

Degree Programs in Pure and Applied Sciences,
Graduate School of Science and Technology,
University of Tsukuba

Master's/Doctoral Program in Chemistry

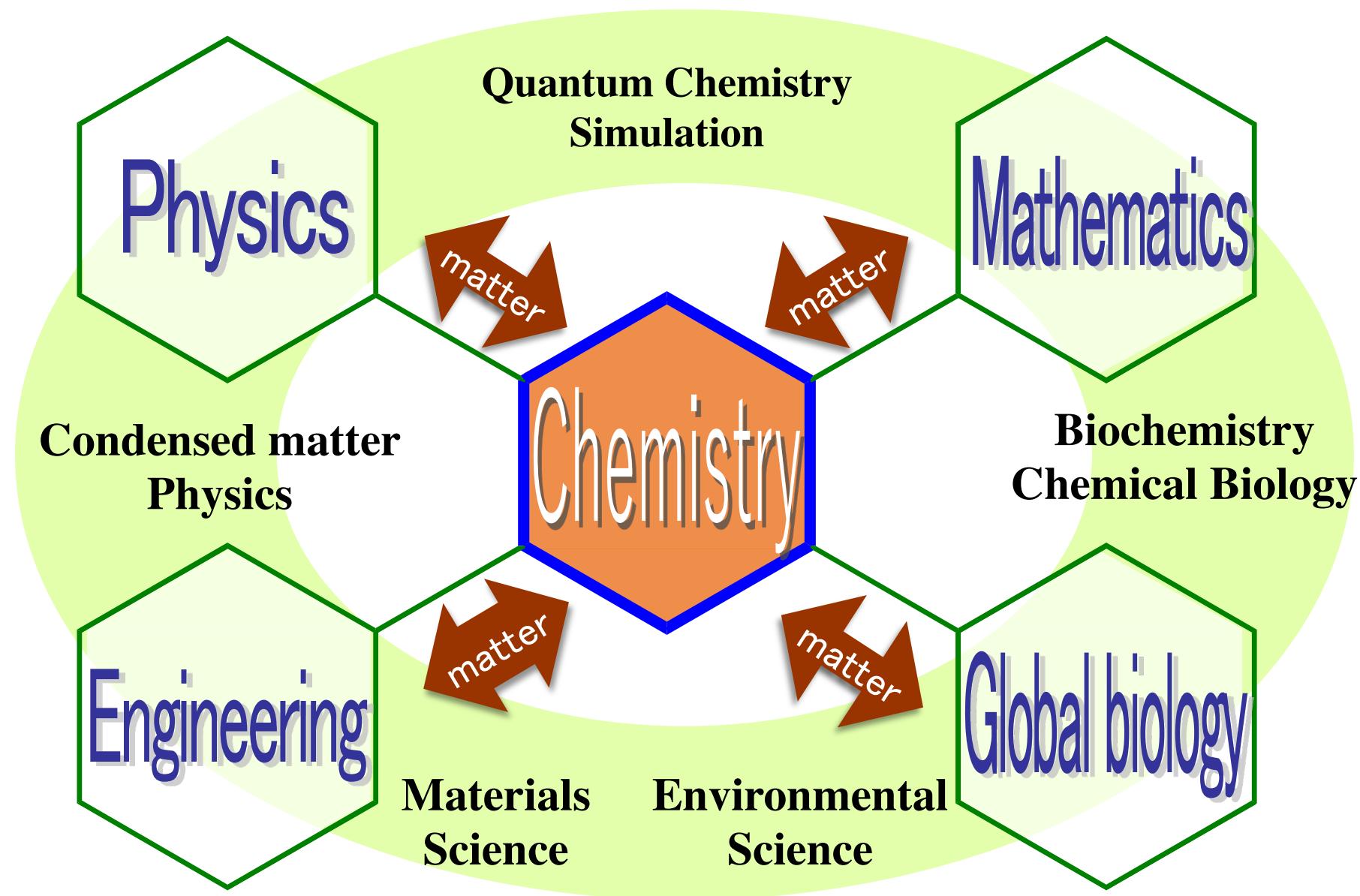
<https://program.chem.tsukuba.ac.jp/>



【Contact】

Tel : 029-853-6505 (Office)

E-mail : chkyomu@chem.tsukuba.ac.jp (Office)
: sasamori@chem.tsukuba.ac.jp (Prof. Sasamori)



Chemistry is “Heart of Science”, because it studies matter, its composition, and its changes.

《 Design, Synthesis, Properties, Functions 》

Chemist : "artificer" for creating molecules and substances

"What is a chemical bond?"

It should be important to understand "how the chemical bonds are created".

- ▶ Handles substances with a well-defined structure
- ▶ One molecule, a group of substances changes the world
- ▶ Creating the basis of a material society

Research Fields in Degree Program of Chemistry

Inorganic/Analytical Chemistry

Inorganic Chemistry

Complex Chemistry

Synthetic Inorganic Chemistry

Analytical Chemistry

Structural Biochemistry

Physical Chemistry

Organic Chemistry

Supramolecular Chemistry

Synthetic Organic Chemistry

Organoelement Chemistry

Bioorganic Chemistry

Medicinal Chemistry

Molecular Condensed Matter

Physical Chemistry

Cooperative Graduate School (AIST Tsukuba Central)

Materials Inorganic Chemistry

High-pressure Organic Chemistry

Surface Electrochemistry

Organic Electronics Chemistry

Functional Polymer Gel Chemistry

Organometallic Chemistry

Photofunctional Materials Chemistry

Pure Chemistry

Applied Chemistry

Research Fields in Degree Program of Chemistry

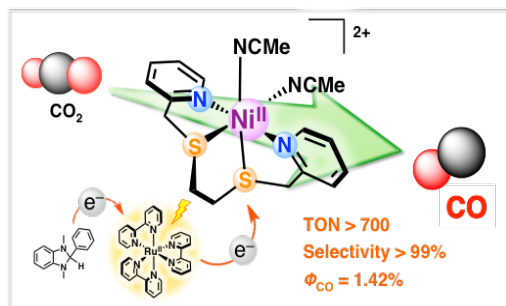
Research Field	Professor	Research
Inorganic Chemistry	Takahiko KOJIMA	Synthesis of transition-metal complexes and their reactivity in various redox and catalytic reactions; supramolecular redox chemistry of non-planar and fused porphyrins.
Analytical Chemistry	Kiyoharu NAKATANI	Studies on chemical processes at microdroplet/solution and microparticle/solution interfaces using electrochemical and spectroscopic techniques.
Synthetic Inorganic Chemistry	Masayuki NIHEI	Creation of multi-nuclear metal clusters with controlled structures and electronic states; chemistry of functional metal complexes with controlled electronic states and structures.
Molecular Condensed Matter	Kazuya SAITO	Structure and property of soft molecular systems, and dynamics and phase transitions in them.
Physical Chemistry	Taka-aki ISHIBASHI	Studies on interfaces and condensed phases by linear and nonlinear molecular spectroscopy; Synthesis of emissive compounds and kinetic analyses of formation and deactivation processes of the emissive state by TCSPC; Studies on photofunctions and photochemical properties of newly fabricated molecular assemblies and inorganic particles in mesoscopic scale.
Bioorganic Chemistry	Hideo KIGOSHI	Isolation, structural elucidation, synthesis, and bioorganic studies of bioactive natural products. Design, synthesis and biological evaluation of novel biologically active molecules.
Organoelement Chemistry	Takahiro SASAMORI	Low-coordinated and multiple-bonded compounds of heavier group 14 elements and organoelement chemistry of Group 13-15.
Supramolecular Chemistry	Takashi NAKAMURA	Precise construction of functional molecules based on supramolecular chemistry, and exploration of their properties such as molecular recognition and selective reaction. Studies on supramolecular metal complexes utilizing organic ligands and metal ions.
Structural Biology and Chemistry	Kenji IWASAKI	Study of proteins in soft-tissue sarcoma, chromatin remodeling factors and a photosensing flavoprotein. Structural biology and chemistry using single-particle electron microscopy and its development.
Medicinal Chemistry	Noriki KUTSUMURA	Design and synthesis of orexin receptor agonists/Design and synthesis of opioid ligands/Research and development for narcorepsy, severe pain, depression, pollakiurea, malaria, other protozoal diseases, and cancer drugs.

Inorganic Chemistry Lab (Kojima Lab)

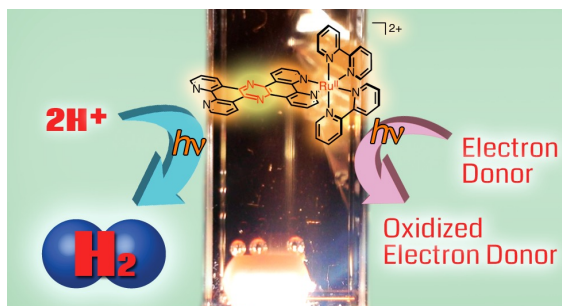
Bio-inspired Redox Chemistry

Redox behavior of transition metal complexes

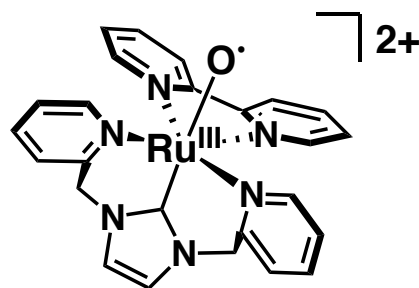
Photocatalytic CO₂ reduction



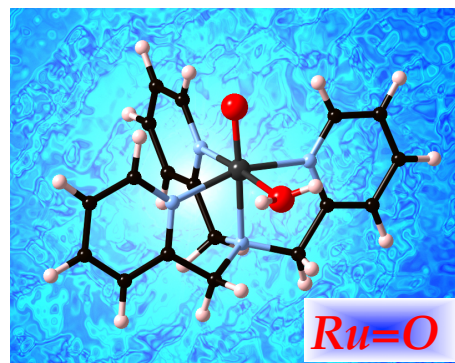
Photocatalytic H₂ evolution



Proton-coupled electron transfer

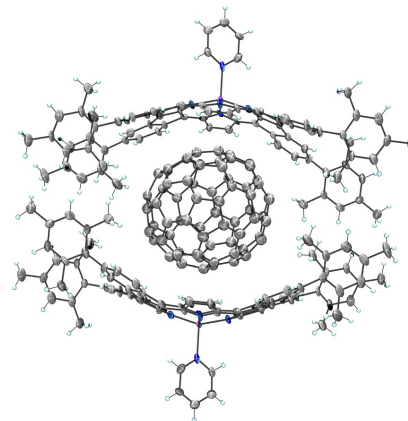


Oxidation reactions in water

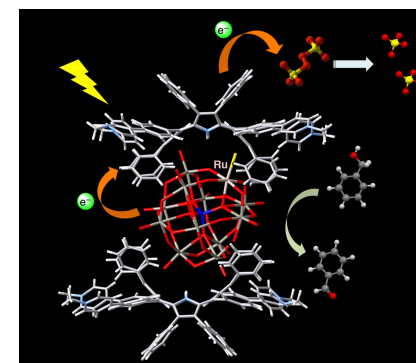


Chemistry of nonplanar porphyrins

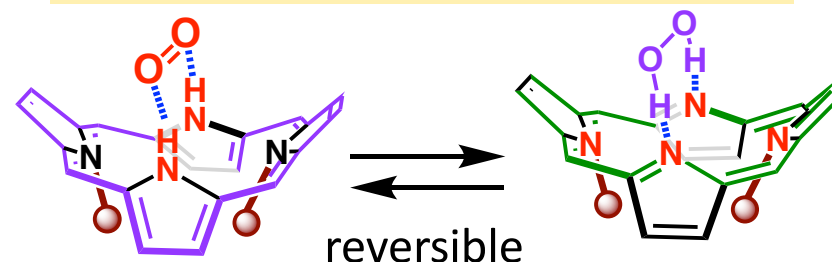
Supramolecular structures



Photoinduced electron transfer



O₂–H₂O₂ interconversion



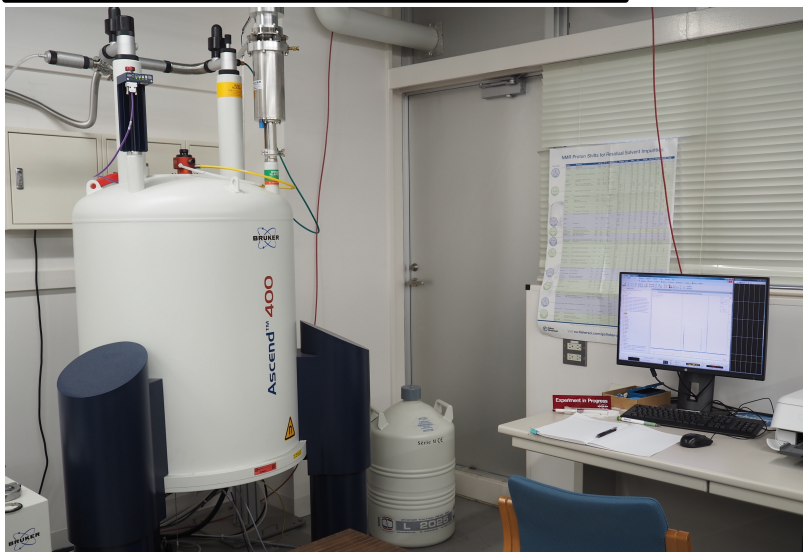
Artificial photosynthetic systems and highly selective oxidation systems based on bio-inspired transition-metal complexes as catalysts

