

A decorative graphic consisting of two horizontal lines and two vertical lines. The top horizontal line starts from the left edge and ends with a small dark blue square. The bottom horizontal line starts from the right edge and ends with a small dark blue square. The two vertical lines are positioned on the left and right sides, extending from the top line to the bottom line.

INTRODUCTORY
COLUMNS OF
LABORATORIES

Division of Synthetic Chemistry

– Organoelement Chemistry –



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Scope of Research

π -Extended aromatic compounds such as higher acenes and porphyrins are attractive as organic functional materials. In particular, we focus on the control of thin-film structure by self-assembly of the materials to investigate the correlation between packing structure and charge carrier mobility. We are also interested in the compounds including heavy main group elements to elucidate the similarities and differences in structures and reactivities between organic compounds and the corresponding heavier congeners.



KEYWORDS

Organic Semiconductor

Aromatic Compound

Self-Assembly

Main Group Element

Reactive Intermediate

Recent Selected Publications

Murakami, H.; Yamauchi, M.; Fujita, T.; Yamada, H., Retro-Diels–Alder-Triggered Supramolecular Polymerization of Tetrabenzoporphyrin into Pyramidal Aggregates, *Angew. Chem. Int. Ed.*, **64**(40), e202507402 (2025).

Uchida, D.; Yukimoto, M.; Tokitoh, N.; Yamauchi, M.; Yamada, H.; Mizuhata, Y., Reactivity of a Methylene-Bridged 1,3-Bis(germylene) in Dynamic Equilibrium with Its Dimer, *Angew. Chem. Int. Ed.*, **64**(34), e202508927 (2025).

Ueno, S.; Yamauchi, M.; Shioya, N.; Matsuda, H.; Hasegawa, T.; Yamamoto, K.; Mizuhata, Y.; Yamada, H., Hydrogen-Bond-Directed Supramolecular Organic Semiconductor Thin Films Realized via Thermal Precursor Approach, *Angew. Chem. Int. Ed.*, **64**(31), e202425188 (2025).

Kasahara, S.; Hayashi, H.; Okumura, T.; Matsumoto, M.; Yamauchi, M.; Mizuhata, Y.; Aratani, N.; Yamada, H., Shape-Persistent Anthracene-Based Macrocycles Prepared by Reversible Boronic Ester Formation: Crystallization and Structural Analysis, *ChemPlusChem*, **90**(5), e202500014 (2025).

Miyazaki, K.; Teranishi, K.; Matsuda, H.; Matsuo, K.; Yamauchi, M.; Mizuhata, Y.; Shioya, N.; Hasegawa, T.; Yamada, H., Single-Crystal Organic Field-Effect Transistors Based on 5,15-Bisaryl-Tetrabenzoporphyrins: Synthesis, Structure, and Charge Transport Properties, *Adv. Mater. Interfaces*, **12**(20), 2400946 (2025).



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Scope of Research

Fundamental studies are being conducted for the creation of new functional π -systems with novel structures and properties, and for evaluation of their application as organic semiconducting materials for photovoltaic and electroluminescent devices. The major subjects are: 1) organochemical transformation of fullerenes C_{60} and C_{70} , specifically organic synthesis of endohedral fullerenes by the technique of molecular surgery; 2) generation of ionic fullerene species and their application for the synthesis of functional material; 3) synthesis of new carbon-rich materials by the use of transition metal complex; and 4) creation of new functional π -materials with unique photoelectric properties.

KEYWORDS

π -Conjugated Systems Endohedral Fullerenes
Functional Materials Helical Structures
Radical Species

Recent Selected Publications

Zhang, Z.; Zhu, H.; Gu, J.; Shi, H.; Hirose, T.; Jiang, L.; Zhu, Y.; Zhong, D.; Wang, J., Nonplanar Nanographene with a Large Conjugated π -Surface, *J. Am. Chem. Soc.*, **146**, 24681-24688 (2024).
Nakazono, R.; Hu, W.; Hirose, T.; Amaya, T., Synthesis and Characterization of a Cyclic Trimer of a Chiral Spirosilabifluorene, *Chem. Eur. J.*, **30**, e202401343 (2024).
Hashikawa, Y.; Okamoto, S.; Murata, Y., Synthesis of Inter-[60]Fullerene Conjugates with Inherent Chirality, *Nat. Commun.*, **15**, 514 (2024).
Liu, W.; Huang, G.; Chen, C.-Y.; Tan, T.; Fuyuki, H.; Hu, S.; Nakamura, T.; Truong, M. A.; Murdey, R.; Hashikawa, Y.; Murata, Y.; Wakamiya, A., An Open-Cage Bis[60]fulleroid as Electron Transport Material for Tin Halide Perovskite Solar Cells, *Chem. Commun.*, **60**, 2172-2175 (2024).
Huang, G.; Sadai, S.; Hashikawa, Y.; Murata, Y., Reactions of Diaminonaphthalenes with a Cage-Opened C_{60} Derivative, *Asian J. Org. Chem.*, **13**, e202300634 (2024).

Division of Synthetic Chemistry

– Advanced Inorganic Synthesis –



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Scope of Research

We are focusing on the precise synthesis of inorganic nanoparticles by controlling the primary (size, shape, composition, *etc.*) and secondary (spatial arrangement) structures to tune properties such as electron confinement, carrier oscillation, spin, and catalysis. These high-quality inorganic nanoparticles are applied to both high-performance nanodevices (*e.g.*, single electron transistor, plasmon waveguide, and nanocomposite magnet) and photo-energy conversion materials (*e.g.*, overall water splitting and solar cell).

KEYWORDS

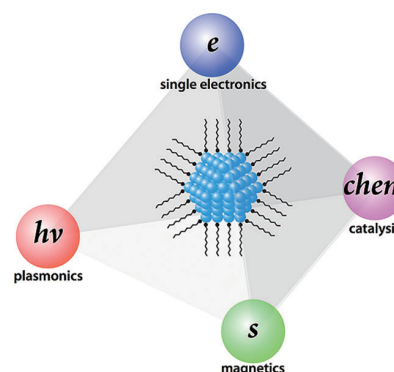
Inorganic Nanomaterials

Quantum Dots

Plasmonics

Oxidation Reduction Reactions

Photocatalysts



Recent Selected Publications

Zhu, L.; Nagai, N.; Xia, Y.; Muto, M.; Teranishi, T.; Saruyama, M., Direct Synthesis of Three-Dimensional Ag Nanocrystals Superlattices and Their Superhydrophobic Film for a Potential Surface-Enhanced Raman Scattering Substrate, *Nanoscale*, **17**(40), 23416-23424 (2025).

Matsumoto, K.; Kudo, M.; Tatetsu, Y.; Sato, R.; Takahata, R.; Teranishi, T., Atomic Diffusion Barriers and Inter-Element Miscibility Guide the Development of Unexplored Crystal Phases, *Chem. Sci.*, **16**(40), 18705-18712 (2025).

Takekuma, H.; Sato, R.; Iida, K.; Kawawaki, T.; Haruta, M.; Kurata, H.; Nobusada, K.; Teranishi, T., Intrinsic Visible Plasmonic Properties of Colloidal PtIn₂ Intermetallic Nanoparticles, *Adv. Sci.*, **11**, 2307055 (2024).

Saruyama, M.; Takahata, R.; Sato, R.; Matsumoto, K.; Zhu, L.; Nakanishi, Y.; Shibata, M.; Nakatani, T.; Fujinami, S.; Miyazaki, T.; Takenaka, M.; Teranishi, T., Pseudomorphic Amorphization of Three-Dimensional Nanocrystal Superlattices through Morphological Transformation of Nanocrystal Building Blocks, *Chem. Sci.*, **15**, 2425-2432 (2024).

Tahara, H.; Sakamoto, M.; Teranishi, T.; Kanemitsu, Y., Coherent Electronic Coupling in Quantum Dot Solids Induces Cooperative Enhancement of Nonlinear Optoelectronic Responses, *Nat. Nanotechnol.*, **19**, 744-750 (2024).

Li, Z.; Saruyama, M.; Asaka, T.; Teranishi, T., Waning-and-Waxing Shape Changes in Ionic Nanoplates upon Cation Exchange, *Nat. Commun.*, **15**, 4899 (2024).

Division of Materials Chemistry – Chemistry of Polymer Materials –



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Scope of Research

We perform kinetic and mechanistic analyses toward understanding chemical and physicochemical reactions occurring in polymerization systems and better routes for synthesis of well-defined polymers. In particular, new well-defined polymers or polymer assemblies are prepared by living polymerization techniques, and their structure-properties relationships are precisely analyzed. Projects in progress include: 1) kinetics and mechanisms of living radical polymerization (LRP); 2) synthesis of new polymeric materials by living polymerizations and their structure/properties studies; and 3) synthesis, properties, and applications of concentrated polymer brushes (CPB).

KEYWORDS

Precision Polymerization
Polymer Brush
Hybrid Materials
Living Radical Polymerization
Tribology



Recent Selected Publications

Okubo, H.; Hase, K.; Tamamoto, K.; Tsujii, Y.; Nakano, K., In-Situ Observation of Ice-Adhesion Interface Under Tangential Loading: Anti-Icing Mechanism of Hydrophilic PPEGMA Polymer Brush, *Tribol. Lett.*, **72**, 96 (2024).
Takahashi, Y.; Mizukami, M.; Tsujii, Y.; Kurihara, K., Surface Forces Characterization of Concentrated PMMA Brush Layers under Applied Load and Shear, *Langmuir*, **40**, 325-334 (2023).
Okubo, H.; Kagiwata, D.; Nakano, K.; Tsujii, Y., Layered Structure and Wear Mechanism of Concentrated Polymer Brushes, *Langmuir*, **39**, 18458-18465 (2023).
Ishida, K.; Kondo, T., Evaluation of Surface Free Energy Inducing Interfacial Adhesion of Amphiphilic Cellulose Nanofibrils, *Biomacromolecules*, **24**, 3786-3793 (2023).
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Division of Materials Chemistry

– Polymer Controlled Synthesis –



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Scope of Research

Our research focuses on creation of new organic molecules with potential as key reagents and materials for future science and technologies. Furthermore, we have been developing new organic and polymeric materials based on our tailor-made molecules. For example, we are developing a new living radical polymerization method using heavier heteroatom compounds as controlling agents. Another topic is the synthesis of cycloparaphenylenes, hoop-shaped π -conjugated molecules, based on new synthetic strategies. We also study various condensed states of polymers by both static and dynamic methods to understand the relationship between structure and physical properties.

KEYWORDS

Organic Synthesis
Living Radical Polymerization
Curved π -Conjugated Molecules
Polymer Synthesis
Polymer Properties



Recent Selected Publications

Tong, T.; Kibune, M.; Tosaka, M.; Matsumiya, Y.; Watanabe, H.; Yamago, S., Melt Rheology of Dendritic Hyperbranched Polyacrylates Synthesized by Controlled Radical Polymerization: Evidence of Self-Similar Branch Structure Formation, *J. Am. Chem. Soc.*, **147**(29), 25652-25661 (2025).

Yamago, S.; Tong, T.; Tosaka, M.; Morimitsu, Y.; Tanaka, K., Atomic Force Microscopy Visualization of Branches in Dendritic Hyperbranched Polymers Synthesized by One-Step Radical Polymerization, *Small*, **21**(45), e08975 (2025).

