

# **Professor Profiles 2022**

School of Materials and Chemical Technology

Tokyo Institute of Technology

## Creating Future Society with the Power of Materials and Chemistry

Tokyo Tech boasts a world-class research team in the fields of materials and applied chemistry, and has achieved outstanding results to date. The School of Materials and Chemical Technology contributes to creating future society through developing novel materials useful in solving society's problems related to the environment, resources, energy, and health and medicine, as well as improving the quality of our lives. In particular, we aim to realize a carbon-neutral society, which is important for the Sustainable Development Goals (SDGs). The School is composed of the Department of Materials Science and Engineering, which focuses on studying solid materials, and the Department of Chemical Science and Engineering, which focuses on molecules and chemistry, and covers a wide range of subjects from atoms and electrons to devices and plants. We also promote innovative material development integrated with information science. Through such cutting-edge research, we foster global researchers and engineers who can lead the development of materials in the future.



## Message from the Dean

The School of Materials Science and Engineering, as its name suggests, focuses on "materials" in its research and education. The difference in the way we approach materials is a distinctive feature of our two departments. In the Department of Materials Science and Engineering, we make sure the materials we create have optimized required properties. In the Department of Chemical Science and Engineering, materials are created through chemical reactions and processes that take advantage of the characteristics of raw materials. Both fields cover aspects such as micro to macro scales, and atoms and electrons to devices and plants. Recently, many research projects integrating information science are also being conducted. Through the cutting-edge research at our school, we are fostering researchers and engineers who can lead in the development of materials in the future. We live surrounded by materials and therefore must live in harmony with them. As they vary widely — some beneficial, some harmless, and some harmful —, we must have a firm grasp of their characteristics when creating materials and handle them with a solid sense of ethics. Based on this attitude, we are "Creating Future Society with the Power of Materials and Chemistry" — this is the concept of the School of Materials Science and Engineering.

Hidetoshi SEKIGUCHI

# Department of Materials Science and Engineering

## Vision

Create new materials and engineering technologies that contribute to industrial development and cultivate individuals who make a difference to society

Materials. They play an important role in forming, molding, and advancing societies. They are responsible for the considerable transformations in our daily lives. After all, they are what give shape to science and technology. At the Department of Materials Science and Engineering, we work to continuously progress the field of materials science. Our students are trained to use the advanced and specialized knowledge of materials they acquire to carry out original and challenging research and development. They learn to find creative solutions to materials-related problems on their own, and furthermore, to conceive of ways to implement these solutions in the real world. The curriculum is designed to allow students to acquire a broad range of fundamental knowledge in materials science, from metallic materials and organic materials to inorganic materials. Through our courses, students also gain the knowledge and develop the creativity necessary to bring new, innovative industrial materials into existence. Our students will become the leading scientists and engineers in the field of materials science that are sought by the industrial world.

## Message from the Department Chair

Materials science is the oldest and strongest field of study at Tokyo Institute of Technology. To uphold this long-standing reputation, we strive to always be at the cutting edge of the field in terms of research and education. This department includes all areas of materials science; metallurgy, organic and polymeric materials, and inorganic materials. Students are presented with opportunities not only to comprehensively learn fundamentals, but also to cultivate their creativity and originality to develop new materials. Our team of faculty and staff members serve as helpful guides on the path towards advanced skills and knowledge. Welcome to the innovative field of materials science and engineering for sustainable societies and a sustainable world.

# Materials Science and Engineering

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|  | <b>Shigeo Asai</b>   |
|   | Associate Professor  |
|   | asai.s.aa ● m.titech.ac.jp   |
|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Structure and properties of polymers / Electrical conductive polymer composites / Ion-conducting polymer blends / Microcellular plastics                                   |
| <b>Current Research Projects</b>  | Polymers treated with high-pressure CO <sub>2</sub> / Biodegradable polymers and polymer blends / Electrical conductive polymer composites / Ion-conducting polymer blends |

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|  | <b>Masaki Azuma</b>  |
|  | Professor  |
|  | azuma.m.ab ● m.titech.ac.jp  |
|  | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>  | Solid state chemistry / Transition metal oxides / Precise structural analysis / Functional materials |
| <b>Current Research Projects</b>   | Negative thermal expansion / Multiferroics / Lead-free piezoceramics                                 |

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|---|---|
|  | <b>Tso-Fu Mark Chang</b>  |
|   | Associate Professor   |
|   | chang.m.aa ● m.titech.ac.jp   |
|   | <b>Major</b> Human Centered Science and Biomedical Engineering / Materials Science and Engineering  |
| <b>Research Field</b>   | Metallic catalysts / Visible-light composite photocatalysts / Flexible functional materials / Chemical sensors / Electroless & electrochemical deposition |
| <b>Current Research Projects</b>  | Development of metal-based catalytic materials for chemical sensors, visible-light photocatalyst, and flexible functional materials.                      |

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|  | <b>Toshiyuki Fujii</b>  |
|  | Professor   |
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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Microstructure in metals / Mechanical properties of materials / High strength and high conductivity copper alloys / Fatigue of metals |
| <b>Current Research Projects</b>   | Evolution of dislocation structures during cyclic deformation of metals and alloys  |

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|  | <b>Hiroshi Funakubo</b>  |
|   | Professor  |
|   | funakubo.h.aa ● m.titech.ac.jp   |
|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Functional inorganic films / Ferroelectric materials / CVD / Inorganic device                      |
| <b>Current Research Projects</b>  | Ferroelectric devices / Inorganic capacitor/film devices / Thermoelectric devices / Thin Film SOFC |

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|  | <b>Yoshihiro Gohda</b>  |
|  | Associate Professor   |
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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Condensed matter theory / Computational materials science / Magnetic metals / Nano-interfaces |
| <b>Current Research Projects</b>   | Theory of permanent magnets / Theory of surface nanostructures                                |

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|  | <b>Michikazu Hara</b>   |
|   | Professor   |
|   | hara.m.ae ● m.titech.ac.jp  |
|   | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering |
| <b>Research Field</b>   | Catalyst / Chemical reaction / Inorganic / Heterogeneous catalysis              |
| <b>Current Research Projects</b>  | JST, ALCA / JST, ACCEL / JST, ASTEP STAGEIII / NexTEP-B                         |

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|  | <b>Teruaki Hayakawa</b>  |
|  | Professor  |
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|  | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>  | Polymer Synthesis / Polymer Thin Films / Self-Organizing Polymeric Materials / Directed Self-Assembly  |
| <b>Current Research Projects</b>   | Precise Synthesis of Block Copolymers / Directed Self-Assembly / Nano-Defect Management For Block Copolymer Lithography / Nanoporous Polymeric Materials |

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|  | <b>Yuhei Hayamizu</b>  |
|   | Associate Professor  |
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|   | <b>Major</b> Materials Science and Engineering / Human Centered Science and Biomedical Engineering |
| <b>Research Field</b>   | Bio-Nano Interface / Peptide Self-Assembly / 2D nanomaterials / Biosensors                         |
| <b>Current Research Projects</b>  | Bio-Nano Interface / Peptide Self-Assembly / 2D nanomaterials / Biosensors                         |