Development of new redox- and photo-functionality based on nonplanar porphyrins

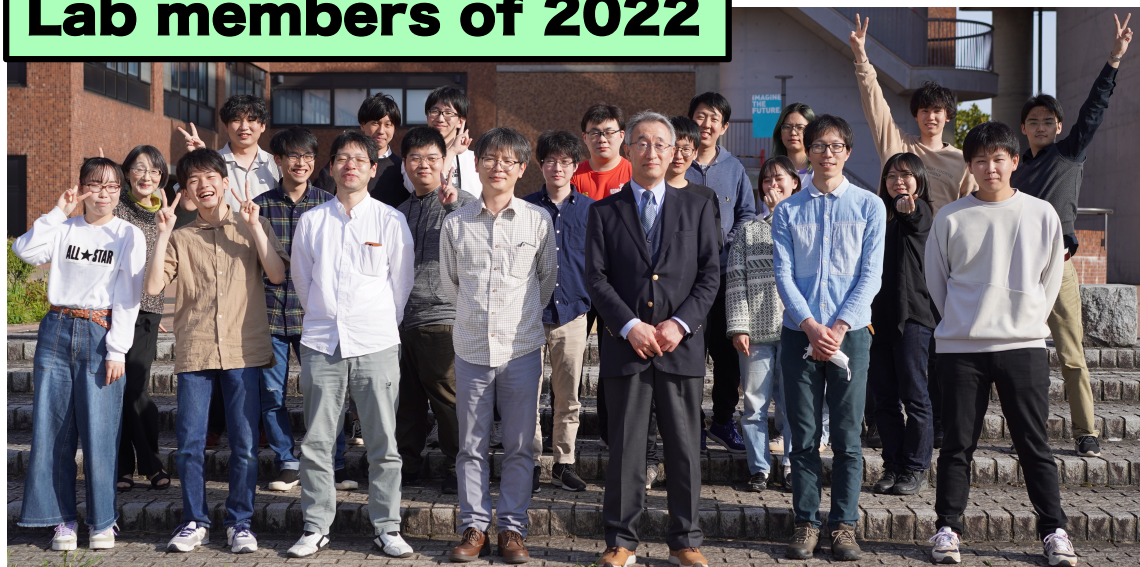
Contact: Takahiko Kojima: 029-853-4323; kojima@chem.tsukuba.ac.jp

■ ■ Labs, Equipment, and Lab members ■ ■

NMR spectrometer



Lab members of 2022



GC-MS apparatus



Labs



Experiment



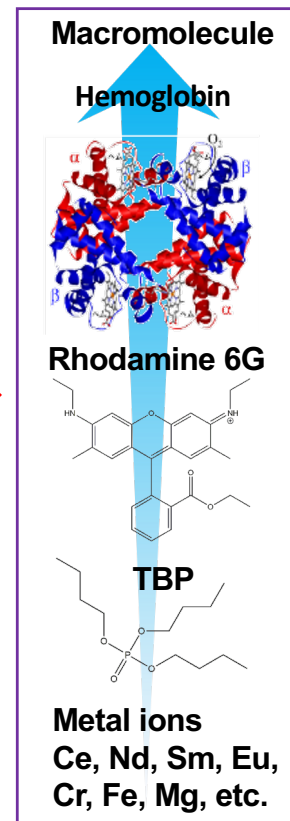
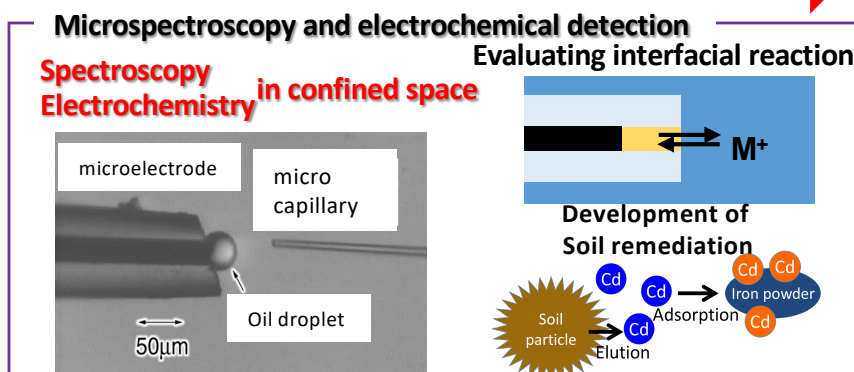
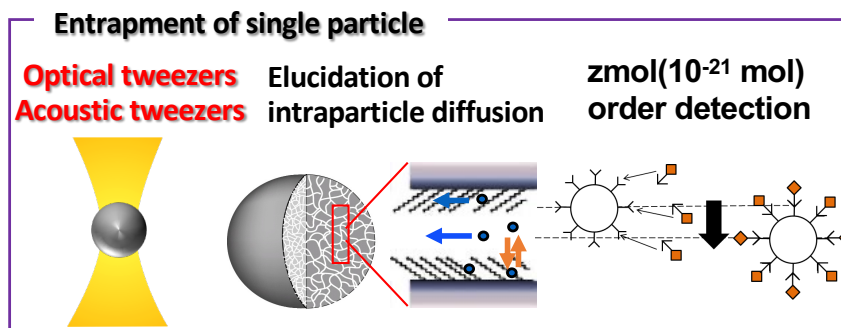
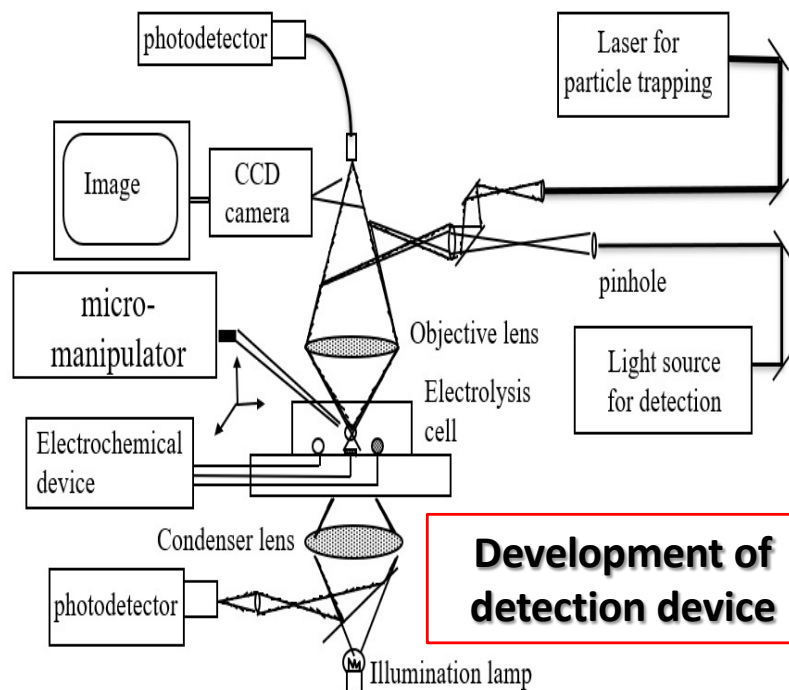
For more info,

Kojima lab Tsukuba chem



Analytical Chemistry (Nakatani Lab.)

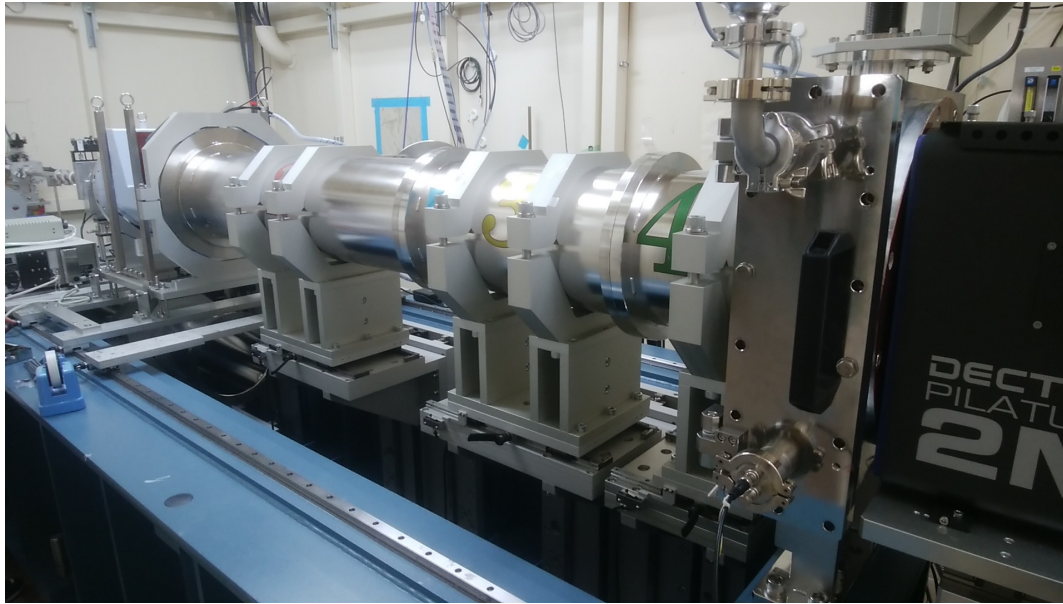
Analytical Chemistry based on micro/nano-sized particle



Development of detection device according to target and phenomenon

- Chemical process at interface of the particle and inside the particle
- Separation mechanism of minor actinide from highly active liquid waste
- Regulation and expression mechanisms of oxygen affinity in hemoglobin
- Development of novel detection scheme for proteins and DNAs

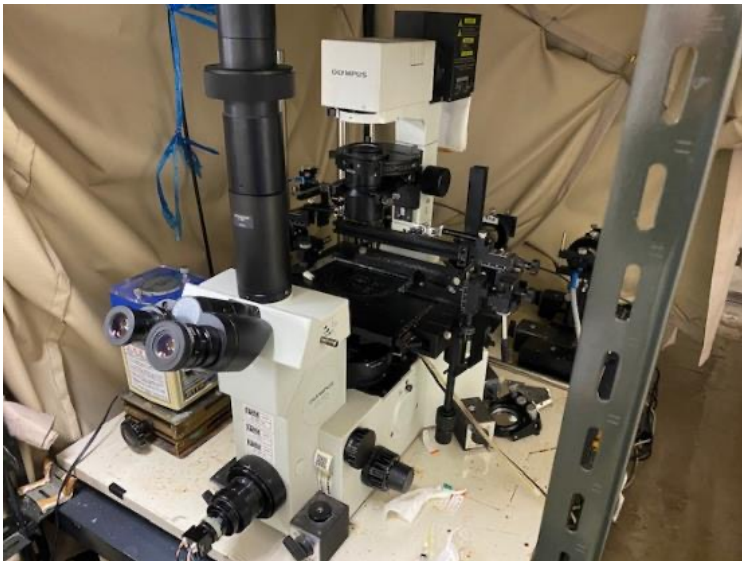
Synchrotron radiation (X-ray) system



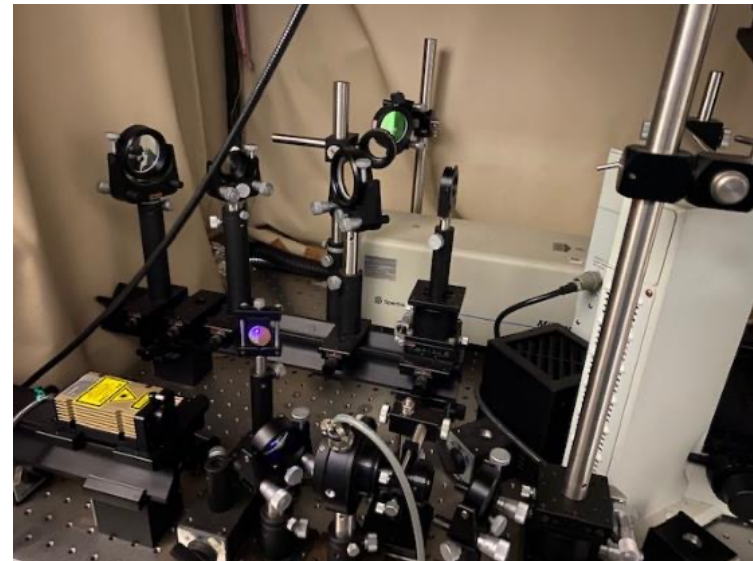
Detection devices based on ultrasound



Microspectroscopy



Optical system for spectroscopy



ICP-QQQ-MS
Contribution to
underground physics



Ge-semiconductor
Essential for radiation
measurements



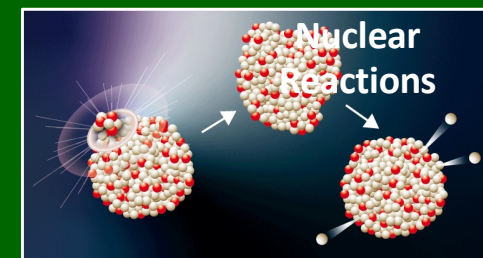
**World-class analytical
instruments for ultra-sensitive
and accurate analysis**
Instrumental Analysis



