Flow channel device and fine particle concentration method, 2017-100218

[3]K20170183 Method of making electrode, 2017-212322

[4]K20170182 substrate, 2017-212321

[5]K20170181 Method for calibrating electrode pair, 2018-048702

[6]K20170184 Current measurement method, 2018-048703

[7]G20160138WO Device for detecting biological material, detection device for detecting biological substance, method for measuring ionic current, PCT/JP2017/016041

[8]G20170071WO Sample analysis method and sample analysis device, PCT/JP2017/036124

[9]G20170116WO Classification analysis method, classification analysis apparatus and storage medium for classification analysis, PCT/JP2017/044534

[10]G20120069CN METHOD AND APPARATUS FOR CONTROLLING THE MOVEMENT RATE OF MATERIAL, 201380001058.10001

[11]G20130020EP Method of analysis of sample, 13879507.5

[12]G20120083US One particle analysis apparatus and analysis method, 14/484305

[13]G20140042US Biomolecule sequencing apparatus, method, and program, 15/061871

[14]G20150113WO Electric measuring device and electric measuring device, G20150113WO

Contributions to International Conferences and Journals

M. Taniguchi	Scientific Reports (Editorial Boral Member)
M. Taniguchi	Japanese Journal of Applied Physics (Associate Editor)

Publications in Domestic Meetings

The Japan Society of Applied Physics	12 papers
The Chemical Society of Japan	9 papers
The Japan Society of Mechanical Engineers	1 paper
Japan Society for Molecular Science	2 papers

Grant-in-Aid for Scientific Research

M. Taniguchi	Single molecule sequencing method by tunnel current	¥35,880,000
M. Tsutsui	Creation of high performance monomolecular thermoelectric materials	¥4,420,000
M. Tsutsui	Single molecular tunnel current applying molecular orientation control by dielectrophoretic method	¥4,940,000
H. Tanaka	Single molecular sequencing using graphene	¥4,628,000
W. Tonomura	To the cells culture system with hyper gravity load and mechanical irritation loading on centrifuge channel	¥1,560,000
A. Arima	Creation of comprehensive one cell analysis method using nanopore trap method	¥2,990,000

Entrusted Research

M. Taniguchi	Japan Science and Technology Agency	Development of improved solid nanogap nanopore for 4th generation DNA sequencing and 1 molecule resolution quantitative analysis	¥14,950,000
M. Taniguchi	New Energy and Industrial Technology Development Organization	Innovative noise reduction to realize processing of ultra small main signal from sensor · nanotechnology related to signal amplification etc. · material development / research and development of nanotechnology materials realizing detection of ultra small output signal for Energy / Environment New Technology Leading Program / Next Generation IoT Society	¥15,000,000
T. Kawai	Japan Science and Technology Agency	Development of InSECT system using nano · micropore	¥172,762,000

Contribution to Research

M. Tsutsui	The Asahi Glass Foundation	¥2,000,000

Cooperative Research

M. Taniguchi	FUJIREBIO Inc. --> The Miraca Research Institute	¥4,464,000
M. Taniguchi	Kirin Co., Ltd.	¥3,500,000
M. Taniguchi	TOSHIBA CORPORATION	¥950,000
M. Taniguchi	SCREEN Holdings Co., Ltd.	¥4,488,000
M. Taniguchi	SCREEN Holdings Co., Ltd.	¥10,320,000
M. Taniguchi	Toshiba Memory Corporation	¥950,000
M. Taniguchi	ADVANTEST CORPORATION	¥600,000
M. Taniguchi	DAIKIN INDUSTRIES, Ltd.	¥5,775,000

Other Research Fund

M. Taniguchi Kyoto University (Re-entrusted by MEXT) ¥33,540,000

Department of Nano-Intelligent Systems

Original Papers

[1]Identification of Individual Bacterial Cells through the Intermolecular Interactions with Peptide-Functionalized Solid-State Pores, M. Tsutsui, M. Tanaka, T. Marui, K. Yokota, T. Yoshida, A. Arima, W. Tonomura, M. Taniguch, T. Washio, M. Okochi, and T. Kawai: Analitical Chemistry, 90 (2018) 1511−1515.