Kayahara, E.; Okahara, R.; Shibata, A.; Abe, M.; Yamago, S., Synthesis and Physical Properties of $[n]$ Cycloparaphenylene Ketone ($n = 6, 7, 8,$ and 10), *Angew. Chem. Int. Ed.*, **64**(33), e202509754 (2025).

Kayahara, E.; Hirata, S.; Mizuhata, Y.; Yasuda, Y.; Kusakabe, Y.; Kaji, H.; Yamago, S., Synthesis of π -Extended [1.1]Paracyclophanes, [1.1] $[n]$ PCP ($n=2, 3,$ and 4), and Their Through-Space Conjugation, *Chem. Eur. J.*, **31**(1), e202402225 (2025).

Yamin, N.; Tosaka, M.; Yamago, S., Elucidation of the Termination Mechanism of the Radical Polymerization of Isoprene, *Macromolecules*, **58**(9), 4665-4672 (2025).

Division of Materials Chemistry

– Inorganic Photonics Materials –



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Scope of Research

NV centers in diamond have been extensively interested because a single spin of the NV center can be manipulated and detected at room temperature. Furthermore, a spin-coherence time of the NV center is very long. The spin-coherence time is the time to retain coherence (superposition state) and directly relates to the sensitivity of sensors of magnetic field, electric field and temperature. Therefore, the unique and excellent properties of the NV center are expected to be applied for quantum computing, quantum communication, bio-imaging, and high-sensitive sensor with nano-scale resolution.



KEYWORDS

Diamond Quantum Materials NV Center Quantum Sensing Quantum Information Science

Recent Selected Publications

Nishikawa, T.; Morioka, N.; Abe, H.; Murata, K.; Okajima, K.; Ohshima, T.; Tsuchida, H.; Mizuochi, N., Coherent Photoelectrical Readout of Single Spins in Silicon Carbide at Room Temperature, *Nat. Commun.*, **16**, 3405 (2025).

Fujiwara, M.; Ohori, M.; So, F. T. K.; Makino, Y.; Morioka, N.; Ohki, I.; Igarashi, R.; Nishikawa, M.; Mizuochi, N., Single Tin-Vacancy Center in Nanoscale Diamond, *Discover Nano*, **20**, 81 (2025).

Chigusa, S.; Hazumi, M.; Herbschleb, E. D.; Matsuzaki, Y.; Mizuochi, N.; Nakayama, K., Nuclear Spin Metrology with Nitrogen Vacancy Center in Diamond for Axion Dark Matter Detection, *Phys. Rev. D*, **111**, 075028 (2025).

Kawase, R.; Kawashima, H.; Kato, H.; Tokuda, N.; Yamasaki, S.; Ogura, M.; Makino, T.; Morioka, N.; Mizuochi, N., Control of Impurity Incorporation into CVD Diamond Synthesized with *Tert*-Butylphosphine for Quantum Applications, *Appl. Phys. Lett.*, **126**, 074002 (2025).

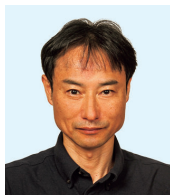
So, F. T.-K.; Hariki, N.; Nemoto, M.; Shames, A. I.; Liu, M.; Tsurui, A.; Yoshikawa, T.; Makino, Y.; Ohori, M.; Fujiwara, M.; Herbschleb, E. D.; Morioka, N.; Ohki, I.; Shirakawa, M.; Igarashi, R.; Nishikawa, M.; Mizuochi, N., Small Multimodal Thermometry with Detonation-Created Multi-Color Centers in Detonation Nanodiamond, *APL Mater.*, **12**, 051102 (2024).

Division of Materials Chemistry

– Nanospintronics –



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Scope of Research

Conventional electronics uses only the charge of electrons, while traditional magnetic devices use only the spin degree of freedom of electrons. Aiming at complete control of both charge and spin in single solid-state devices, an emerging field called spintronics is rapidly developing and having an impact on information technologies. By combining the atomic-layer deposition with nanofabrication, we focus on the development of spin properties of various materials and the control of quantum effects in mesoscopic systems for novel spintronics devices.



KEYWORDS

Spintronics
Magnetism
Magnetic Materials

Recent Selected Publications

Shiota, Y.; Taniguchi, T.; Hayashi, D.; Narita, H.; Karube, S.; Hisatomi, R.; Moriyama, T.; Ono, T., Handedness Manipulation of Propagating Antiferromagnetic Magnons, *Nat. Commun.*, **15**, 9750 (2024).

Kobayashi, Y.; Itoh, T.; Hisatomi, R.; Moriyama, T.; Shiota, Y.; Fan, X.; Ono, T., Spin-Torque Ferromagnetic Resonance Based on Current-Induced Impedance, *Appl. Phys. Lett.*, **125**, 022405 (2024).

Narita, H.; Ishizuka, J.; Kan, D.; Shimakawa, Y.; Yanase, Y.; Ono, T., Magnetization Control of Zero-Field Intrinsic Superconducting Diode Effect, *Adv. Mater.*, **35**, 2304083 (2023).

Moriyama, T.; Sánchez-Tejerina, L.; Oda, K.; Ohkochi, T.; Kimata, M.; Shiota, Y.; Nojiri, H.; Finocchio, G.; Ono, T., Micromagnetic Understanding of Evolutions of Antiferromagnetic Domains in NiO, *Phys. Rev. Mater.*, **7**, 054401 (2023).

Hayashi, D.; Shiota, Y.; Ishibashi, M.; Hisatomi, R.; Moriyama, T.; Ono, T., Observation of Mode Splitting by Magnon-Magnon Coupling in Synthetic Antiferromagnets, *Appl. Phys. Express*, **16**, 053004 (2023).

Division of Biochemistry – Biofunctional Design-Chemistry –



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KITAGAWA, Maho (U. G.)

TSUJINO, Kyoko (U. G.)

Scope of Research

The ultimate goal of our research is the regulation of cellular functions by designed peptides and proteins. Current research subjects include (1) Detection and manipulation of RNA modifications and RNA higher-order structures towards understanding of RNA-mediated gene regulation, (2) design of artificial regulators of gene expression, and (3) development of novel intracellular delivery systems aiming at elucidation and control of cellular functions using designed membrane permeable peptide vectors.



KEYWORDS

Protein/Peptide Design
RNA Modification
Nucleic Acid Structure
Intracellular Delivery
DNA/RNA Binding Protein

Recent Selected Publications

Otonari, K.; Asami, Y.; Ogata, K.; Ishihama, Y.; Futaki, S.; Imanishi, M., Highly Sequence-Specific, Timing-Controllable m⁶A Demethylation by Modulating RNA-Binding Affinity of m⁶A Erasers, *Chem. Commun.*, **61**(1), 69-72 (2025).

Kuriyama, M.; Hirose, H.; Kawaguchi, Y.; Michibata, J.; Maekawa, M.; Futaki, S., *KCNN4* as a Genomic Determinant of Cytosolic Delivery by the Attenuated Cationic Lytic Peptide L17E, *Mol. Ther.*, **33**(2), 595-614 (2025).

Kawaguchi, Y.; Kikkawa, A.; Kimura, S.; Abe, H.; Futaki, S., Microcondensate-Mediated Intracellular Infusion of mRNA Across the Plasma Membrane, *Angew. Chem. Int. Ed.*, **65**(1), e12139 (2026).

Obata, K.; Tanaka, K.; Futaki, S.; Imanishi, M., Structural Control of RNA Demethylation: G-Quadruplex Proximity Suppresses ALKBH5 Activity, *Chem. Eur. J.*, **31**(71), e01788 (2025).

Michibata, J.; Kawaguchi, Y.; Furuyama, Y.; Sasaki, Y.; Akiyoshi, K.; Futaki, S., Addition of Oligoarginine to a Membrane Permeabilizing Peptide M-Lycotoxin Facilitates Intracellular Antibody Infusion from Microcondensate, *Bioconjug. Chem.*, **36**(7), 1494-1503 (2025).

Division of Biochemistry – Chemistry of Molecular Biocatalysts –



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Scope of Research

Plant hormones are a group of small molecules that are synthesized by plants and control their growth, development and environmental responses. This laboratory aims at elucidating how plant hormones are made and act in plants. Towards this goal, we combine chemical (organic chemistry, biochemistry, and analytical chemistry) and biological (molecular genetics, physiology, molecular biology, genomics) approaches. We are also looking for new hormone-like compounds by using mutant plants that show morphological phenotypes.

KEYWORDS

Plant Hormone

Biosynthesis

Hormone Perception

Unknown Hormone

Transporter



Recent Selected Publications

Ishida, T.; Zhang, Y.; Zhu, H.; Fudano, S.; Peng, Y.; Seto, Y.; Mashiguchi, K.; Liu, J.; He, Z.; Zhang, S.; Yamaguchi, S., Stepwise Deactivation of Gibberellins during Rice Internode Elongation, *Proc. Natl. Acad. Sci. USA*, **112**(23), e2415835122 (2025).

Mashiguchi, K.; Morita, R.; Tanaka, K.; Kodama, K.; Kameoka, H.; Kyozuka, J.; Seto, Y.; Yamaguchi, S., Activation of Strigolactone Biosynthesis by the DWARF14-LIKE/KARRIKIN-INSENSITIVE2 Pathway in Mycorrhizal Angiosperms, but Not in Arabidopsis, a Non-Mycorrhizal Plant, *Plant Cell Physiol.*, **64**, 1066-1078 (2023).

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Mashiguchi, K.; Seto, Y.; Onozuka, Y.; Suzuki, S.; Takemoto, K.; Wang, Y.; Dong, L.; Asami, K.; Noda, R.; Kisugi, T.; Kitaoka, N.; Akiyama, K.; Bouwmeester, H.; Yamaguchi, S., A Carlactonoic Acid Methyltransferase That Contributes to the Inhibition of Shoot Branching in Arabidopsis, *Proc. Natl. Acad. Sci. U.S.A.*, **119**(14), e2111565119 (2022).

Ishida, T.; Watanabe, B.; Mashiguchi, K.; Yamaguchi, S., Synthesis and Structure-Activity Relationship of 16,17-Modified Gibberellin Derivatives, *Phytochem Lett.*, **49**, 162-166 (2022).

Division of Biochemistry – Molecular Biology –



<https://www.scl.kyoto-u.ac.jp/~molbio/en/index.html>



Assoc. Prof.
TSUGE, Tomohiko
(D. Sc.)



Assist. Prof.
KATO, Mariko
(D. Agr.)

Students

HAGHIR, Shahrzad (D3)

ODOI, Miku (D3)

SILVOSA MILLADO, Cyrose Suzie (D2)

Guest Scholars

KAWACHI-REUSCHER, Miki (D. Agr.)

NAMBARA, Eiji (D. Agr.)

Georg-August-Universität Göttingen, Germany, 14 October 2025–24 October 2025

University of Toronto, Canada, 5 December 2025–16 December 2025

Scope of Research

This laboratory aims to clarify the molecular bases of regulatory mechanisms involved in plant development, especially morphogenesis and environment adaptation, using techniques of forward and reverse genetics, molecular biology, and biochemistry. Current major subjects are: 1) COP9 signalosome modulating signal transduction in the nuclei, 2) RNA processing mediated gene expression regulation, 3) phospholipid signaling in cell morphogenesis, and 4) transcriptional network for cell morphogenesis.