From biology to heavy elements
Lab Experiments



Chemical separation



Production of new isotopes

**Nuclear/Radiochemical approaches to
Environmental Analytical Chemistry**



アイソトープ環境動態研究センター

C R I E D CENTER FOR RESEARCH IN
ISOTOPES AND ENVIRONMENTAL DYNAMICS

Aya SAKAGUCHI

ayaskgc@ied.tsukubai.ac.jp

The whole planet is a laboratory!
Field Work



AMS

Counting ultra trace
amount of atoms



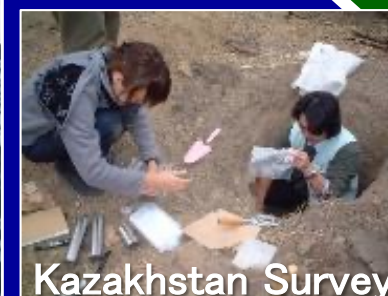
Ukraine Survey

lake, river, soil



Marine Surveys

coral, sediments, seawater



Kazakhstan Survey

Pu and U contamination

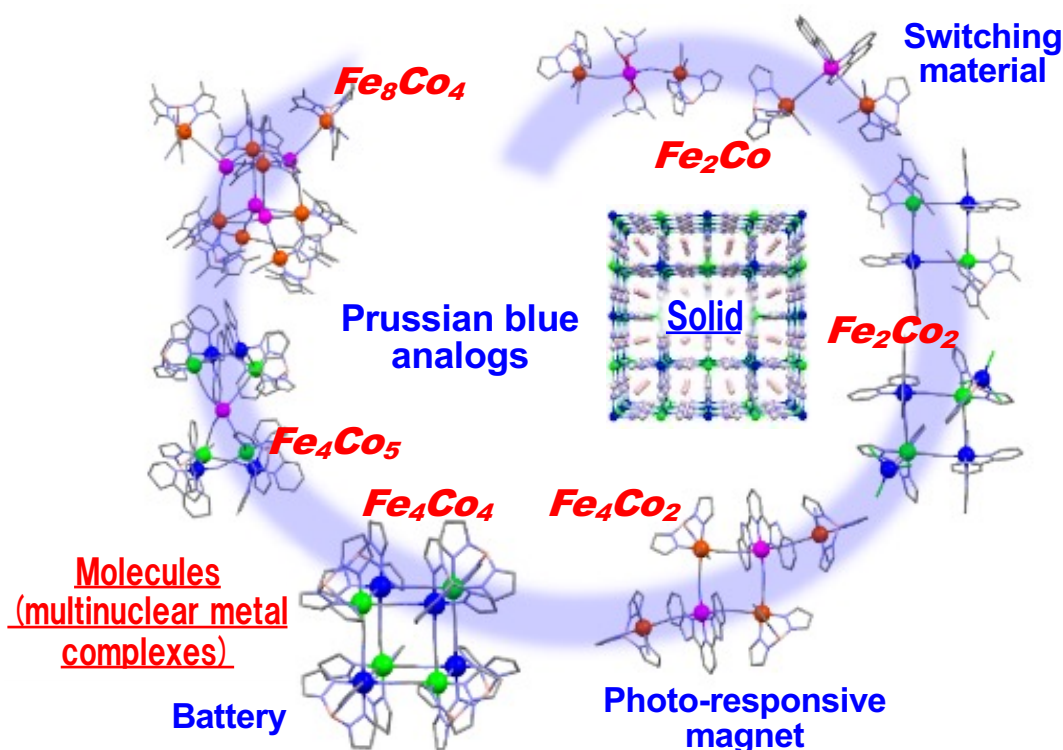


**Bucket
chemistry**

Synthetic Inorganic Chemistry Lab (Nihei Lab)

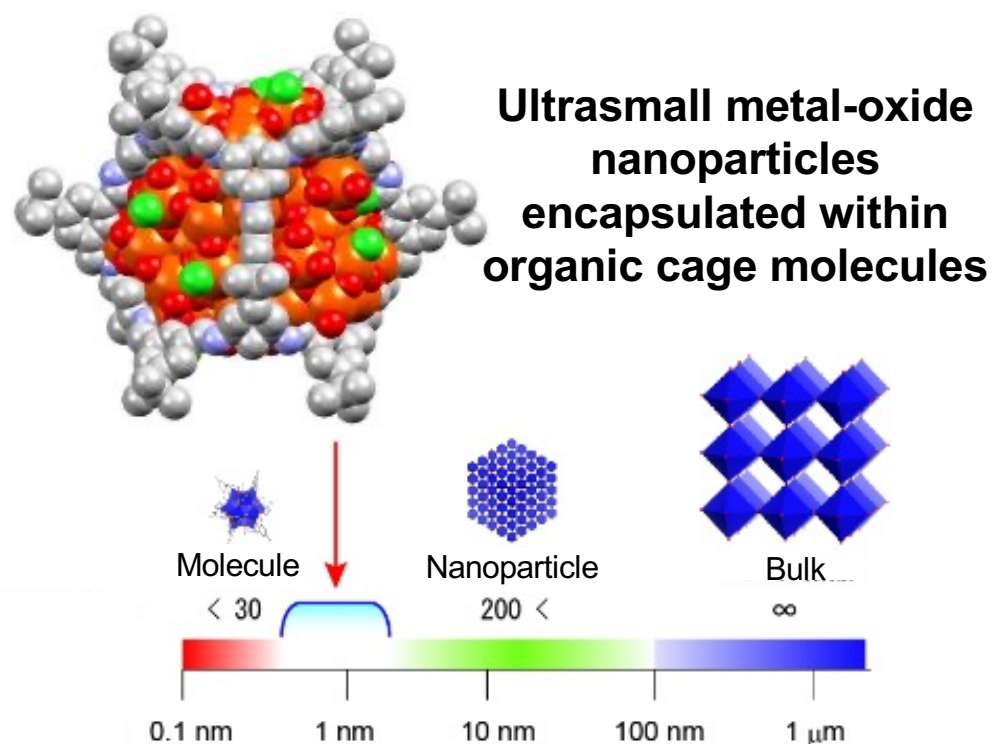
Prof. Masayuki NIHEI, Assoc. Prof. Takuya SHIGA, Assist. Prof. Nozomi MIHARA

Molecular units of inorganic solid
—Emergence of unique properties—



Innovative Molecular Functions
Based on Rational Control of
Intramolecular Electron Transfer

The world's smallest metal oxide nanoparticles (Diameter : 1-2 nm)



Exploration of new chemistry at the
boundary of molecules and nanoparticles

Synthetic Inorganic Chemistry Lab (Nihei Lab)



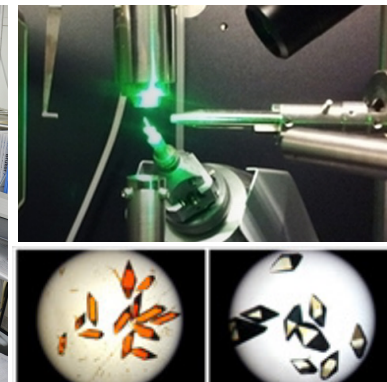
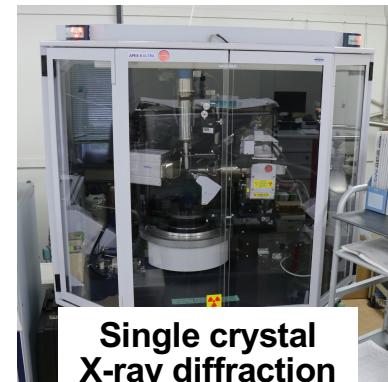
Organic/inorganic synthesis



Powder X-ray diffraction



Single crystal X-ray diffraction



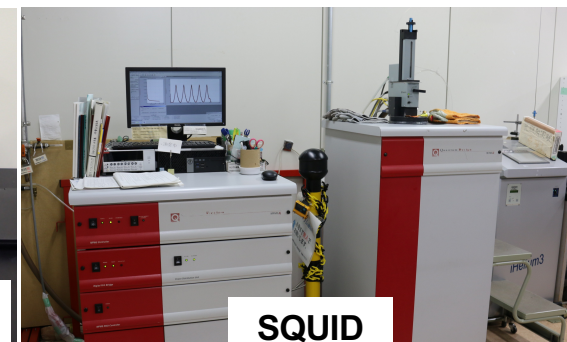
Atomic force microscopy



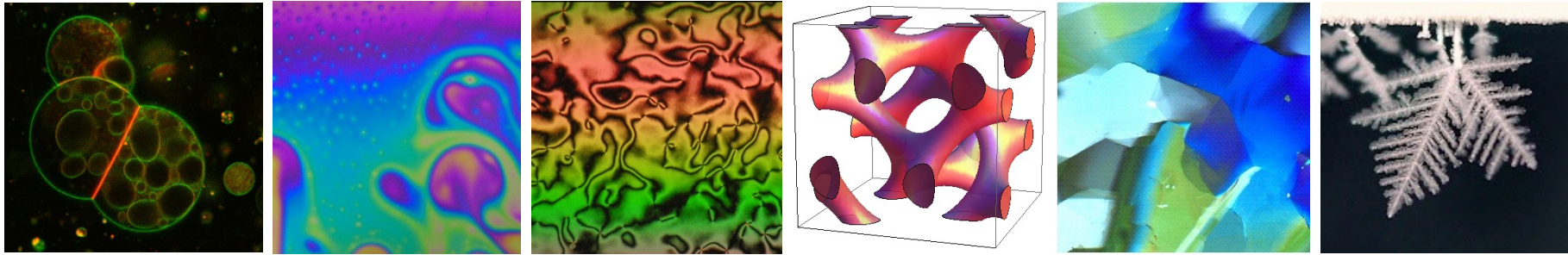
Energy dispersive X-ray spectroscopy



SQUID



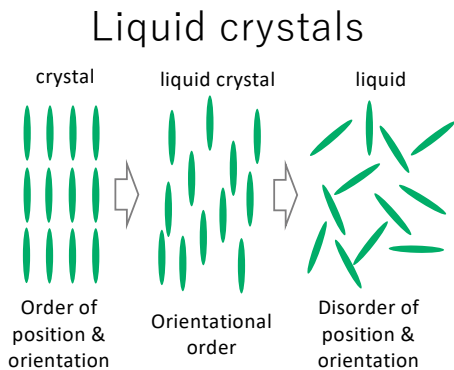
Molecular Condensed Matter Lab



Soft Matter: Liquid crystals, amphiphilic compounds

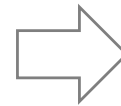
Hard Matter: Molecular crystals

Relation between “Tree(s)” and “Forest”?



Solid, liquid, and gas are three well-known forms of matter. Liquid crystals have intermediate properties between solid and liquid and are indispensable for modern displays.

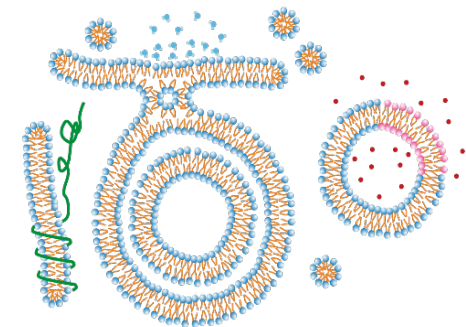
Molecular
shape &
properties



Effects on
aggregation &
properties

Properties of matter around us depend on the shape and properties of constituent molecules. We pursue an understanding of the relations between molecular and bulk properties. Our research subject ranges from molecular crystals through liquid crystals to colloidal suspensions of membranes.

Biomembranes



Cell membranes are made of amphiphilic molecules known as phospholipids. Physicochemical properties of lipid membranes govern their geometry and biological functions.