[2]Discriminating single-bacterial shape using low-aspect-ratio pores, M. Tsutsui, T. Yoshida, K. Yokota, H. Yasaki, T. Yasui, A. Arima, W. Tonomura, K. Nagashima, T. Yanagida, N. Kaji, M. Taniguchi, T.Washio, Y. Baba and T. Kawai: Scientific Reports, 7 (1) (2017) 17371.

International Conferences

[1]Machine Learning Independent of Population Distributions for Measurement, T. Washio, G. Imamura and G. Yoshikawa: DSAA2017: 4th IEEE International Conference on Data Science and Advanced Analytics, (2017) .

[2]Measurement Oriented Machine Learning for Advanced Sensing Technologies (invited), T. Washio: 4th Asia-Pacific World Congress on Computing Science 2017 (APWC on CSE 2017).

[3]Measurement-oriented Machine Learning for Advanced Sensing (invited), T. Washio: The MANA International Symposium 2018.

Patents

[1]K20160437 Identification Method, Classification Analysis Method, Identification Instrument, Classification Analysis Instrument and Memory Media, 2017-092075

[2]G20170116WO Identification Method, Classification Analysis Method, Identification Instrument, Classification Analysis Instrument and Memory Media, JP2018-14926

Contributions to International Conferences and Journals

T. WASHIO	22st ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. WASHIO	Knowledge and Information Systems (KAIS): An International Journal (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 Member)
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 23rd SIGKDD Conference on Knowledge Discovery and Data Mining (2017SIGKDD) Workshop of Causal Discovery (Program Committee)
T. WASHIO	The 21st Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2017) (Senior Program Committee)
T. WASHIO	The 4th IEEE International Conference on Data Science and Advanced Analysis (DSAA2017) (Technical Research Track 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)
T. WASHIO	The SIAM Data Mining Conference 2018 (SDM 2018) (Program Committee)
T. WASHIO	The 22nd Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD2018) (Senior Program Committee)
T. WASHIO	24rd ACM SIGKDD Conference on Knowledge Discovery and Data Mining (Program Committee)
T. WASHIO	ACM Transaction on Knowledge Discovery from Data (TKDD) (Editorial Board Member)
T. WASHIO	The 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (Program Committee)
T. WASHIO	SISAP 2018: 11th International Conference on Similarity Search and Applications (Program Committee)
T. WASHIO	The 2018 IEEE International Conference on Data Mining (ICDM) (Area Program Committee Chair)
T. WASHIO	The 2018 ACM SIGKDD Workshop on Causal Discovery (CD 2018) (Senior Program Committee)

Publications in Domestic Meetings

The 65th JSAP Spring Meeting	1 paper
Fall Meeting, Japan Welding Society	1 paper
The 78th JSAP Fall Meeting	3 papers
Spring Meeting, Japan Welding Society	1 paper

Entrusted Research

T. Washio	Japan Science and Technology Agency	Extraction of Information Characterizing Cell Physiology from Super-High-Resolution Image time Series	¥13,130,000
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	¥22,620,000

Cooperative Research

T. Washio	Kobe Steel, Ltd	¥1,080,000
T. Washio	National Institue for Materials Science	¥0,000

Department of Nanodevices for Medical Applications

Original Papers

[1]A New Cell Separation Method Based on Antibody-Immobilized Nanoneedle Arrays for the Detection of Intracellular Markers., : Nano Lett, 17 (2017) 7117-7124.

[2]Synthesis and assembly of Hepatitis B virus envelope protein-derived particles in Escherichia coli., H. Li, K. Onbe, Q. Liu, M. Iijima, K. Tatematsu, M. Seno, H. Tada, S. Kuroda: Biochemical and Biophysical Research Communications, 490 (2017) 155-160.