KEYWORDS

Morphogenesis
mRNA Processing
Phospholipid Signaling

Signal Transduction
COP9 Signalosome



Recent Selected Publications

Szewc, L.; Zhang, X.; Bajczyk, M.; Bielewicz, D.; Zimna, M.; Yura, K.; Kato, M.; Nomoto, M.; Garcia-León, M.; Rubio, V.; Tada, Y.; Furumoto, T.; Aoyama, T.; Szweykowska-Kulinska, Z.; Staiger, D.; Jarmolowski, A.; Tsuge, T., The Plant Cleavage Factor I Complex Is Essential for Precise Cleavage and Polyadenylation Site Determination, *Plant Physiol.*, **199**(3), k1af483 (2025).

Haghir, S.; Yamada, K.; Kato, M.; Tsuge, T.; Wada, T.; Tominaga, R.; Ohashi, Y.; Aoyama, T., The *Arabidopsis* Basic-Helix-Loop-Helix Transcription Factor LRL1 Activates Cell Wall-Related Genes During Root Hair Development, *Plant Cell Physiol.*, **66**(3), 384-399 (2025).

Kato, M.; Watari, M.; Tsuge, T.; Zhong, S.; Gu, H.; Qu, L.-J.; Fujiwara, T.; Aoyama, T.; Redundant Function of the *Arabidopsis* Phosphatidylinositol 4-phosphate 5-kinase Genes *PIP5K4-6* is Essential for Pollen Germination, *Plant J.*, **117**(1), 212-225 (2024).

Division of Biochemistry – Chemical Biology –



<https://www.scl.kyoto-u.ac.jp/~uesugi/>



Prof.
UESUGI, Motonari
(D. Pharm. Sc.)



Assist. Prof.
ABO, Masahiro
(D. Pharm. Sc.)



Assist. Prof.
NISHIO, Kosuke
(D. Med. Sc.)



Assist. Prof.
SINGH, Vaibhav Pal
(D. Med. Sc.)

Students

FARRAG, Asmaa Mostafa
Abdelbari Soliman (D4)
LATOS, Krystian (D2)
YAMAMOTO, Yuma (D1)

OKITA, Ryunosuke (iD1)
ASANO, Junta (iD1)
HERRERA, Matthew
Dewell (M1)

AYATOLLAHI,
Parisa Sadat (M1)
OBEID Omar (M1)
SONG, Sereimongkol (M1)

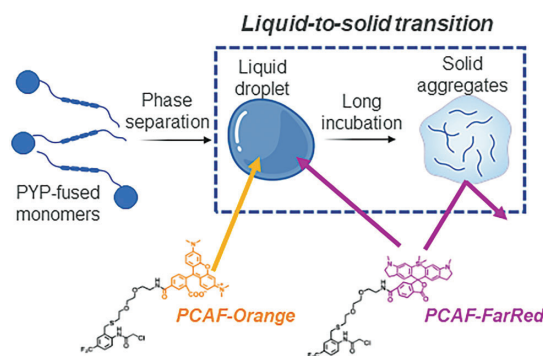
JAISWAL, Sakshi (R. S.)
HARITH, Muhammad (R. S.)
OMOTE, Koyo (U. G.)

Guest Res. Assoc.

KIM, Hyosuk (Ph. D.) Yonsei University, Korea, R., 1 April 2023–31 March 2026

Scope of Research

Chemical biology is an interdisciplinary field of study that is often defined as “chemistry-initiated biology.” As biological processes all stem from chemical events, it should be possible to understand or manipulate biological events using chemistry. Our laboratory has been discovering or designing unique organic molecules that modulate fundamental processes in human cells. Such synthetic organic molecules often serve as tools for basic cell biology. Discovery or design of small molecules with unique biological activities permits small-molecule-initiated exploration of complex cellular events. Our mission is to create a new world of bioactive synthetic molecules: new modes of activity, new shapes, and new sizes. We hope that these basic studies open new avenues for small-molecule applications in a range of fields.



KEYWORDS

Chemical Biology Self-Assembly Chemical Library
Chemoproteomics Immunology

Recent Selected Publications

Farrag, A. M. A. S.; Ota, K.; Yoshimura, H.; Takemoto, M.; Mitarai, T.; Kamikawa, T.; Abo, M.; Singh, V. P.; Cui, C.; Zhou, L.; Ishidate, F.; Fujiwara, T.; Sato, S.; Hori, Y.; Ozawa, T.; Kikuchi, K.; Uesugi, M., Live-Cell Monitoring and Omics Analysis of Liquid-Solid Transitions of Biomolecular Condensates, *J. Am. Chem. Soc.*, **147**(41), 37056-37064 (2025).

Takemoto, M.; Delghandi, S.; Abo, M.; Yurimoto, K.; Odagi, M.; Singh, V. P.; Wang, J.; Nakagawa, R.; Sato, S.; Takemoto, Y.; Farrag, A. M. A. S.; Kawaguchi, Y.; Nagasawa, K.; Honjo, T.; Chamoto, K.; Uesugi, M., Covalent Plant Natural Product That Potentiates Antitumor Immunity, *J. Am. Chem. Soc.*, **147**(3), 2902-2912 (2025).

Singh, V. P.; Hirose, S.; Takemoto, M.; Farrag, A. M. A. S.; Sato, S.; Honjo, T.; Chamoto, K.; Uesugi, M., Chemoproteomic Identification of Spermidine-Binding Proteins and Antitumor-Immunity Activators, *J. Am. Chem. Soc.*, **146**(24), 16412-16418 (2024).

Zhuo, S.; Noda, N.; Hioki, K.; Jin, S.; Hayashi, T.; Hiraga, K.; Momose, H.; Li, W.; Zhao, L.; Mizukami, T.; Ishii, K.; Li, Y.; Uesugi, M., Identification of a Self-Assembling Small-Molecule Cancer Vaccine Adjuvant with an Improved Toxicity Profile, *J. Med. Chem.*, **66**(18), 13266-13279 (2023).

Toh, K.; Nishio, K.; Nakagawa, R.; Egoshi, S.; Abo, M.; Perron, A.; Sato, S.; Okumura, N.; Koizumi, N.; Dodo, K.; Sodeoka, M.; Uesugi, M., Chemoproteomic Identification of Blue-Light-Damaged Proteins, *J. Am. Chem. Soc.*, **144**(44), 20171-20176 (2022).

Nishio, K.; Toh, K.; Perron, A.; Goto, M.; Abo, M.; Shimakawa, Y.; Uesugi, M., Magnetic Control of Cells by Chemical Fabrication of Melanin, *J. Am. Chem. Soc.*, **144**(37), 16720-16725 (2022).

Division of Environmental Chemistry

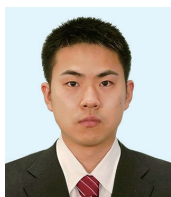
– Molecular Materials Chemistry –



<https://www.scl.kyoto-u.ac.jp/~moma/index-e.html>



Prof.
KAJI, Hironori
(D. Eng.)



Assoc. Prof.
SUZUKI, Katsuaki
(D Human & Envirntl. Studies)



Assist. Prof.
CHOI, Heekyoung*
(D. Sc.)



Techn. Staff
MAENO, Ayaka



Techn. Staff
KAKUYAMA, Keisuke
(D. Sc.)

*New Research Field Development Project

Students

MURAKAMI, Kimiya (D3)
FUJINAKA, Masatoshi (D3)
SATO, Hiroki (D3)
ISHIHARA, Kuraudo (D2)
YASUDA, Yuka (D1)

OKUMURA, Ryosuke (D1)
TAKARAKO, Masataka (M2)
KAWABATA, Kazuhiro (M2)
KOZAKA, Shunsuke (M2)
KONDO, Ryo (M1)

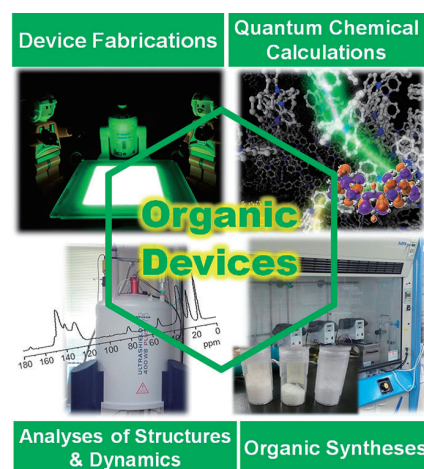
NISHIKAWA, Kohei (M1)
SAKURAI, Yuta (M1)
AZUMA, Yusaku (U. G.)
SHIRAGA, Riku (U. G.)
TAKAHASHI, Kento (U. G.)

Scope of Research

Our research goal is to develop high-performance organic electroluminescence devices, organic solar cells, and polymer materials. Toward this, we carry out syntheses, device fabrications, precise structure characterizations, and quantum chemical calculations for high functional organic materials. Along with exploring novel synthetic routes and novel devices, we perform detailed analyses of structures and dynamics, mainly by sophisticated solid-state NMR spectroscopy, in order to obtain structure–dynamics–property relationships.

KEYWORDS

Organic Light-Emitting Diodes Solid-State NMR
Quantum Chemical Calculation Amorphous Materials
Dynamic Nuclear Polarization Enhanced NMR



Recent Selected Publications

- Ishihara, K.; Kaji, H., Predictions of Molecular Orientation and Charge Mobility in Organic Vacuum-Deposited Thin Films by Multiscale Simulation, *Commun. Mater.*, **6**(1), 116 (2025).
- Yasuda, Y.; Shizu, K.; Tanaka, H.; Kaji, H., Enhanced Luminance of Pentaazaphenylene-Based Delayed Fluorescence Emitters by Breaking Forbidden Transition, *Angew. Chem. Int. Ed.*, **64**(24), e202504390 (2025).
- Sato, H.; Kanda, S.; Kaji, H., Elucidation of Molecular-Level Charge Transport in an Organic Amorphous System, *npj Comput. Mater.*, **11**(1), 39 (2025).
- Okumura, R.; Tanaka, H.; Shizu, K.; Fukushima, S.; Yasuda, Y.; Kaji, H., Development of an Organic Emitter Exhibiting Reverse Intersystem Crossing Faster than Intersystem Crossing, *Angew. Chem. Int. Ed.*, **63**, e202409670 (2024).
- Shizu, K.; Kaji, H., Quantitative Prediction of Rate Constants and Its Application to Organic Emitters, *Nat. Commun.*, **15**, 4723 (2024).
- Shizu, K.; Ren, Y.; Kaji, H., Promoting Reverse Intersystem Crossing in Thermally Activated Delayed Fluorescence via the Heavy-Atom Effect, *J. Phys. Chem. A*, **127**, 439-449 (2023).

Division of Environmental Chemistry

– Hydrospheric Environment Analytical Chemistry –



https://inter3.kuicr.kyoto-u.ac.jp/scope_E.html



Prof.
SOHRIN, Yoshiki
(D. Sc.)



Assoc. Prof.
TAKANO, Shotaro
(D. Sc.)



Assist. Prof.
ZHENG, Linjie
(D. Sc.)



Assist. Prof. *
ALAM, Mahboob
(Ph. D.)