Molecular Condensed Matter Lab





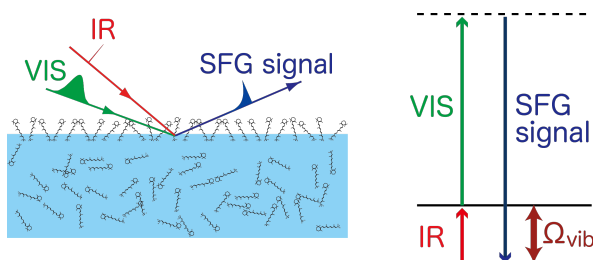
Physical Chemistry Laboratory

Ishibashi Group : Taka-aki Ishibashi, Masato Kondoh, Yuki Nojima

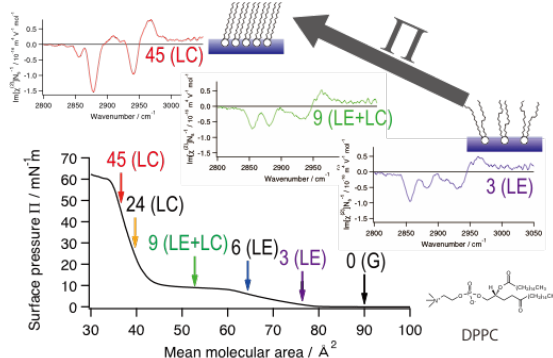
Physical Chemistry of interfaces and solution phase by various spectroscopic techniques

Surface VSFG

Molecules at interfaces are selectively probed by nonlinear spectroscopy



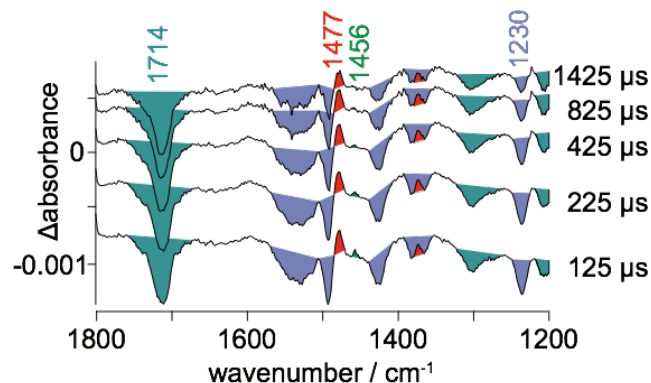
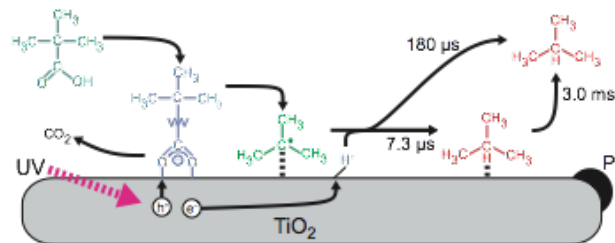
VSFG spectra
of lipid monolayers on water



Time-resolved IR

Short-lived chemical species are traced by IR spectroscopy

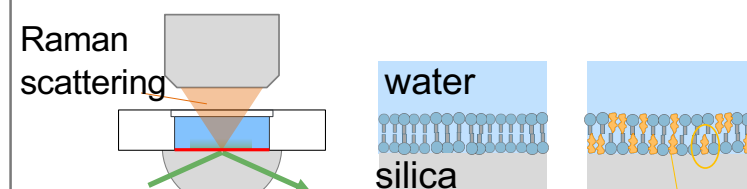
A photocatalytic process on TiO₂
studied by TR-IR



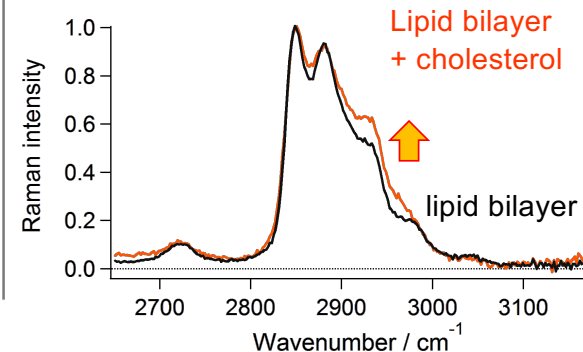
TIR-Raman

Total Internal Reflection
geometry allowed interface
sensitive observation by Raman

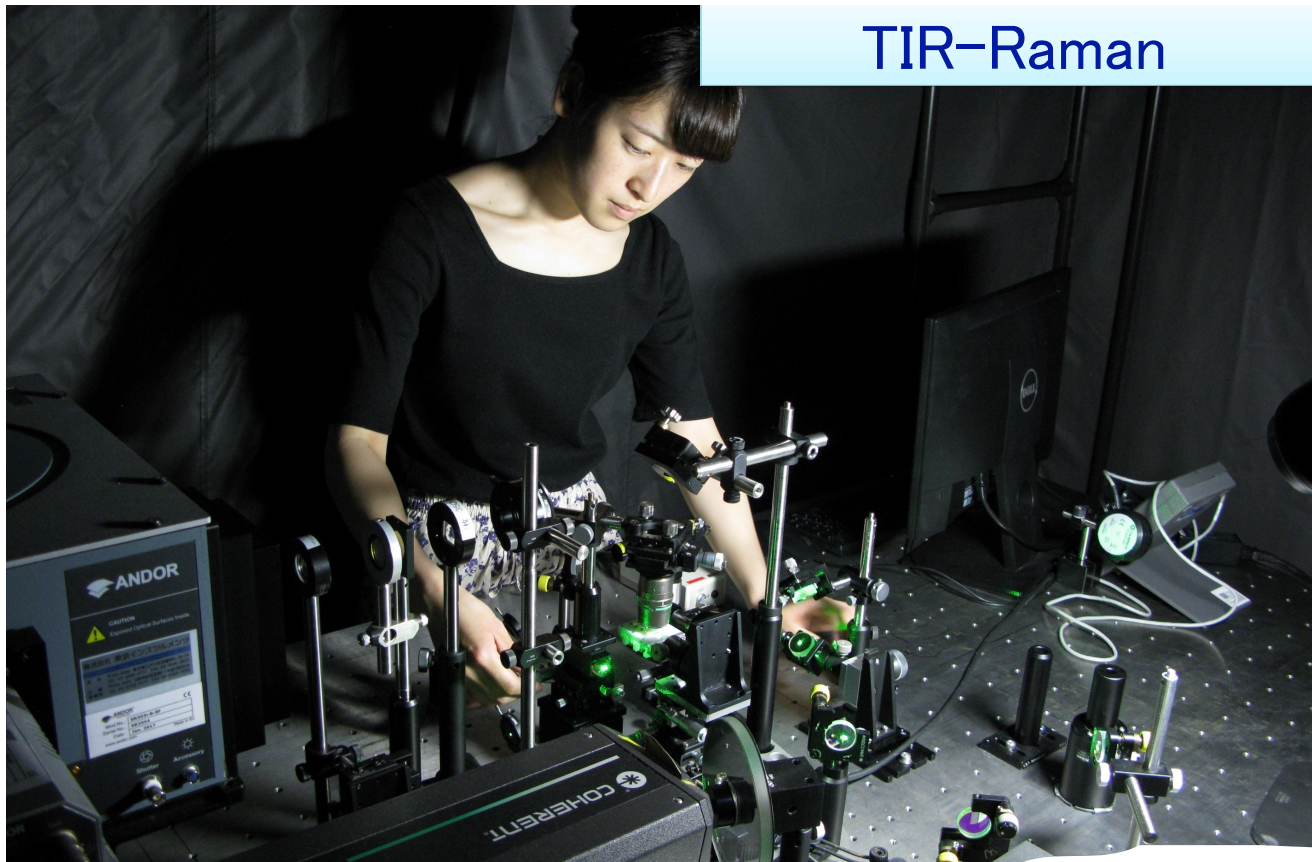
Supported lipid-bilayers + cholesterol
probed by TIR-Raman



