Introduction to Applied Chemistry for Environment

2022

Tokyo Metropolitan University

Faculty & Graduate School of Urban Environmental Sciences

Department of Applied Chemistry for Environment

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Welcome to the Department of Applied Chemistry for Environment

Professor Tetsuya SHISHIDO
(Dean of the Faculty and Head of Department, 2022)

We have inherited our ancestors' desire for a unified knowledge that embraces everything. (Erwin Schrodinger)

"Curiosity" is the main driving force behind at least one of the most important activities of the human spirit: science. Furthermore, this spiritual curiosity is a very natural part of human nature. (Shinichiro Tomonaga)

Dear freshmen, congratulations on your enrolment.

The world is still in a difficult situation due to COVID-19. Our daily lives continue to be affected by many restrictions and event cancellations. In spite of the difficulties you have experienced, I am sure that you are very excited about entering our university and are looking forward to university life. I expect that you will acquire profound knowledge in order to realize your future aspirations, and that you will grow as a person with a broad perspective by gaining a variety of experiences through interaction with not only your peers in this department but also with a wider range of people.

These two wonderful quotes at the beginning of this message are both from Nobel Prize winners. As these words suggest, intellectual inquisitiveness and curiosity are innate in human beings and have been passed down from generation to generation. I believe that you are all carrying such aspirations, waiting for the opportunity to make them come true. The university experience differs from the passive study you experienced before as it requires you to work proactively, based on your own intellectual pursuits and curiosity, and on the objectives, you wish to achieve. Moreover, it is crucial to develop a scientific way of thinking and to continuously think about what you don't understand, what questions you have and what you want to solve. These are the skills that you will need to succeed in the future.

Chemistry is the universal science of matter and its changes. Today's society is faced with a variety of challenges, including energy and environmental problems, and chemistry plays a vital role in resolving these issues. Addressing these issues requires a global approach and a global perspective, as well as communication skills. The objective of the Department of Applied Chemistry for Environment is to develop qualified human resources who can utilize the power of chemistry to tackle and contribute to addressing these issues.

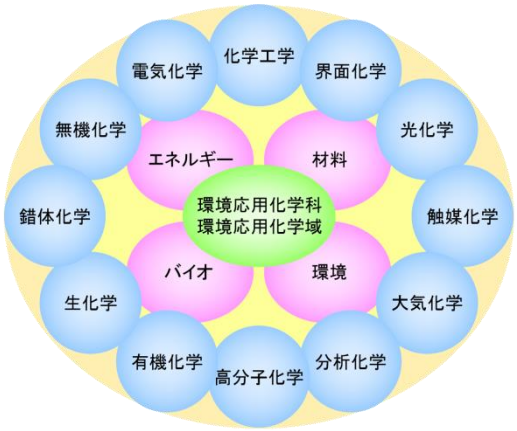
What you are about to study involves things that modern science has yet to understand. The results of your laboratory research, or the ideas you develop as you continue to ponder questions raised in lectures, may provide clues to the answers to those mysteries. The intellectual excitement that comes from this process is invaluable and can only be gained by taking the initiative and constantly considering the issues. It would be wonderful to share such intellectual excitement with you in our department. Together let's make your university experience fruitful and rewarding. Professor Junichiro Kawaguchi, JAXA’s HAYABUSA Project Manager, says, "If we stay at the current level and try to keep our feet on the ground, we will never be able to see the horizon that lies beyond." I hope that you will be able to unleash your own intellectual curiosity, have a meaningful university life and experience significant growth.

About Department of Applied Chemistry for Environment

The Department of Applied Chemistry for Environment offers education and research in applied chemistry, materials science that can be used in engineering. In particular, the department aims to nurture people with the qualities to contribute to the development of chemistry, which is directed towards and essential for the sustainable development of humanity and urban society under the limited global resources and energy, while living in harmony with the global environment.

As for research, the department conducts world-leading research in a wide range of application fields, including the environment, energy, materials, and biotechnology, and for example, the department's advanced research into the realization of a "hydrogen energy society" is attracting a great deal of national and international attention. In addition, the graduate research you will experience in our laboratories will help you to become a true researcher and engineer capable of dealing with global issues. In all of our research, we are keenly aware of the need to contribute to the improvement of the urban environment, not only by pursuing fundamental theories but also by realizing these theories using real devices.

From an educational perspective, in order to foster researchers and engineers who can contribute to the solution of environmental and energy problems, the curriculum is structured so that students can learn, step by step, from the basics to specialized areas, the knowledge and abilities necessary to create materials and substances that harmonize with the global environment and urban society in a wide range of fields, including the environment, energy, materials, and biotechnology, and to develop a rich human society in harmony with the environment. Active learning is incorporated in each academic year to encourage independent learning, and the objectives of the year are clearly defined in order to develop students who can play an active role in the global community.



Structure of the faculty and department

The Department of Applied Chemistry for Environment consists of the following 10 laboratories and 1 collaborative laboratory.

Kawakami Laboratory (Advanced Functional Materials field): Based on polymer chemistry, the laboratory's research aims to create new environmental and energy materials and biomaterials that contribute to the environment, energy, medicine, and welfare.

Asayama Laboratory (Advanced Functional Materials field): The research focuses on the creation of biomaterials that maintain human health and improve quality of life (QOL), focusing particularly on drug delivery systems (DDS).

Kubo Laboratory (Advanced Material Design field): Based on basic research on the synthesis of functional organic materials, we propose energy-related materials and light-emitting materials that contribute to a sustainable society.

Setaka Laboratory (Advanced Material Design field): By studying the synthetic structures of organic molecules containing silicon, which is a homologue of carbon, we are carrying out basic research on the development of molecular functions that utilize the characteristics of typical elements.

Kanamura Laboratory (Energy Devices field): Based on inorganic materials chemistry, the research focuses on the development of new materials for the next generation of rechargeable batteries and fuel cells.

Kajihara Laboratory (Energy Devices field): The research focuses on inorganic solid-state materials with optical and electronic functions, mainly ceramics and glass, and on the formation and application of regular microstructures based on electrochemical processes.

Takagi Laboratory (Environmental Molecular Chemistry field): Based on nano-structural chemistry and photochemistry, we are developing photo-functional nanomaterials and researching artificial photosynthetic reactions, as well as organic reactions catalysed by gold nanoparticles and gold clusters.

Analytical Chemistry Laboratory (Molecular Measurement Chemistry field) Research is being carried out on novel analytical methods, chemical sensors, and biosensors for the fast and accurate measurement of microelements in environmental and biological samples on site.

Shishido Laboratory (Chemistry for Environment field): Based on a molecular theoretical understanding of catalysis, we are working on the design of catalysts at the molecular and nano levels, with the aim of creating "highly efficient molecular transformation processes" and "effective systems for environmental protection and purification".

Shudo Laboratory (Chemistry for Environment field): Research is carried out into engineering applications aimed at reducing the environmental impact of energy use systems, such as the use of alternative fuels to petroleum such as hydrogen to increase the efficiency of engines and the power output of fuel cells.

Amano Laboratory (Photoenergy Material Conversion field): For the production of chemicals and energy carriers using renewable energy, we are developing functional materials and reaction processes such as photocatalysts, photoelectrodes and electrocatalysts.

※ Collaborative laboratory

Course structure and various events ・ Support system

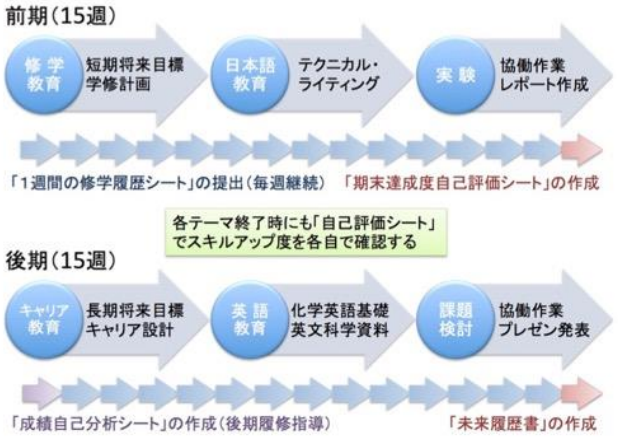
Undergraduate School - Department of Applied Chemistry for Environment curriculum

In this day and age, with so much information available on the internet, the traditional "cramming and memorizing" (passive learning) has become meaningless. In order to adapt to a rapidly changing environment, it is important for students to develop their own "independent proactive approach to learning" and to develop "solid academic skills". From the time students enroll at the university, the department introduces Active Learning (AL), in which students take the initiative in their studies, and lectures on problem finding and solving are given until the end of their graduate studies. In addition, in order to cope with globalization, from the first year of undergraduate studies we have introduced a program to help students acquire speaking, listening, reading, and writing skills in English in the field of chemistry.

In all compulsory subjects the ICT-based "Web tests" are used to support Active Learning and ensure the consolidation of knowledge. As the academic year progresses, more advanced Project Based Learning (PBL) classes are introduced, and problem finding and solving lectures are given throughout the department. This encourages students to develop proactive learning habits and the ability to identify and solve problems on their own.

Basic Seminar on Applied Chemistry for Environment

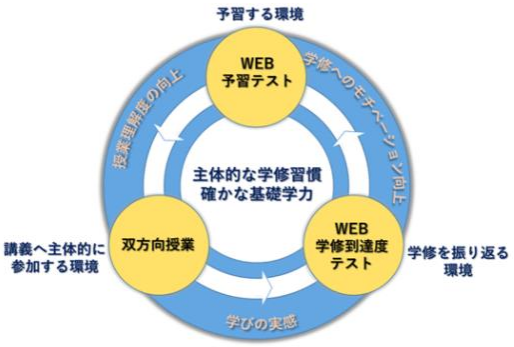
In the first academic year, with the aim of "fostering a stronger sense of motivation for studying at university and encouraging active, independent and self-reliant study habits", a variety of educational programs such as career education, Japanese writing exercises, Chemistry in English, problem-solving research, and research projects taught in English are offered in the AL subject Basic Seminar on Applied Chemistry for Environment.



Students are required to submit "Learning Record", "Achievement self-evaluation sheet", "Academic results self-analysis sheet", and a "Future CV", in which they are asked to imagine what they want to be in ten years' time, to prevent the loss of study habits and to provide an environment in which students can acquire self-management skills. Through this process of reflection and goal-setting, a shift from "passive learning" to "active and independent learning" can be achieved.

Specialized subjects

The department's strengths lie in the diversity of its teaching staff, who come from a variety of research backgrounds and offer courses on the environment, energy, materials, and biotechnology. In order to encourage the continuous development of "independent learning habits" acquired in the first year, all compulsory courses in the second and third years provide an environment for students to develop the "habit to pre-study material prior to lectures", an "environment for students to actively participate in lectures", and an "environment for students to reflect on their studies" through the use of ICT such as e-learning systems.



In order to create an environment where students can make preparation to lections a habit, we offer web-based preparation tests. By checking the content of lectures in advance, students can improve their understanding of the lectures. To create an environment where students can actively participate in lectures, we offer interactive classes using devices such as clickers. It provides students with the opportunity to use the knowledge they have gained in preparation for the lesson, thus increasing both their involvement in the lesson and their ability to apply that

knowledge. The web-based achievement test is designed as a means for students to evaluate their learning. This allows students to check their level of achievement at any time and motivates them for the next stage of their studies.

Experiments and graduation research

In the second and third years, students carry out experiments in various fields of chemistry to acquire the experimental skills necessary to become a researcher in chemistry, and in the fourth year, students join a laboratory where they work on their own original research topic.

The Department of Applied Chemistry for Environment is highly regarded worldwide for its research capabilities, and is ranked 7th in the field of chemistry and 9th in the field of materials science in the University Ranking 2017 (Asahi Shimbun Publishing). The Department of Applied Chemistry for Environment is proud to bring together the accumulated knowledge of various research fields, and together with current students, graduate students, and future students, we will promote research that will lead to the future of the Earth and humankind.

Special Research Presentation and MIP

The results of the year-long special research will be presented at a two-day Special Research Presentation in March. Each student will give a 10-minute presentation, after which they will answer questions from teachers and students. The Most Impressive Presentation (MIP) is awarded to the student with the best research presentation. The MIP is also awarded to the student with the best research presentation at the Master's Thesis Presentation.

Department of Applied Chemistry for Environment Standard Course Model

The Department of Applied Chemistry for Environment has prepared a "Standard Course Model" to help you plan your course of study. It is basically the same as the "Course Guide", but is divided into different fields for clarity. In general, designated subjects can only be taken in the year in which they are assigned. Please note that failure in compulsory and designated courses may result in repeating a year. A member of the Basic Education Committee will help you with general and specialized subjects in your first and second year, and a member of the Academic Affairs Committee will help you with specialized subjects in your third and fourth year. Students with excellent grades are exempted from taking the written examination for the graduate school entrance examination.

Specialized courses are offered in Environmental Chemistry, Energy Chemistry, Physical Materials Chemistry, Nanotechnology, Organic Materials Chemistry, Polymer ・ Biological Chemistry, Analytical Chemistry, and Chemical Engineering. Furthermore, there are common subjects such as English for Applied Chemistry, Safety Chemistry, Chemical Technology Economics, Ethics in Engineering, as well as a Seminar on Applied Chemistry for Environment and Applied Chemistry for Environment Experiments, which all students take, and Special Research ・ Seminar for 4th year students. The Advanced Seminar in Applied Chemistry for Environment offers PBL-type lectures in small groups in order to develop a proactive learning approach. Please read the syllabus carefully, as the order of courses to be taken in some fields is fixed. Students are advised to follow the standard course model and timetable carefully to ensure a good balance between the various disciplines. For more information, please refer to the course guide and syllabus.