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|  | <b>Miyuki Hayashi</b>   |
|  | Professor   |
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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering   |
| <b>Research Field</b>  | Physicochemical properties of Melts in Metallurgy / Ironmaking process / Environmentally Friendly High Temperature Process  |
| <b>Current Research Projects</b>   | Thermochemical properties and structures of molten silicates containing iron ions / Utilization of low grade iron ore / Development of new iron ore sinters aiming for CO <sub>2</sub> emission reduction |

# Materials Science and Engineering

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| Research Field  | Biointerfaces / Surface & interface science / Scanning probe microscopy / Nanophotonics  |
| Current Research Projects   | Development of atomic force microscopes / Biomaterials informatics / Single-molecule force and vibrational spectroscopy  |

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|  | <b>Hidenori Hiramatsu</b><br>Professor<br>hiramatsu.h.aa ● m.titech.ac.jp<br>Major Materials Science and Engineering |
| Research Field   | Thin film growth / Optoelectronic properties / Superconductivity / Optoelectronic devices                            |
| Current Research Projects  | Nitride-, chalcogenide-, and oxide-semiconductors / Pnictide superconductors   |

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|  | <b>Takuya Hoshina</b><br>Associate Professor<br>hoshina.t.aa ● m.titech.ac.jp<br>Major Materials Science and Engineering                     |
| Research Field  | Dielectric and ferroelectric materials / Phonon analysis / Terahertz measurement / Computational and information science                     |
| Current Research Projects   | Development of novel ferroelectric materials / Terahertz dielectric spectroscopy / Computational and information science for material design |

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|  | <b>Hideki Hosoda</b><br>Professor<br>hosoda.h.aa ● m.titech.ac.jp<br>Major Materials Science and Engineering / Energy Science and Engineering / Human Centered Science and Biomedical Engineering   |
| Research Field   | Functional materials / Alloy design / Phase stability / Shape change materials / Intermetallics / Composites / Biomaterials / Microstructural control   |
| Current Research Projects  | Dynamics of domain homo interface in shape change materials / Development of advanced medical devices based on shape memory alloys / Development of Ti-based or precious-metal-based functional biomaterials / Development of ferromagnetic-shape-memory-alloy-based smart-composites |

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|  | <b>Toshiyuki Ikoma</b><br>Professor<br>ikoma.t.aa ● m.titech.ac.jp<br>Major Human Centered Science and Biomedical Engineering / Materials Science and Engineering   |
| Research Field  | Nanomedicine / Biosensing / Regenerative medicine / Inorganic material  |
| Current Research Projects   | Multifunctional nanomaterials for theranostics / Calcium phosphate and collagen composites for tissue engineering / hydroxyapatite and silver composites for antimicrobial biomedical devices / Biointerface of materials and cells |

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|  | <b>Tomonari Inamura</b><br>Professor<br>inamura.t.aa ● m.titech.ac.jp<br>Major Materials Science and Engineering / Energy Science and Engineering |
| Research Field   | Phase transformation in metals / Crystallography / Metallography / Shape memory alloy   |
| Current Research Projects  | Super long life shape memory alloy, Biomedical titanium alloy   |

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|  | <b>Ken Ishikawa</b><br>Associate Professor<br>ishikawa.k.ab ● m.titech.ac.jp<br>Major Materials Science and Engineering / Energy Science and Engineering |
| Research Field  | Optoelectronic organic materials / Biomimetic organic materials  |
| Current Research Projects   | Organic solar cells / Organic transistors / Liquid crystals / Structural color materials   |

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|  | <b>Toshihiro Isobe</b><br>Associate Professor<br>isobe.t.ad ● m.titech.ac.jp<br>Major Materials Science and Engineering                               |
| Research Field   | Inorganic materials / Environmental materials / Separation technology / Ceramics manufacturing process  |
| Current Research Projects  | Development of environmental purification material / Development of negative thermal expansion materials / Development of ceramic separation membrane |

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|  | <b>Keigo Kamata</b><br>Associate Professor<br>kamata.k.ac ● m.titech.ac.jp<br>Major Materials Science and Engineering / Energy Science and Engineering |
| Research Field  | Catalyst / Chemical reaction / Inorganic / Heterogeneous catalysis   |
| Current Research Projects   | Catalyst / Chemical reaction / Inorganic / Heterogeneous catalysis   |

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|  | <b>Toshio Kamiya</b><br>Professor<br>kamiya.t.aa ● m.titech.ac.jp<br>Major Materials Science and Engineering  |
| Research Field   | Materials science / Semiconductor devices / Simulation / Electronic structure and carrier transport   |
| Current Research Projects  | Design and development of new oxide semiconductors / Materials design using first-principles calculations / Development of thin-film transistors and light-emitting devices |

# Materials Science and Engineering

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Oxide electronics / Energy harvesting / Optoelectronic device / Superconductivity / Electrochemistry   |
| <b>Current Research Projects</b>  | High performance thermoelectric materials using thin film interface / Multifunctional memory device / High-temperature superconducting materials |

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|  | <b>Hitoshi Kawaji</b>  |
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|  | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>  | Inorganic / Solid state physics / Functional materials / Thermal properties  |
| <b>Current Research Projects</b>   | Phase transition mechanism of multiferroic materials / Heat capacity, thermal expansion and thermal conductivity of ceramics / Phase transition of materials trapped in nanospaces |

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|  | <b>Kenichi Kawamura</b>   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Solid chemistry / High temperature oxidation of metals / Electrochemistry in solid                        |
| <b>Current Research Projects</b>  | Referenceless zirconia oxygen sensor / Electrochemical protection for high-temperature oxidation of metal |

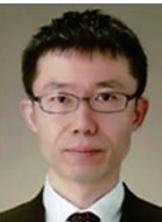
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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering  |
| <b>Research Field</b>  | Intermetallic compounds / Thermoelectric materials / Phase diagrams / Microstructure and lattice defects control   |
| <b>Current Research Projects</b>   | Heat resistant alloys design based on intermetallic phases / Thermoelectric materials design based on phase equilibria / Reliability evaluation of thermoelectric materials / Deformation behavior of intermetallic alloys |

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Optical materials and devices / Laser processing / Adhesion science / Glass materials  |
| <b>Current Research Projects</b>  | Micro glass melting system for combinatorial science / Ultra-thin glass laminate seal for medical applications / Microsphere-based integrated optical circuits |

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|  | <b>Yoshitaka Kitamoto</b>  |
|  | Professor  |
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|  | <b>Major</b> Human Centered Science and Biomedical Engineering / Materials Science and Engineering |
| <b>Research Field</b>  | Magnetic materials and devices / Biomaterials and biodevices / Nanomaterials and nanodevices       |
| <b>Current Research Projects</b>   | Nanomedicine materials and devices / Biomagnetic nanoparticles and clusters                        |

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|   | Associate Professor   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Catalysis / inorganic material / Ammonia synthesis / Acid and base catalyst   |
| <b>Current Research Projects</b>  | Ammonia synthesis using electride-based catalyst / Synthesis of alloy nanoparticle catalyst / Selective hydrogenation reactions |

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|  | <b>Equo Kobayashi</b>   |
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|  | <b>Major</b> Materials Science and Engineering / Human Centered Science and Biomedical Engineering  |
| <b>Research Field</b>  | Non-ferrous metals / Biomedical materials / Functional materials / Standardization of medical devices   |
| <b>Current Research Projects</b>   | Alloy designing of biomedical beta type Ti alloys / Biodegradable Mg-matrix composite / Microstructural control of novel Al alloys / High performance Cu alloys |