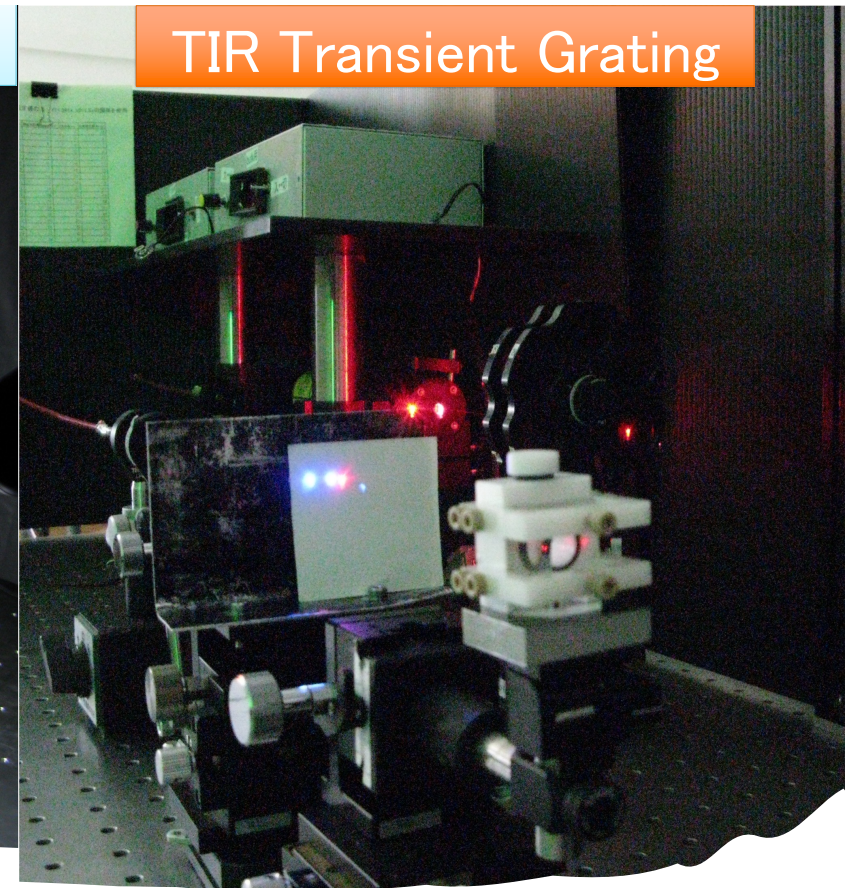
Ex. laser



TIR-Raman



TIR Transient Grating

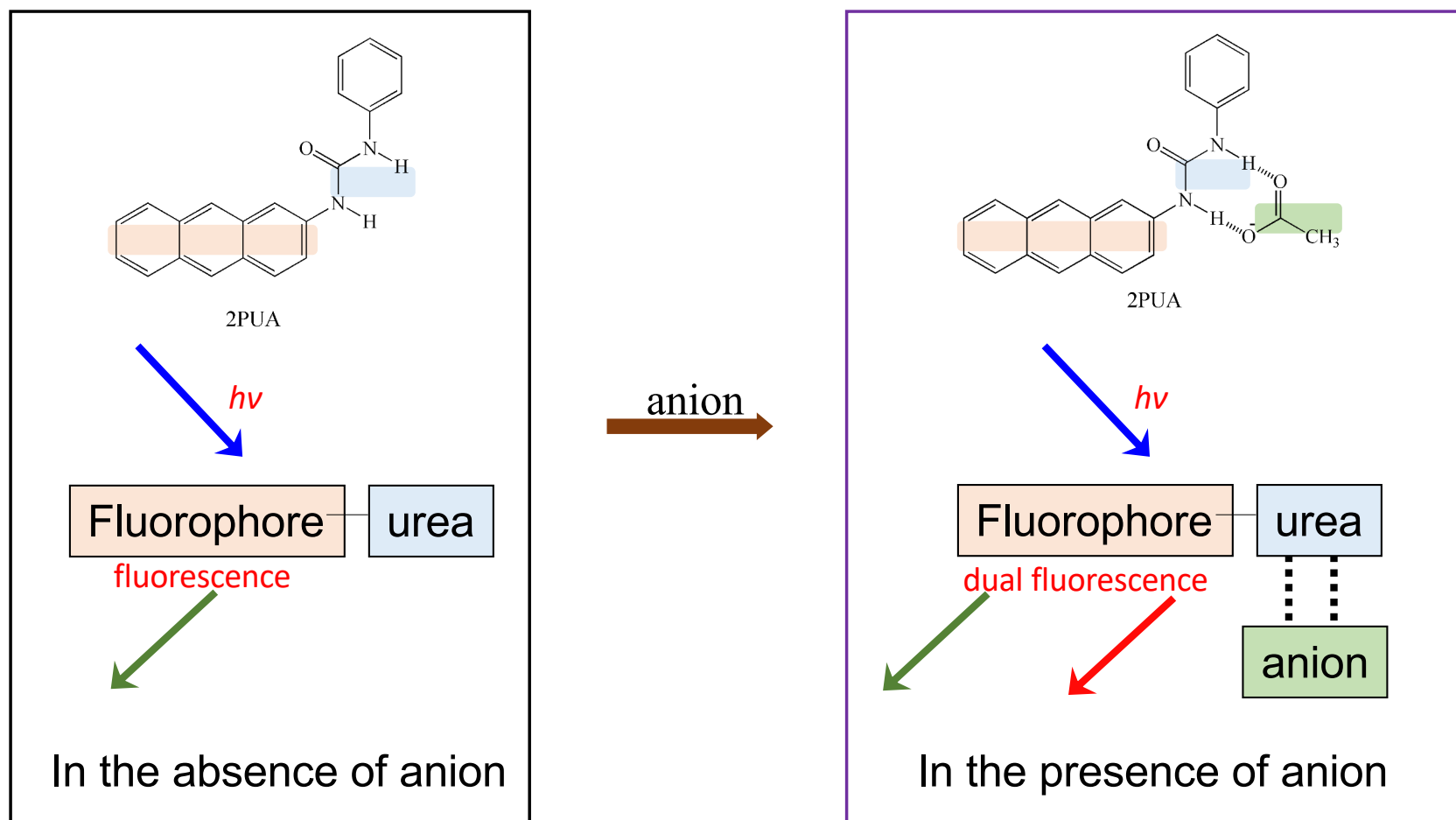


Surface VSFG



*We are doing experiments
like this
using our own instruments.*

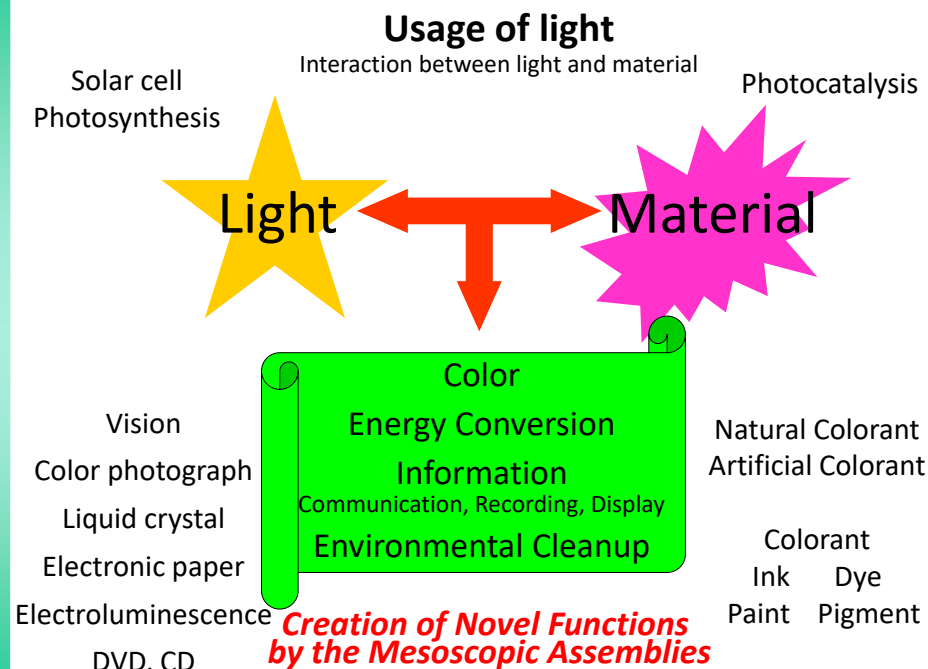
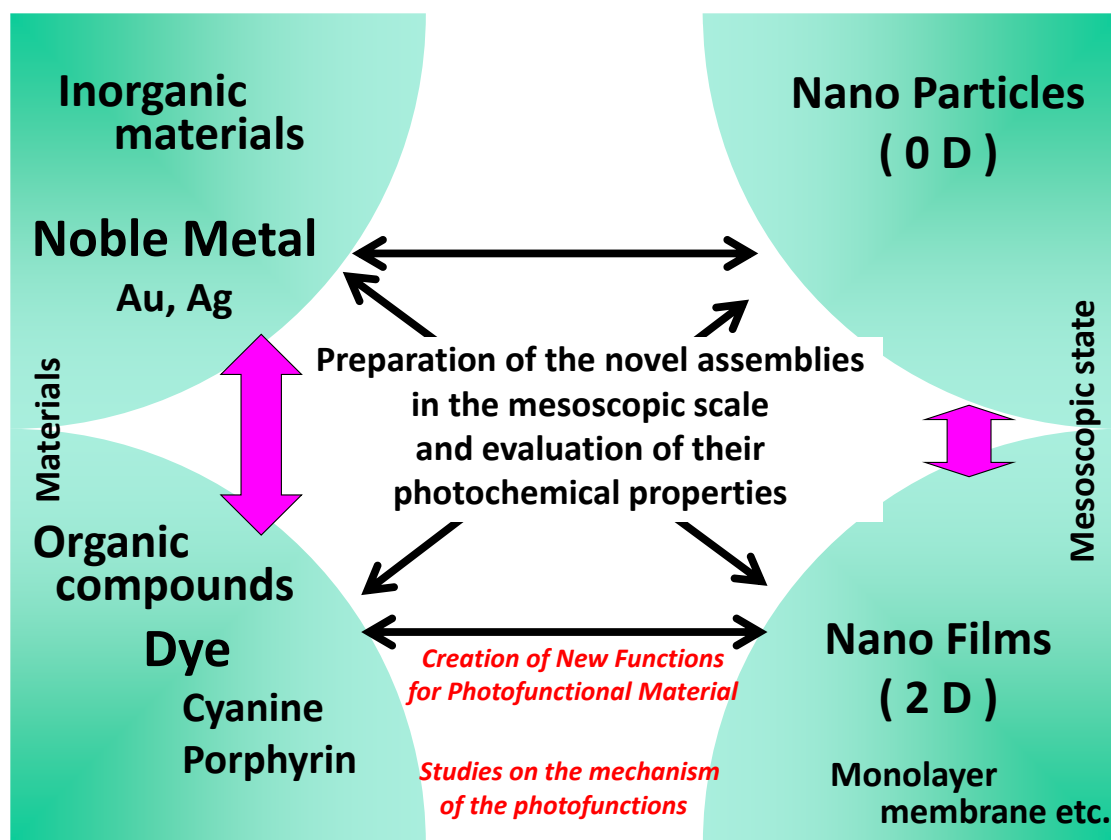
Anion recognition by fluorescent aromatic urea compounds



- 1) The aim is to create new urea derivatives in which the fluorescence state is changed by hydrogen bonding.
- 2) The formation and dissipation processes of fluorescent states involving hydrogen bonding with anions are analyzed kinetically by fluorescence lifetime measurements and the results are fed back to molecular design.

Photo physical chemistry related to
surfaces, interfaces, nano-particles, and nano-films

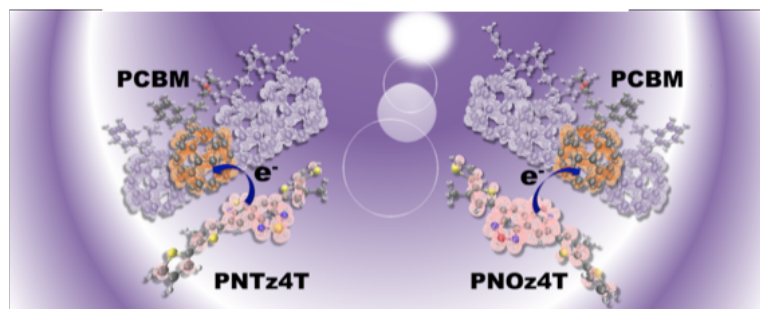
Studies on the photofunctions and photochemical properties
of the newly created assemblies in the mesoscopic scale



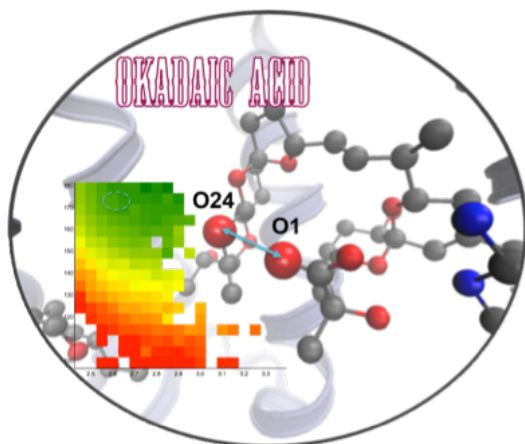
[1]



[2]



[3]



Computational/Theoretical chemistry

Computational studies by model chemistry

Redox potential of Fe-S model cluster [1]

Rate constant for organic photovoltaics [2]

Intramolecular hydrogen bonds in okadaic acid [3]

(Theme for Graduate school students)

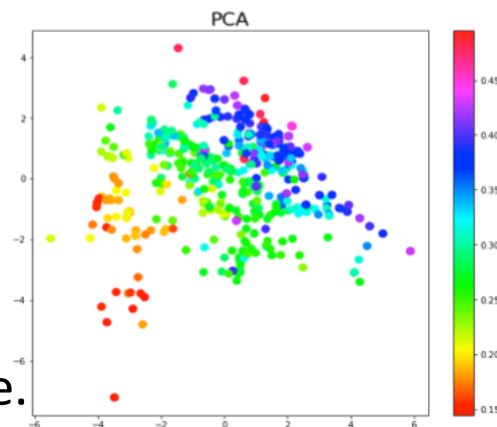
Cluster formation mechanism of citric acid

Degradation mechanism of β -lactamase

Studies using machine learning (ML)

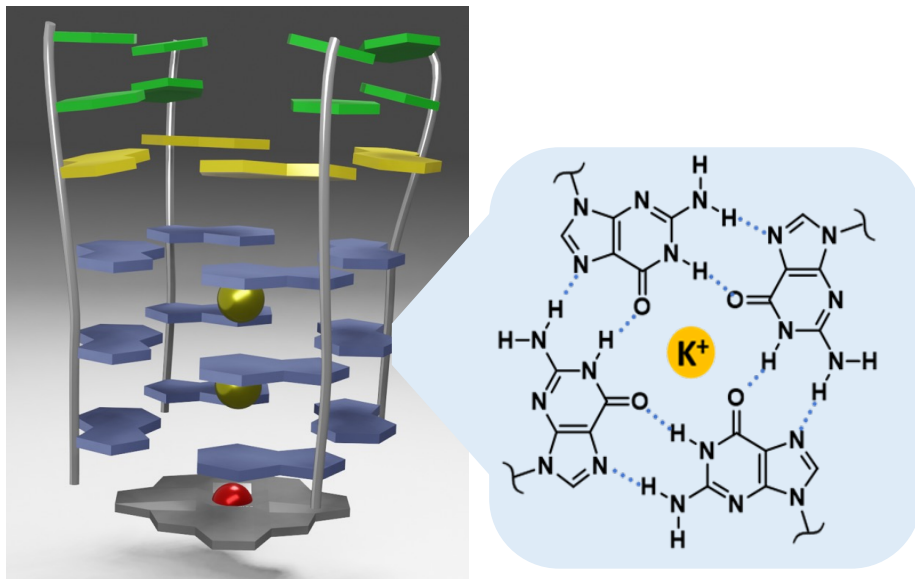
Parameters for LC-DFT

Appropriate domain segmentation by reducing the dimension of the information from a molecule.

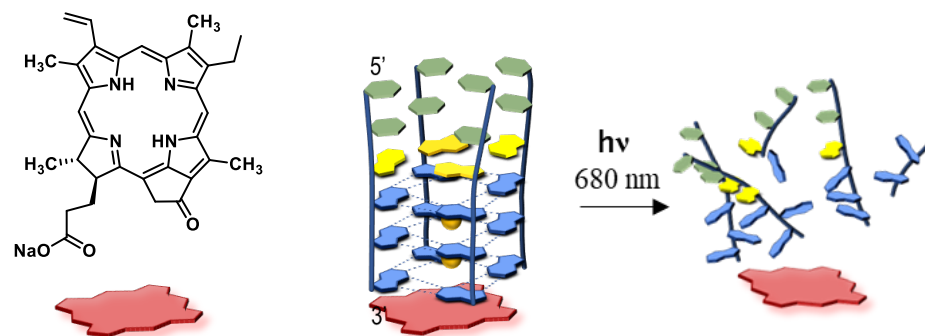


Momotake Group : Atsuya Momotake (Associate Professor)

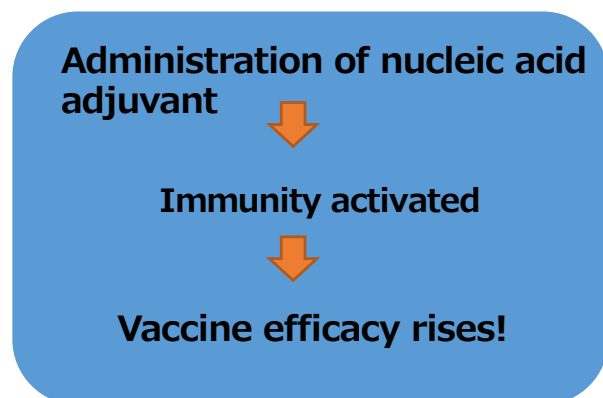
1. Development of highly functional and highly stable nucleic acid enzymes



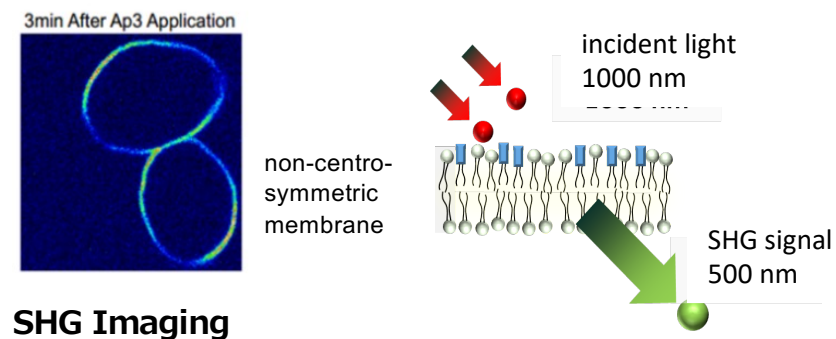
3. Development of photosensitizers that can be used in hypoxic regions



2. Development of nucleic acid adjuvants



4. Molecular Development for Nonlinear Optical Microscopy



Bioorganic Chemistry – Natural Product Chemistry

Unravel the Mysteries of Life by Organic Chemistry!