学士（Bachelor）

	1年次（B1）	2年次（B2）	3年次（B3）	4年次（B4）
全学共通科目	基礎科目群 ・基礎ゼミナール ・実践英語Ⅰ ・実践英語Ⅱ ・情報リテラシー実践Ⅰ ・情報リテラシー実践Ⅱ 理系共通基礎科目群 ・一般化学Ⅰ, Ⅱ ・微分積分Ⅰ, Ⅱ ・線形代数Ⅰ, Ⅱ ・確率統計 ・物理通論Ⅰ, Ⅱ ・生物学概説ⅠA ・物理学実験第1 （・一般生物学Ⅰ） （・一般生物学Ⅱ） 教養科目群・基盤科目・キャリア教育科目 ・環境調和化学入門 ・先端生命化学入門 その他の科目 ・エネルギー化学入門 ・現場体験型インターンシップ		・必修科目 ・（指）指定科目（履修年次が指定されている科目） ・選択必修科目 ・推奨科目（選択必修科目や自由科目の中で、学科で履修を奨めている科目） ・選択科目（自由選択科目の科目選択の際に、参考として挙げている科目）	
専門教育科目	基礎専門教育科目群・コース専門教育科目群A ・（指）環境応用化学基礎ゼミナール 1A, 1B, 2A, 2B	・（指）応用化学英語1 学生実験 ・（指）環境応用化学基礎実験 A, B	・（指）応用化学英語2 ・（指）環境応用化学アドバンスゼミナール A, B ・（指）環境応用化学実験第 1A, 1B ・（指）環境応用化学実験第 2A, 2B	研究・研究室ゼミナール
	環境化学系	・環境化学	・Green Chemistry	
	エネルギー化学系	・エネルギー環境化学	・Introduction to Energy Chemistry ・エネルギー材料化学	
	材料物理化学系 ・物質量子化学	・材料熱力学1 ・材料物理化学 ・基礎物理化学	・材料熱力学2 ・界面物理化学	・（指）環境応用化学特別研究Ⅰ, Ⅱ
	無機材料化学・ナノテク系	・無機物質化学 1, 2	・電子材料化学 ・ナノマテリアル化学	
	有機材料化学系	・有機物質化学 1, 2	・物理有機化学 ・有機マテリアル化学	・（指）環境応用化学ゼミナールⅠ, Ⅱ
	高分子・生命化学系	・生命化学 1, 2	・バイオマテリアル化学 ・高分子マテリアル化学	
	分析化学系	・環境分析化学 1, 2	・機器分析化学 1, 2	
	化学工学系	・化学システム工学	・材料プロセス工学	
	コース専門教育科目群B	・安全化学	・化学技術経済論 ・工学倫理 ・インターンシップ ・学外実習	

Graduation requirements and Degrees ・ Qualifications offered

Students graduating from the Department of Applied Chemistry for Environment will be awarded the degree of Bachelor of Engineering. A minimum of 130 credits in the prescribed courses is required to obtain a degree (graduation). For details of the requirements for a bachelor's degree (graduation requirements), please refer to the "Course Guide".

In addition, upon graduation, students can become qualified as "the person in charge of handling poisonous and deleterious substances" and "specified high-pressure gas handling supervisor", as well as qualified to take the "Hazardous Materials Engineer (1st class)", "Chemical Analysis Technician (2nd level)" and "Fire Defence Equipment Officer (1st class)" examinations (some of them can be taken while studying).

Graduate School - Graduate School of Urban Environmental Sciences curriculum

Master Degree

In the Faculty of Applied Chemistry for Environment, about 50% of lectures are given in English, and there are also courses taught in English by foreign faculty members, creating a curriculum that is in line with globalization. The curriculum is based on a quarter system to allow students to study abroad for a short period of time, and admission in October and graduation in September are also available for students who have studied abroad or for international students.

In addition, each student is assigned to a laboratory in the Department of Applied Chemistry for Environment, where they engage in their own research under the supervision of a supervisor and write a graduation thesis (master's thesis). Degree holders are expected to play an active role in many fields as researchers and engineers with a high level of professional knowledge and research skills.

Main events (in case of autumn admission, the following events take place six months later)

Course Plan: in April of the first academic year, students submit a two-year course plan to their supervisor for further guidance.

Midterm Presentation: in December of the first academic year, students present their midterm report in the form of a poster presentation.

Master's thesis presentation: in February of the second academic year, students present the results of their two-year research and submit their thesis.

Completion requirements

In order to obtain a Master Degree, students must acquire a minimum of 30 credits in the prescribed course subjects, submit a thesis, and pass a final examination (presentation). However, there is a system for reducing the period to complete the master's degree, and students who are recognized as especially outstanding in their research achievements may complete the degree in a minimum period of one year.

PhD Degree

In the PhD course, students are assigned to a laboratory in the Department of Applied Chemistry for Environment, where they work on their own research under a supervisor and write a thesis (doctoral thesis). PhD degree graduates are expected to be experts with the ability to plan original research, and to supervise and oversee research and development.

Main events (similar to the Master's course, autumn admission is also available)

Presentation of research plan: in the first semester of the first year, the research content and plan for the doctoral course are presented.

Midterm Presentation: in the second semester of the second year, the progress of the research will be presented.

Public hearing: in the second half of the third year, a presentation is given on the content and results of the conducted research in the doctoral course, and a Q&A session is held.

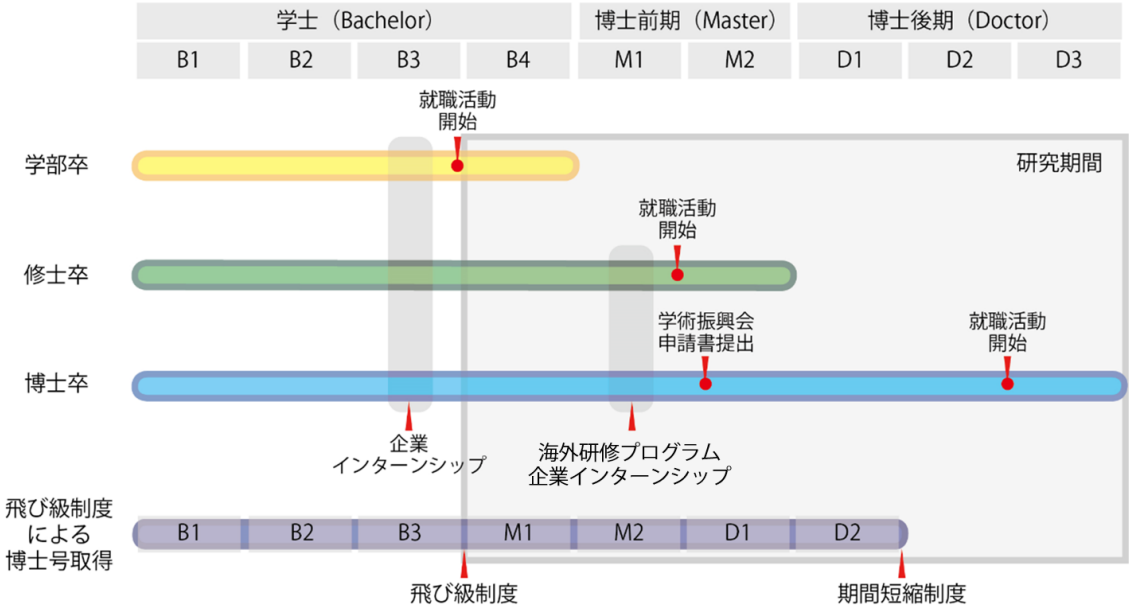
Completion requirements

To obtain a PhD degree, candidates must acquire a minimum of 20 credits in the prescribed course subjects, submit a thesis, and pass a final examination (public hearing). In addition, the applicant must have an article published or accepted for publication in a recognized scientific journal with a review refereeing panel, related to the thesis topic. However, there is a system for reducing the period to complete the degree, and candidates who are recognized as especially outstanding in their research achievements may complete the doctoral course in less than two years (the total duration for both the master's and doctoral courses should be at least three years). For students who are working, or who are unable to complete their studies within the standard course period due to childbirth, childcare or long-term healthcare reasons, there is a long-term course system.

Degrees that can be acquired

Upon completion of the course in Applied Chemistry for Environment, students are awarded the degree of "Master (in Engineering)" or "Doctor (in Engineering)".

University ・ Graduate life and various events ・ Support system



The date of the event varies from company to company, but it is usually held for third-year undergraduates (B3) and first-year master's students (M1). For students who are planning to go on to postgraduate study and who wish to participate in a company internship, we recommend that they do so in B3 rather than M1. The internship will enable students to think about their goals for the future at an early stage and to concentrate on their postgraduate lectures and research.

Global education

Many postgraduate students participate in international conferences to present their research, which requires practical English skills for presentations and discussions. In addition, in a modern, globalized world, the ability to disseminate information, communicate and lead on an international scale is required.

During the summer and spring holidays, the language Centers of foreign universities in the USA, UK, Canada, Australia, Thailand, Malaysia, Taiwan (Chinese), Austria (German), France (French), etc. offer "short-term language courses" of 3 to 4 weeks. For more information, please refer to the website of our University's International Center (graduate students are also welcome).

“Overseas Training Program” for graduate students is held every November for about a week, visiting companies and universities in the United States and Southeast Asia to give presentations in English. This is a great opportunity for those who aim to enter a doctoral course or to be active in the international community in the future.

International Exchange and Research Study Abroad: our University encourages students to study through the Exchange Program for six months or up to one year at an overseas partner university during their undergraduate studies without taking a leave of absence (studying abroad is compulsory for students with an international minor), and the Financial Support Program for Exchange Students, which allows students to study at an overseas research institution for a few months or up to six months after being assigned to a laboratory (from the fourth year of undergraduate studies to graduate school graduation). At present, we have exchange agreements with more than 50 foreign universities, and students studying at these universities are exempt from paying tuition fees, and are provided with accommodation and support for their expenses during their stay. In order to become an exchange student, students are required to score above a certain level in an examination such as TOEFL or IELTS (not required for short-term English language training). Applications for exchange program are accepted twice a year, in spring and autumn.

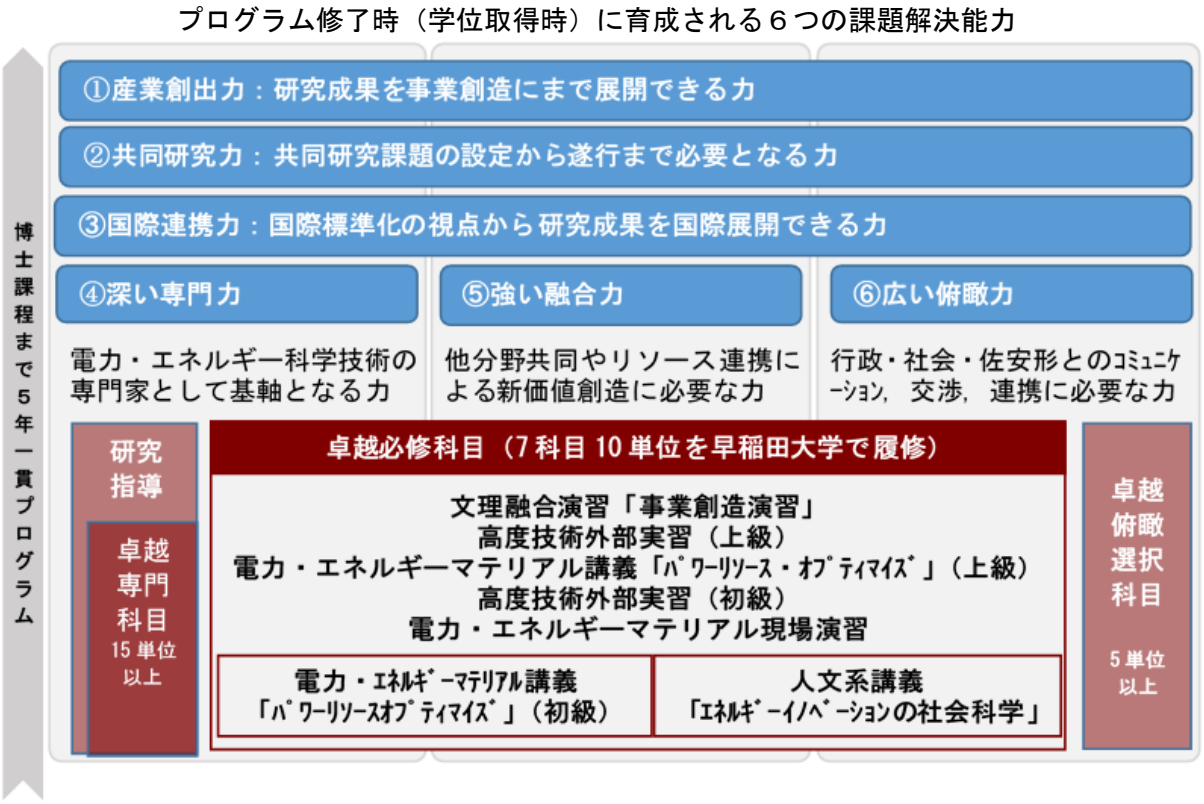
Scholarship System

At our graduate school, there is a scholarship system (graduate school research incentive scholarship) that provides annual payments of 1.8 million yen (no repayment required) to excellent graduate students who are motivated to enter the doctoral course, about 8 applicants are selected each year from among all prospective students. In addition to the scholarships offered by the Japan Student Services Organization (JASSO), which provides a monthly research grant of 200,000 yen and an annual research grant of up to 1.5 million yen (in FY2019) to postgraduate students in the doctoral course, they are also eligible to apply for a JSPS Research Fellowship, but achievements (presentations at academic conferences and submission of papers) are also important, so it is necessary to proceed with research systematically. As mentioned above, the academic environment of the doctoral course is much better than in the past, which is why it is recommended to enter the doctoral course if you want to work as a researcher in the future.