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|   | Associate Professor   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Heat resistant alloys/steels / Microstructure control / Intermetallic alloys / Ferrous materials  |
| <b>Current Research Projects</b>  | Novel Ni base superalloy design / Creep deformation mechanisms in Ni based wrought superalloys / Microstructural control in heat resistant ferritic steels with Laves phase precipitation |

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|  | Professor   |
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|  | <b>Major</b> Nuclear Engineering / Materials Science and Engineering  |
| <b>Research Field</b>  | Safety metallurgy for nuclear reactor / Metal smelting and refining / Metal recycle / Iron and steel making   |
| <b>Current Research Projects</b>   | Accessibility for removal of fuel debris in BWR plant after severe accident / Elements Strategy Initiative Project for Magnetic Materials / Thermodynamics and kinetics of steelmaking slags toward effective and high speed refining |

# Materials Science and Engineering

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Molecular devices / Single-electron devices / Scanning probe microscopy / Nanoscale electrical properties  |
| <b>Current Research Projects</b>  | Molecular Transistors / Single-Electron Transistors / Nanoscale Electro- and Electroless-Plating / Analysis of Electrical Properties of Nanomaterials by Scanning Tunneling Microscopy (STM) and Scanning Tunneling Spectroscopy (STS) |

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|  | <b>Akifumi Matsuda</b>   |
|  | Associate Professor  |
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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering  |
| <b>Research Field</b>  | Electronic and energy materials / Inorganic thin films and nanomaterials / Atomic-scale material processing / New materials development    |
| <b>Current Research Projects</b>   | Synthesis of glass-based thermoelectric materials / low-temperature epitaxy of wide band-gap semiconductors / Self-assembled nanomaterials |

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|  | <b>Satoru Matsuishi</b>   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Solid state chemistry / Inorganic functional materials / Electronic Structure Analysis        |
| <b>Current Research Projects</b>  | Functional mixed-anion materials / Inorganic phosphor materials / Superconductor / Electrides |

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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering   |
| <b>Research Field</b>  | Physical chemistry of organic materials / Nanofibers and nanomaterials / Polymer membranes and thin films / Energy conversion and storage |
| <b>Current Research Projects</b>   | Nanocomposite membranes / Nanocomposite electrolytes / Functional thin films / Functional nanofibers                                      |

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|  | <b>Nobuhiro Matsushita</b>  |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Solution process / Functional ceramics / Electronic materials / Biomedical materials  |
| <b>Current Research Projects</b>  | Solution-processed transparent conductive oxide film / Conducted noise suppressing material in GHz range / Nanostructure fabrication for solid oxide fuel cells / Surface modification for nanostructured bioactive interface / Sensors device using ceramics electrode |

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|  | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering |
| <b>Research Field</b>  | Energy conversion / Colloid / Thermoelectric / Plasmon                          |
| <b>Current Research Projects</b>   | Sensitized thermal cell / Plasmonic color                                       |

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Organic material / Polymer synthesis / Semiconducting polymer / Organic electronics                              |
| <b>Current Research Projects</b>  | High mobility organic semiconducting polymers / Fluorescent semiconducting polymer dots / Crack detection paints |

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|  | <b>Masahiro Miyauchi</b>  |
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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering |
| <b>Research Field</b>  | Photoelectrochemistry / Catalysis / Semiconductor / Wet chemical synthesis      |
| <b>Current Research Projects</b>   | Photocatalysis / Solar cell / Artificial photosynthesis / Methane reforming     |

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|   | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering                 |
| <b>Research Field</b>   | Organic electronics / Organic transistors / Organic conductors / Solid-state physical chemistry |
| <b>Current Research Projects</b>  | New organic transistor materials / Single-crystal organic transistors                           |

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|  | <b>Junko Morikawa</b>  |
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|  | <b>Major</b> Human Centered Science and Biomedical Engineering / Materials Science and Engineering                                   |
| <b>Research Field</b>  | Polymer physics / Thermophysical properties measurements / Thermal management / Thermal properties of materials / Polymer processing |
| <b>Current Research Projects</b>   | Multi-spectrum thermal imaging of polymer composite / Heat storage materials / Materials informatics                                 |

# Materials Science and Engineering

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Light metals and alloys / Electron microscopy / Dislocation dynamics / Thin metal films / Magnetic nano particles  |
| <b>Current Research Projects</b>  | Microstructural controlling of aluminum alloys / In-situ TEM observation of dislocation motion in alloys / Micromechanics based dislocation dynamics simulation / Characterization and magnetic anisotropy of nano-magnets |

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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering       |
| <b>Research Field</b>  | Organic and polymeric materials for catalysis   |
| <b>Current Research Projects</b>   | Pt-free fuel cell catalysts/ mesoporous carbon / hyperbranched polymers for catalysis |

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|  | <b>Nobuo Nakada</b>   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Metals and alloys / Iron and steel / Metallurgy / Mechanical property   |
| <b>Current Research Projects</b>  | Microstructural control for steels with excellent mechanical properties / Relationship between microstructure and mechanical property in structural metals and alloys / Thermomechanical processing and phase transformations |

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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Inorganic environmental materials / Surface wettability control / Ceramics processing |
| <b>Current Research Projects</b>   | Superwettability / Dynamic wettability / Photocatalyst                                |

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Solid state physics with laser / Laser science / Ultrafast phenomena / Inorganic materials science |
| <b>Current Research Projects</b>  | Coherent control of electron-phonon coupled system   |

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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Diffraction crystallography / Electron microscopy / Physical properties of thin film / Nanohetero structure |
| <b>Current Research Projects</b>   | stress measurement of thin film / electronic state of magnetic alloy / in-situ X-ray diffraction            |

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| <b>Research Field</b>   | Surface and interface physics / Physics at metal surfaces / Nano-structures / Photoelectron spectroscopy |
| <b>Current Research Projects</b>  | Electronic structure of Bi-related ultra-thin films / Hydrogen adsorption on metal surfaces              |

|  |   |
|--|---|
|  | <b>Fumiyasu Oba</b>   |
|  | Professor   |
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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Computational materials science / Inorganic materials science / Electronic materials / Energy materials           |
| <b>Current Research Projects</b>   | Computational exploration of novel semiconductors / Systematic investigation of lattice defects in semiconductors |

|   |   |
|---|---|
|  | <b>Susumu Onaka</b>   |
|   | Professor   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Physical metallurgy / Deformation and fracture / Strength / Micromechanics  |
| <b>Current Research Projects</b>  | Control of microstructures by severe plastic deformation / Micromechanical analysis on deformation behavior of materials / Modeling of microstructural changes in metals and alloys |

|  |   |
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|  | <b>Yukio Ouchi</b>  |
|  | Professor   |
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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Physical chemistry and electrochemistry of ionic liquids / Surface Science / Nonlinear optical spectroscopy / Photoelectron emission spectroscopy / |
| <b>Current Research Projects</b>   | Surface and interface chemistry of ionic liquids / Electronic structural control of ionic liquids / Polymer-ionic liquid composites /               |