We have accepted many graduate students from domestic and overseas universities and techs:

Ibaraki Univ, Chiba Univ, Chuo Univ, Tokyo Univ of Science, Japan Women's Univ, Shanghai Normal Univ, etc.

Medicines
Agrochemicals
etc.

**Chemical
Biology**

Bioactivity

**Total
Synthesis**

Isolation

STAFF

KIGOSHI, Hideo
YOSHIDA, Masahito
OHYOSHI, Takayuki

STUDENTS

PhD Course: 3
Master Course: 12
Undergraduate: 2
Research Students: 2



Isolation



Hunting of marine animals

Total Synthesis



HPLC separation



Microwave reactor



Thermostatic bath



Automatic chromatography

Bioactivity



CO₂ incubator



Clean bench

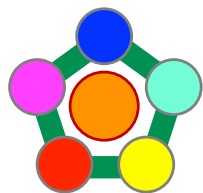
Chemical Biology



LC-Mass spectrometer



Fluorescence spectrometer

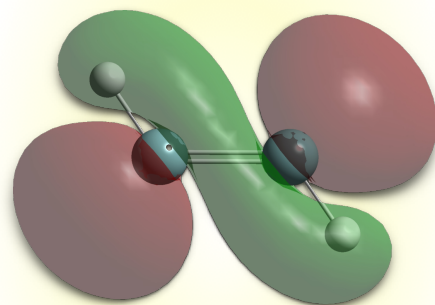


Organoelement Chemistry

Sasamori Group

Main Group Element Chemistry

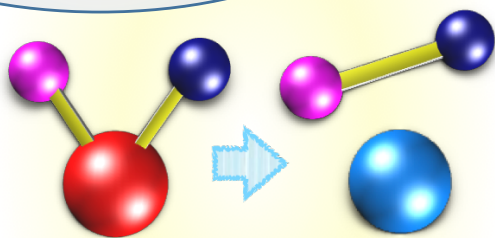
organic chemistry
C, N, O chemistry →
2nd row elements



Creation of novel
chemical bonds

Element Chemistry
Si, P, S, etc.
Heavier Element
Chemistry

$\text{Si} \equiv \text{Si}$



Main group element
catalysis

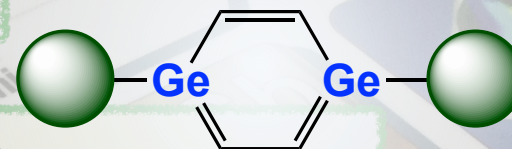
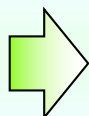
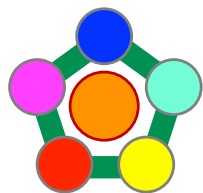


Photo- and electro-
chemical functions

Creation of novel
compounds utilizing specific
properties of each **Element**



Utilizes abundant main group elements
• small molecules activation • novel functions

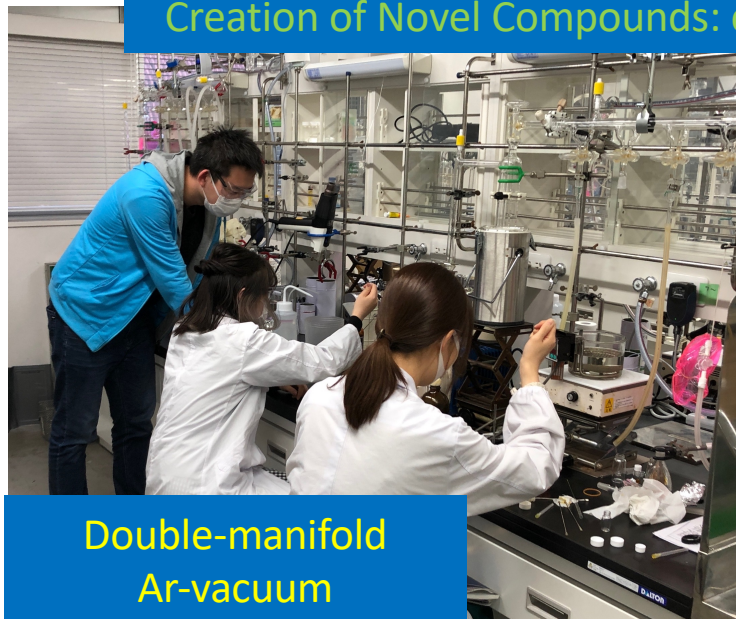


Organoelement Chemistry

Sasamori Group

Main Group Element Chemistry

Creation of Novel Compounds: custom-talored glasswares and advanced instruments



Double-manifold
Ar-vacuum



Ar-column
ay low-temp.



Ar glove box



Single-crystal
XRD analysis



NMR



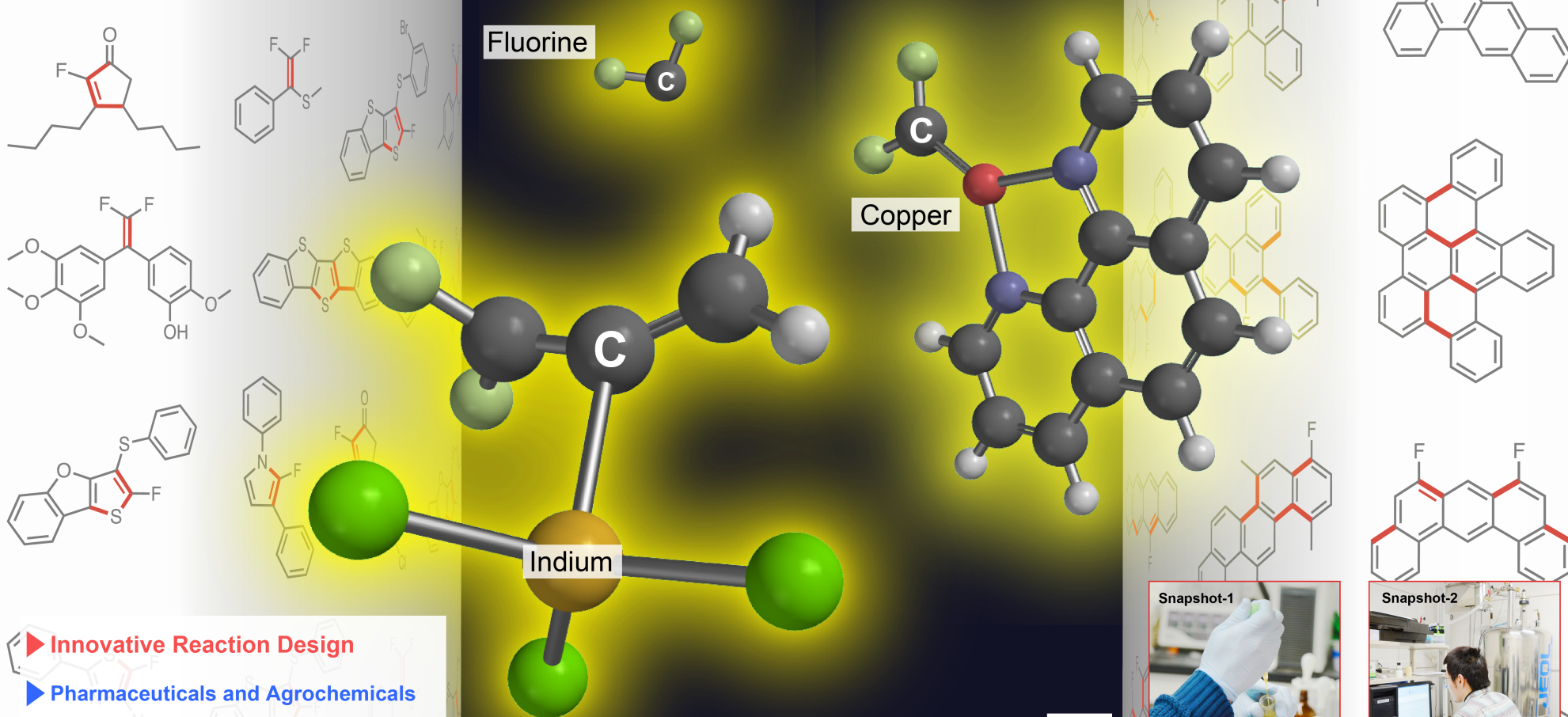
Electrochemical
Measurements
under Ar at L.T.



Fast filtration
under Ar

Synthetic Organic Chemistry Powered by Novel Active Species

Active species are molecules and ions that promote formation of new chemical bonds, generating a wide variety of compounds. The Fuchibe Group is focusing on developing unique synthetic reactions for organic compounds by creating/utilizing characteristic active species, typically including metal elements and fluorine.



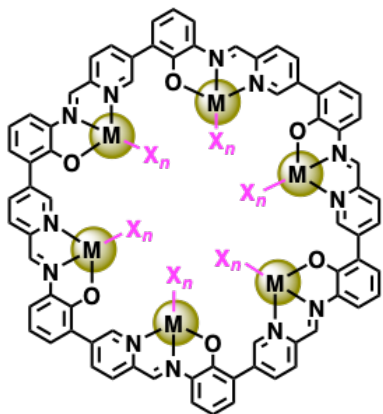
- Innovative Reaction Design
- Pharmaceuticals and Agrochemicals
- Organic Semiconductors and Devices

Contact : Kohei Fuchibe
kfuchibe@chem.tsukuba.ac.jp

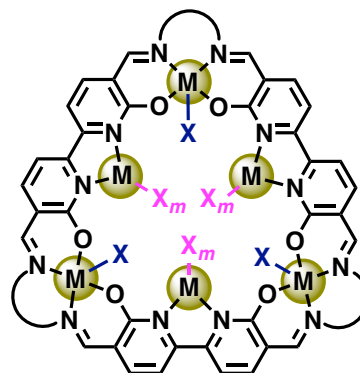
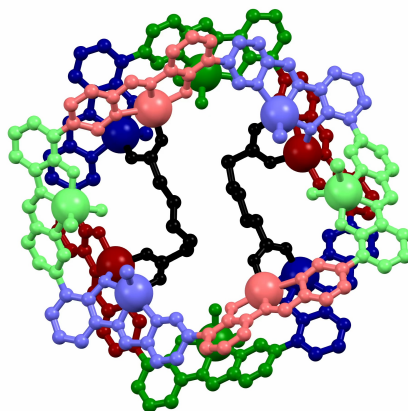


Nakamura Group (Supramolecular Chemistry)

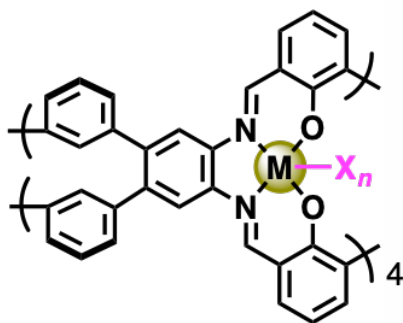
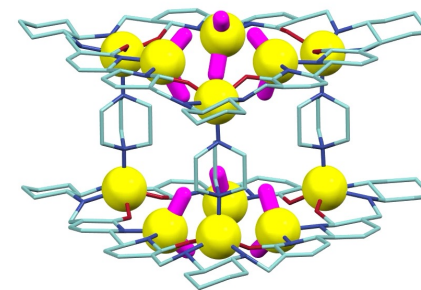
We design unique macrocyclic oligomers, and create supramolecules that produce novel substances through the control of functions such as molecular recognition.



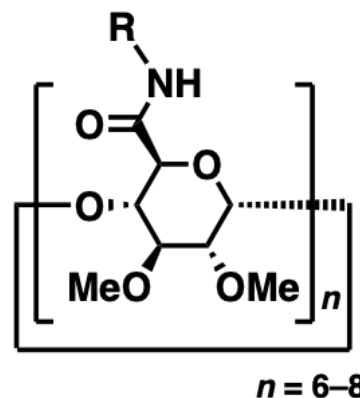
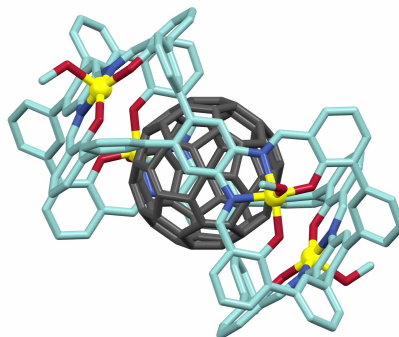
Capturing molecules by multipoint coordination



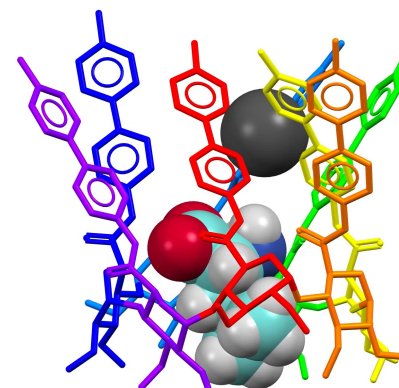
Arrangement of metal coordination sites



Belt-shaped macrocycle



Amide-cyclodextrin



Nakamura group welcomes graduate students to do research together!!