2018 Ministry of Education, Culture, Sports, Science and Technology (MEXT) WISE Program (Doctoral Program for World-leading Innovative & Smart Education) **By implementing the "Power Energy Professionals" training program (PEP)**

Developing advanced PhD researchers to promote the creation of new industries in the power and energy sectors

Ministry of Education, Culture, Sports, Science and Technology (MEXT) launched the WISE Program (Doctoral Program for World-leading Innovative & Smart Education), which aims to establish a five-year doctoral degree program that combines the world's highest level of education and research capabilities through systematic collaboration with domestic and international (https://www.jsps.go.jp/j-takuetsu-pro/). The Department of Applied Chemistry for Environment's advanced research and educational capabilities in energy and material chemistry-related technologies are combined with the collaboration of partner universities (13 in Japan and 6 overseas) and partner institutions (domestic and overseas research institutes and energy-related companies such as electricity, oil, and gas companies) to provide students with in-depth expertise in electric power and energy engineering that matches the needs of the times. The Power Energy Professionals training program (PEP) is a five-year integrated doctoral program, designed to nurture world-class doctoral students with deep expertise in power and energy engineering that meets the needs of the times, as well as the broad overview and fusion of the humanities and sciences necessary to design and create a next-generation energy system that will revolutionize society, including the economy, policies and systems, and the ability to collaborate internationally, conduct joint research and create new industries.



Comments from course attendees

Yuri Nara (Tokyo Metropolitan University & Graduate School of Urban Environmental Sciences, Faculty of Applied Chemistry for Environment, 1st year Master's Degree Program)

I am participating in the Power Energy Professionals training program (PEP), which focuses on the power and energy sector. The aim of this program is to develop human resources who can take a broad view of the entire industry, from the "production" in the energy materials field to the "consumption" in the power systems field, and who can proactively develop next-generation electrical and energy systems for society. In the future, I would like to try working not only in academia or companies, also try creating my own business, or be active in various fields of society, such as international organizations or governmental agencies. I feel that it is very beneficial for me to gain perspectives that will contribute to my future career, such as interdisciplinary fields, environmental economics, social systems, law, and business models under the guidance of teachers and consulting faculty from different fields

in this program. There are also lectures where you can interact and exchange opinions with students majoring in other fields at other universities, which is both stimulating and meaningful. Furthermore, I feel that one of the benefits of the program is not only the acquisition of a wide range of knowledge, but also the opportunity to promote my own research activities. Specifically, the education and research guidance from science and engineering teachers from 13 universities, RA expenses and various scholarships allow students to concentrate on their research activities. Currently, I am conducting research on the theme of "hydrogen production by water electrolysis using functional polymers". In the future, I would like to continue to search for new methods, challenge new research contents, and conduct research that can create a new energy industry that meets the needs of the times.

Faculty ・ Department facilities and common equipment

The main facilities for our departments are located in Building 9 on the Minami-Osawa Campus. Including common facilities for all students (lecture rooms, student laboratories, seminar/meeting rooms, common equipment, etc.), facilities operated jointly with other faculties, support facilities (administrative offices, medical offices), and laboratories belonging to the department. Each laboratory has its own facilities and carries out advanced research.

In order to detect and analyse microscopic phenomena with a high degree of precision and in a short period of time, the department has a large collection of analytical instruments and equipment in a common-use space. These instruments are used for research projects and postgraduate studies. In addition to this equipment common to all faculties and departments, we have installed large-scale equipment and high-performance analytical equipment at university-wide research facilities and jointly operated them to perform more advanced measurements and analyses. The table below shows the equipment that is closely related to this department and faculty among the common equipment that is shared with other departments. In addition, there is equipment in the RI Research Building that can handle radioactive materials.

Equipment name	Apparatus name	Functions
Scanning Electron Microscope (SEM)	JEOL JSM-7500	morphological observation ・ elemental analysis
X-ray Diffractometer (XRD)	Rigaku SmartLab Rigaku MiniFlex600	analysis of crystal structures and regular structures
Single Crystal X-ray Diffraction (SC-XRD)	Bruker D8 Venture	analysis of the atomic arrangement of crystals
X-ray Photoelectron Spectroscopy (XPS)	JEOL JPS9010MX	analysis of the composition and state of solid surfaces
Nuclear Magnetic Resonance System (NMR)	JEOL ECS-300	determination of molecular structure
Solid State Nuclear Magnetic Resonance System (NMR)	JEOL ECA-400	analysis of solid structures
Mass Spectrometer (MS)	JEOL JMS-700	measurement of molecular weight
Elemental Analyzer (EA)	Perkin Elmer 2400 CHN	confirmation of molecular composition ・ evaluation of purity
Inductively Coupled Plasma-optical Emission Spectrometer (ICP)	SPECTRO CIROS-120	qualitative ・ quantitative analysis of compositional elements
Atomic Absorption Spectrometer (AAS)	Shimadzu AA7000	qualitative ・ quantitative analysis of compositional elements
Differential Scanning Calorimeter (DSC)	Hitachi DSC-7000X Shimadzu DSC-60	analysis of temperature changes in structures
Simultaneous Differential Thermogravimetric Analyzer (TG-DTA)	Hitachi STA-7300	analysis of temperature changes in structures
Zeta-potential・ Particle size Analyzer	Otsuka Electronics ELS Z	measurement of surface electrical properties ・ particle size
Laser Raman Spectrometer	JASCO NRS-4100	analysis of chemical bonds and functional groups

University Offices and Facilities

Academic Affairs Division (http://www.kisokyo.tmu.ac.jp/kyomu/)

The office is located in Building 1 and deals with all aspects of academic affairs at the university, in Information on lecture cancellations and student call-ins is posted on the bulletin board in front of the counter and is also available on a dedicated website (https://jjh.tmu.ac.jp/, for smartphone version https://jjh.tmu.ac.jp/campusweb/campussmart.do). These pages are also used for course applications and checking academic transcripts. The Academic Affairs Division for specialized courses is located on the 2nd floor between Building 8 and Building 9, near Building 9.

Student Support Center (https://gs.tmu.ac.jp/)

This office handles all aspects of student life, including applications for scholarships and tuition fee exemptions, use of dormitories and boarding houses, classrooms, auditoriums, the school building (Building 7) and various sports facilities, and assistance in finding employment. These are located in Building 1 (Student Affairs) and Building 7 (Employment Office). There is also a student counselling room where students can consult with a counsellor and a medical office (Health Support Center). Students can apply for insurance (Student Education and Research Accident Insurance). Please also refer to the booklet "CAMPUS".

Library and Information Center Main Building (https://www.lib.tmu.ac.jp/)

The library contains approximately 600,000 volumes and is open for public use from 9.00 am to 10.00 pm on weekdays and from 9.00 am to 7.00 pm on Saturdays and during the spring, summer, and winter holidays. Students can borrow up to 10 books for a period of two weeks. The library also has laptops available for borrowing and use in the library. If you apply for the use of My Library at the counter, you can reserve books and order materials via the Internet. There are also branch libraries at the Hino and Arakawa campuses, both of which can be accessed as well.

IT facilities (https://www.comp.tmu.ac.jp/tmuner/)

There are computer rooms in Building 1 and the Information Processing Facility, which are open outside of class hours. Laptop computers can also be borrowed from the AV Building and the Library and Information Center. User accounts are issued at the time of enrolment, but students are required to take an introductory course in Practical Information Literacy I.

Tokyo Metropolitan University Coop (Cooperative Union) (https://www.univcoop.jp/tmu/)

The cafeteria and purchasing department are located in the Center of the Minami-Osawa campus and are open from lunchtime to night-time during the school term (on Saturdays and during holidays open only for lunch). In addition to selling textbooks, books, stationery, lunch boxes, etc., students can make travel arrangements, purchase insurance (Student Mutual Aid), and apply for driving licenses, TOEIC, TOEFL, and other examinations. If you become a member of the Co-op, you can buy books at a 10% discount. In addition, students can use the internet to purchase books, CDs, and DVDs.

International Center (http://www.ic.tmu.ac.jp) ・ International House

This is the contact point for the university's international exchange services and is located in the International House. It provides support for exchange and English language training abroad, as well as advice on study abroad. International conferences and various academic meetings are held in the main conference room and the middle conference room of the International House. The Department of Applied Chemistry for Environment Master's thesis presentation and special research presentations are usually held in the Large Conference Room. There is also a French restaurant open for lunch.

Cafeteria building (Tom's Dining and shop)

This convenience store is located to the south-east of Building 9. In addition to selling lunch boxes, there is a cafeteria open for business, and its proximity to Buildings 11 and 12 makes it a convenient place for students to eat and rest as they attend more specialized lectures.

Project Research Building and Frontier Research Building

As facilities for advanced and extensive research, the Project Building (next to the Sports Square) was completed in 2009 and the Frontier Research Building (next to the East Gate) in 2014. There are also laboratories in the Department of Applied Chemistry for Environment that are used for this purpose.

Sports facilities

On the east side of the Minami-Osawa campus there are various sports facilities, including a baseball field, a playing field, a gymnasium, a training room, a heated indoor swimming pool, tennis courts and a multi-purpose sports ground (futsal and softball courts). These facilities are used for physical education classes (physical exercises), clubs and circles activities, as well as for sports competitions organized by students of the Department of Applied Chemistry for Environment. The tennis courts and swimming pool are also open to the public at specified hours. For more information, please contact the Student Support Center.

Introduction of the laboratories

Advanced Functional Materials　KAWAKAMI Laboratory

Professor	Associate professor	Associate professor
Hiroyoshi KAWAKAMI	Kiyoshi SATO	Masafumi YAMATO

Associate professor	Research assistant professor
Manabu TANAKA	Toyotaka NAKAE

Research outline

In order for humanity to achieve sustainable development in the future, it is important to create materials that take into account, solve environmental and energy problems. We are conducting "research on the basics and applications of materials (environmental and energy materials)" that enable the implementation of sustainable technology and nanotechnology. Meanwhile, bioengineering, which links chemistry, biology, medical science, and engineering, is a research field that will play a central role in the future of life sciences and environmental sciences. Our laboratory also carries out research on the “fundamentals and applications of materials (biomaterials)”, which are the most important factors in the development of bioengineering.

In our laboratory, each of us is working on a research theme, rigorously investigating the methodology, originality, and purpose of our research in order to create new environmental and energy materials, biomaterials based on polymer chemistry, organic chemistry, and molecular biology. Students learn through daily research activities and presentations at conferences, international meetings, and strive to develop their skills for the future and to contribute to the environment, energy, medicine, and welfare of mankind.