# Materials Science and Engineering

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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Physical properties of organic materials / Polymer alloys / Composites / Interfacial adhesion                                   |
| <b>Current Research Projects</b>  | Control of structure and properties in multicomponent polymer systems / Interfacial structure and adhesion in polymeric systems |

|  |  |
|--|--|
|  | <b>Yoshimitsu Sagara</b>   |
|  | Associate Professor  |
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|  | <b>Major</b> Materials Science and Engineering                                     |
| <b>Research Field</b>  | Supramolecular Chemistry / Organic Functional Materials / Mechanosensing Materials |
| <b>Current Research Projects</b>   | Supramolecular Mechanophores / Mechanoresponsive Luminescence                      |

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|---|---|
|  | <b>Takumi Sannomiya</b>   |
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|   | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering / Human Centered Science and Biomedical Engineering |
| <b>Research Field</b>   | Transmission electron microscopy / Nanooptical materials / Plasmonics / Biosensors  |
| <b>Current Research Projects</b>  | Cathodoluminescence on Plasmonic Nanostructures   |

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|  | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>  | Inorganic electronic material / Superconductivity / Spintronics / Novel nanomaterial  |
| <b>Current Research Projects</b>   | Exploration of innovative electronic materials such as topological insulators and superconductors / Computational material search and design / Single-crystal growth / Magnetotransport and spectroscopic measurements. |

|   |   |
|---|---|
|  | <b>Hiroyo Segawa</b>  |
|   | Specially Appointed Professor   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Glass science / Optical materials / Inorganic-organic hybrid materials / Anodization                                |
| <b>Current Research Projects</b>  | Synthesis of functional oxynitride glasses / Luminescent glass materials / Functional alumina films via anodization |

|  |  |
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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering  |
| <b>Research Field</b>  | Metal physics / Thin film technology / Magnetic thin films / Nanohetero structures   |
| <b>Current Research Projects</b>   | Design of functional nanohetero structures / Interface interactions in nanohetero structures / Perpendicular exchange bias / Magnetic semiconductors |

|   |   |
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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Physical properties / Structure analysis / Fibers / Composites  |
| <b>Current Research Projects</b>  | Structure changes of polymeric materials under stress as measured by synchrotron radiation X-ray scattering / Intrinsic strength of carbon fibers / Effects of carbon nanofiller-dispersions on physical properties of elastomers and adhesives |

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|  | <b>Major</b> Human Centered Science and Biomedical Engineering / Energy Science and Engineering Materials Science and Engineering  |
| <b>Research Field</b>  | Biomedical materials / Bio-MEMS / Biosensor / Electrodeposition / Wearable sensor / Hybrid materials   |
| <b>Current Research Projects</b>   | Material design & the mechanical property evaluation of electrodeposited gold for high sensitive inertia detection device / Material design & evaluation of metal / polymer hybrid structure for wearable sensor |

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|  | <b>Masahiro Susa</b>   |
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|   | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering  |
| <b>Research Field</b>   | Physical chemistry of materials / Steelmaking process / Thermophysical properties measurements   |
| <b>Current Research Projects</b>  | Thermophysical properties measurements of iron oxide scale on steel / Water droplet boiling on steel surface / Mould flux designing for high speed continuous casting of steel |

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|  | <b>Eiji Tada</b>  |
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|  | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>  | Electrochemistry / Corrosion science / Surface treatment / Metallurgy   |
| <b>Current Research Projects</b>   | Environmentally induced cracking of metallic materials / Galvanic corrosion of metallic joints / Numerical simulation of aqueous corrosion of metals and alloys |

# Materials Science and Engineering

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|   | <b>Major</b> Materials Science and Engineering / Human Centered Science and Biomedical Engineering |
| <b>Research Field</b>   | Shape memory alloy / Phase transformation / Metallurgy   |
| <b>Current Research Projects</b>  | Martensitic transformation / Noble shape memory alloys / Biomedical titanium alloys                |

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| <b>Research Field</b>  | Physical Metallurgy of Alloys and Intermetallics / High-temperature Alloy Design / Phase Equilibria and phase transformations   |
| <b>Current Research Projects</b>   | Design principle of Titanium aluminides, super heat-resistant steels, superalloys / Structure of Intermetallics / Creep Deformation of high-temperature metallic and intermetallic alloys |

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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Heat-resistant metallic materials / High-temperature strength / Alloy development / Microstructure  |
| <b>Current Research Projects</b>  | Development of Mg-rich nanolamellar alloys / Microstructure control of Ni-based superalloys / Evaluation of precipitate morphology in superalloys / Dislocation movements in heat-resistant Mg alloys |

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| <b>Research Field</b>  | Bio-based plastic / Biodegradable polymer / Bioprocess / Chemolithotrophic bacteria                |
| <b>Current Research Projects</b>   | Biosynthesis and characterization of structurally new microbial polyesters                         |

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|   | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>   | Dielectrics / Ferroelectrics / Piezoelectrics / Electroceramics  |
| <b>Current Research Projects</b>  | Development of energy storage capacitor / Development of high temperature capacitor / Reliability of multi-layered capacitor/Development of ultrasonic transducers |

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|  | <b>Major</b> Energy Science and Engineering / Materials Science and Engineering           |
| <b>Research Field</b>  | High temperature oxidation of metallic materials / Physical chemistry at high temperature |
| <b>Current Research Projects</b>   | High temperature steam oxidation of austenitic steels                                     |

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|   | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>   | Nanoscale properties of organic materials / Photophysics of organic molecules / Single-molecule spectroscopy  |
| <b>Current Research Projects</b>  | Conformation and photophysics of conjugated polymers for electroluminescence / Plasmon enhancement of molecular photophysics in single hybrid nanoparticles / Photophysics of novel semiconductor and perovskite nanocrystals / Nanoscale properties of organic photon-upconversion systems |

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|  | <b>Major</b> Materials Science and Engineering   |
| <b>Research Field</b>  | Solid state chemistry / Topochemical reaction / High pressure reaction / Structural analysis |
| <b>Current Research Projects</b>   | Topochemical synthesis / High pressure synthesis / Anion engineering                         |

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|   | <b>Major</b> Materials Science and Engineering  |
| <b>Research Field</b>   | Inorganic glass materials / Photonic materials / High-temperature chemistry / Ion dynamics in materials / Nuclear waste vitrification |
| <b>Current Research Projects</b>  | Combinatorial material processing / In situ vitrification analysis / Chemical strengthening of glass / Optical MEMS                   |

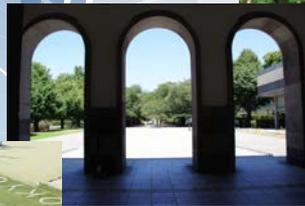
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|  | <b>Major</b> Materials Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>  | Engineering ceramics and composites / Solid mechanics / Fracture mechanics / Statistical mechanics / Weibull statistics/ Reliability  |
| <b>Current Research Projects</b>   | Stochastic analysis on ceramic granule collapse in powder compact during cold isostatic pressing / A theory on estimating internal stress during sintering of ceramic multiphase laminates / Easy-to-use torsion test Method and multiaxial fracture criteria / Weibull statistics of porous ceramics / Numerical simulation of linearity in Weibull plot |