[3]Preclinical evaluation of cisplatin-incorporated bio-nanocapsule as chemo-radiotherapy for human hepatocellular carcinoma., S.H. Shin, S.S. Park, J. Choi, J.H. Lee, K.J. Lee, E.J. Ju, J. Park, E.J. Ko, I. Park, J. Jung, S. Kuroda, S.M. Hong, J.J. Hwang, J.S. Lee, S.Y. Song, S.Y. Jeong, E.K. Choi: Oncology Reports, 38 (2017) 2259-2266.

[4]Low immunogenic bio-nanocapsule based on hepatitis B virus escape mutants, J. Jung, M. Somiya, S.Y. Jeong, E.K. Choi, S. Kuroda: Nanomedicine, 14 (2018) 595-600.

[5]Albumin-Encapsulated Liposomes: A Novel Drug Delivery Carrier With Hydrophobic Drugs

Encapsulated in the Inner Aqueous Core., Y. Okamoto, K. Taguchi, K. Yamasaki, M. Sakuragi, S. Kuroda, M. Otagiri: , 107 (2018) 436-445.

International Conferences

[1]Planar membrane displaying IgGs in an oriented immobilization manner for biosensor surface. (poster), Iijima M., Kuroda S.: 5th International Conference on Bio-Sensing Technology, May 7-10, 2017, Riva del Garda, Italy.

[2]Specific delivery of the NF-κB corepressor sMPAID to inflammatory region by using early infection machinery of hepatitis B virus. (oral), Xu Z, Tatematsu K, Okamoto K, Kuroda S.: National Tsing Hua Univerisity - Osaka University Life Science Student Symposium.

[3]Evaluation of mechanical property of intermediate filament related with stiffness of breast cancer cell by use of nanoneedle and AFM (oral), Yamagishi A, Susaki M, Takano U, Iijima M, Kuroda S, Okada T, Nagasaki A, Nakamura C.: The 2017 MRS Fall Meeting.

[4]Mechanical Separation of Neural Stem Cell Derived from Human iPS Cell Using Nanoneedle Array (poster), Matsumoto Y, Shimizu K, Kawamura R, Yamagishi A, Iijima M, Kuroda S, Nakamura C.: IGER International Symposium on Cell Surface Structures and Functions 2017.

[5]Development of scaffolding molecule for improving function of biomolecules (poster), Iijima M, Kuroda S.: 42nd FEBS Congress.

[6]Capsular- and Planar-Scaffold for Clustering and Oriented Immobilization of Sensing Molecules. (poster), Iijima M, Kuroda S.: Nanotech France 2017 Conference and Exhibition.

[7]Analysis of Cell Attachment and Entry of Hepatitis B Virus. (oral), Liu Q, Somiya M, Kuroda S.: 5th JAPAN-TAIWAN-KOREA HBV Research Symposium 2017.

[8]NOVEL HEPARIN-BINDING DOMAIN OF HEPATITIS B VIRUS: APPLICATION TO DRUG DELIVERY SYSTEM. (oral), Liu Q, Somiya M, Kuroda S.: Biomaterials International 2017.

[9]Establishment of human olfactory receptor-expressing cell lines for high throughput odorant analysis. (poster), Nakamura M, Yamazaki T, Takai M, Tatematsu K, Kuroda S.: The 21th SANKEN International Symposium.

[10]Creation and application of hepatitis B virus-mimicking nanoparticle for drug delivery. (poster), Liu Q, Somiya M, Kuroda S.: The 21th SANKEN International Symposium.

[11]Bio-nanocapsule-based scaffold for clustering and oriented-immobilization of sensing molecules. (poster), Yamada Y, Iijima M, Kuroda S.: The 21th SANKEN International Symposium.

Review Papers

Automated Single-Cell Analysis and Isolation System : Basics and Applications : A Paradigm Shift in the Cell Screening System by Single-Cell Isolation Robot, K. Tatematsu, S. Kuroda, 化学と生物, The Japan Society for Bioscience, Biotechnology, and Agrochemistry, 55 (2017), 684-689.