Main research subjects

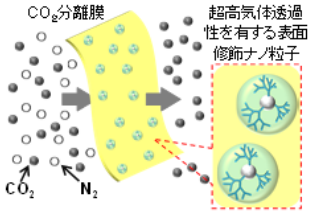
- Functional Polymer Separation Membrane (solutions to environmental problems such as global warming based on the creation of highly functional separation materials)
- Polymer Electrolyte Membrane (development of high ionic conductivity materials for fuel cells, secondary batteries, electrolytic synthesis)
- Nanofiber (properties, higher-order structure control and application of single nanofiber and nanofiber structures)
- Supramolecular systems (development of supramolecular catalysts for carbon dioxide fixation, hydrogen production, fuel cells)
- High-order structure control for functional expression (development of orientation, concentration and position control methods using magnetic science)
- Epigenetics engineering (drug delivery systems, cell differentiation by epigenetics engineering)
- Biomimetics (the control of free radicals in living organisms by the synthesis of artificial enzymes that exceed the biological enzymes)
- Cellular engineering (cell-based regenerative medicine, stem cell therapy, immune cell therapy, artificial organs, Alzheimer's treatment)

Research keywords

Nanofiber Engineering, Carbon Dioxide Separation Membrane, Direct Air Capture (DAC), Fuel Cell, Lithium Ion Battery, Air Battery, Water Electrolysis, Catalyst, Magnetic Science, Epigenetics Engineering, Control of Free Radicals in Living Organisms, Regenerative Medicine, Aging Science, Drug Delivery

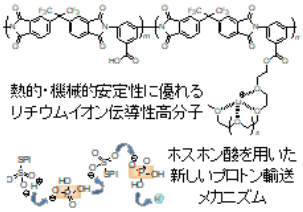
機能性分離膜

（気体分離、Direct Air Capture (DAC)、精密多孔、ナノ濾過、ナノ粒子複合膜、ナノファイバー複合膜 等）



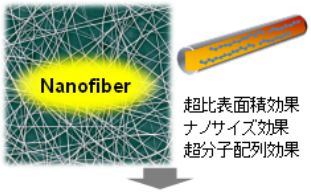
固体高分子電解質膜

（燃料電池、リチウムイオン二次電池、空気電池、水電解、新規高分子合成、相分離 等）



機能性ナノファイバー

（電気伝導性、イオン伝導性、触媒応用、単体物性評価、特殊構造形成 等）

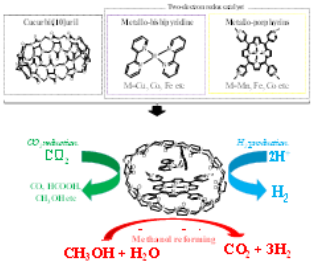


超比表面積効果
ナノサイズ効果
超分子配列効果

電気的特性、光学特性、吸着特性、分子認識、物質輸送特性

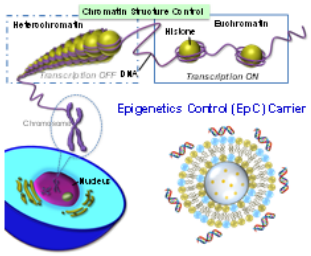
超分子システム

（触媒・・・二酸化炭素固定化、水素生成、燃料電池用触媒 等）



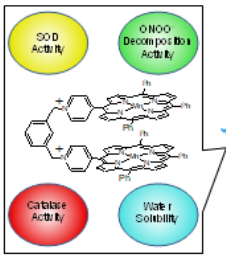
エピジェネティクス工学

（細胞分化治療、DDS、クロマチン構造制御、老化制御、癌治療 等）



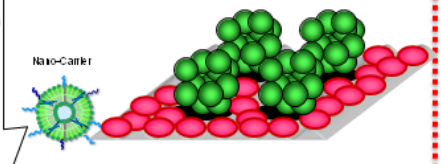
生体内フリーラジカル制御

（人工酵素、抗酸化剤、ミトコンドリア指向性、COPD治療、糖尿病治療　等）



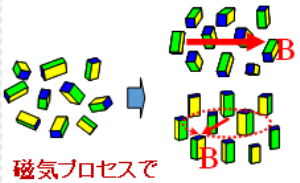
細胞工学

（再生医療、幹細胞治療、免疫細胞治療、人工臓器、アルツハイマー治療 等）



高性能異方性材料

（光学材料，放熱材料，PTC素子，ナノコンポジットゲル，バイオセンサー 等）



磁気プロセスで
材料特性を最大限引き出す

Advanced Functional Materials　ASAYAMA Laboratory

Associate professor

Shoichiro ASAYAMA

Research outline

We are developing biomaterials (bio-functional materials) that maintain human health and improve the Quality of Life (QOL). In our research on biomaterials, we are mainly working to establish Drug Delivery Systems (DDS) for advanced and homogeneous medicine. As DDS materials, which are water-soluble (liquid phase) biomaterials, we are synthesizing new carriers for biopharmaceuticals and other drugs (nucleic acids, proteins, bioactive zincs) to adapt them to treat diseases for which there is no cure yet. Moreover, we develop novel biomaterials, such as polymers that have a curative therapeutic effect (intelligent materials that change their structure and function in response to external stimuli) or solid-phase surface modification to ensure long-term stability in the body (biocompatible materials with high affinity to blood and biological tissue). Therefore, our laboratory promotes interdisciplinary research in chemistry and life sciences, contributing to the medical care and welfare (living environment) of mankind through research that combines biochemistry, organic chemistry, polymer chemistry, molecular and cellular biology, pharmacy, and medicine.

Main research subjects

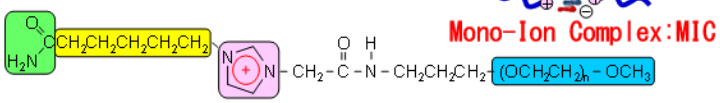
- Nucleic Acid (Plasmid DNA, various RNAs) Delivery System:
  Delivery of microgene condensates to unexplored spaces in the body → Treatment of genetic diseases and oligometastatic intractable cancers
- Bioactive Zinc （Zn^{2+}） Delivery System:
  Remote control of blood concentration of hypoglycemic hormones → Revolutionary treatment of diabetes and intelligent materials
- Biopharmaceutical delivery:
  PEG modification of proteins by the simplest non-covalent linkage → treatment of chronic and rare diseases
- Implantable biomaterials:
  Construction of biocompatible surfaces using end-modified cholesterol PEG → Biocompatible materials and medical devices

Research keywords

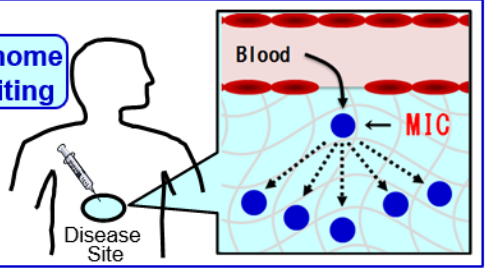
Biomaterials (bio-functional materials), Drug Delivery System (DDS), Carrier Materials (polymers), Genes (plasmid DNA), Bioactive Zn^{2+}, Biopharmaceuticals, Biocompatibility, Biomolecular Engineering, Medicine and Welfare

Gene Delivery System

Delivery to Unexplored Space by pDNA MIC

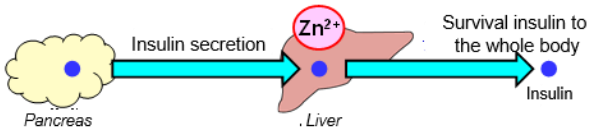


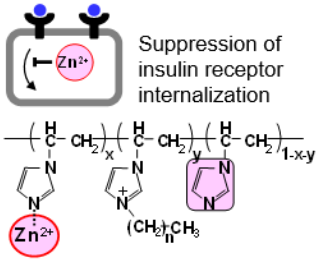
Genome Editing



Zn^{2+} Delivery System

Remote Control of Hypoglycemic Hormone



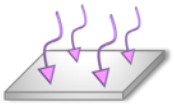


Suppression of insulin receptor internalization

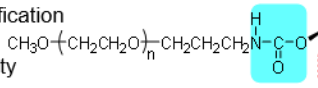
Metallomics

Protein Delivery & Solid-Phase Biomaterials

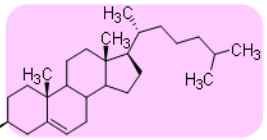
Cholesterol End-Modified PEG for Functional Biomaterial



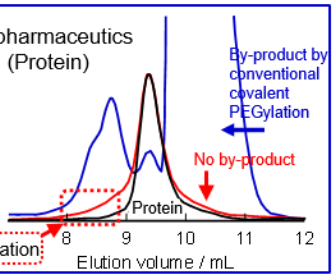
Surface modification with biocompatibility



Biopharmaceutics (Protein)



Most simple non-covalent PEGylation



Advanced Material Design　KUBO Laboratory

Professor
Yuji KUBO

Assistant professor
Masato ITO

Research outline

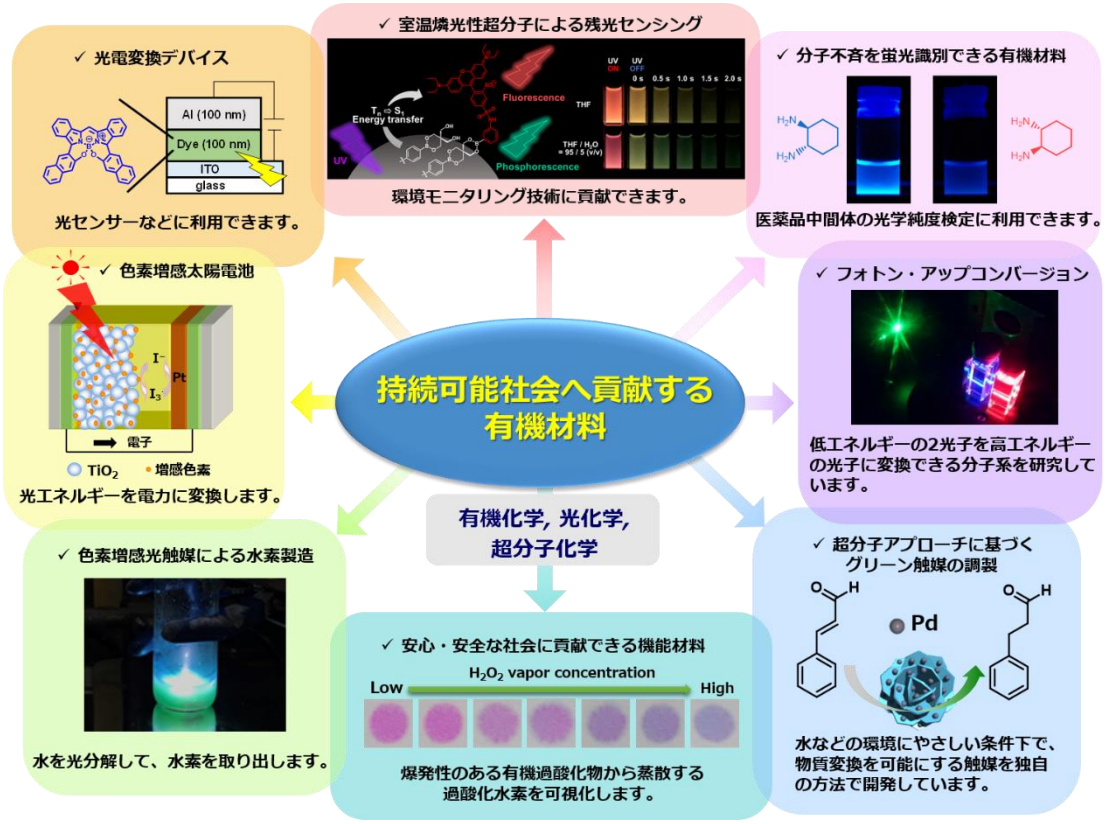
One of the main goals of organic chemistry is to construct new principles of "manufacturing" by combining atoms and molecules as desired, and to create unique molecular functions according to these methodologies. In our laboratory, we aim to develop organic materials that can contribute to a sustainable society, based on organic chemistry, supramolecular chemistry (e.g., self-organization) as a method of hierarchical construction of materials, and the creation of new materials by incorporating photochemistry in the development of functionalization. In particular, we are working day and night to disseminate information to the world through proposals for photoelectric conversion devices, solar cells, and chemosensors that can be applied to hydrogen production and environmental protection technologies for the effective use of renewable energy, as well as supramolecular materials with environmentally friendly material conversion functions. We are also actively promoting international exchange through our research.

Main research subjects

- Synthesis of organic dyes for application in photoelectric conversion devices
- Construction of photon up-conversion and exciton splitting systems for efficient use of light energy
- Synthesis and evaluation of dye-sensitized organic solar cells (International collaboration)
- Synthesis of dye-sensitized photocatalysts for hydrogen production
- Production of organic supramolecular materials with room-temperature phosphorescence
- Synthesis and functionalization of solid-state luminescent conjugated molecules
- Creation of multiple stimuli-responsive molecules for use as sensor materials
- Development of functional materials that contribute to a safe and secure society

Research keywords

Synthetic Organic Chemistry, π-conjugated molecules, dyes, Supramolecule, Self-organization, Room Temperature Phosphorescence, Solid State Luminescence, Hydrogen Production, Organic Solar Cells, Chemosensor


✓ 光電変換デバイス
Al (100 nm)
Dye (100 nm)
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glass
光センサーなどに利用できます。
✓ 室温燐光性超分子による残光センシング
Fluorescence
Phosphorescence
THF
環境モニタリング技術に貢献できます。
✓ 分子不斉を蛍光識別できる有機材料
医薬品中間体の光学純度検定に利用できます。
✓ 色素増感太陽電池
電子
増感色素
光エネルギーを電力に変換します。
持続可能社会へ貢献する
有機材料
✓ フォトン・アップコンバージョン
低エネルギーの2光子を高エネルギーの光子に変換できる分子系を研究しています。
有機化学, 光化学,
超分子化学
✓ 色素増感光触媒による水素製造
水を光分解して、水素を取り出します。
✓ 安心・安全な社会に貢献できる機能材料
Low
High
爆発性のある有機過酸化物から蒸散する
過酸化水素を可視化します。
✓ 超分子アプローチに基づく
グリーン触媒の調製
Pd
水などの環境にやさしい条件下で、
物質変換を可能にする触媒を独自
の方法で開発しています。

Advanced Material Design　　SETAKA Laboratory

Professor

Wataru SETAKA

Assistant professor

Yusuke INAGAKI

Research outline

Fine chemicals, such as those used in pharmaceuticals and liquid crystals, are applied chemical materials that enrich our lives in modern society. Many of these are organic molecular materials that exhibit a high degree of functionality even in small quantities. Organic molecules are composed mainly of carbon, hydrogen, nitrogen, and oxygen atoms, and there is an infinite degree of combination of these elements, making it possible to design and synthesize molecules with diverse structures. We are developing new functionalities of organosilicon molecules by incorporating silicon atoms, an element with a low environmental impact, into them. In other words, through research into the design, synthesis, and functional evaluation of organosilicon molecules with new structures, we are working to establish the basic principles for the development of new fine chemicals.