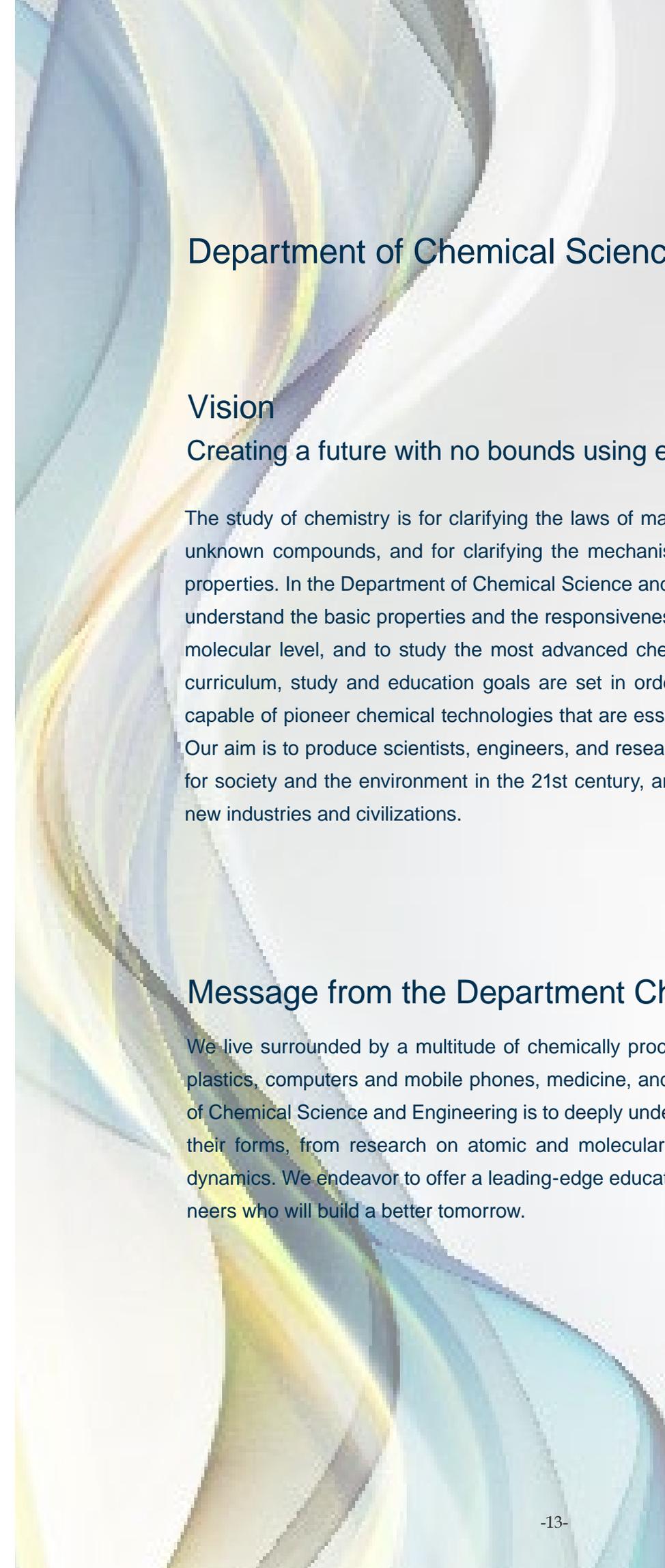
# Materials Science and Engineering

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|   | <b>Major</b> Nuclear Engineering /<br>Materials Science and Engineering  |
| <b>Research Field</b>   | Severe environment resistant materials / Materials for nuclear and fusion applications / Ceramic-based composites / Porous ceramics  |
| <b>Current Research Projects</b>  | Development of high performance ceramic-based composites / High performance porous ceramics based on microstructure control / Development of novel severe environment resistant ceramics |

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|  | <b>Mamoru Yoshimoto</b>  |
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|  | <b>Major</b> Materials Science and Engineering /<br>Energy Science and Engineering   |
| <b>Research Field</b>  | Solar cells / Inorganic thermoelectric materials / Surface nano-functionalization / Superconducting / Magnetic materials                     |
| <b>Current Research Projects</b>   | UV Solar cells / Flexible glassy thermoelectric materials / Development of novel uniaxial pressure-induced thin film crystallization process |





## Department of Chemical Science and Engineering

### Vision

Creating a future with no bounds using expertise in chemistry

The study of chemistry is for clarifying the laws of material conversion, for synthesizing unknown compounds, and for clarifying the mechanisms of manifestations of physical properties. In the Department of Chemical Science and Engineering, our aim is to deeply understand the basic properties and the responsiveness of substances at an atomic and molecular level, and to study the most advanced chemical technology systems. In the curriculum, study and education goals are set in order to develop individuals who are capable of pioneer chemical technologies that are essential for sustaining a rich society. Our aim is to produce scientists, engineers, and researchers who can take responsibility for society and the environment in the 21st century, and expert professionals who open new industries and civilizations.

### Message from the Department Chair

We live surrounded by a multitude of chemically processed materials, such as clothes, plastics, computers and mobile phones, medicine, and fuel. The goal of the Department of Chemical Science and Engineering is to deeply understand chemical phenomena in all their forms, from research on atomic and molecular interactions to studies on global dynamics. We endeavor to offer a leading-edge education to aspiring scientists and engineers who will build a better tomorrow.

# Chemical Science and Engineering

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|   | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>   | Polymer functional materials / Polymer spectroscopy / Polymers for optical applications / Polymer inorganic hybrid materials  |
| <b>Current Research Projects</b>  | Aggregation structure and optical properties of aromatic polymer films at very high pressure (~10GPa) / Molecular design, synthesis and photo-physical properties of highly fluorescent & phosphorescent polyimides / Wavelength and light intensity dependences of photoconductivity of polymer films / Structural analysis of polymer thin films using VT pMAIRS spectroscopy and synchrotron X-ray diffraction |

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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>  | Tribology / Lubricant chemistry / Surface modification / Surface chemistry  |
| <b>Current Research Projects</b>   | Friction-reducing mechanism of organic polymers having multiple adsorption sites / Tribological characteristic of a fingertip on an organic molecular film-coated surface / Synergistic friction-reducing effect between surface roughness and adsorbed molecular films |

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|  | <b>Hajime Arai</b>   |
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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering |
| <b>Research Field</b>   | Energy storage device / Electrochemistry / Material Science                    |
| <b>Current Research Projects</b>  | Zinc Air Battery / Aqueous Battery / Advanced interfacial analysis             |

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|  | <b>Tetsuro Fuchino</b>   |
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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Process Systems Engineering / Process Safety Engineering and Management  |
| <b>Current Research Projects</b>   | Development of Process Design Rationale Based Operation Design Environment / Process Safety Information Management through Plant Lifecycle |

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|   | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>   | Physical organic chemistry / Functional $\pi$ -electronic materials / Functional polymer materials / Molecular assembly |
| <b>Current Research Projects</b>  | Electronic and optoelectronic organic materials / Functional soft materials / New methods for materials synthesis       |

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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Polymer structure / Polymer property / Molecular simulation   |
| <b>Current Research Projects</b>   | Mechanism of helix-sense inversion of polyaspartates / Orientation and properties for surface-grafted polypeptides / Molecular dynamics simulations of polymer chains |