Techn. Staff
NAKAHARA, Fumiko

*New Research Field
Development Project

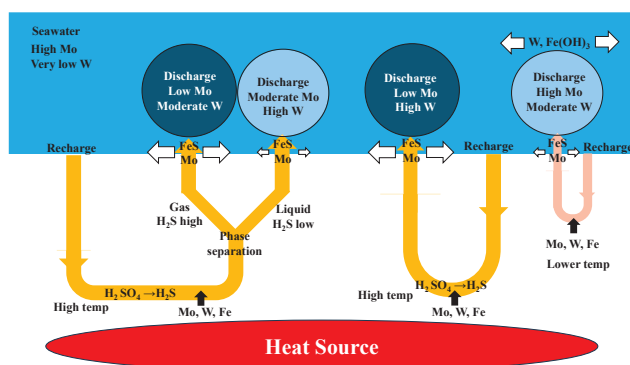
Students

MATSUOKA, Kohei (D3)
GODA, Aoi (M2)

GOSHONA, Shinya (M2)
MIZUTANI, Atsuki (M2)

TAKANO, Miyu (M1)

Scope of Research



(i) Biogeochemistry of trace elements in the hydrosphere: Novel analytical methods are developed for trace metals and their isotopes. Distribution of trace elements in the hydrosphere and their effects on the ecosystem are investigated. The study also covers hydrothermal activity, deep biosphere, and paleocean. (ii) Ion recognition: Novel ligands and ion recognition system are designed, synthesized, and characterized.

KEYWORDS

Marine Chemistry Analytical Chemistry Trace Elements Stable Isotopes Metal Ion Recognition

Recent Selected Publications

Matsuoka, K.; Takano, S.; Kawagucci, S.; Toki, T.; Sohrin, Y., Concentrations and Isotope Ratios of Mo and W in Okinawa Trough Hydrothermal Fluids: Novel Probes for Hydrothermal Processes in a Back-Arc Basin, *Geochem. J.*, **59**(6), 283-298 (2025).

Sohrin, Y.; Zheng, L.; Chan, C.-Y.; Nakaguchi, Y.; Takano, S.; Sohrin, R.; Liao, W.-H.; Ho, T.-Y., Acid-Leachability of Metals from Suspended Particles in the Pacific Ocean, *Mar. Chem.*, **273**, 104571(2025).

Zheng L., Study on the Biogeochemical Cycling Processes of Trace Metals in the Pacific Ocean Based on Multi-Element Analysis, *Oceanography in Japan*, **34**, 185-202 (2025).

Sakata, K.; Takano, S.; Matsuki, A.; Takeichi, Y.; Tanimoto, H.; Sakaguchi, A.; Kurisu, M.; Takahashi, Y., Atmospheric Chemistry in East Asia Determines the Iron Solubility of Aerosol Particles Supplied to the North Pacific Ocean, *Atmos. Chem. Phys.*, **25**, 11087-11107 (2025).

Chan, C.-Y.; Zheng, L.; Sohrin, Y., The Behaviour of Nickel, Copper, Zinc, and Cadmium in the Subarctic Pacific Ocean: East-West Differences, *J. Oceanogr.*, **81**, 149-162 (2025).



Prof.
HASEGAWA, Takeshi
(D. Sc.)



Assist. Prof.
SHIOYA, Nobutaka
(D. Sc.)



Res. (pt.)
MATSUDA, Hiroshi
(D. Eng.)

Students

OKA, Takayuki (D2)
ARAKI, Taisuke (D1)
SUGIMOTO, Emi (M2)
OONUKEI, Tomoya (M2)

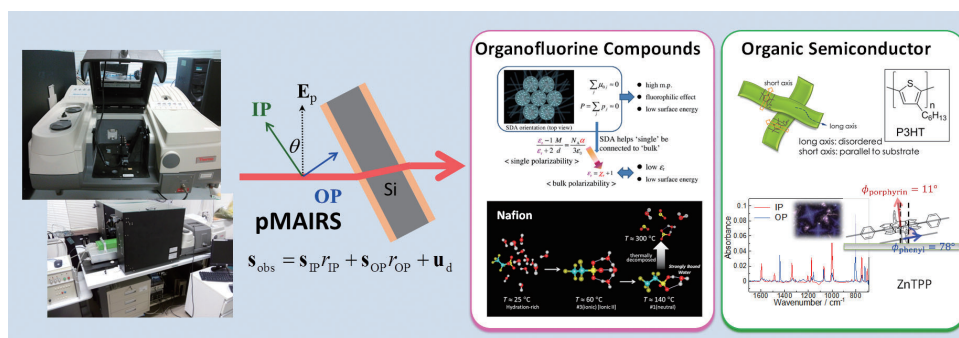
KONNO, Shun (M1)
TAKADA, Seiichiro (M1)
NAKAJIMA, Hayato (M1)

Scope of Research

To understand the chemical structure and properties of a molecular aggregated system, the keywords of molecular interactions and orientation are focused on, and the molecular aggregates are investigated by using originally developed spectroscopic techniques. The current major topics are: (1) perfluoroalkyl-specific properties in a condensed system; (2) controlling factors of molecular packing and orientation in a thin film of an organic semiconductor compound; (3) development of new molecular orientation analytical technique “MAIRS2.”

KEYWORDS

Infrared and Raman Spectroscopy
Surface and Interface Chemistry
Perfluoroalkyl Compounds
Organic Semiconductors
pMAIRS and MAIRS2



Recent Selected Publications

- Shimoaka, T.; Ootsuki, M.; Yamaguchi, Y.; Shioya, N.; Hasegawa, T., Molecular Orientation Analysis of Perfluoroalkyl Groups in the Solid Surface by Backscattering Raman Spectrometry, *Anal. Sci.*, **41**(8), 1355-1364 (2025).
- Oonuki, T.; Araki, T.; Oka, T.; Matsuda, H.; Shioya, N.; Kano, J.; Hibara, A.; Hasegawa, T., Molecular Disaggregation Process of PTFE Using Sodium Chloride: A Study by Infrared Spectroscopy, *J. Phys. Chem. B*, **129**(17), 4249-4255 (2025).
- Oka, T.; Shioya, N.; Abe, R.; Maruyama, S.; Hasegawa, T., Suppression of Molecular Disordering in Liquid Crystalline Thin Films by Side-Chain Engineering, *J. Phys. Chem. C*, **129**(9), 4806-4813 (2025).

Division of Environmental Chemistry – Molecular Microbial Science –



<https://molmicro.kuicr.kyoto-u.ac.jp/en/>



Prof.
KURIHARA, Tatsuo
(D. Eng.)



Assoc. Prof.
KAWAMOTO, Jun
(D. Agr.)



Assist. Prof.
OGAWA, Takuya
(D. Agr.)

Specially Contracted Staff

KITAYAMA, Kaori

Students

INOUE, Hiromu (D3)

YOUN, Jae Hyung (D2)

YANG, Yuanzheng (D2)

SHIMODA, Kaichi (M2)

TAKANO, Haruka (M2)

YAMASHITA, Atsuki (M2)

SANKARALINGAM,

Nivitha Vani (M2)

KAMADA, Mayu (M1)

SOGA, Akinori (M1)

GE, Yirun (M1)

Scope of Research

Microorganisms are found almost everywhere on Earth. They have a great diversity of capacities to adapt to various environments, including chemically and physically unusual environments. Our main subject is to clarify the molecular basis of environmental adaptations of microorganisms and their application. Specific functions of proteins and lipids with essential roles in environmental adaptation of extremophilic microorganisms are of our particular interest. We also undertake mechanistic analysis of microbial enzymes, in particular, those involved in unique metabolic pathways, and their application.



KEYWORDS

Extremophiles

Phospholipid Acyltransferase

Bacterial Cold-Adaptation Mechanism

Extracellular Membrane Vesicle

Polyunsaturated Fatty Acid

Recent Selected Publications

Inoue, H.; Kawano, K.; Kawamoto, J.; Ogawa, T.; Kurihara, T., Rapid Screening and Identification of Genes Involved in Bacterial Extracellular Membrane Vesicle Production Using a Curvature-Sensing Peptide, *J. Bacteriol.*, **207**(5), e0049724 (2025).

Suwanawat, N.; Ogawa, T.; Toyotake, Y.; Kawamoto, J.; Kurihara, T., Biochemical Characterization and Mutational Analysis of Lysophosphatidic Acid Acyltransferases of *Escherichia coli* Highlighting Their Involvement in the Generation of Membrane Phospholipid Diversity, *J. Biochem.*, **177**(4), 259-272 (2025).

Zhu, M.; Kawamoto, K.; Imai, T.; Ogawa, T.; Kurihara, T., Enhancing Extracellular Membrane Vesicle Productivity of *Shewanella vesiculosa* HM13, a Prospective Host for Vesiculation-Mediated Protein Secretion, by Weakening Outer Membrane-Peptidoglycan Linkage, *J. Biosci. Bioeng.*, **138**, 137-143 (2024).

Casillo, A.; Fanina, S.; Kamasaka, K.; Kawamoto, J.; Kurihara, T.; Lanzetta, R.; Corsaro, M. M., Structural Study of a Polysaccharide Component of *nfnB* Mutant of *Shewanella vesiculosa* HM13, *Carbohydr. Res.*, **541**, 109148 (2024).

Ogawa, T.; Kuboshima, M.; Suwanawat, N.; Kawamoto, J.; Kurihara, T., Division of the Role and Physiological Impact of Multiple Lysophosphatidic Acid Acyltransferase Paralogs, *BMC Microbiol.*, **22**, 241 (2022).

Division of Multidisciplinary Chemistry – Polymer Materials Science –



<https://www.scl.kyoto-u.ac.jp/~polymat/e-index.html>



Prof.
TAKENAKA, Mikihiro
(D. Eng.)



Assoc. Prof.
OGAWA, Hiroki
(D. Eng.)



Assist. Prof.
NAKANISHI, Yohei
(D. Eng.)



Assist. Prof.
SHIBASAKI, Kazuki *
(D. Eng.)

*New Research Field
Development Project

Techn. Staff

ISODA, Kumiko
TATEISHI, Nayuko

Res. (pt.)

NISHIDA, Koji (D. Eng.)

Students

SEKO, Tamio (D3)

ARAWAKA, Masato (D3)

SAWADA, Satoshi (D2)

TAMURA, Yukiko (D2)

BANDO, Shusuke (D2)

HOSOMI, Yu (M2)

KUBO, Haruki (M2)

YOSHINO, Syunki (M2)

SHITOTSU, Yui (M1)

MATSUMOTO, Ryohei (M1)

SASAKI, Asaka (M1)

TAKAHATA, Momoko (U. G.)

TERUYAMA, Jun (U. G.)

NAKAYAMA,

Tsubasa (U. G.)

Scope of Research

The structure and molecular motion of polymer substances are studied, mainly using scattering methods such as X-ray, neutron, and light with intent to solve fundamentally important problems in polymer science. The main projects are studied on 1) the morphologies and the dynamics of self-assembling processes in block copolymers, 2) the hierarchical structures in crystalline polymer and rubber-filler systems, 3) the viscoelastic effects in glassy materials, 4) formation processes and ordering structures in polymer thin films.



KEYWORDS

Polymer Physics Polymer Properties Self Assembly Softmatter Hierarchical Structure

Recent Selected Publications

Tamura, Y.; Arakawa, M.; Takenaka, M.; Nakanishi, Y.; Fujinami, S.; Shibata, M.; Yamamoto, K.; Miyata, N.; Yamada, M.; Seto, H.; Yamada, N. L.; Aoki, H.; Miyazaki, T., Modeling the Extraction of Bound Rubber from Silica-Filled Styrene-Butadiene Rubber with Toluene, *Polymer*, **333**, 128662 (2025).