Main research subjects

- Synthesis of "molecular gyrocomas" in which a benzene ring rotates in a crystal and crystal properties associated with the rotational motion

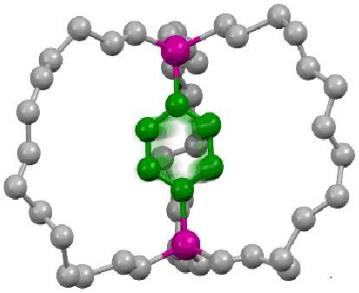
  Cage compounds with cross-linked benzene rings are expected to have similar functionalities to gyrocomas because the benzene rings can rotate in one axis. The π-electron system of the rotor has been designed to develop solid-state functionalities such as solid-state luminescence, dielectric properties, and birefringence.
- Functional applications of structural chemistry in flexible cage-type silacycloalkanes

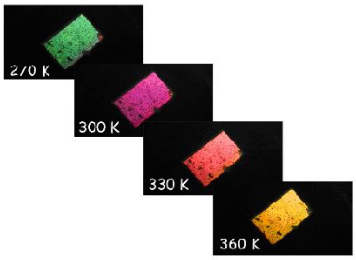
  Cycloalkanes with a flexible structure exhibit a unique structural topology chemistry called in-/out-isomer isomeric transformation. Our research aims to investigate the basis of this structural chemistry and its application to functional applications.
- Synthesis and dynamic molecular conformation control of silicon-based rotaxanes

  Molecules in which an axial molecule is stuck in a macrocyclic molecule are known as rotaxanes. We are studying the structure and properties of the axle molecule as the cyclic molecule rapidly shuttles over the axle molecule.

Research keywords

Molecular Machines, Molecular Motion, Functional Organic Materials, Structural Organic Chemistry, Main Group Element Chemistry, X-ray Crystallography

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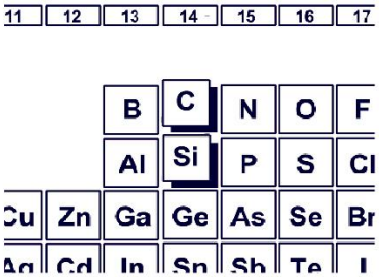
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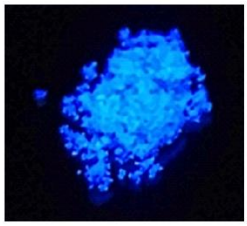
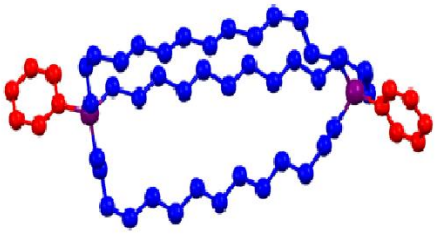
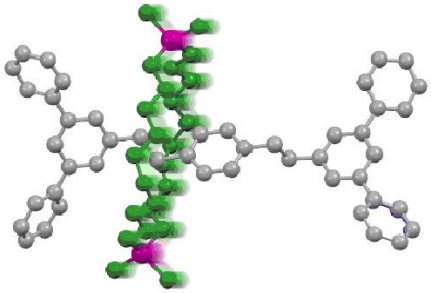






Energy Devices　KANAMURA Laboratory

Professor

Kiyoshi KANAMURA

Assistant professor

Hirokazu MUNAKATA

Research assistant professor　Research assistant professor

Yukihiro NAKABAYASHI　Eric Jianfeng CHENG

Research outline

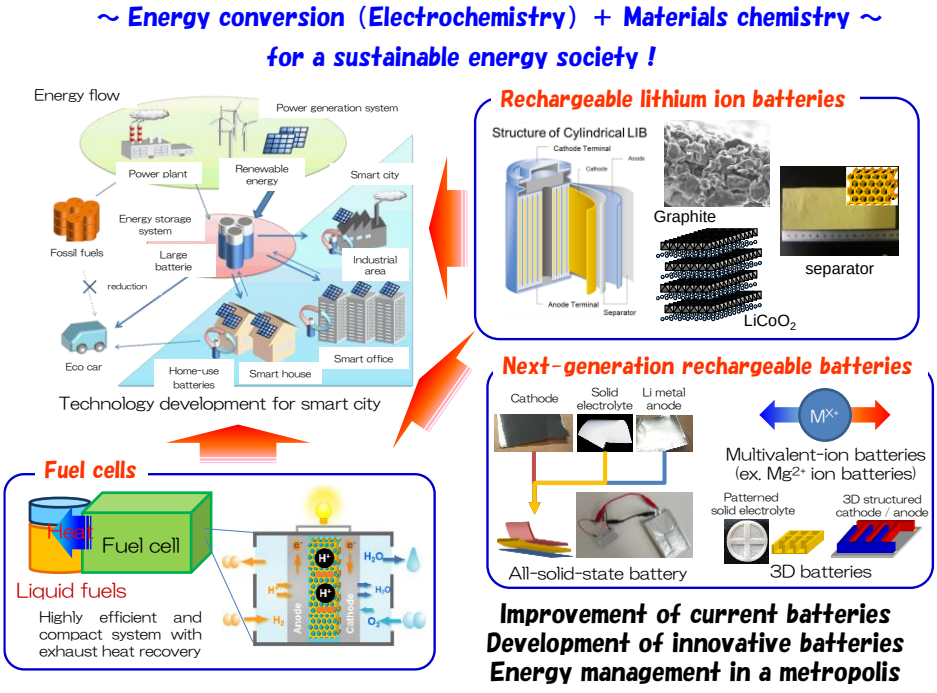
We conduct research on energy functional materials based on inorganic materials chemistry and applied electrochemistry. In particular, we focus on the development of materials and systems for electrochemical energy conversion devices such as fuel cells and rechargeable batteries, with the aim of building a sustainable energy society and a low-carbon society. Our research focuses on energy devices that can contribute to carbon dioxide reduction, not only by improving the performance of current batteries, but also by developing innovative batteries based on polymers, ceramics and carbon materials with artificially ordered structures, and all-solid-state batteries with excellent safety characteristics.

Main research subjects

- Research on next-generation fuel cells (analysis of electrode reaction processes, research and development of new electrolytes, electrode catalysts and heat management)
- Research on lithium-ion batteries (analysis of electrode reaction processes, research and development of new active materials, electrolyte materials, separators and other components)
- Fundamental and applied research on next-generation rechargeable batteries (all-solid-state batteries, magnesium batteries, lithium metal batteries)
- Synthesis and high functionalization of ceramics, polymers, and metallic materials for battery applications

Research keywords

Batteries, Fuel Cells, Electrochemistry, Inorganic Materials Chemistry, Structured Materials, Energy Conversion Chemistry



Energy Devices　KAJIHARA Laboratory

Professor
Koichi KAJIHARA

Associate professor
Takashi TAKEI

Associate professor
Takashi YANAGISHITA

Assistant Professor
Masanao ISHIJIMA

Research outline

Solid oxides such as ceramics and glass have long been familiar to us as stoneware, jewelry, and porcelain, but the boom in new glass and fine ceramics in the 1980s led to the development of many new materials such as optical fibers, ceramic turbochargers, high temperature superconducting materials and neodymium magnets, which have also attracted attention as advanced materials. Our research focuses on these inorganic solid materials and materials for opto- and electronic functional materials that support sustainable urban environments and low-carbon societies. Our research focuses on both basic research, such as the development of low environmental impact synthesis methods, structural and physical property analysis, and the search for new materials, and applied research, such as device development. We also use electrochemical reactions to develop new inorganic materials and to control the nanometer-scale geometry of materials. Based on these results, we are developing a variety of devices with entirely new functions.

Main research subjects

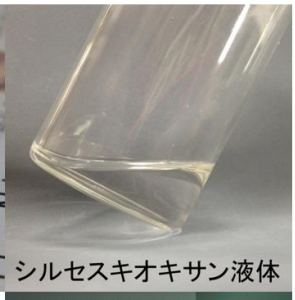
- Synthesis of inorganic solid materials with low environmental impact
- Functionalization of ceramics, glasses, and silicon-based organic-inorganic hybrids
- Physical properties of silica glass and its application to rare earth-doped fluorescent and luminescent materials
- High efficiency energy conversion using inorganic solid materials
- Research on formation of nanostructures by self-organizing processes
- Research on precision separation
- Research on energy devices (nanoscale shape control of materials for secondary battery electrodes, electrolytic capacitors)
- Research on optical devices (enhancement of the photoelectric field by metal nanoparticles, highly efficient formation of surfaces that suppress reflection)

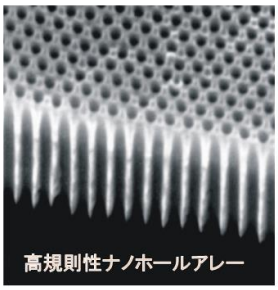
Research keywords

Inorganic Solid State Chemistry, Ceramics, Glass, Silica, Luminescence, Transparency, Electronic and Ionic Conductivity, Low Environmental Impact Synthesis, High Efficiency Energy Conversion, Porous Alumina, Electrochemistry, Self-organization, Nanoimprinting, Batteries, Solar Cells

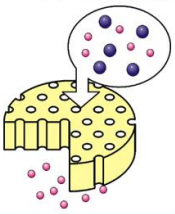
セラミックス・ガラスを中心とした
光・電子機能性無機系固体材料の開発と応用

電気化学プロセスにもとづくナノ規則構造の
形成と機能性デバイス作製への応用

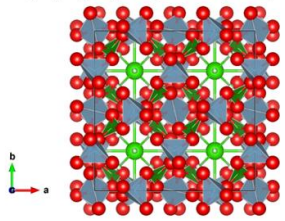




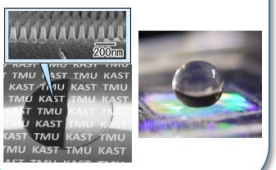
精密分離フィルター
ウイルス，生体蛋白分離



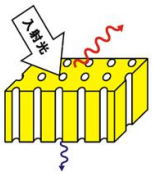
新規リチウムボラサイト
$Li_4B_4M_3O_{12}Cl$ (M = Al, Ga)



バイオミメティクス
反射防止，超撥水・撥油



各種機能デバイス
光学素子，Liイオン電池



Environmental Molecular Chemistry　TAKAGI Laboratory

Professor
Shinsuke TAKAGI
Professor
Hiroshi TACHIBANA
(University Education Center)
Assistant professor
Tetsuya SHIMADA
Associate professor
Tamao ISHIDA

Research outline

In our laboratory, we are trying to control the flow of electrons and energy by arranging molecules as desired under the slogan of "learning naturally and exceeding nature". Arranging molecules is one of the ultimate nanotechnology, and it enables the development of nanomaterials and the construction of elaborate chemical reaction systems, which was not possible with conventional chemistry. Our research focuses on the development of functional dye materials and artificial photosynthesis models using our unique molecular arrangement technology. The photosynthetic reaction is an ideal energy conversion reaction that makes clever use of molecular arrangement, and if artificial photosynthesis can be realized, it would contribute greatly to solving environmental and energy problems. On the other hand, ultrafast time-resolved spectroscopy and waveguide spectroscopy using ultra-short pulsed lasers are used to pursue the scientific principle and to discover new laws and principles that will lead to the development of science.

Main research subjects

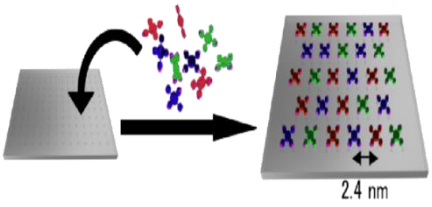
- Aligning molecules as desired: active alignment and orientation control of functional dyes on nanolayered particles
- Manipulating space as desired: active control of molecular space and nano-space structures between nanosheet layers
- Photoreactions as desired: research into photochemical reactions in molecularly controlled structures

Research keywords

Nano-structured Chemistry, Photochemistry, Energy, Artificial Photosynthesis, Nano-pigment Materials, Clay Minerals, Inorganic/Organic Complexes, Catalysis of Gold Nanoparticles and Gold Clusters, Organic Reactions using Heterogeneous Metal Catalysts

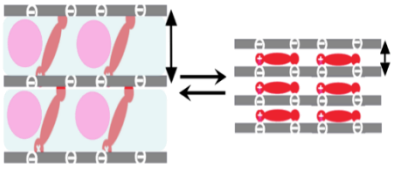
Research content

１） Aligning molecules as desired: active alignment and orientation control of molecules on nanolayered particles



The research on developing techniques to align and orientate molecules using nanolayered compounds as host materials. In addition to the design and synthesis of the nanolayered particles and molecules, we also carry out our own hybridization methods, structural characterization of the resulting materials and investigation of their photochemical properties and functionality. This has resulted in the discovery of a new principle of molecular alignment.

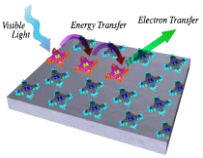
２）Manipulating space as desired: active control of molecular space and nano-space structures between nanosheet layers



It has been found that the space surrounded by nanolayered particles and guest dyes provides a unique chemical reaction field and generates

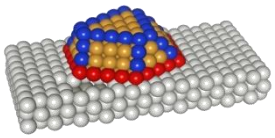
unique functionalities. This knowledge has led to the development of materials that change their colour according to their surroundings, and to the conjugation of spatial control and chemical reactions.