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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering / Earth-Life Science   |
| <b>Research Field</b>   | Self-assembly and organic thin films / Nanotechnology / Surface and interface chemistry / Chemical evolution and origins of life  |
| <b>Current Research Projects</b>  | High resolution STM and AFM studies of self-assembled monolayers, bio-interfaces, and devices / Development of highly sensitive tip-enhanced and surface-enhanced optical microscopy and spectroscopy with nanostructures / Nano-spectroscopic approaches to chemical evolution and origins of life at mineral-organic interfaces |

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|  | <b>Major</b> Nuclear Engineering / Chemical Science and Engineering   |
| <b>Research Field</b>  | Inorganic Materials / Chemical Process Engineering / CO <sub>2</sub> Capture & Utilization / Low-carbon Energy System   |
| <b>Current Research Projects</b>   | Advanced CO <sub>2</sub> Capture Process / Carbon-free Hydrogen Production / Electrochemical CO <sub>2</sub> Conversion |

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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering                                    |
| <b>Research Field</b>   | Solid state chemistry / Energy conversion materials / Lithium ion batteries / Design of electrochemical interface |
| <b>Current Research Projects</b>  | Development of next-generation batteries (all solid-state battery / Li-ion battery / photo-rechargeable battery)  |

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|  | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering   |
| <b>Research Field</b>  | Electrochemistry / Inorganic materials and devices / Chemical Engineering  |
| <b>Current Research Projects</b>   | Grid cooperative / distributed real time smart energy system / Perovskite / Si tandem solar cells / Solid oxide fuel cell / electrolyte cell |

# Chemical Science and Engineering

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|   | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>   | Physical chemistry / Coordination chemistry / Advanced material chemistry / Nanoparticle / Cluster science |
| <b>Current Research Projects</b>  | Structural analysis and functionalization of subnanoparticles  |

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|  | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering             |
| <b>Research Field</b>  | Organic electrosynthesis / Functional polymer / Polymer synthesis / Electrochemical device |
| <b>Current Research Projects</b>   | Organic electrosynthesis / Functional polymer  |

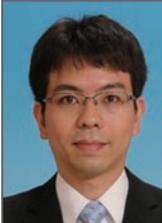
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|   | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>   | Structural analysis of polymeric materials based on synchrotron X-ray scattering and vibrational spectroscopies / polymeric thin film / Liquid crystalline polymers   |
| <b>Current Research Projects</b>  | Lyotropic liquid crystals formed by rigid functional-polymers / Anisotropy in physical properties of highly oriented polymers (optical, mechanical, and thermal properties) / Molecular orientation control in thin films. Variable temperature p-polarized multiple angle incidence resolution spectroscopy (VT-pMAIRS) for biaxially oriented thin films. |

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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Polymer synthesis / Functional polymer / Organic chemistry  |
| <b>Current Research Projects</b>   | Living anionic polymerization of functional monomers / Synthesis of polymers containing adamantyl groups / Synthesis of water-soluble thermoresponsive polymers |

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|  | <b>Shigekazu Ito</b>  |
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|   | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>   | Physical organic chemistry / Organic synthesis / Catalysis  |
| <b>Current Research Projects</b>  | Open-shell singlet heterocycles toward functional materials, Low-coordinated phosphines for (chiral) gold catalysis |

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|  | <b>Yukitaka Kato</b>   |
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|  | <b>Major</b> Nuclear Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>  | Energy storage and conversion / Carbon recycling energy system / Energy carrier / Nuclear energy system  |
| <b>Current Research Projects</b>   | Thermochemical energy storage materials and systems / Active carbon recycling energy system / Innovative hydrogen permeation membrane / Low carbon nuclear energy system |

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|   | <b>Major</b> Chemical Science and Engineering               |
| <b>Research Field</b>   | Polymer science / Photochemistry / Bioimaging / Physiology  |
| <b>Current Research Projects</b>  | Functional Fluorescent Dye / Bioimaging / Polymer synthesis |

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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering |
| <b>Research Field</b>  | Polymer / Hybrid materials / Photonics / Liquid crystals                       |
| <b>Current Research Projects</b>   | Design of aligned nanostructures for anisotropic functional materials          |

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|   | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>   | Materials for chemical equipment / Composites / Epoxy resin / Smart structure / Risk Based Maintenance / Graphene  |
| <b>Current Research Projects</b>  | Evaluation of durability of plastic / Creation of furan resin based green composite / Mass production of high-aspect-ratio few-layer-graphene by high-speed laminar flow |

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|  | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>  | Atomistic materials modeling / Machine learning / Solar cells   |
| <b>Current Research Projects</b>   | Machine learning for renewable energy system management Machine learning for large scale ab initio simulations. Ab initio modeling of phenomena in materials for electrochemical power sources. Computational spectroscopy. |

# Chemical Science and Engineering

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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>   | Process Systems Engineering / Process Intensification / Process Informatics / Renewable Energy / Nitrogen Cycle   |
| <b>Current Research Projects</b>  | Development of methods and tools for synthesis / analysis and control of complex process systems<br>Multiscale analysis and synthesis of chemical process intensified by alternative energy sources<br>Multiscale design and control of process systems for production and utilization of hydrogen energy carrier |

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|  | <b>Shinsuke Mori</b>   |
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>  | Plasma chemistry / Plasma surface modification / Plasma reforming / Nanomaterial synthesis   |
| <b>Current Research Projects</b>   | Synthesis of nanocarbon materials / Plasma surface modification / Plasma CO <sub>2</sub> reforming / Ammonia synthesis by non-thermal plasma |

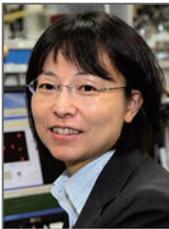
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|  | <b>Tetsuro Murahashi</b>   |
|   | Professor  |
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|   | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>   | Organometallic chemistry / Coordination chemistry / Catalysis / Inorganic chemistry                |
| <b>Current Research Projects</b>  | Synthetic inorganic and organometallic chemistry / Inorganic and Organometallic reaction chemistry |

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|--|---|
|  | <b>Ken Nakajima</b>   |
|  | Professor   |
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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Polymer nanomechanics / Polymer physics / Rubber/elastomer materials  |
| <b>Current Research Projects</b>   | nanomechanical property mapping by atomic force microscope on various polymeric materials / development of nanorheological measurement based on atomic force microscope, Investigation of rubber-filler interface / heterogeneous stress distribution of stretched rubber |

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|  | <b>Ryuhei Nakamura</b>   |
|   | Professor  |
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|   | <b>Major</b> Earth-Life Science / Chemical Science and Engineering                 |
| <b>Research Field</b>   | Chemical Science and Engineering / Energy Science and Engineering                  |
| <b>Current Research Projects</b>  | Origin of Life, Systems Chemistry, Electrochemistry at Deep-Sea Hydrothermal Vents |

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|  | <b>Kazuko Nakazono</b>  |
|  | Associate Professor   |
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|  | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>  | Supramolecular Chemistry / Polymer Chemistry / Material Chemistry   |
| <b>Current Research Projects</b>   | Development of polymer materials with supramolecular structure / Synthesis of new polymer materials by polymer reaction |