Ogawa, H.; Tobita, N.; Ono, S.; Wang, P.; Kubozono, T.; Yoshihara, D.; Yamada, S.; Arakawa, M.; Yamamoto, S.; Tanaka, K.; Takenaka, M., Nondestructive Evaluation of the Spatial Distribution of Nanofillers and Network Structures in Buried Epoxy Resins under Adhesion Conditions, *ACS Appl. Polym. Mater.*, **7(15)**, 10051-10061 (2025).

Ogawa, H.; Mashita, R.; Kishimoto, H.; Ono, S.; Yashiro, W.; Kabe, T.; Masunaga, H.; Takenaka, M., New Insights into the Fracture Precursors of Rubber Reinforced with a Nanofiller, *Small Struct.*, **6(9)** 2500257 (2025).

Kishimoto, M.; Mita, K.; Ogawa, H.; Shibasaki, K.; Arakawa, M.; Takenaka, M., Strain-Induced Density Fluctuations in Linear Low-Density Polyethylene, *J. Appl. Crystallogr.*, **58(3)**, 879-885 (2025).

Arakawa, M.; Kabe, T.; Iwata, T.; Takenaka, M., Differences in Hierarchical Structural Changes between Unoriented P(3HB) and P(3HB-co-3HH) under Stretching, *J. Appl. Crystallogr.*, **58(3)**, 886-896 (2025).



Assoc. Prof.
MATSUMIYA, Yumi
(D. Eng.)

Students

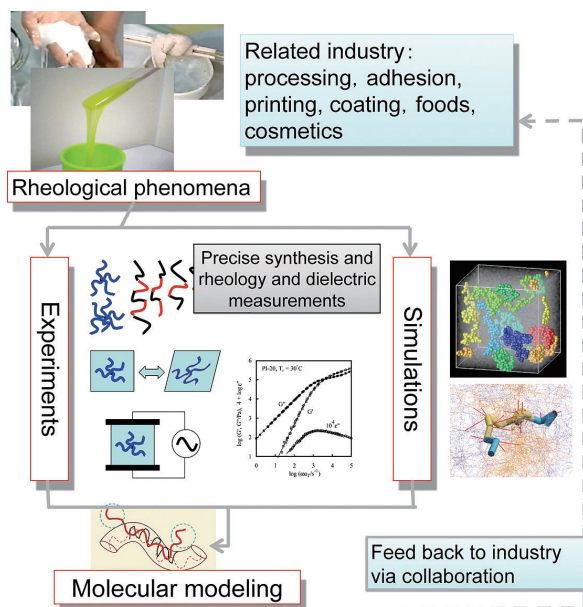
HAYASHI, Taichi (M2)
TOMIURA, Yuya (M2)

Scope of Research

Research focus is placed on the molecular origin of rheological properties of various materials. Depending on time and temperature, homogeneous polymeric materials exhibit typical features of glass, rubber, and viscous fluid while heterogeneous polymeric systems exhibit plasticity in addition to these features. For basic understanding of these features, the molecular motion and structures at various scales are studied for polymeric systems in deformed state. Rheological measurements are performed with various rheometers. Auto-correlation of the molecular orientation is also investigated with dynamic dielectric spectroscopy. Analysis of rheological and dielectric behavior elucidates a new aspect of softmatter physics.

KEYWORDS

Rheology Dielectric Spectroscopy
Soft Matter Mesoscopic Model



Recent Selected Publications

- Matsumiya, Y.; Watanabe, H. Non-university of Constraint Release Relaxation in Entangled Linear Polymers of Various Chemical Structures, *Rubber Chem. Tech.*, **97(4)**, 471-511 (2024).
- Zhang, Y.; Tang, J.; Chen, Q.; Kwon, Y.; Matsumiya, Y.; Watanabe, H., Nonlinear Stress Relaxation of End-Associative Star Chain. 2. Behavior Under Double-Step Strain, *J. Soc. Rheol. Jpn.*, **52(2)**, 143-160 (2024).
- Zhang, Y.; Tang, J.; Chen, Q.; Kwon, Y.; Matsumiya, Y.; Watanabe, H., Nonlinear Stress Relaxation of End-Associative Star Chain. 1. Behavior Under Single-Step Strain, *J. Soc. Rheol. Jpn.*, **52(2)**, 123-141 (2024).

Division of Multidisciplinary Chemistry

– Molecular Aggregates –



<https://www.scl.kyoto-u.ac.jp/~wakamiya/english/index.html>



Prof.
WAKAMIYA, Atsushi
(D. Eng.)



Senior Lect.
MURDEY, Richard
(Ph. D.)



Assist. Prof.
NAKAMURA, Tomoya
(D. Eng.)



Assist. Prof. *¹
TRUONG, Minh Anh
(D. Eng.)



Specially Appointed Assist. Prof.
CHEN, Chien-Yu
(Ph. D.)



Guest Res. Assoc. *²
SERIWATTANACHAI,
Chaowaphat



Guest Res. Assoc. *³
Nguyen Thi Hue

P. D.

TAN, Tiancheng (D. Sc.)

Program-Specific Res.

MURATA, Hiroshi
SHIMAZAKI, Ai
IWASAKI, Yasuko
MATSUSHIGE, Yuko

Res. (pt.)

NAKAMURA, Yuki

Assist. Techn. Staff

HARAMATSU, Megumi

Students

HASEGAWA, Akio (D3)
MIYAKE, Yuki (D2)
HARATA, Fuyuki (D2)
HIRA, Shota (D2)
ALY, Aly (D2)
SAKAMOTO, Chihiro (D1)
CHO, Woojin (M2)
LING, Yüke (M2)
YANASE, Ibuki (M2)
NORIEGA, Javier Pablo (M2)
CHEN, Yongyong (M1)
TANAKA, Hayato (M1)

*¹ New Research Field Development Project

*² School of Materials Science and Innovation, Mahidol University, Thailand, 7 July 2025–24 December 2025

*³ Institute for Photovoltaics, University of Stuttgart, Vietnam, Germany, 6 October 2025–31 March 2026

Scope of Research

We design and synthesize unique electronic materials with sophisticated device applications in mind. These materials have novel solid-state aggregation structures or well-defined interface orientation that promote efficient electrical current flow or enhance device lifetime. Electronic devices based on these new materials are then evaluated using advanced measurement techniques, and the results are used to inform the next direction of the materials chemistry. We call this synergistic approach for achieving our research goals “Needs Inspired Fundamental Science”.



KEYWORDS

Molecular Design and Synthesis Molecular Aggregation Functional Materials Semiconductors Perovskite Solar Cells

Recent Selected Publications

Harata, F.; Kaneko, R.; Hu, S.; Ohashi, N.; Nakamura, T.; Truong, M. A.; Murdey, R.; Wakamiya, A., Substrate-Independent and Antisolvent-Free Fabrication Method for Tin Perovskite Films via Imidazole-Complexed Intermediates, *ACS Energy Lett.*, **10**(10), 5047-5056 (2025).
Tan, T.; Murdey, R.; Sumitomo, S.; Sato, K.; Abe, T.; Wakamiya, A., Tailored 3-Alkoxy-*N,N,N,2,2*-Pentamethylpropan-1-Ammonium Bis (trifluoromethylsulfonyl)Imide Ionic Liquids for Room-Temperature Fluoride-Ion Batteries, *Angew. Chem., Int. Ed.*, **64**(23), e202422299 (2025).
Truong, M. A.; Funasaki, T.; Adachi, Y.; Hira, S.; Tan, T.; Akatsuka, A.; Yamada, T.; Iwasaki, Y.; Matsushige, Y.; Kaneko, R.; Asahara, C.; Nakamura, T.; Murdey, R.; Yoshida, H.; Kanemitsu, Y.; Wakamiya, A., Molecular Design of Hole-Collecting Materials for Co-Deposition Processed Perovskite Solar Cells: A Tripodal Triazatruxene Derivative with Carboxylic Acid Groups, *J. Am. Chem. Soc.*, **147**(3), 2797-2808 (2025).
Nakamura, T.; Nagai, T.; Miyake, Y.; Yamada, T.; Miura, M.; Yoshida, H.; Kanemitsu, Y.; Truong, M. A.; Murdey, R.; Wakamiya, A., Single-Isomer Bis(Pyrrolidino)Fullerenes as Electron-Transporting Materials for Tin Halide Perovskite Solar Cells, *Chem. Sci.*, **16**(5), 2265-2272 (2025).
Hu, S.; Wang, J.; Zhao, P.; Pascual, J.; Wang, J.; Rombach, F.; Dasgupta, A.; Liu, W.; Truong, M. A.; Zhu, H.; Kober-Czerny, M.; Drysdale, J. N.; Smith, J. A.; Yuan, Z.; Aalbers, G. J. W.; Schipper, N. R. M.; Yao, J.; Nakano, K.; Turren-Cruz, S.-H.; Dallmann, A.; Christoforo, M. G.; Ball, J. M.; McMeekin, D. P.; Zaininger, K.-A.; Liu, Z.; Noel, N. K.; Tajima, K.; Chen, W.; Ehara, M.; Janssen, R. A. J.; Wakamiya, A.; Snith, H. J., Steering Perovskite Precursor Solutions for Multijunction Photovoltaics, *Nature*, **639**(8053), 93-101 (2025).

Advanced Research Center for Beam Science – Particle Beam Science –



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Prof.
WAKASUGI, Masanori
(D. Sc.)



Assoc. Prof.
TSUKADA, Kyo
(D. Sc.)



Techn. Staff
TONGU, Hiromu

Students

KAGAMI, Rin (M2)

OHTAKE, Ryuji (M1)

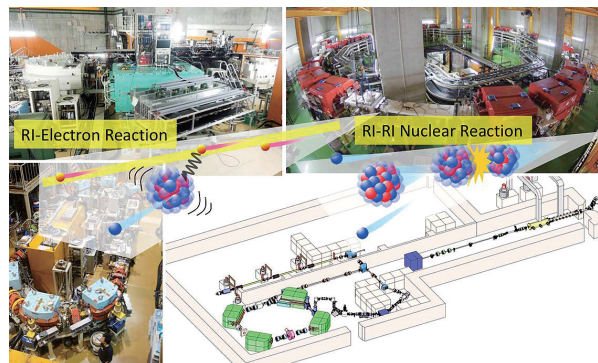
KOBAYASHI, Hiroki (M2)

Scope of Research

One of our research is an experimental research for unstable nuclear structures by means of the electron and heavy-ion accelerators. We address the technical development in an RI beam production driven by a high-energy electron beam, an electron scattering from the RI's in combination with the RI target inserted in an electron storage ring, and the precision mass measurement for extremely short-lived and rare exotic nuclei using a heavy-ion storage ring. We will address some technical development aiming at a nuclear photo-absorption cross-section measurement and the beam recycling in a heavy-ion storage ring to study the nuclear reactions involving rare exotic nuclei.

KEYWORDS

Beam Physics Accelerator Physics
Unstable Nuclear Physics Storage Ring
Electron Linac



Recent Selected Publications

Tsukada, K.; Abe, Y.; Enokizono, A.; Goke, T.; Hara, M.; Honda, Y.; Hori, T.; Ichikawa, S.; Ito, Y.; Kurita, K.; Legris, C.; Maehara, Y.; Ohnishi, T.; Ogawara, R.; Suda, T.; Tamae, T.; Wakasugi, M.; Watanabe, M.; Wauke, H., First Observation of Electron Scattering from Online-Produced Radioactive Target, *Phys. Rev. Lett.*, **131**, 092502 (2023).