センシング分子の精密整列化技術, M. Iijima, S. Kuroda, Chemical Engineering, 化学工業社, 62[11] (2017), 785-791.

Current Progress of Virus-mimicking Nanocarriers for Drug Delivery, Somiya M, Liu Q, and Kuroda S., Nanotheranostics, Ivyspring International Publisher Pty Ltd, 1[4] (2017), 415-429.

アカデミア発 DDS 技術の起業化・事業化の課題, S.Kuroda, Drug Delivery Systems, The Japan

Society of Drug Delivery System, 32 (2017), 251-258.

Books
[1]High-throughput analysis of mammalian receptor tyrosine kinase activation in yeast cells N. Yoshimoto, S. Kuroda, “ERK Signaling: Methods in Molecular Biology book series”, Springer International Publishing, 1487 (35-52) 2017.

Patents
[1]G20170157WO 医薬, PCT/JP2018/010791

Comprehensive Analysis Center

Original Papers
[1]Helically Chiral 1-Sulfur-Functionalized [6]Helicene: Synthesis, Optical Resolution, and Functionalization, T. Tsujihara, D.-Y. Zhou, T. Suzuki, S. Tamura and T. Kawano: Org. Lett., 19 (2017) 3311-3314.

[2]Tetrahedral Copper(II) Complexes with a Labile Coordination Site Supported by a Tris-tetramethylguanidinato Ligand, I. Shimizu, Y. Morimoto, D. Faltermeier, M. Kerscher, S. Paria, T. Abe, H. Sugimoto, N. Fujieda, K. Asano, T. Suzuki, P. Comba and S. Itoh: Inorg. Chem., 56 (2017) 9634-9645.

[3]Facile Synthesis of Spirooxindoles Via an Enantioselective Organocatalyzed Sequential Reaction of Oxindoles with Ynone, S. Takizawa, K. Kishi, M. Kusaba, J. F. Bai, T. Suzuki and H. Sasai:: Heterocycles, 95 (2017) 761-767.

[4]Electron hybridization and anharmonic thermal vibration effect on structure transition of SrTiO3 at high-pressure and low-temperature, T. Yamanaka, M. Ahart, H.-k. Mao and T. Suzuki: Solid State Commun, 249 (2017) 54-59.

[5]Syntheses, Crystal Structures and Solid-State Absorption Spectra of n-Propylsulfanyl- and Isopropylsulfanyl-Substituted 2,5-Di(1,3-dithiol-2-ylidene)-1,3-dithiolane-4-thione Derivatives with Methoxycarbonyl Groups, K. Ueda, H. Kusanagi, H. Nanbo, T. Takehara and T. Suzuki: Bull. Chem. Soc. Jpn, 90 (2017) 306-311.

[6]Thermoelectric Properties of Epitaxial beta-FeSi2 Thin Films on Si(111) and Approach for Their Enhancement, T. Taniguchi, S. Sakane, S. Aoki, R. Okuhata, T. Ishibe, K. Watanabe, T. Suzuki, T. Fujita, K. Sawano and Y. Nakamura: J. Electron. Mater., 46 (2017) 3235-3241.

[7]N,N-Dimethylformamide-stabilized copper nanoparticles as a catalyst precursor for Sonogashira-Hagihara cross coupling, H. Oka, K. Kitai, T. Suzuki and Y. Obora: RSC Advances, 7 (2017) 22869-22874.

[8]Impact of Phenyl Groups on Oxygen-bridged V-shaped Organic Semiconductors, C. Mitsui, W. Kubo, Y. Tanaka, M. Yamagishi, T. Annaka, H. Dosei, M. Yano, K.-i. Nakamura, D. Iwasawa, M. Hasegawa, T. Takehara, T. Suzuki, H. Sato, A. Yamano, J. Takeya and T. Okamoto: Chem. Lett., 46 (2017) 338-341.

[9]Thermoelectric properties of epitaxial β-FeSi 2 thin films grown on Si(111) substrates with various film qualities, W. Kentaro, T. Tatsuhiko, S. Shunya, A. Shunsuke, S. Takeyuki, F. Takeshi and N. Yoshiaki: Jpn. J. Appl. Phys., 56 (2017) 05DC04.