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|---|--|
|  | <b>Akira Ohtomo</b>  |
|   | Professor  |
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|   | <b>Major</b> Chemical Science and Engineering / Materials Science and Engineering  |
| <b>Research Field</b>   | Inorganic solid-state chemistry / Crystal engineering / Oxide electronics  |
| <b>Current Research Projects</b>  | Materials and chemical research in the field of complex metal oxides and hydrides for novel electronic and magnetic properties / Epitaxial growth of oxide semiconductors for visible-light driven water splitting and power electronics applications / Electrochemical induction of normal to superconducting transitions |

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|  | <b>Mina Okochi</b>   |
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|  | <b>Major</b> Chemical Science and Engineering / Human Centered Science and Biomedical Engineering / Earth-Life Science |
|  | Biotechnology / Peptide technology / Bioelectronics / Biomedical engineering   |
|  | Peptide-based biosensors / Screening of functional peptides / IgE epitope analysis for allergy analysis                |

|   |   |
|---|---|
|  | <b>Shinichi Ookawara</b>  |
|   | Specially Appointed Professor   |
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|   | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>   | Microreactor / Microfluidic device / CFD  |
| <b>Current Research Projects</b>  | 3D (Printed) Micro / Mini-Fluidic Devices for Chemical, Environmental and Energy process applications |

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|  | <b>Hideyuki Otsuka</b>  |
|  | Professor   |
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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Polymer chemistry / Polymer reactions / Dynamic covalent chemistry / Chemistry of soft materials  |
| <b>Current Research Projects</b>   | Polymer reactions based on dynamic covalent chemistry / Preparation and evaluation of self-healing polymers / Synthesis and characterization of mechanochromic polymers |

# Chemical Science and Engineering

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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Polymer synthesis / Polymer reaction / Composites / Nano materials  |
| <b>Current Research Projects</b>  | Developing novel organic-silica nanocomposites / Developing novel functional polymers for energy devices / Developing novel nano-particles / Controlling nanostructures of organic-silica nanocomposites / Controlling radical polymerization of multi-vinyl monomers |

|  |   |
|--|---|
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>  | Polymer Synthesis / Precision Polymerization / Living Polymerization / Bio-Based Polymers   |
| <b>Current Research Projects</b>   | Development of Unprecedented Precision Polymerization / New Polymer Materials by Means of Precision Polymerization / Precision Polymerization of Renewable Monomers |

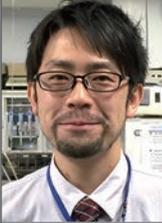
|   |  |
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|   | <b>Major</b> Chemical Science and Engineering                              |
| <b>Research Field</b>   | Supramolecular chemistry / Organic chemistry / Coordination chemistry      |
| <b>Current Research Projects</b>  | Metal-induced peptide folding and assembly / Advanced molecular topologies |

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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Biopolymer / Soft material / Biomolecular chemistry / Bioengineering   |
| <b>Current Research Projects</b>   | Development of protein / filamentous virus-based functional soft materials based on control of their self-assembly and functionalization through genetic engineering / machine learning. |

|   |  |
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|  | <b>Hidetoshi Sekiguchi</b>   |
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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>   | Plasma processing / Reaction engineering with high energy density field / Thermal energy engineering / Environmental chemical engineering  |
| <b>Current Research Projects</b>  | Bioenergy conversion using external energetic fields including plasma, ultrasound, and molten salt / Preparation of functional materials using various plasmas / Chemical energy storage |

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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Biopolymer / Natural polymer / Self-assembly / Surface and interfacial chemistry  |
| <b>Current Research Projects</b>   | Enzymatic synthesis and applications of cellulose oligomers and their derivatives / Identification and applications of polymer-binding peptides / Assembly and applications of filamentous bacteriophages |

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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Solid-state chemistry / Solid-state physics / Functional inorganic thin films / Materials informatics with robotics                                 |
| <b>Current Research Projects</b>  | Functional inorganic thin films with anion engineering / Solid-state batteries / High-speed materials discovery using machine learning and robotics |

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|--|---|
|  | <b>Yusuke Shimoyama</b>   |
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>  | CO <sub>2</sub> utilization / Separation process / Material process Current Research Projects: Metal-CO <sub>2</sub> battery / Material process in high-pressure CO <sub>2</sub> / Bioactive and pharmaceutical separation in CO <sub>2</sub> solvent |
| <b>Current Research Projects</b>   | Supercritical extraction of emulsion for nanosuspension / sol-gel reaction in supercritical carbon dioxide / Supercritical drying for carbon electrode fabrication  |

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|  | <b>Atsushi Shishido</b>  |
|   | Professor  |
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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering |
| <b>Research Field</b>   | Polymer / Light / Liquid crystal / Material                                    |
| <b>Current Research Projects</b>  | Design of functional films for photonic and mechanical applications            |

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|--|--|
|  | <b>Yoshiaki Shoji</b>  |
|  | Associate Professor  |
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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Organic Synthesis / Main-Group Chemistry / Supramolecular Chemistry  |
| <b>Current Research Projects</b>   | Development of functional $\pi$ -electronic materials / Functional molecular assembly / Highly reactive main-group species |

# Chemical Science and Engineering

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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Solid State Chemistry / Energy Conversion Materials / Novel Energy Storage Device, and Material Search by Machine Learning  |
| <b>Current Research Projects</b>  | Development of Machine Learning Technique for Material Search of Lithium Ionic Conductors<br>Liquid Phase Synthesis of Solid Electrolyte for Lithium-Sulfur Battery Cathodes<br>Interfacial Reaction Analysis of All-Solid-State Lithium Battery Using Epitaxial Model Electrodes |

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|  | <b>Teruoki Tago</b>  |
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>  | Chemical engineering / Catalysis and reaction engineering / Petrochemical / Biomass  |
| <b>Current Research Projects</b>   | Synthesis of metal-encapsulated zeolites and their application for catalytic reaction / Synthesis of carbon supported metal catalysts and their application for biomass conversion |

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|  | <b>Toshiro Takao</b>   |
|   | Associate Professor  |
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|   | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>   | Organometallic chemistry / Coordination chemistry / Cluster chemistry / Chemistry of catalysis   |
| <b>Current Research Projects</b>  | Development of cluster catalysis / Synthesis of mixed-ligand polyhydrido cluster / Synthesis of heterometallic cluster / Activation of small molecules using polyhydrido cluster |

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|  | <b>Koichiro Takao</b>   |
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|  | <b>Major</b> Nuclear Engineering / Chemical Science and Engineering   |
| <b>Research Field</b>  | Coordination chemistry of actinides / Ionic liquids / Nuclear fuel cycle / Treatment and disposal of nuclear wastes   |
| <b>Current Research Projects</b>   | Fundamental Study on Advanced Nuclear Fuel Reprocessing Based on Actinide Coordination Chemistry / Retrieval of Long-lived Fission Products from Vitrified Nuclear Wastes / Microwave-assisted Solvent Extraction of Platinum Group Metals / Exploring Catalytic Activity of Uranyl Complexes |

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|  | <b>Masayoshi Tanaka</b>  |
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|   | <b>Major</b> Human Centered Science and Biomedical Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Bionanotechnology/Biomaterialization/Proteomics/Biomedical engineering/Microbiology  |
| <b>Current Research Projects</b>  | Screening technique development of membrane curvature sensors / Green synthesis of functional nanomaterials / Drug target screening/Photothermal therapy |