３）Photoreactions as desired: research into photochemical reactions in molecularly controlled structures



Our research focuses on photoelectron transfer and photoenergy transfer reactions using molecules with controlled sequences. We have succeeded in constructing a light collecting system model for artificial photosynthesis based on our findings. By combining nanostructure chemistry and photochemistry, we aim to realize artificial photosynthetic photoreactions.

4）Research on catalysis by gold nanoparticles and gold clusters for sustainable developments



Gold nanoparticles and gold clusters immobilized on various supports work as catalysts for environmental purification and synthesis of valuable chemicals. Since the catalytic properties of gold nanoparticles depend on the type of supports, we are developing new catalysts through the study of nanostructured catalysts using nanolayered compounds and nanoporous materials. In addition, we are investigating the catalytic properties of gold nanoparticles and clusters aiming at achievement of environmentally benign chemical processes.

Molecular Measurement Chemistry　ANALYTICAL CHEMISTRY Laboratory

Associate professor	Associate professor	
Hizuru NAKAJIMA	Shungo KATO	
Assistant professor	Assistant professor	Professor
Sifeng MAO	Hidetaka NORITOMI	Nahoko KASAI (University Education Center)

Research outline

As the microscope is an important tool to see the smallest of things, the basis of science is to analyze things and make them visible. In our laboratory, we are developing new analytical methods using micro-reactor fields and chemical sensors and biosensors in order to quickly reveal what, in what form and how much is contained in various samples, including environmental and biological samples, at actual sites. We are also conducting research on chemical reactions in the atmosphere.

Main research subjects

- Development of a micro chemical analysis system using a CD-type microchip
- Development of an ultra-compact fluorescence detector using OLEDs and organic photodiodes
- Development of a portable immuno-analysis device and a portable genetic testing device
- Development of exosome analysis method using a surface plasmon resonance sensor
- Development of an ISFET array sensor for pH measurement of seafloor sediment interstitial water
- Research on the fabrication of nanowires and single cell analysis using a microchemical pen
- Research on the variation of hydrogen concentration in the atmosphere in urban and remote areas
- Research on long-range transport of polluted air by measuring trace elements in the air
- Atmospheric observations using small, low-power, miniature gas sensors

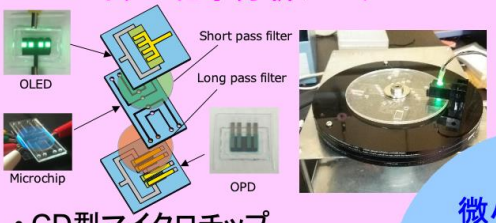
Research keywords

Environmental Measurements, Biomolecular Measurements, On-site Analysis, Micro Chemical Analysis System (μTAS), Chemical Sensors, Biosensors, Chemical Pen, Atmospheric Chemistry, Transboundary Air Pollution, Volatile Organic Compounds, Hydrogen, Volcanic Gas Observation

分析化学研究室

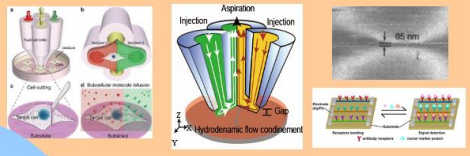
マイクロ化学・バイオ分析システムの開発と医療検査/大気環境測定への応用

マイクロ化学分析システム



- CD型マイクロチップ
- 有機EL，有機フォトダイオード

化学ペン（マルチノズルシステム）

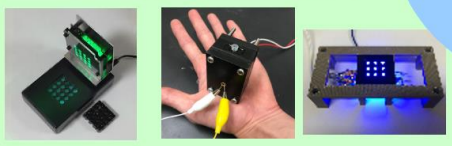


- ナノワイヤーの作製
- バイオセンサー
- 単一細胞分析

微小反応場を利用する分析法

医療検査
食品分析
環境測定
大気化学

携帯型医療検査装置



- 酵素免疫測定法(ELISA)
- 遺伝子検査(PCR, LAMP)

→ ポイントオブケアテスト

大気環境測定

- 大気中水素濃度測定
- 長距離越境汚染の研究
- 小型センサーでの大気観測

Chemistry for Environment　SHISHIDO Laboratory

Professor
Tetsuya SHISHIDO
Associate professor
Hiroki MIURA

Research outline

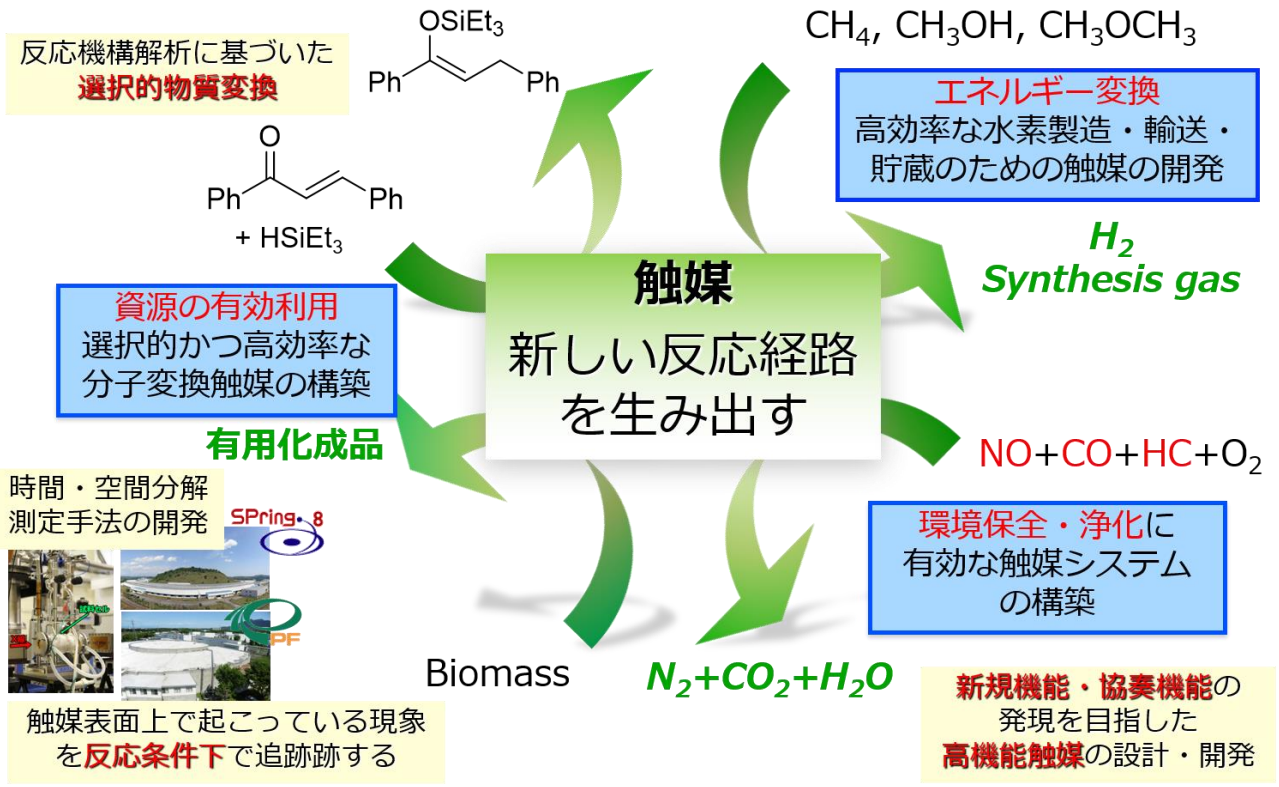
Catalysts are functional materials that are indispensable in modern society. Most of the products we use around us are manufactured using catalysts. Catalysts also purify exhaust gases from cars and factories and prevent environmental problems such as acid rain and photochemical smog. Thus, catalysts are very useful and important functional materials. Recent advances in analytical methods and theoretical chemical calculations have made it possible to analyze catalyst-driven phenomena (chemical reactions) at the atomic and molecular level. In our laboratory, we use a variety of spectroscopic techniques to study the structure and electronic state of the catalyst surface, and combine this with kinetic studies to reveal the phenomena occurring on the catalyst. Based on this knowledge, we are designing and constructing highly functional catalysts to develop new and highly efficient molecular transformation processes and systems for environmental protection and purification.

Main research subjects

- Development of new selective molecular transformation reactions using metal or alloy nanoparticles
- Mechanisms of acid and base formation on solid surfaces and their applications
- Development of efficient and selective conversion reactions of stable small molecules such as methane and carbon dioxide
- Development of catalysts for the efficient removal of environmental pollutants
- Development of highly efficient hydrogen production, transport, and storage systems

Research keywords

Catalytic Chemistry, Physical Chemistry, Surface Science, Solid Acid-Base, In-situ Analysis, Environmentally Friendly Reactions, Green Chemistry, Environment and Energy


反応機構解析に基づいた
選択的物質変換
OSiEt3
Ph
Ph
O
Ph
Ph
+ HSiEt3
CH4, CH3OH, CH3OCH3
エネルギー変換
高効率な水素製造・輸送・
貯蔵のための触媒の開発
H2
Synthesis gas
触媒
新しい反応経路
を生み出す
資源の有用利用
選択的かつ高効率な
分子変換触媒の構築
有用化成品
NO+CO+HC+O2
時間・空間分解
測定手法の開発
SPring-8
PF
環境保全・浄化に
有効な触媒システム
の構築
Biomass
N2+CO2+H2O
触媒表面上で起こっている現象
を反応条件下で追跡跡する
新規機能・協奏機能の
発現を目指した
高機能触媒の設計・開発

Chemistry for Environment　SHUDO Laboratory

Professor

Toshio SHUDO

Research outline

With the aim of reducing the environmental impact of humankind's use of energy, our laboratory carries out applied engineering research to improve the thermal efficiency of engines and the power output of fuel cells using hydrogen and various other alternative fuels to petroleum. About 20% of Japan's energy use comes from cars, and when comparing the engines and fuel cells used in car power systems, the engines have the advantage in terms of power output, while the fuel cells have the advantage in terms of efficiency. Therefore, in our laboratory, we are particularly interested in improving the thermal efficiency of engines and the power output of fuel cells. In this context, hydrogen has very different ignition and combustion characteristics to hydrocarbons such as gasoline and diesel oil, and there are many interesting research questions to be addressed in engine combustion using hydrogen. In addition to hydrogen engines powered solely by hydrogen, we are also investigating combustion systems in which hydrogen controls the ignitability of other fuels. There are various approaches to improve the power generation performance of fuel cells, and we are conducting empirical research to improve the power density of fuel cells by modifying the structure of the flow path that supplies the reactants to the electrodes.

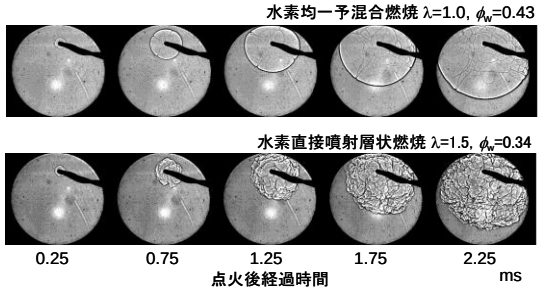
Main research subjects

- Environmentally sustainable energy use systems
- Improving the efficiency and reducing the environmental impact of automotive power systems
- Improving power output density in fuel cells by using a reaction flow path structure
- Improving thermal efficiency by reducing wall heat transfer in hydrogen engines
- Low temperature oxidation reaction control of high efficiency and low pollution premixed compression auto-ignition combustion
- Methanol application as a hydrogen carrier with high energy density
- Highly efficient hydrogen production by electrolysis of methanol

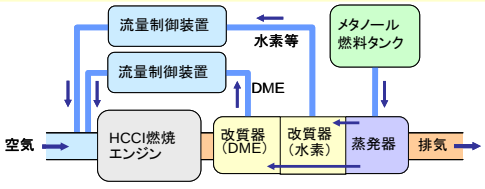
Research keywords

Energy, Hydrogen, Combustion, Engines, Fuel Cells, Alternative Fuels, Environmentally Friendly Energy Usage, Environmental Impact Reduction

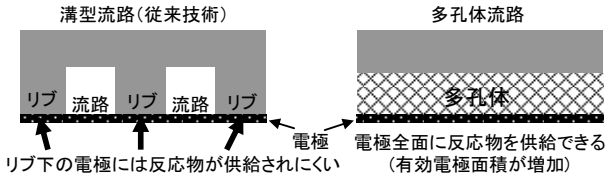
水素の直接噴射層状給気燃焼によるエネルギー効率向上

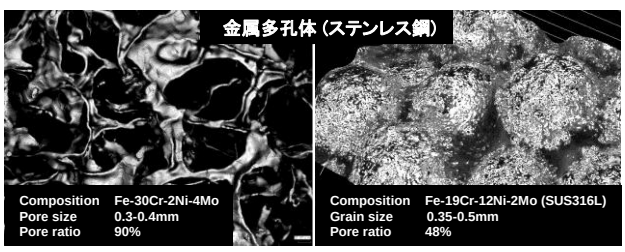


廃熱回収メタノール改質式予混合圧縮着火エンジンシステム



金属多孔体を利用した全面供給型の反応物流路による燃料電池の発電性能向上





Photoenergy Material Conversion　AMANO Laboratory

Professor	Assistant professor
Fumiaki AMANO	Kosuke BEPPU

Research outline

Although renewable energy sources such as solar and wind power have been in the spotlight for some time, they are not suitable for storing energy for long periods. Therefore, research is being carried out into the production of hydrogen as a fuel by electrolysis of water. Hydrogen is transportable and can be used in remote locations.