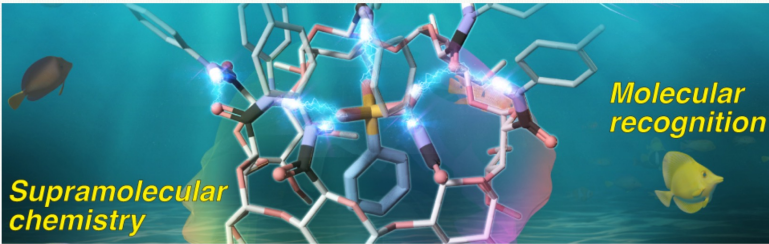
Contact: Takashi NAKAMURA (nakamura@chem.tsukuba.ac.jp)

Web: <https://www.chem.tsukuba.ac.jp/nakamura/en/index.html>

Nakamura Group (Supramolecular Chemistry)

Department of Chemistry, Faculty of Pure and Applied Sciences
University of Tsukuba
Nakamura Group (Supramolecular Chemistry)

日本語 English



Supramolecular chemistry
Molecular recognition

- Home
- Research Outline
- Members
- Publications
- Research Facilities
- Contact / Access
- Photo Gallery
- Link

Welcome!

Nakamura Group (Supramolecular Chemistry), University of Tsukuba. We design and synthesize unique macrocyclic oligomers, and create supramolecules that produce novel substances through the control of functions such as molecular recognition.

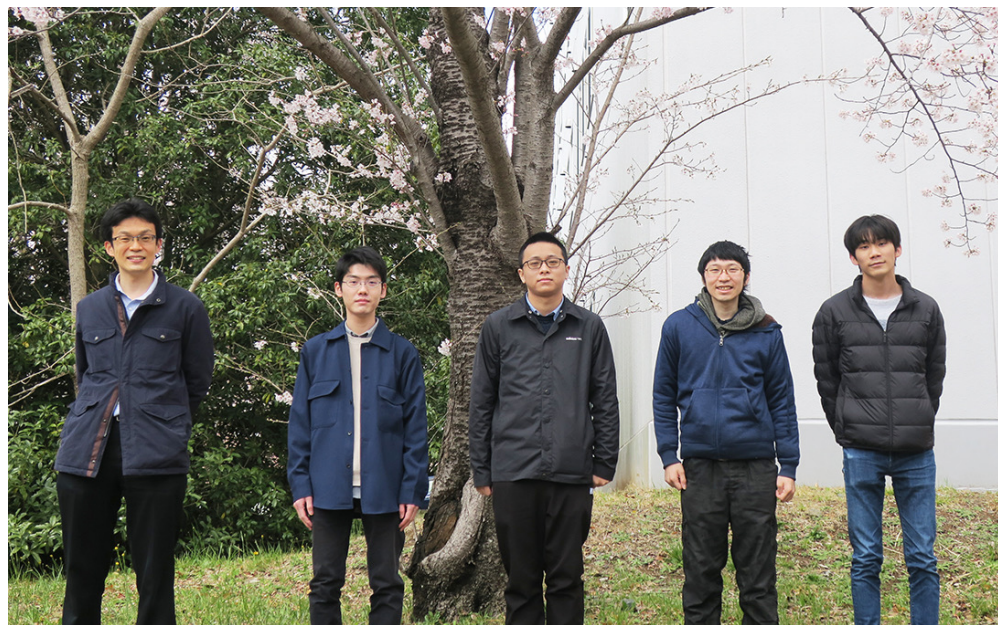

News

- Apr. 08, 2022 Assist. Prof. Nakamura receives the Young Scientists' Award in the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Japan ([MEXT webpage \(Japanese\)](#)). **NEW**
- Apr. 05, 2022 [Members](#) and [Photo Gallery](#) have been updated. **NEW**
- Mar. 04, 2022 [Our introduction video](#) has been uploaded to YouTube.
- Jan. 20, 2022 Assist. Prof. Nakamura has been awarded as 2021 BEST FACULTY MEMBER, University of Tsukuba.

Admissions

Nakamura group welcomes graduate students to do research together!!
[Master's/Doctoral Program in Chemistry](#)
[Master's/Doctoral Program in Materials Innovation](#)

Introduction Video (March 2022)



**Our research group has started
since April 2021.**

**Let's experience the fun of research
and build up a new chemistry!!**

Nakamura group welcomes graduate students to do research together!!

Contact: Takashi NAKAMURA (nakamura@chem.tsukuba.ac.jp)

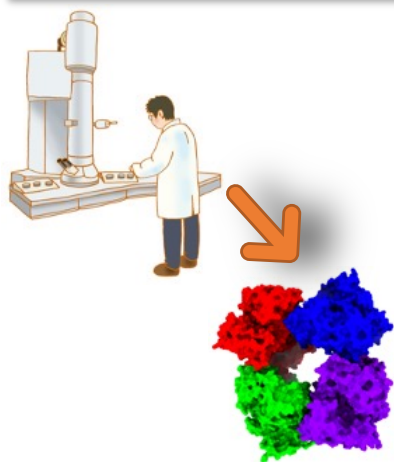
Web: <https://www.chem.tsukuba.ac.jp/nakamura/en/index.html>

Iwasaki's Laboratory

Structural Biology and Chemistry

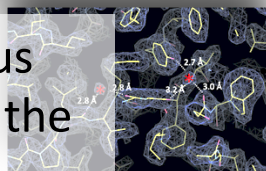
Elucidate the structure of biomolecules to **unravel the mysteries of life, elucidate pathogenesis at the molecular level**, and help in the latest drug discovery (not only small molecule drugs, but also middle-molecule drugs, the latest technology in biomolecular drugs, and gene therapy).

One billion yen national project Two of the **cutting edge cryo-electron microscopes for drug discovery** was installed in our **laboratory in FY2021**.



Elucidating Pathogenesis at
the Molecular and Atomic
Levels
Contributing to Drug
Discovery for Therapy

The cryo-EM image gives us
the atomic coordinates of the
molecule!
(a technique that won the
2017 Nobel Prize in Chemistry)



- Elucidating the Molecular Mechanism of Synovial Sarcoma Development
- Elucidation of the Molecular Mechanism of Malignant Lobular Tumor Development
- Elucidation of the Mechanism of Optical Sensor of *Euglena*



Collaboration with
Pharmaceutical
Companies
Tsukuba Becomes a
Center for Structural
Biology

cryo-EM@Univ. of Tsukuba

The cryo-electron microscopes are in the P2 room.

CRYO-ARM 300II



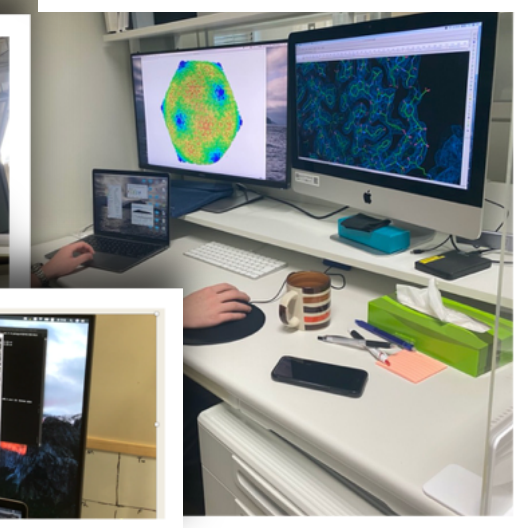
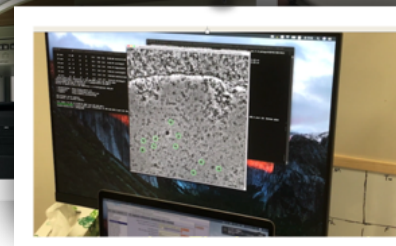
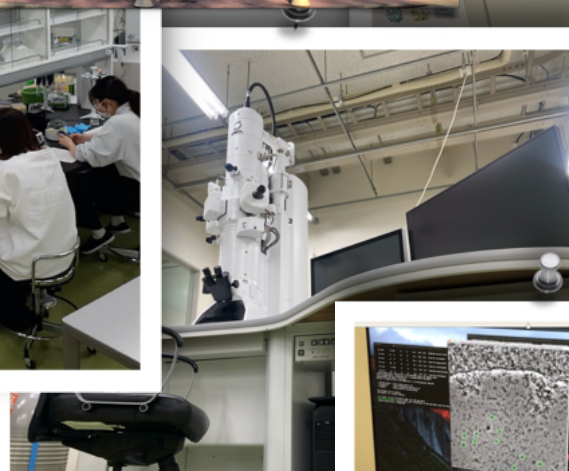
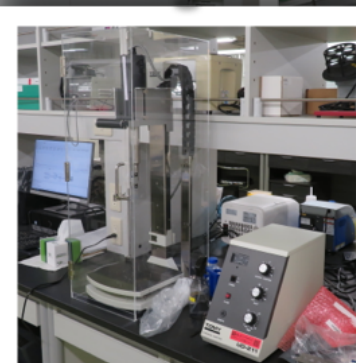
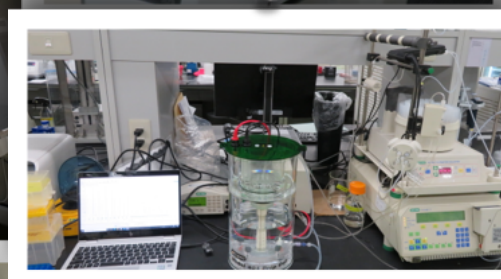
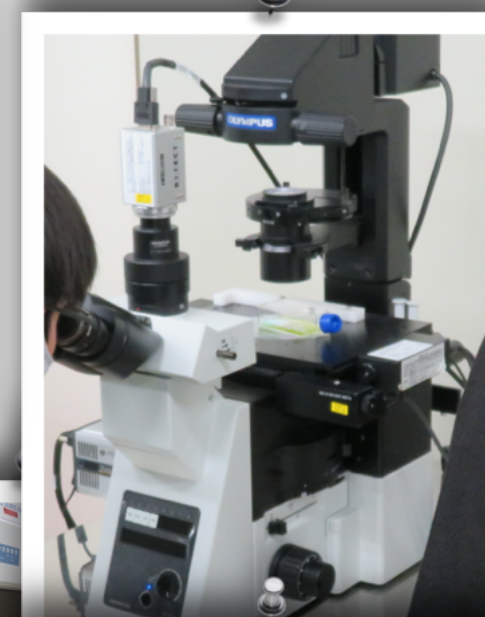
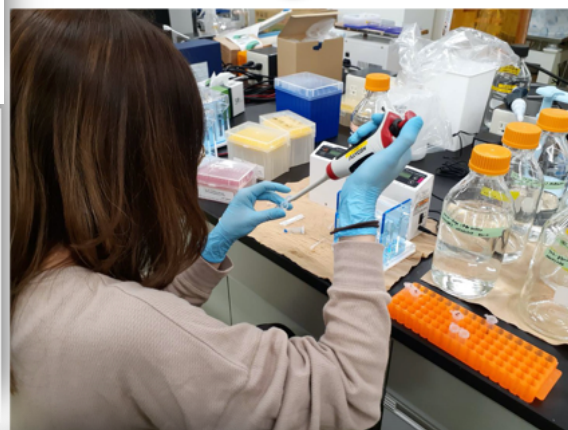
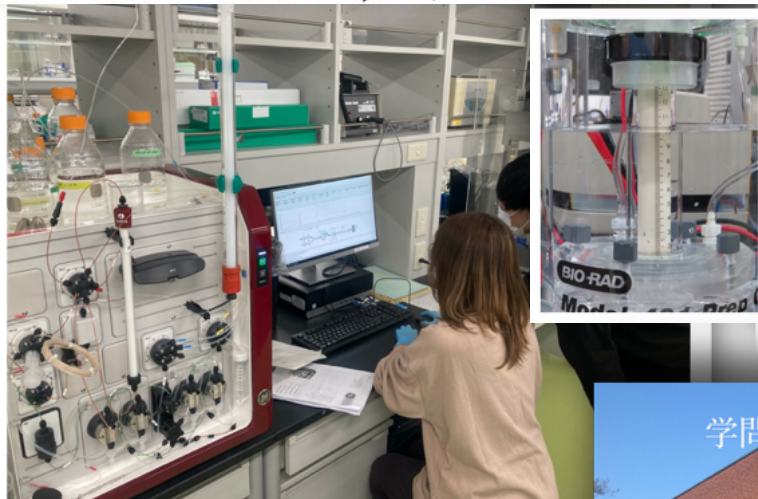
CRYO-ARM 200



JEM-1400+TVIPS 4K

Elsa holder





Medicinal Chemistry Lab.