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|  | <b>Hiroshi Tanaka</b>  |
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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Natural product chemistry / Synthetic organic chemistry / Chemical biology / Carbohydrate chemistry                              |
| <b>Current Research Projects</b>   | Synthesis of 18F PET tracers / Synthesis of food-orientated natural products / Synthesis of biologically important carbohydrates |

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|  | <b>Katsunori Tanaka</b>  |
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|   | <b>Major</b> Human Centered Science and Biomedical Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Synthetic Chemistry / Natural Products Chemistry / Glycochemical Biology / In Vivo Chemistry   |
| <b>Current Research Projects</b>  | In Vivo Glycan Delivery System / In Vivo Molecular Imaging / In Vivo Metal Catalysis and Metalloenzyme / In Vivo Synthesis of Natural Products, Drugs and Functional Materials / Therapeutic In Vivo Synthetic Chemistry |

|  |   |
|--|---|
|  | <b>Ken Tanaka</b>   |
|  | Professor   |
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|  | <b>Major</b> Chemical Science and Engineering   |
| <b>Research Field</b>  | Organic synthesis / Organometallic chemistry / Asymmetric catalysis   |
| <b>Current Research Projects</b>   | (Asymmetric) Catalysis for Construction of Non-Centro Chiralities / (Asymmetric) Catalysis for Construction of Multiple-Centro Chiralities / (Asymmetric) Catalysis Using Cationic Transition-Metal Complexes / (Asymmetric) Synthesis of Novel Organic Molecules |

|   |  |
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|  | <b>Izumi Taniguchi</b>   |
|   | Associate Professor  |
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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>   | Nanostructure material processing / Energy storage device / Aerosol technology / Powder engineering / Chemical engineering   |
| <b>Current Research Projects</b>  | Synthesis of nanostructured electrodes for lithium sulfur and lithium ion batteries by using aerosol and powder technologies / Development of novel energy storage devices |

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|--|--|
|  | <b>Masatoshi Tokita</b>  |
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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Polymer structures / Polymer properties / Polymer liquid crystals / Soft materials   |
| <b>Current Research Projects</b>   | Creation of optical films using soft materials / Macroscopic orientation of microdomains of liquid crystalline block copolymers / Surface modification using polymer brushes / Nanoparticle dispersion using polymer brushes |

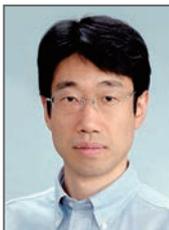
# Chemical Science and Engineering

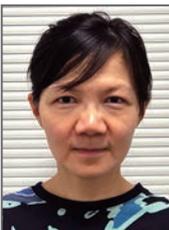
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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>   | Polymer synthesis / Polymer reaction / Functional polymer / Organometallic chemistry  |
| <b>Current Research Projects</b>  | Synthesis of Elements-block $\pi$ -Conjugated Polymers / Living Coordination Dispersion Polymerization / Three-component Polycondensation Processes |

|  |  |
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|  | <b>Sakae Toyoda</b>  |
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>  | Atmospheric chemistry / Earth and environmental chemistry / Material cycle analysis / Analytical chemistry   |
| <b>Current Research Projects</b>   | Global budget analysis of atmospheric nitrous oxide / Impact of ocean acidification on the production of nitrous oxide / Global cycle analysis of atmospheric molecular hydrogen |

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|  | <b>Takehiko Tsukahara</b>  |
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|   | <b>Major</b> Nuclear Engineering / Chemical Science and Engineering  |
| <b>Research Field</b>   | Nuclear Analytical Chemistry / Radioactive Waste Management / Nuclear Fuel Cycle / Functional Nanomaterial   |
| <b>Current Research Projects</b>  | Microfluidic-based analysis and separation of radionuclides / Creation of photonic crystal polymer for metal ion sensing / Novel phase-transition-based solvent extraction of target radionuclides |

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|  | <b>Hiroyuki Wada</b>   |
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|  | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering / Human Centered Science and Biomedical Engineering   |
| <b>Research Field</b>  | Photofunctional chemistry / Nano material / Laser  |
| <b>Current Research Projects</b>   | Preparation of nanoparticle by laser process / Photoacoustic bioimaging by organic nanoparticles / Cancer treatment by photodynamic therapy / Quantum dot sensitized solar cell / Lithium ion battery using nanoparticles for electrode / Nanophosphors for white light emitting diode |

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|   | <b>Major</b> Energy Science and Engineering / Chemical Science and Engineering |
| <b>Research Field</b>   | Materials engineering / Chemical engineering / Electrochemistry / Battery      |
| <b>Current Research Projects</b>  | Engineering of carbonnanotube for battery electrode application                |

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|  | <b>Keita Yamada</b>   |
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|  | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering  |
| <b>Research Field</b>  | Isotopomics / Organic geochemistry / Environmental chemistry / Isotope geochemistry   |
| <b>Current Research Projects</b>   | Source identification of volatile organic compounds in the atmosphere / Development of diagnosis of disease based on stable isotopic changes in metabolites / Discrimination between natural and synthetic organic compounds in foods based on stable isotopic signatures |

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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>   | Chemical engineering / Fuel cell materials and systems / Bio-inspired membranes / Membrane Science and Technology  |
| <b>Current Research Projects</b>  | Electrolyte membranes and electro-catalysts for polymer electrolyte fuel cells and solid alkaline fuel cells / Functionalized membranes inspired from bio-systems / Materials for water splitting / Antifouling membrane materials for water treatment |

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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Macromolecular chemistry / Inorganic chemistry / Nanoscience / Material Science                    |
| <b>Current Research Projects</b>   | Atom hybridization / Synthesis of Subnano metal Particles / Development of Advanced Nano-materials |

|   |  |
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|   | <b>Major</b> Chemical Science and Engineering / Energy Science and Engineering   |
| <b>Research Field</b>   | Post-fuel cell / Energy conversion chemistry / Material conversion chemistry / Green chemistry   |
| <b>Current Research Projects</b>  | Direct conversion of methane to higher hydrocarbons by new catalyst / Direct electrochemical synthesis of organic hydride by new electrocatalyst |

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|  | <b>Major</b> Chemical Science and Engineering  |
| <b>Research Field</b>  | Nanospace catalysis / Zeolites / Catalytic reaction chemistry / Green chemistry  |
| <b>Current Research Projects</b>   | Direct conversion of methane into chemicals Conversion of methanol into light olefins Control of Al distribution in zeolite framework Advanced characterization of nanospace catalysts |

# Chemical Science and Engineering

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|   | Major Chemical Science and Engineering  |
| Research Field  | Transport phenomena / Membrane separation / Mixing operation  |
| Current Research Projects   | Modeling of flow characteristics of mixing equipment for chemical reaction / Optimum design and operational conditions of membrane separation module for blood purification / Modeling of transport phenomena in membrane separation processes in food industry |

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|  | Major Chemical Science and Engineering                              |
| Research Field   | Supramolecular chemistry / Nanospace chemistry / Material chemistry |
| Current Research Projects  | Development of functional polyaromatic nanospaces                   |



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1 October 2022

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