Ogawara, R.; Abe, Y.; Ohnishi, T.; Enokizono, A.; Hara, M.; Hori, T.; Ichikawa, S.; Kurita, K.; Maehara, Y.; Suda, T.; Tsukada, K.; Wakasugi, M.; Watanabe, M.; Wauke, H., Ion-Trapping Properties of SCRIT: Time Evolutions of ^{138}Ba Charge State Distributions, *Nucl. Instr. Met.*, **B541**, 90-92 (2023).

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Li, H. F.; Naimi, S.; Sprouse, T. M.; Mumpower, M. R.; Abe, Y.; Yamaguchi, Y.; Nagae, D.; Suzaki, F.; Wakasugi, M.; Arakawa, H.; Dou, W. B.; Hamakawa, D.; Hosoi, S.; Inada, Y.; Kajiki, D.; Kobayashi, T.; Sakaue, M.; Yokoda, Y.; Yamaguchi, T.; Kagesawa, R.; Kamioka, D.; Moriguchi, T.; Mukai, M.; Ozawa, A.; Ota, S.; Kitamura, N.; Masuoka, S.; Michimasa, S.; Baba, H.; Fukuda, N.; Shimizu, Y.; Suzuki, H.; Takeda, H.; Ahn, D. S.; Wang, M.; Fu, C. Y.; Wang, Q.; Suzuki, S.; Ge, Z.; Litvinov, Yu. A.; Lorusso, G.; Walker, P. M.; Podolyak, Zs.; Uesaka, T., First Application of Mass Measurements with the Rare-RI Ring Reveals the Solar r-Process Abundance Trend at $A = 122$ and $A = 123$, *Phys. Rev. Lett.*, **128**, 152701 (2022).

Kusumoto, T.; Inoue, S.; Ogawara, R.; Kodaira, S., Measurement of the Energy Spectrum of Laser-Accelerated Protons Using FNTD: Development of an Easy and Quick Method for Energy Spectrometry, *Radiat. Meas.*, **151**, 106715 (2022).

Advanced Research Center for Beam Science – Laser Matter Interaction Science –



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Prof.
TOKITA, Shigeaki
(D. Eng.)



Assist. Prof.
OKAZAKI, Daiki
(D. Eng.)



Assist. Prof.
KIRITA, Yuri
(D. Sc.)



Program-Specific Res.
BU, Xiangbao
(Ph. D.)



Res. (pt.)
HASHIDA, Masaki
(D. Eng.)

Res. (pt.)

MASUNO, Shin-ichiro

Assist. Techn. Staff

MATSUMOTO, Keiko
KAMEI, Yuki

Students

CUI, Qingyue (D1)
UETA, Isshin (M2)

HIYANE, Soshi (M2)
LEE, Sungho (M2)

ISHIHARA, Shunto (M1)
ITO, Hiroaki (M1)

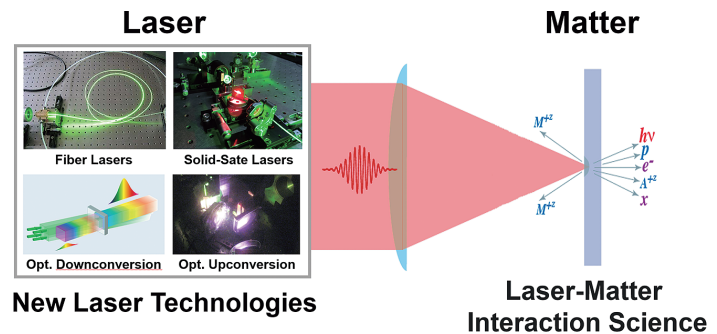
NAKAGAWA, Haruto (M1)

Scope of Research

We are developing cutting-edge high-intensity laser sources and studying experimental research on the laser interaction with matter by using the new laser sources. We are promoting cross-disciplinary research based on high-intensity laser technologies such as development of high-intensity mid-infrared solid-state lasers and fiber lasers, research on particle acceleration and wavelength conversion with plasmas produced by high-intensity ultrafast lasers, development of laser isotope separation method for neutrino research, and search for dark matter using high-intensity lasers.

KEYWORDS

High Power Laser Optics
Ultrafast Laser Physics
Laser-Plasma Interaction Physics
Laser Isotope Separation
Dark Matter



Recent Selected Publications

Ishida, G.; Sugimoto, M.; Uehara, H.; Tokita, S.; Nishijima, Y.; Goya, K., Fiber-in-Line Infrared Spectrometer Fabricated by Femtosecond Laser Structuring of Microchannels in Fluoride Glass Fiber, *Opt. Express*, **33(17)**, 35550-35559 (2025).

Yu, L.; Okazaki, D.; Kirita, Y.; Tokita, S.; Uehara, H.; Yasuhara, R., Numerical Investigation of Fe-Doped Chalcogenide Chirped Pulse Amplifier, *Opt. Express*, **33(16)**, 33435-33445 (2025).

Fujioka, K.; Matsumoto, Y.; Tamaru, Y.; Yoshida, H.; Ogino, J.; Tokita, S.; Tsubakimoto, K.; Yamamoto, K.; Yogo, A.; Kawanaka, J.; Miyanaga, N., Fabrication, Spectroscopic Characteristics, and Lasing Performance of Nd,La:CaF₂ Transparent Ceramics, *Opt. Mater. Express*, **15(4)**, 890-902 (2025).

Goya, K.; Noda, S.; Ishida, G.; Tachibana, K.; Uehara, H.; Tokita, S., Mid-Infrared Refractometer Based on Side-Polished Indium Fluoride Fiber for Monitoring Relative Humidity, *Appl. Phys. Express*, **18(3)**, 032003 (2025).

Furuse, H.; Ueno, D.; Omata, K.; Imai, M.; Tokita, S., Mid-Infrared Fine-Grained Er:Y₂O₃ Laser Ceramics Fabricated by Spark Plasma Sintering, *Ceram. Int.*, **50(22)**, 46925-46931 (2024).

Advanced Research Center for Beam Science – Electron Microscopy and Crystal Chemistry –



<http://eels.kuicr.kyoto-u.ac.jp/EMCC/home-en.html>



Assoc. Prof.
HARUTA, Mitsutaka
(D. Sc.)



Assist. Prof.
NEMOTO, Takashi
(D. Sc.)

Program-Specific Res.

MATSUNO, Junya (D. Sc.)
KIYOMURA, Tsutomu

Researcher (pt.)

OGAWA, Tetsuya (D. Sc.)

Students

WU, Jiayi (D1)
SEKOGUCHI, Maho (M2)

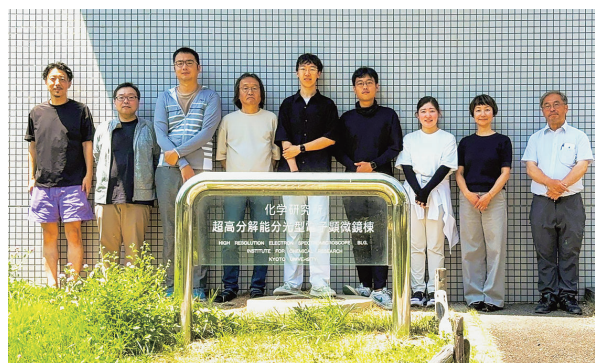
CHO, Minhyuk (M1)

Scope of Research

In the field of nanotechnology, the importance of high spatial resolution analysis of materials further increases. We study the structure and the electronic state of materials at atomic scale through direct imaging of atoms or molecules by (scanning) transmission electron microscopy ((S)TEM) combined with energy dispersive X-ray spectroscopy (EDS) and electron energy-loss spectroscopy (EELS), which gives the information of elemental and electronic state. And we are studying with the aim of establishing new analytical methods using electron microscopes and evaluating materials using these methods.

KEYWORDS

STEM
EELS
EDS
Elemental Mapping
Electronic State



Recent Selected Publications

Iwashimizu, C.; Haruta, M.; Kurata, H., Anisotropic Atomic Contrast by Final-state Selection in Electron Energy-loss Spectroscopy, *Phys. Rev. B*, **111**(15), [155147-1]-[155147-8] (2025).

Lin, I-C.; Haruta, M.; Nemoto, T.; Kurata, H., Isotropic Behavior of Oxygen Vibrations in PbTiO₃ Investigated by Ti L_{2,3}-Edge Electron Energy-loss Spectroscopy, *Phys. Rev. B*, **110**, [035109-1]-[035109-8] (2024).

Lin, I-C.; Haruta, M.; Nemoto, T.; Goto, M.; Shimakawa, Y.; Kurata, H., Extraction of Anisotropic Thermal Vibration Factors for Oxygen from the Ti L_{2,3}-Edge in SrTiO₃, *J. Phys. Chem. C*, **127**(36), 17802-17808 (2023). Supplemental cover

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Haruta, M.; Kikkawa, J.; Kimoto, K.; Kurata, H., Comparison of Detection Limits of Direct-Counting CMOS and CCD Cameras in EELS Experiments, *Ultramicroscopy*, **240**, [113577-1]-[113577-6] (2022).



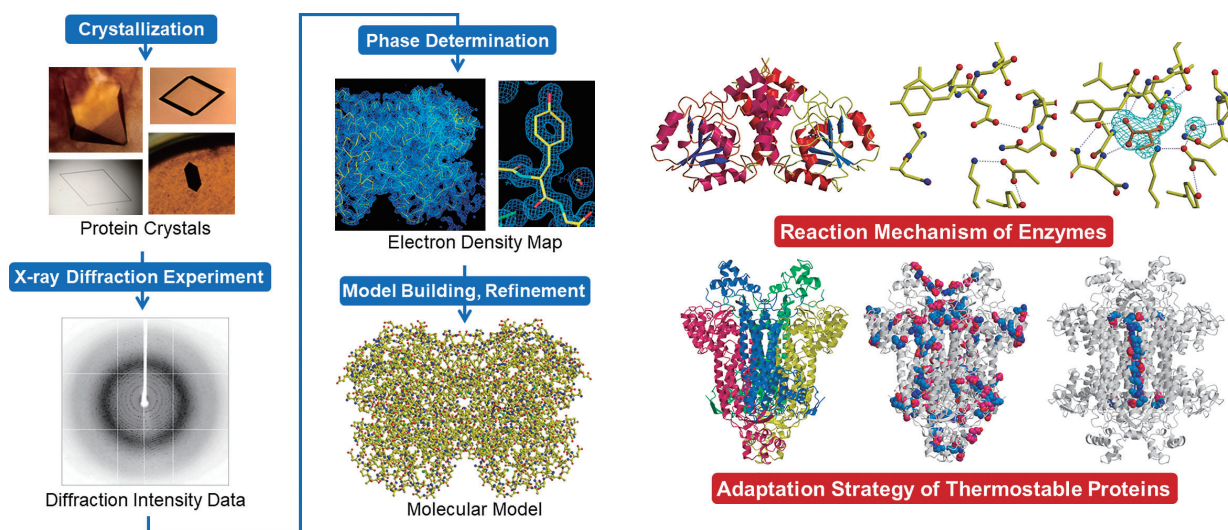
Assist. Prof.
FUJII, Tomomi
(D. Sc.)