Photosynthesis is the process by which plants produce sugars from carbon dioxide using the visible light contained in sunlight. In other words, the production of fuel using sunlight is artificial photosynthesis. An essential part of this process is the catalyst, a substance that speeds up the rate of chemical reactions. A catalyst is a substance that works by absorbing light energy, and is called a "photocatalyst".

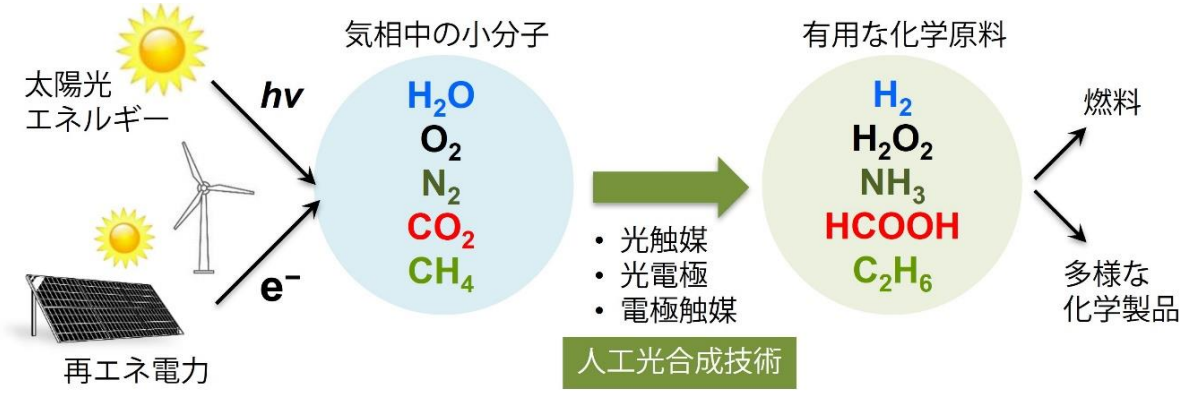
We strive to improve the performance of electro-catalysts and photocatalysts by designing materials that make the most of the characteristics of the materials. If artificial photosynthesis can be used to produce fuels and chemicals from renewable energy sources, then decarbonization is not far away.

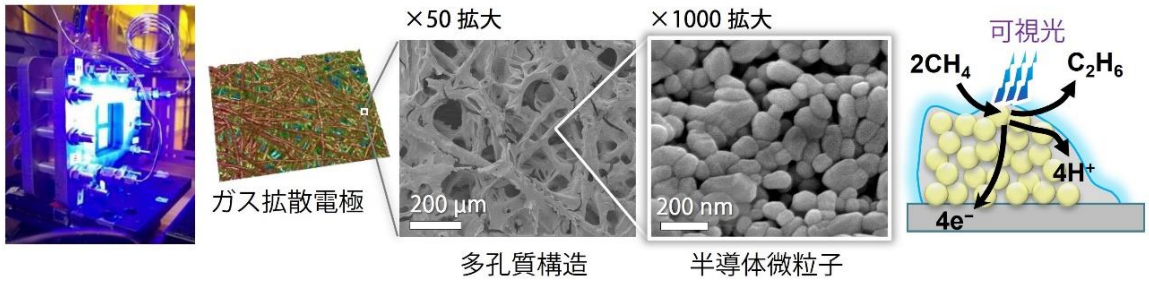
Main research subjects

- Development of molecular transformation reaction processes using photocatalysts, photoelectrodes, electro-catalysts
- Production of fuels and chemicals (hydrogen, hydrogen peroxide) using renewable energies
- Conversion of carbon resources such as methane and carbon dioxide into useful chemicals
- Development of functional materials, such as photocatalysts, photoelectrodes and electro-catalysts, based on new perspectives and methods
- Academic understanding of material properties and surface reaction mechanisms using a variety of spectroscopic and calculation techniques

Research keywords

Photocatalyst, Photoelectrode, Electro-catalyst, Artificial Photosynthesis, Renewable Energy, Energy Carrier Solid State Catalysis, Photo-electrochemistry, Inorganic Materials Chemistry, Surface Science, Reaction Engineering, Spectro-analytical Chemistry


太陽光
エネルギー
hv
e⁻
再エネ電力
気相中の小分子
H2O
O2
N2
CO2
CH4
• 光触媒
• 光電極
• 電極触媒
人工光合成技術
有用な化学原料
H2
H2O2
NH3
HCOOH
C2H6
燃料
多様な
化学製品


ガス拡散電極
×50 拡大
200 μm
多孔質構造
×1000 拡大
200 nm
半導体微粒子
可視光
2CH4
C2H6
4H+
4e⁻

Campus life

Life as a 2nd year university student

Yuta Nakamura

(Faculty of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 2nd year)

I am very happy that I chose to study Applied Chemistry for Environment at the University. There is a wide range of research in the field of chemistry, from the most common to the biggest problems in the world, such as materials, biotechnology, environment and energy. In order to approach them, chemists combine the elements of the periodic table to form original and fascinating ideas. During the past two years, I have had the opportunity to visit the laboratories and hear many stories from the professors, which has given me a sense of respect and admiration for this process, and I am really looking forward to my future research life. I strongly feel that I am steadily acquiring the skills necessary for a researcher in my specialized courses. During the summer break, I took a PBL-type lecture in which we read a chemistry paper, presented it, and discussed it together, under the careful guidance of senior students in the doctoral course. It was a real challenge just to read the scientific papers written in English, but by the end of the course I felt that I had developed presentation skills, material preparation and logical thinking, and that I had grown in many ways. This class was extremely intensive and valuable for me. The Department of Applied Chemistry for Environment also offers a variety of other ways for students to develop, such as a weekly Learning Record (first year students), twice a year interviews (second year students), PBL lessons, and classes that include presentations. I feel very grateful for this. In the future, I will value the importance of a broad perspective and the ability to take action, and I will further develop the skills necessary for research.

Life as a 4th year university student

Yuki Yasui

(Faculty of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 4th year)

In the fourth academic year, students will spend most of their time in the assigned laboratory, in contrast to the lecture-based life of the third year. In the laboratory, you will be taught from the beginning by your professors and senior graduate students how to operate and carry out experiments on your assigned research theme, in order to achieve your goal of presenting your thesis or attending an academic conference in the spring. Conducting research that no one has ever done before means that it is often difficult to get things right, but it is very rewarding to think and work independently, through trial and error, to solve problems. In addition, there are also progress report meetings in the lab where you can report the results of your research, and journal meetings where you can share and discuss the contents of your recent papers with everyone. I learned a lot from the opinions of others and from watching the excellent presentations of my seniors. By experiencing the many interesting and difficult aspects of chemistry on a daily basis, I became aware of what I would like to do in the future, such as enjoying the excitement of basic research and developing an interest in applied research. Furthermore, since I am conducting research on a topic directly related to environmental issues, my awareness of environmental issues has also increased. The fragmentary knowledge that I have learned up to the third year is now connected through research, and I am able to learn more about the fun of chemistry and keenly realize the importance of basic knowledge. I believe that my senior year will be a valuable year where I can immerse myself in chemistry and grow as a person.

Life as a Master's Student

Nao Yasuda

(Graduate School of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 1st year Master’s program)

In the Master's program, students are provided with an environment where they can plan their own experiments and actively conduct them, which allows more freedom and long-term research than in the undergraduate program. I am currently a member of the Material Conversion Chemistry Laboratory, where I am conducting research to promote the complex formation of Eu3+compounds on clay nanosheets. The value of this theme is that the complex structure can be maintained in an underwater system, and I am currently conducting research with the goal of developing it into an energy transfer system. In graduate school, I am able to conduct my research relatively freely, and I am less constrained by time constraints than in the corporate world. Therefore, I would like to encourage those who are motivated to enter a Master's program and engage in research to the fullest extent possible. The most significant change in my life in the Master's program since my fourth year as an undergraduate student was the increase in opportunities to give presentations outside the university, including presentations at academic conferences. Interaction with researchers from other universities and other disciplines is a very worthwhile experience. It is also a good opportunity to review your own presentation. I believe that it is important to take advantage of regular opportunities to present at meetings and seminars, as it takes time to get used to speaking publicly, and it is very rare to suddenly improve if you do not regularly do so.

International Conference Experience

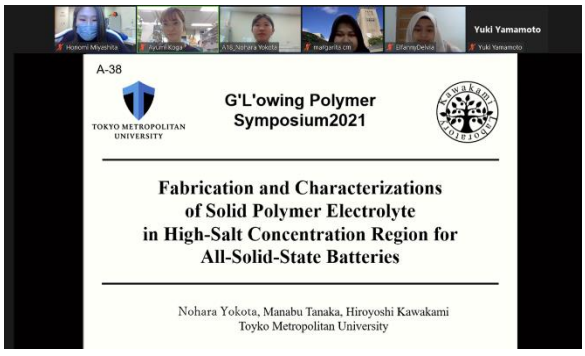
Nohara Yokota

(Graduate School of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 2nd year Master's program)

I participated in a conference called 4th G'L'owing Polymer Symposium, which was held in online format in July 2021, and gave a short presentation in English. There were many PhD students and international students participating in this conference, and I was anxious about my first presentation in English, but thanks to the guidance of my lab teacher in preparing the speech and practicing the presentation, I was able to perform calmly in the actual presentation.

The reason why I joined an international conference is because I want to become a researcher who can be active globally in the future. I have always had a certain aversion to English, especially listening and speaking, but I have always wanted to develop the ability to communicate with researchers from overseas, so I decided to participate.

After attending the conference, I found it difficult to understand the English of the other speakers when they spoke about technical subjects, but the flow of their explanations and the discussions based on their results were written in English that was easy to understand and comprehend even for a non-specialist like me, and I will refer to it when I give my own presentations in English in the future. During the Q&A session, there were lively discussions regardless of the field of study or nationality, which inspired me to have more experience and to be able to have such discussions in the future. In my presentation, I explained in poor English during the Q&A session, but I think that my willingness to convey the significance and results of my research to the other party has been improved.



Online International Conference

The hurdle of giving a presentation in English at an international conference may seem overwhelming and daunting. However, some of these conferences are held in Japan every year, and now that they are usually held online, the hurdle of attending an international conference has been lowered, making it easier for people to attend. It is a good opportunity to make use of the Chemistry English you learnt as an undergraduate, and if you have the chance, please try to attend an international conference.

Overseas Training Program Experience

Hideya Arima

(Graduate School of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 1st

year Master's program)

(In 2018, it was conducted on the West Coast of the United States, and in 2019 in Singapore and Malaysia, but in 2020 and 2021, due to the impact of the Novel Coronavirus, it was conducted in Japan with an online connection to overseas countries as an alternative. In this Program, we mainly did "Business Idea Presentation to Global Companies" and "Discussion with Overseas Researchers". I have never had the experience of talking to people from overseas before, and I wanted to take part in this program because I wanted to challenge myself in a way that I have never done before during my student life. For the presentations we considered business ideas to solve social issues on the theme of "Creating new values in the world using science technology" and presented them in English to engineers from global companies. Although there were a lot of harsh remarks, it was a valuable experience for us to receive opinions that helped us to brush up our ideas. For the discussion with overseas researchers, we personally made appointments with overseas researchers before the day of the Program and discussed my research with them. The process of making appointments and having one-on-one discussions was a new experience for me, and I was very anxious, but I think it was a good experience that helped me grow as a researcher, as I was able to see what skills I lacked. I believe that the appeal of this program is that it allows you to engage with people from a wide range of backgrounds. Listening to people I would not normally have the chance to meet, such as founders of venture companies and world-class researchers, broadened my horizons and made me understand that there are countless places to work as a researcher, both in Japan and overseas. If you are interested, please come and join us.

Life in a PhD Course

Yuma Nihori

(Graduate School of Urban Environmental Sciences, Department of Applied Chemistry for Environment,

1st year of PhD program)

Most people imagine campus life in a doctoral course as "wearing a white coat and staying overnight to carry out experiments". Of course, there are people who live a similar life, but in many cases it is a little different. Once assigned to a laboratory, undergraduate and Master's students absorb knowledge and skills under the guidance of a given research theme. On the other hand, in the doctoral course, the main focus is to set your own research theme based on the knowledge and skills you have acquired up to that point and to promote your research on your own. While academic knowledge is of course important in conducting research, the repetition of trial and error in day-to-day research is crucial. I feel that this process is similar to the passionate enthusiasm for certain things, such as sports or part-time work. For this reason, some of the people who say "research is interesting" when they join a laboratory surprisingly did not do well as undergraduates. On the contrary, such people tend to be overly enthusiastic about research, and it is not uncommon for them to spend their days doing experiments.になる場合も珍しくありません。

However, being a PhD student does not mean that you will only be doing experiments. There are many opportunities to interact with researchers from other universities and overseas at social gatherings with laboratory members and academic societies. Through these opportunities, I have been able to build friendships with very active and fascinating people, both at a domestic and international level, and gain valuable experience!

In conclusion, I would like to remind you that although it may seem far-fetched to new students, a PhD is an accessible career path with possibilities for everyone.