[10]Comprehensive Synthesis of Photoreactive Phenylthiourea Derivatives for the Photoaffinity Labeling, A. Ishida, L. Wang, Z. P. Tachrim, T. Suzuki, Y. Sakihama, Y. Hashidoko and M. Hashimoto: ChemistrySelect, 2 (2017) 160-164.

[11]Enantiodifferentiation in the Photoisomerization of (Z,Z)-1,3-Cyclooctadiene in the Cavity of γ-Cyclodextrin-Curcubit[6]uril-Wheeled [4]Rotaxanes with an Encapsulated Photosensitizer, Z. Yan, Q. Huang, W. Liang, X. Yu, D. Zhou, W. Wu, J. J. Chruma and C. Yang: Org. Lett., 19 (2017) 898-901.

[12]Temperature-Driven Planar Chirality Switching of a Pillar[5]arene-Based Molecular Universal Joint, J. Yao, W. Wu, W. Liang, Y. Feng, D. Zhou, J. J. Chruma, G. Fukuhara, T. Mori, Y. Inoue and C. Yang: Angew. Chem., Int. Ed, 56 (2017) 6869-6873.

International Conferences

[1]Ir catalyzed asymmetric tandem reaction of meso-diols (invited), T. Suzuki: 2nd International Conference and Exhibition on Scientific Program 1034th Conference 2_{nd} International Conference and Exhibition on Materials Science and Chemistry.

[2]Ir catalyzed asymmetric tandem reaction of meso-diols (invited), T. Suzuki: Green Chemistry New Zealand 2017.

[3]Catalytic Asymmetric Synthesis of Natural Products Using Ir Catalyzed Tishchenko-type Reaction (poster), T. Suzuki: 18th Tetrahedron Symposium.

Review Papers

Recent topics in the desymmetrization of meso-diols, T. Suzuki, Tetrahedron Lett., Elsevier, 58 (2017), 4731-4739.

Comprehensive Analysis Center of the Institute of Scientific and Industrial Research, T. Matsuzaki, K. Asano, Journal of the Mass Spectrometry Society of Japan, The Mass Spectrometry Society of Japan, 65 (2017), 223-227.

Publications in Domestic Meetings

Advanced Molecular Transformations by Organocatalysts	1 paper
137th Annual Meething of the Pharmaceutical Society of Japan	1 paper
Symposium on Progress in Organic Reactions and Syntheses	1 paper
Annual Meething of the Chemical Society of Japan	2 papers
CSJ Chemistry Festa	1 paper

Grant-in-Aid for Scientific Research

T.Suzuki	Development and application of asymmetric redox cascade reaction using iridium catalyst	¥2,080,000

Entrusted Research

T.Suzuki	Research grant	JSR Corporation	¥500,000

Cooperative Research

T.Suzuki	NITTO KASEI CO., LTD.	¥600,000
T.Suzuki	Panasonic Corporation	¥552,000

Reserch Laboratory for Quantum Beam Science

Original Papers

[1]Radical Ions of a p-Bowl Sumanene: Effects of Strained Structure on the Electronic Transitions Revealed by Radiation Chemical and Theoretical Studies., M. Fujitsuka, S. Tojo, T. Amaya, T. Hirao, and T. Majima.: J. Phys. Chem. A, 121 (26) (2017) pp 4902–4906.

International Conferences

[1]Anomalous increase of the contact angle of water droplets on the surface of PADC detector exposed to proton (poster), T. Kusumoto, K. Kuraoka, Y. Mori, M. Kanasaki, K. Oda, S. Kodaira, Y. Honda, S. Tojo, R. Barillon, T. Yamauchi: 27^{th} International Conference on Nuclear Tracks and Radiation Measurements, Strasbourg, Germany, August 28-September 1, 2017.

Patents

[1]K20120247 撮像システム及び撮像方法, 2013-030165