Scope of Research

This laboratory analyzes X-ray crystallographic structures of biological macromolecules and studies the structural biology about the relationships between protein structures and their functions and properties based on the crystal structures. The main research themes are elucidation of the reaction mechanism of enzymes, the relationship between the multiform conformation and the functional variety of proteins, the structural basis for the domain-arrangements of multi-domain proteins or protein-protein interactions, structure determination for structure-based protein engineering and industrial application, and the adaptation strategy of proteins from thermophilic or cold-adapted bacteria.

KEYWORDS

Crystal
X-ray Crystallographic Analysis
Structural Biology
Protein Crystallography
Structure and Function



Recent Selected Publications

Fujii, T.; Sato, A.; Okamoto, Y.; Yamauchi, T.; Kato, S.; Yoshida, M.; Oikawa, T.; Hata, Y., The Crystal Structure of Maleylacetate Reductase from *Rhizobium* sp. Strain MTP-10005 Provides Insights into the Reaction Mechanism of Enzymes in Its Original Family, *Proteins: Structure, Function, and Bioinformatics*, **84**, 1029-1042 (2016).

Fujii, T.; Yamauchi, T.; Ishiyama, M.; Gogami, Y.; Oikawa, T.; Hata, Y., Crystallographic Studies of Aspartate Racemase from *Lactobacillus sakei* NBRC 15893, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **71**, 1012-1016 (2015).

Fujii, T.; Goda, Y.; Yoshida, M.; Oikawa, T.; Hata, Y., Crystallization and preliminary X-ray Diffraction Studies of Maleylacetate Reductase from *Rhizobium* sp. Strain MTP-10005, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **64**, 737-739 (2008).

Fujii, T.; Oikawa, T.; Muraoka, I.; Soda, K.; Hata, Y., Crystallization and Preliminary X-ray Diffraction Studies of Tetrameric Malate Dehydrogenase from the Novel Antarctic Psychrophile *Flavobacterium frigidimaris* KUC-1, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **63**, 983-986 (2007).

Fujii, T.; Sakai, H.; Kawata, Y.; Hata, Y., Crystal Structure of Thermostable Aspartase from *Bacillus* sp. YM55-1: Structure-based Exploration of Functional Sites in the Aspartase Family, *J. Mol. Biol.*, **328**, 635-654 (2003).

International Research Center for Elements Science – Synthetic Organotransformation –



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Prof.
NAKAMURA, Masaharu
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PINCELLA, Francesca
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Assist. Prof.
DOBA, Takahiro
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Program-Specific Assist. Prof.
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Program-Specific Assist. Prof.
MINEO, Keito
(D. Agr.)

Students

ISERI, Kenta (D3)
YIN, Haozhi (D3)
WU, Beiling (D3)
WU, Dongran (D3)
CHEN, Litian (D2)
ZHANG, Hao (D2)

JAYAWEEERA KANKANAMGE,
Hema Malani (D2)
FUKUDA, Kenji (D1)
TAKEUCHI, Soshi (M2)
WANG, Nan (M2)
ANDO, Masaki (M1)

SEKIYA, Sota (M1)
KOGUCHI, Shiori (M1)
YU, Zixuan (R. S.)
SOGA, Teppei (U. G.)
ITAI, Hyotaro (U. G.)
OGAWA, Mitsuki (U. G.)

Program-Specific Res.

IMAI, Makiko (D. Agr.)
KATHRIARACHCHIGE DON,
Suresh Kalum Kathriarachchi (D. Sc.)
LIU, Haoyue (D. Agr.)

Res. (pt.)

MATSUMURA, Hiroyuki (D. Eng.)
AVENA, Ramon
Francisco Bernardino
AOKI, Satoshi (D. Sc.)

HATANO, Osamu (D. Med. Sc.)
ENOMOTO, Terumichi (D. Sc.)
NISHIMURA, Nozomi
MINAMI, Yohei (D. Eng.)
YAMAMOTO, Senri (D. Agr.)

Scope of Research

Our research activity focuses on the development of new molecular transformations, which can contribute to better or ideal synthesis of functional molecules as well as to exploitation of new chemical (metal and carbon) resources. The present research subjects are (1) metal-catalyzed carbon-carbon and carbon-heteroatom bond forming reactions by using universal metals such as iron (2) development of small metallic nanocluster catalysts based on supramolecular approaches (3) utilization of woody biomass as the renewable carbon resources by mild catalytic transformations of wood molecules into useful compounds and materials.



KEYWORDS

Iron Catalysis Organotransformation Woody Molecular Transformation Supramolecular & Superatomic Catalysis

Recent Selected Publications

Wu, D.; Doba, T.; Nakamura, M., Iron-Catalyzed C–N Coupling Using Polycyclic Aromatic Hydrocarbon as a Redox Mediator, *Org. Lett.*, **27**(49), 13643-13648 (2025).

Matsuda, H.; Hong, S. H.; Ahn, S.; Avena, R. F.; Jeong, Y.; Hwang, K. M.; Son, E.; Kang, S.; Ko, S.-B.; Kim, T.; Nakamura, M., Sustainable Iron-Catalyzed Carbazole Dimerization for High Triplet Host/Electron Blocking Materials of Efficient Deep Blue OLEDs, *Commun. Mater.*, **6**(1), 248 (2025).

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Saito, R.; Isozaki, K.; Mizuhata, Y.; Nakamura, M., Synthesis of N₂-Type Superatomic Molecules, *J. Am. Chem. Soc.*, **146**(30), 20930-20936 (2024).

Pincella, F.; Isozaki, K.; Sato, R.; Teranishi, T.; Takaya, H.; Nakamura, M., Reusable Magnetite Nanoparticle (Fe₃O₄ NP) Catalyst for Selective Oxidation of Alcohols under Microwave Irradiation, *ACS Omega*, **9**(23), 24477-24488 (2024).



Prof.
SHIMAKAWA, Yuichi
(D. Sc.)



Assist. Prof.
GOTO, Masato
(D. Sc.)



Techn. Staff
ICHIKAWA, Noriyo
(D. Eng.)

Program-Specific Res.

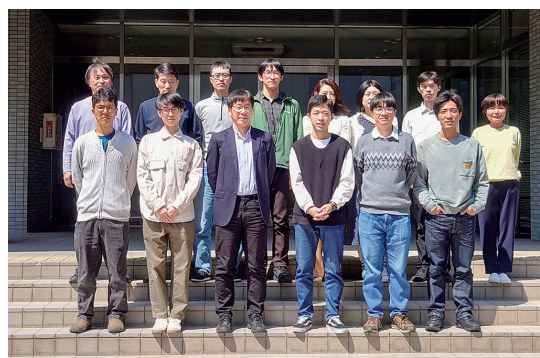
JI, Kunlang (Ph. D.)
IPUTERA, Kevin (Ph. D.)

Students

XIE, Ling-Ling (D3)
CHEN, Chen (D3)
WATANABE, Rei (D3)
FUJI, Souta (D1)
MAKI, Rintaro (M2)
TSURUNAGA, Daiki (M2)
TANAKA, Yusei (M1)

Scope of Research

Transition metal oxides have a wide variety of interesting and useful functional properties, including electronic conduction, superconductivity, ferroelectricity, and ferromagnetism. In fact, some of these oxides are used in current electronic devices. Our research mainly focuses on perovskite-structured transition metal oxides with novel functional properties due to complex couplings between their lattices, charges and spins. We are currently exploring such functional oxides with advanced oxide-synthesis techniques such as high-pressure synthesis and epitaxial thin film growth.



KEYWORDS

Solid State Chemistry Functional Metal Oxides High Pressure Synthesis Epitaxial Thin Film Growth Heterointerface

Recent Selected Publications

Ramachandran, H.; Mu, E. W.; Lomeli, E. G.; Braun, A.; Goto, M.; Hsu, K. H.; Liu, J.; Jiang, Z.; Lim, K.; Busse, G. M.; Moritz, B.; Kas, J. J.; Vinson, J.; Rehr, J. J.; Park, J.; Abate, I. I.; Shimakawa, Y.; Solomon E. I.; Yang, W.; Gent, W. E.; Devereaux, T. P.; Chueh, W. C., A Formal Fe^{III/IV} Redox Couple in an Intercalation Electrode, *Nat. Mater.*, **25**, 91-99 (2026).

Fuji, S.; Isoda, Y.; Lingling, X.; Haruta, M.; Majima, T.; Shimakawa, Y.; Kan, D., Correlation between Structural Properties and Electrochemical Proton Insertion in (001) VO₂ Epitaxial Films. *Appl. Phys. Express*, **18**(4), 045501 (2025).

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Shen, Y.; Ooe, K.; Shitara, K.; Kobayashi, S.; Yoshimura, T.; Yamada, T.; Xie, L.; Shimakawa, Y.; Kan, D., Ultrathin Freestanding Membranes of ZrO₂ with Metastable Structures and Strain-Dependent Electrical Properties, *Phys. Rev. Mater.*, **9**(2), 024411/1-9 (2025).

Isoda, Y.; Pham, T.; Aso, R.; Nakamizo, S.; Majima, T.; Hosokawa, S.; Nitta, K.; Morikawa, Y.; Shimakawa, Y.; Kan, D., Stabilization of Oxygen Vacancy Ordering and Electrochemical-Proton-Insertion-and-Extraction-Induced Large Resistance Modulation in Strontium Iron Cobalt Oxides Sr(Fe,Co)O_y, *Nat. Commun.*, **16**(1), 56/1-9 (2025).

International Research Center for Elements Science – Organometallic Chemistry –



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Prof.
OHKI, Yasuhiro
(D. Eng.)



Assist. Prof.
TANIFUJI, Kazuki
(D. Sc.)



Assist. Prof.
IZU, Hitoshi
(D. Sc.)

Res. (pt.)

FUJISAKI, Yoshie

Program-Specific Res.

YAMANASHI,
Ryotaro (D. Eng.)
LU, Siming (D. Eng.)
Kamal (Ph. D.)

Students

TANAKA, Kanata (D2) SHIMOYAMA, Sayaka (D1)
MATSUOKA, Yuto (D2) ADACHI, Taira (M1)
NOMURA, Satsuki (D1) KOIKE, Yuya (U. G.)
SAEED, Hassan (D1) NAKANO, Shoki (U. G.)

Scope of Research

Developing efficient energy storage systems and innovative material production processes is a significant challenge for chemists in contributing to a sustainable society. We approach these problems using transition metal clusters, of which multiple metal atoms work together as catalysts and functional materials. Our laboratory focuses explicitly on creating a new method to synthesize the clusters with atomic precision and applying the obtained clusters to difficult chemical conversions, such as the reduction of CO₂ and N₂.

KEYWORDS

Transition Metal Clusters
Homogeneous Catalysis
Nitrogen Fixation
Bioinorganic Chemistry



Recent Selected Publications

Higaki, T.; Tanaka, K.; Izu, H.; Oishi, S.; Kawamoto, K.; Tada, M.; Sameera, W. M. C.; Takahata, R.; Teranishi, T.; Kikkawa, S.; Yamazoe, S.; Shiga, T.; Nihei, M.; Kato, T.; Cramer, R. E.; Zhang, Z.; Meyer, K.; Ohki, Y., An Icosahedral 55-Atom Iron Hydride Cluster Protected by Tri-*Tert*-Butylphosphines, *J. Am. Chem. Soc.*, **147**(4), 3215-3222 (2025).