Research Exchange Program Experience

Mizuki Ochiai

(Graduate School of Urban Environmental Sciences, Department of Applied Chemistry for Environment, 2nd year Master's program)

(Due to the impact of the Novel Coronavirus in 2021, it has not been carried out, so the 2019 data has been reissued)

When I was in my fourth year of undergraduate studies, I was placed in a laboratory and started to do research. I realized that research is being conducted all over the world and is shared in English as a matter of course. I always thought that if I could do research overseas, I would definitely acquire useful skills for the future. That is why, in the summer of my 1st year Master's degree, I participated in a three-month exchange program at the Agency for Science, Technology and Research (A*STAR), Singapore. This program is supported by our university's International Office, and I was able to prepare for my study abroad with peace of mind because the university handled all the procedures such as visa and overseas insurance.

When I actually started my research life abroad, it was very difficult to talk to new people and do research in a new field in English. However, I gradually got used to it and felt that I had grown as a person. I felt that I would like to learn from overseas researchers, as they do not have a hierarchical relationship with their superiors and are able to express their opinions openly to their superiors, as well as work efficiently and clearly distinguish between work and private life.

Member of Natural Product Chemistry group

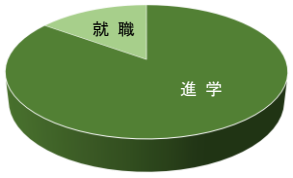
I was able to make a lot of friends through the frequent social events and seminars held by the Singapore's Agency for Science, Technology and Research (A*STAR). On weekends, I was able to explore Singapore with them and spend quality time outside of research. Although it was only three months, I gained so much more than I can write here, such as a new outlook on life, a new sense of values and a higher level of confidence in myself!

Career prospects after graduation

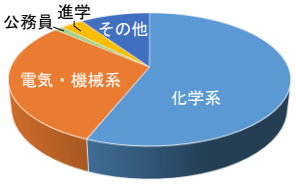
After graduation and completion of courses, you will be active in society as an engineer or researcher based on the specialized knowledge and experience you gained at the university or graduate school. In the 4th academic year, you will belong to one of the laboratories in the Department of Applied Chemistry for Environment, have a research theme, and carry out special research. This is an important period for students to learn the joy of conducting research on their own based on the specialized knowledge they have learned so far, and to acquire the skills to become independent as engineers and researchers. You will also need to make the first choice of whether to work or go on to higher education. Since postgraduate degrees are strongly sought after in the chemical industry, we recommend that you go on to graduate school (Master's・ Doctoral program). Currently, more than 80% of 4th year students advance to graduate school. After completing graduate school, you will have more opportunities to work as a highly specialized researcher or university teacher. In addition, since a doctoral degree is required to be globally active, you should also consider entering a doctoral program and obtaining a PhD degree.

Changes in the Employment System and the Image of Demanded Human Resources

The "Corporate Ethics Charter on Recruitment Selection" has been abolished for university graduates and those who are scheduled to complete their master's degree in or after 2021. There are two main types of application: university recommendation and free application. The trend in recent years has been for employers to strengthen their relationships with universities, and there has been an increase in the number of university recommendations in which alumni visit their home laboratories to make recommendations. The keywords for the human resources that companies are looking for are "emphasis on academic achievement" and "fundamental skills for working in society" (see the Ministry of Economy, Trade and Industry website). The "fundamental skills for working in society" consist of three skills, "the ability to step forward," "the ability to think things through," and "the ability to work in a team," as well as 12 ability elements, which grow through the accumulation of independent action and cooperation, basic academic skills, and professional thinking. Students are also required to have the qualities to cope with globalization, so English proficiency is also necessary. With corporations downsizing their training programs for new employees, newcomers are expected to have higher skills than in the past. These "fundamental skills for working in society" cannot be acquired immediately, so it is necessary to be aware of them on a daily basis. Recruitment requests to our university's departments and fields are stored in the office in an organized manner. If necessary, we also send out information through the e-learning system, KIBACO. The Career Support Division also holds various seminars and information sessions, so please make use of these as well.



Bachelor



Master

Major employers of postgraduates in the last five years

NOK Corporation, Olympus Corporation, Stanley Electric Co., Ltd., Denka Co., Ltd., Toyota Motor Corporation, NICHIAS Corporation, Panasonic Corporation, Lion Corporation, Kao Corporation, LIXIL Corporation, ULVAC, Inc., CATALER Corporation, GS Yuasa Corporation, DENSO Corporation, Toyota Central R&D Labs., Inc., KYOCERA Corporation, Kyodo Printing Co., Ltd., Furukawa Electric Co., Ltd., Chemours-Mitsui Fluoroproducts Co., Ltd., Mitsui Chemicals, Inc., Mitsubishi Aluminum Co., Ltd., Mitsubishi Gas Chemical Company, Inc., Mitsubishi Chemical Corporation, Sumitomo Rubber Industries, Ltd., Sumitomo Chemical Co., Ltd., Sumitomo Seika Chemicals Company, Ltd., Shin-Etsu Chemical Co., Ltd., TAIYO HOLDINGS CO., LTD., Dai Nippon Printing Co., Ltd., DAI NIPPON TORYO CO., LTD., Tokyo Electric Power Company Holdings, Inc., TOYO INK SC HOLDINGS CO., LTD., Toyo Engineering Corporation, Toppan Printing Co. Ltd., Kusumoto Chemicals, Ltd., ZEON CORPORATION, Nippon Paper Industries Co., Ltd., JAPAN CAPACITOR INDUSTRIAL CO., LTD., Hitachi Power Solutions, Showa Denko Materials co., Ltd. (Hitachi Chemical), Fuji Xerox Co., Ltd., civil servants, university teachers, and so on.

Comments from alumni

Kazuhiro Morioka

(Assistant Professor, Department of Bioanalytical Chemistry, Faculty of Pharmaceutical Sciences, Tokyo University of Pharmacy and Life Sciences)

(2015 Completed Doctoral Program in Molecular Applied Chemistry, Graduate School of Urban Environmental Sciences, Tokyo Metropolitan University)

As a student of applied chemistry, you will develop the necessary skills to become a world-class "expert in chemistry" under the guidance of professors who are thoroughly versed in their field. In this wonderful environment, you will be able to study hard and acquire a wide range of specialized knowledge and skills in Chemistry.

Research activities are surely the best opportunity for you to develop during your time at university. By thinking and acting proactively on your own, based on the knowledge and experience you have gained in lectures and experiments, you will be able to tackle unknown problems and develop your independence. Read the papers carefully, be creative, and keep trying over and over. This approach to research, without fear of failure, with sincerity and persistence, will be a valuable asset for your future. The most important thing to remember when undertaking research is to be interested in constant improvement and to enjoy what you learn. Be willing to learn not only about your own field of research, but also about research in other fields. There are many fields of study that may seem unrelated at first glance, but when you explore them deeper, you will find that they are actually connected to your own research and you will make new discoveries. We hope that you will experience the fun of learning while you are still a student through the research activities. The main purpose of a student is to study, but there is so much more to learn at university. Although you are only a student for a few years, it is a free and precious time in your life. Make the most of it by meeting lots of people, discovering and experiencing different things, and broadening your own horizons. The experiences you gain during your time at university will certainly enrich your future!

Publicity and awareness-raising activities, brief overview of history

We carry out a variety of PR and awareness-raising activities to help current students, high school students and the general public to better know the Department of Applied Chemistry for Environment.

Department of Applied Chemistry for Environment website

(https://www.ues.tmu.ac.jp/apchem/)

There is information on the characteristics of the University's departments, education, laboratories, research achievements, campus life and entrance examinations. We actively publish the results of the educational and research activities of our teaching staff and students, in order to fully convey the appeal of our department. We would be grateful if you could use this information to understand the educational philosophy and research trends of our department. We would like you to access this site.

Open class and one-day Chemistry Workshop

The Chemistry Workshop is held in August every year and is designed to give high school students an opportunity to experience how interesting and profound chemistry can be. This workshop is organized as part of the "Introduction to Chemistry" program of the Chemical Society of Japan and as part of the Open Class Program of Tokyo Metropolitan University, where chemistry faculty members and graduate students of the university work together to conduct experiments with participating high school students.

Bluebacks

One of the main missions of our department is to communicate the meaning and significance of chemical materials, which will support the advanced technologies of the 21st century, in an easy-to-understand manner to the students and high school students who will create the future, as well as to the general public, and to cultivate a scientific perspective. Therefore, with the cooperation of Kodansha Science Book Publishing Department, we publish explanatory books (Bluebacks). So far we have published "Amazing Functional Materials Made by Chemistry" (1992) and "The Frontiers of Materials Chemistry" (1998), and in 2010 we published our third book, "New Frontiers of Materials Chemistry".

Colloquium

Our department organizes the "Ouka - Applied Chemistry Colloquium". A colloquium is "an academic meeting at which specialists give talks and answer questions" (Webster's Dictionary). Our Colloquium generally is conducted as described above. There is no limit to the number of people who can take part in the conference, and it is open not only to teachers and students from our own department, but also to people from other departments, depending on the theme. In some cases, overseas researchers who have visited Japan to participate in international conferences or who have visited Tokyo Metropolitan University are invited to give speeches. The Colloquium has been held 392 times since its inception in 1981 at the Department of Industrial Chemistry, Faculty of Engineering, Tokyo Metropolitan University, the predecessor of our department.

Visiting lectures

Our faculty members visit high schools and other institutions to give lectures on the research and educational activities being carried out in our department and how the results are being utilized. If you are interested, please contact us.

History of the University and the Department of Applied Chemistry for Environment

1949 - Establishment of Tokyo Metropolitan University from the former Tokyo Metropolitan High School and five metropolitan vocational schools. Establishment of the Department of Industrial Chemistry, Faculty of Engineering.
1963 - Establishment of Major in Industrial Chemistry, Graduate School of Engineering.
1991 - Relocation from Meguro-Fukazawa Campus to Minami-Osawa Campus.
Establishment of Majors in Industrial Chemistry and Materials Chemistry in the Department of Industrial Chemistry in the Faculty of Engineering.
1998 - Renamed the Major in Industrial Chemistry (Graduate School of Engineering) to Major in Applied Chemistry.

1999 - Renamed the Department of Industrial Chemistry to the Department of Applied Chemistry.
2005 - Tokyo Metropolitan University, Tokyo Metropolitan Institute of Technology, Tokyo Metropolitan University of Health Sciences, and Tokyo Metropolitan College merged to form Tokyo Metropolitan University. Renamed the Department of Applied Chemistry in the Faculty of Engineering to the Department of Urban Environment, Faculty of Urban Environmental Sciences, Materials Chemistry Course.
2006 - Renamed the Graduate School of Engineering, Major in Applied Chemistry, to the Graduate School of Urban Environmental Sciences, Major in Chemistry for Environment and Material Chemistry.
2009 - Reorganization of the Graduate School of Urban Environmental Sciences into a single major, the Major in Chemistry for Environment and Material Chemistry was renamed the Major in Urban Environmental Sciences.
In the Faculty of Applied Molecular Chemistry renamed the Course in Materials Chemistry to the Course in Applied Molecular Chemistry.
2018 - Reorganization of the university, the Faculty of Applied Molecular Chemistry (Graduate School of Urban Environmental Sciences, Department of Urban Environmental Sciences) was renamed the Faculty of Applied Chemistry for Environment; and the Department of Urban Environmental Sciences Course in Applied Molecular Chemistry was renamed Department of Applied Chemistry for Environment.
2020 - University name changed to Tokyo Metropolitan University

Department of Applied Chemistry for Environment The faculty staff list

Course	Laboratory	Name	Room number (with only digits for Building	Phone number	
				Extension	Last 4 digits
Advanced functional materials field	Kawakami Laboratory	Hiroyoshi KAWAKAMI	638	4972	2853
		Kiyoshi SATO	349	4886	2848
		Masafumi YAMATO	137	4837	2844
		Manabu TANAKA	639	4586	
	Asayama Laboratory	Shoichiro ASAYAMA	651	4976	2854
Advanced material design field	Kubo Laboratory	Yuji KUBO	448	4937	3134
		Masato ITO	438	4941	
	Setaka Laboratory	Wataru SETAKA	542	4955	2834
		Yusuke INAGAKI	545	4957	
Energy devices field	Kanamura Laboratory	Kiyoshi KANAMURA	247	4862	2828
		Hirokazu MUNAKATA	246	4861	2826
	Kajihara Laboratory	Koichi KAJIHARA	336	4874	2827
		Takashi TAKEI	142	4933	2841
		Takashi YANAGISHITA	140	4931	2842
		Masanao ISHIJIMA			
Environmental molecular chemistry field	Takagi Laboratory	Shinsuke TAKAGI	446	4893	2839
		Hiroshi TACHIBANA	B44	4822	
		Tamao ISHIDA	B51	4828	2845
		Tetsuya SHIMADA	445	4897	
Molecular measurement chemistry field	Analytical Chemistry Laboratory	Hizuru NAKAJIMA	343	4882	2836
		Shungo KATO	339	4875	2833
		Sifeng MAO	344	4883	
		Hidetaka NORITOMI	148	4838	2824
Chemistry for Environment field	Shishido Laboratory	Tetsuya SHISHIDO	551	4963	2850
		Hiroki MIURA	550	4962	2851
	Shudo Laboratory	Toshio SHUDO	455	4134	2715
Photoenergy Material Conversion field	Amano Laboratory	Fumiaki AMANO			
		Kosuke BEPPU			
Student laboratory		Yoshinori INOUE	290	4872	2831
		Haruko MIYAMOTO	291	4873	2832
Office		Sachie FUJII	134	4810	2820