Matsuoka, Y.; Sakai, Y.; Izu, H.; Shimoyama, S.; Fujisawa, M.; Tada, M.; Lakshan, N. M.; Sameera, W. M. C.; Tanifuji, K.; Ohki, Y., Silylation of N₂ Catalyzed by Cubic [Mo₃S₄Ni] Clusters Bearing Mo-Bound Cyclopentadienyl Ligands, *Coord. Chem. Res.*, **1**, 100001 (2025).

Izu, H.; Shimoyama, S.; Tanifuji, K.; Ohki, Y., Synthesis of Cubic [Mo₃S₄M] (M = Rh, Ir) Clusters for Borylation of C–H Bonds in Aromatic Compounds, *Organometallics*, **43**(24), 3251-3257 (2024).

Izu, H.; Bhave, D. G.; Matsuoka, Y.; Sameera, W. M. C.; Tanifuji, K.; Ohki, Y., Synthesis, Characterization, and Catalytic Activity of a Cubic [Mo₃S₄Pd] Cluster Bearing Bulky Cyclopentadienyl Ligands, *Eur. J. Inorg. Chem.*, **26**(29), e202300399 (2023).

Ohki, Y.; Munakata, K.; Matsuoka, Y.; Hara, R.; Kachi, M.; Uchida, K.; Tada, M.; Cramer, R. E.; Sameera, W. M. C.; Takayama, T.; Sakai, Y.; Kuriyama, S.; Nishibayashi, Y.; Tanifuji, K., Nitrogen Reduction by the Fe Sites of Synthetic [Mo₃S₄Fe] Cubes, *Nature*, **607**, 86-90 (2022).



Prof.
HIRORI, Hideki
(D. Sc.)



Specially Appointed Assoc. Prof.
WATANABE, Hiroshi
(D. Sc.)



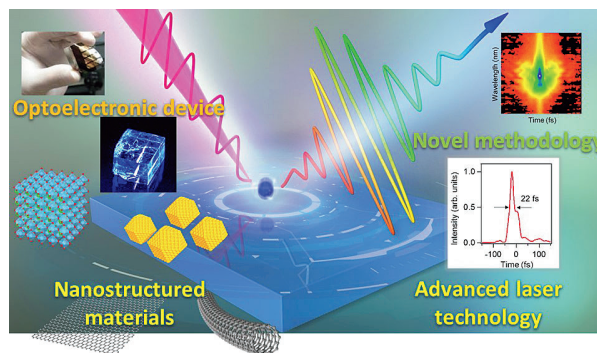
Program-Specific Res.
ZHANG, Zhenya
(D. Sc.)

Students

UMETANI, Hiroto (M2) TAGUCHI, Outa (M1)
WATANABE, Yuichi (M2)

Scope of Research

Our research interest is to understand optical and quantum properties of nanometer-structured materials and to establish opto-nanosience for creation of innovative functional materials. Space- and time-resolved laser spectroscopy is used to study optical properties of semiconductor quantum nanostructures and strongly correlated electron systems in low-dimensional materials. The main subjects are as follows: 1) investigation of optical properties of single nanostructures through the development of a high-resolution optical microscope, 2) ultrafast optical spectroscopy of excited states of semiconductor nanostructures, 3) photophysics of solar cell materials, and 4) engineering material properties with lights.



KEYWORDS

Femtosecond Laser Spectroscopy Single Photon Spectroscopy
Quantum Dots Perovskites
High Harmonic Generation

Recent Selected Publications

- Zhang, Z.; Shiota, Y.; Karube, S.; Watanabe, Y.; Ono, T.; Hirori, H., Ultrafast Modulation of the Anomalous Hall Conductivity by Coherent Magnetization Precession in Co-Pt Thin Films, *Phys. Rev. Applied*, **24(4)**, 044079 (2025).
- Tachizaki, T.; Kanemitsu, Y.; Hirori, H., Time Resolution of Terahertz Scanning Tunneling Microscopy Measurements Inside a Superconducting Magnet Using a Hollow Waveguide, *Rev. Sci. Instrum.*, **96(4)**, 043004 (2025).
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Bioinformatics Center – Chemical Life Science –



<https://cls.kuicr.kyoto-u.ac.jp/en/>



Prof.
OGATA, Hiroyuki
(D. Sc.)



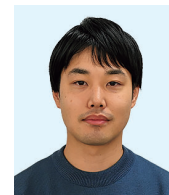
Assoc. Prof.
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(D. Environmental Sc.)



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Specially Appointed Assist. Prof.
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(D. Sc.)



Program-Specific Res.
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Program-Specific Res.
JIANG, Siyu
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Program-Specific Res.
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P. D. *
KIM, Suhyun
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Guest Scholars

GAIA, Morgan (Ph. D.)

CEA - Genoscope, Evry, France,
12 March 2025–26 March 2025

PELLETIER, Eric (Ph. D.)

CEA - Genoscope, Evry, France,
31 October 2025–21 November 2025

Students

YANG, Qingwei (D3)
LIU, Wenwen (D3)
WU, Junyi (D3)

CHEN, Jingjie (D2)
ZHANG, Liwen (D2)
WATANABE, Honoka (D1)

ZHAO, Hongda (D1)
TANG, Wei (M2)
SASAKI, Hiroto (M2)
YU, Zhaoxi (M1)

SHENBAGAN,
Shaanaav Daniel (M1)
OUYANG, Chengzhou (R. S.)
IYANAGA, Kyoka (U. G.)
NAKAZAWA, Yuki (U. G.)

Scope of Research

We are interested in understanding the functioning and evolution of biological systems at varying scales from tiny microbes up to the Earth's environment, by leveraging rapidly accumulating big data in life science and bioinformatics approaches. We currently focus on 1) the evolution of viruses and their links to the origin of life, 2) microbial ecology in different ecosystems, and 3) the development of bioinformatics methods and biological knowledge resources for biomedical and industrial applications. To fuel these research activities, we take part in environmental sampling campaigns such as *Tara* Oceans. Our resources and developed tools are accessible through GenomeNet (www.genome.jp) to scientific communities and the public.



KEYWORDS

GenomeNet Bioinformatics Environmental Genomics Virology Molecular Evolution

Recent Selected Publications

Medvedeva, S.; Guyet, U.; Pelletier, E.; Ruscheweyh, H.-J.; Sunagawa, S.; Ogata, H.; Aylward, F. O.; Gaia, M.; Yutin, N.; Koonin, E. V.; Krupovic, M.; Delmont, T. O., Widespread and Intron-Rich Mirusviruses Are Predicted to Reproduce in Nuclei of Unicellular Eukaryotes, *Nat. Microbiol.*, **11**, 228-239 (2026).

Liu, W.; Nagasaka, K.; Wu, J.; Ban, H.; Mimick, E.; Meng, L.; Neches, R.Y.; Moniruzzaman, M.; Yoshida, T.; Nishimura, Y.; Endo, H.; Okazaki, Y.; Ogata, H., Giant Viruses Specific to Deep Oceans Show Persistent Presence and Activity, *mSystems*, **12**, e0093225 (2025).

Endo, H.; Yamagishi, Y.; Nguyen, T. T.; Ogata, H., Extracellular rRNA Profiling Reveals the Sinking and Cell Lysis Dynamics of Marine Microeukaryotes, *Environ. Microbiol.*, **27**(8), e70164 (2025).

Okazaki, Y.; Nishikawa, Y.; Wagatsuma, R.; Takeyama, H.; Nakano, S.-I., Contrasting Defense Strategies of Oligotrophs and Copiotrophs Revealed by Single-Cell-Resolved Virus–Host Pairing of Freshwater Bacteria, *ISME Commun.*, **5**(1), ycaf086 (2025).

Chen, J.; Ogata, H.; Hikida, H., Sputnik Virophage Disrupts the Transcriptional Regulation of Its Host Giant Virus, *J. Virol.*, **99**(4), e0019225 (2025).

Yang, Q.; Yang, Y.; Xia, J.; Fukuda, H.; Okazaki, Y.; Nagata, T.; Ogata, H.; Endo, H., Taxon-Specific Contributions of Microeukaryotes to Biological Carbon Pump in the Oyashio Region, *ISME Commun.*, **4**(1), ycae136 (2024).

Bioinformatics Center – Bio-knowledge Engineering –



<https://www.bic.kyoto-u.ac.jp/pathway/index.html>



Prof.
MAMITSUKA, Hiroshi
(D. Sc.)



Senior Lect.
NGUYEN, Hao Canh
(D Knowledge Science)



Program-Specific Res.
WIMALAWARNE, Kishan
(D. Eng.)

Students

LEE, John Christer Jun Rong (D1)

JIANG, Zhiqian (M2)

Guest Scholar

NGUYEN, Hoa Mi (Ph. D.) Vietnam National University, Vietnam, 15 November 2025–7 December 2025

Guest Res. Assoc.

PETSCHNER, Peter (Ph. D.) Semmelweis University, Hungary, 16 November 2025–14 December 2025

BLANC-MATHIEU, Romain (Ph. D.) Laboratoire Physiologie Cellulaire & Végétale CEA Grenoble, France, 20 October 2025–15 April 2026

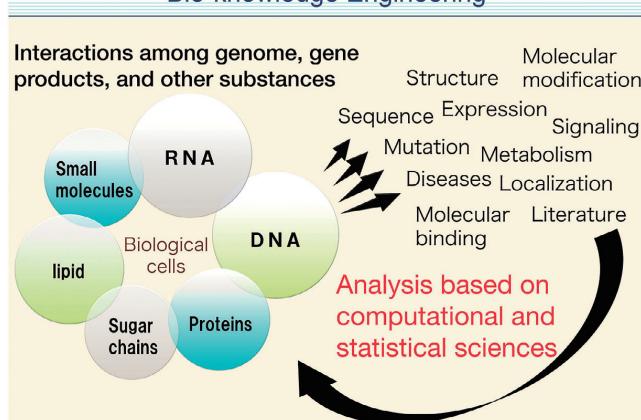
Scope of Research

We are interested in graphs and networks in biology, chemistry, and medical sciences, including metabolic networks, protein-protein interactions and chemical compounds. We have developed original techniques in machine learning and data mining for analyzing these graphs and networks, occasionally combining with table-format datasets, such as gene expression and chemical properties. We have applied the techniques developed to real data to demonstrate the performance of the methods and find new scientific insights.

KEYWORDS

Bioinformatics Machine Learning
Data Mining Artificial Intelligence Systems Biology

Bio-knowledge Engineering



Recent Selected Publications

Lee, J.; Nguyen, C. H.; Mamitsuka, H., Beyond Rigid Docking: Deep Learning Approaches for Fully Flexible Protein-Ligand Interactions, *Brief. Bioinform.*, **26** (5), bbaf454 (2025).

Nguyen, D. H.; Mamitsuka, H.; Nakamura, A., Multiple Wasserstein Gradient Descent Algorithm for Multi-Objective Distributional Optimization, *Proceedings of the 41st Conference on Uncertainty in Artificial Intelligence (UAI 2025) (Proceedings of Machine Learning Research (PMLR))*, **286**, 3182-3199 (2025).

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Nguyen, D. H.; Nguyen, C. H.; Mamitsuka, H., ADAPTIVE: leArning DAta-dePendent, concIse molecular VEctors for fast, Accurate Metabolite Identification from Tandem Mass Spectra, *Bioinformatics (Proceedings of the 27th International Conference on Intelligent Systems for Molecular Biology (ISMB/ECCB 2019))*, **35**(14), i164-i172 (2019).