Prof. : **Noriki Kutsumura**

Assistant Prof. : **Tsuyoshi Saito**

Our group is located at the IIIS building. This research organization is home to world-class specialists in brain research and sleep research, who work hard every day to conduct research that transcends the boundaries between laboratories. We are the only **chemistry group** in IIIS. We are engaged in various collaborative research projects using **drug discovery technologies based on synthetic organic chemistry**. We are also collaborating with many pharmaceutical companies and have some drugs under clinical trials.

E-mail : kutsumura.noriki.gn@u.tsukuba.ac.jp



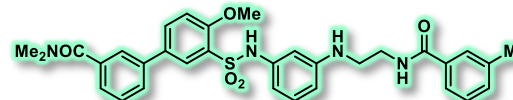
Targeted Drugs

- ✂ narcolepsy medication
- ✂ analgesic without any side effect
- ✂ Drugs for the treatment of protozoan infections
- ✂ antidepressant
- ✂ antitussive
- ✂ Alzheimer's Drugs

Major Recent Achievements

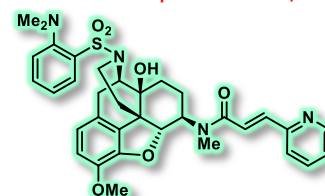
- ✂ World's first OX2R selective agonist

→ Expected as a **treatment for narcolepsy**



- ✂ World's first OX1R selective perfect antagonist

→ Expected as **antidepressants, anxiolytics, and addiction medications**





睡眠覚醒の謎に挑む

睡眠覚醒調節機構を解明し、人々が抱やみに眠れる社会
の実現を目指す世界トップレベルの睡眠科学研究拠点

睡眠医科学研究棟



マウスに化合物を投与



研究室の様子



抽出



化合物を細胞で評価中



研究室の様子



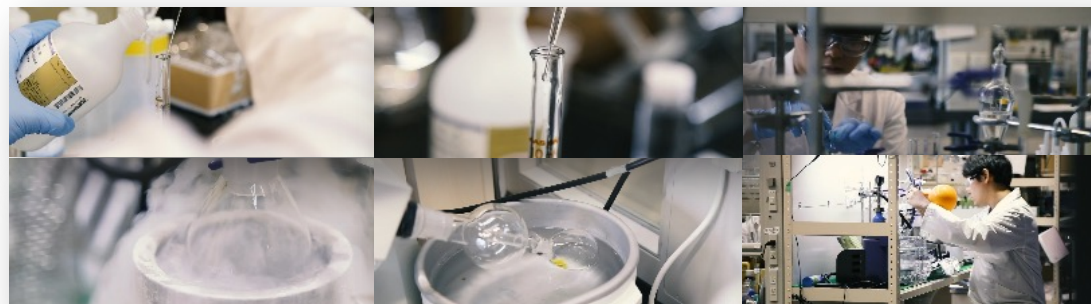
化合物の質量測定



濾過



濃縮



その他IIISの
プロモーション
動画より抜粋

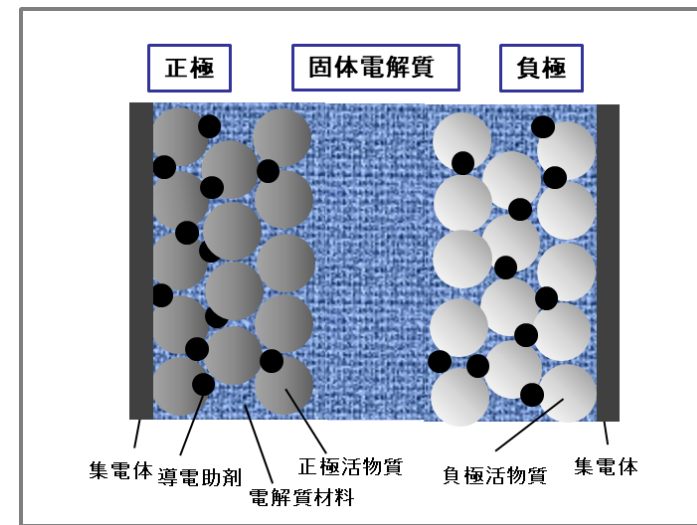
Cooperative Graduate School System(AIST Tsukuba Central)

Research Field	Professor	Research
Material Inorganic Chemistry	Junji AKIMOTO	Studies on inorganic solid state chemistry and electrochemistry for advanced functional materials (including lithium ion battery positive and negative electrode materials, and advanced solid electrolyte materials).
Surface Electrochemistry	Yukari SATO	Functionalization of solid and electrode surfaces; Redox flow battery for renewable energy introduction; Construction of micro multi sensing devices for marine environment.
High-pressure Organic Chemistry	Hajime KAWANAMI	Research on various organic chemistry with a ley word of “high-pressure”.
Organic Electronics Chemistry	Yuji YOSHIDA	Research on structural properties and photo-electrical properties of thin films based on polymers, molecular compounds and organic-inorganic hybrid materials, and chemistry on organic electronics such as organic photovoltaic cells (solar cells).
Nano-carbon Materials Chemistry	Toshiya OKAZAKI	Synthesis of the functionalized nano-carbons and their spectroscopic characterizations.
Organometallic Chemistry	Yumiko NAKAJIMA	Chemistry Design and synthesis of novel transition metal catalysts, development of catalytic reactions for precise synthesis of new organometallic compounds containing main group elements.
Photofunctional Material Chemistry	Yasuo NORIKANE	Photofunctional organic molecules especially showing photo-induced solid-liquid phase transitions and light-driven mechanical motion.
Functional Polymer Gel Chemistry	Yusuke HARA	Research and development of functional polymers and polymer gels for application to soft actuators, soft robots, micro fluidic devices.

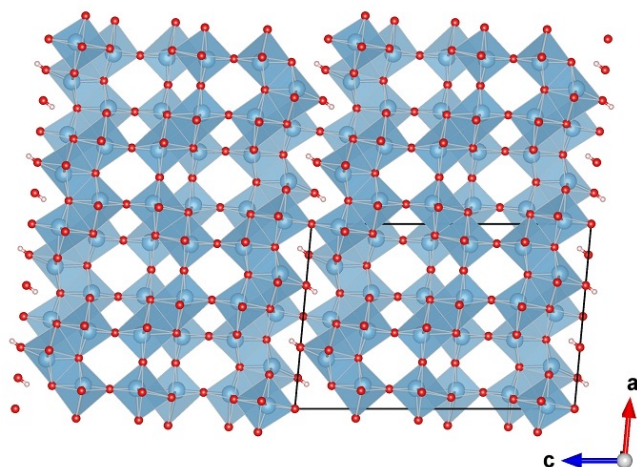
Materials Inorganic Chemistry Lab.
Prof. Junji Akimoto (j.akimoto@aist.go.jp) in AIST

Research Title: Study on Inorganic Oxide Materials for High Performance Battery Applications

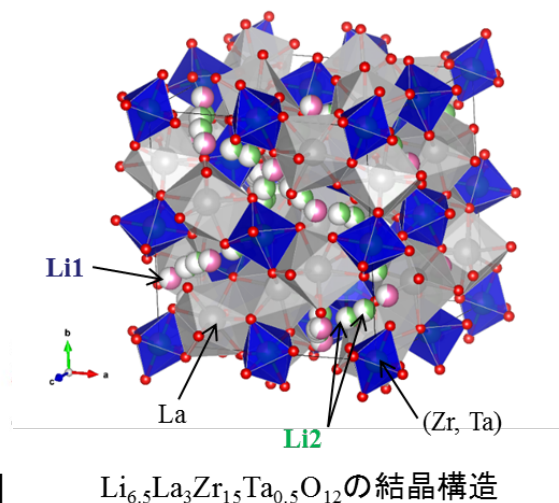
Lithium-ion batteries are expected to be widely used and deployed in large-scale applications such as electric vehicles (EV) and stationary power supplies. In order to realize next-generation high performance battery system, we are studying on new oxide materials utilizing by single crystal growth technology, soft chemical synthesis method, flux synthesis method, hydrothermal synthesis method, etc. In addition, we are studying on new material design by applying accurate crystal structure analysis and electrochemical and physical property measurements for inorganic compounds.



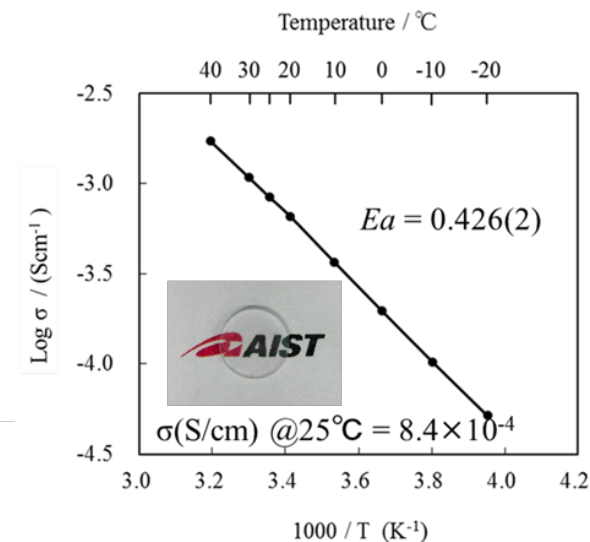
All Solid-State Battery System



Crystal structure analysis of a novel titanium oxide prepared by soft-chemical synthesis.

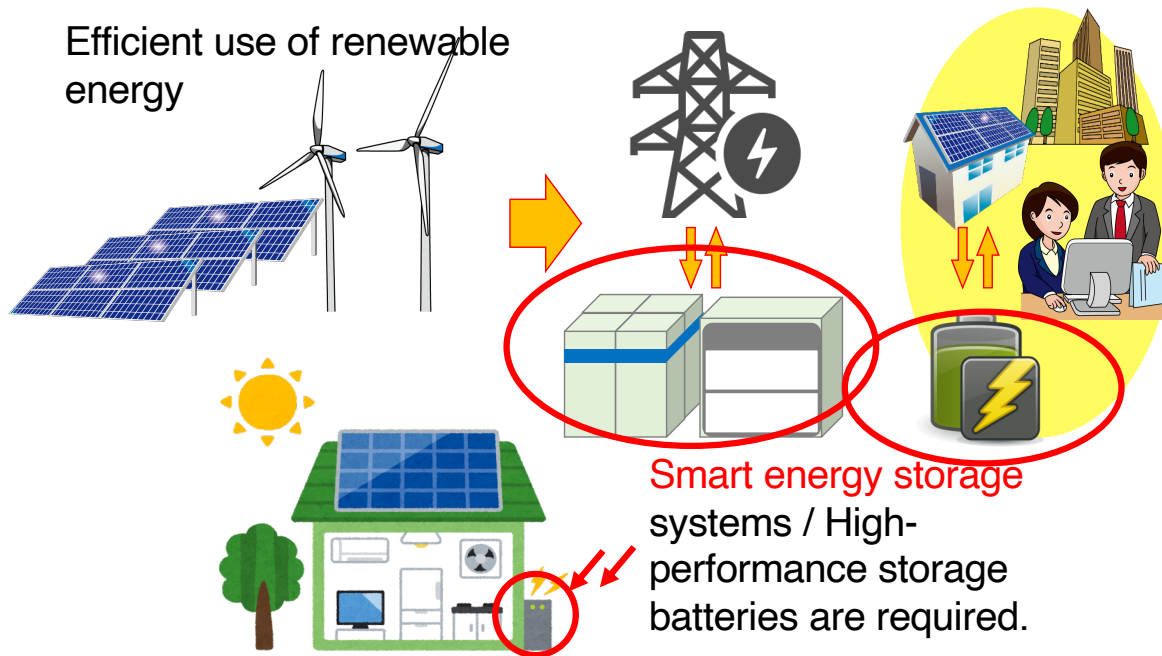


Crystal structure analysis and electrochemical measurements of garnet-type lithium-ion conducting oxide.



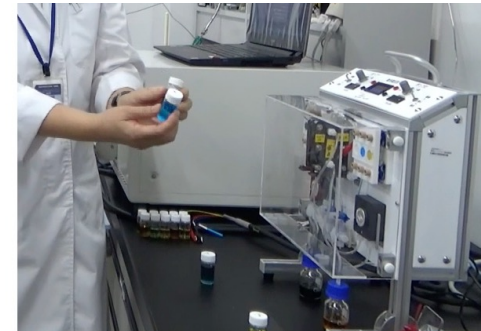
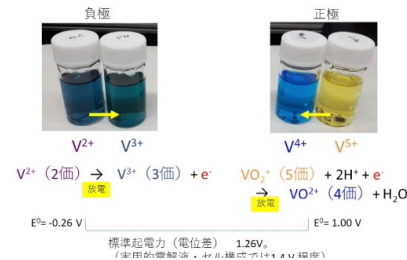
Redox Flow Batteries

Efficient use of renewable energy



We are conducting research and development of **new RFBs** that are no resource constraints and have low environmental impact.

レドックスフロー電池→液体蓄電デバイス
バナジウム系の電解液による放電実験



Environmental protection: Continuous measurement of Sea water pH



In order to predict environmental changes, we will make a small measuring device and observe pH changes. Joint research with the U. of Tokyo. 海水のpH連続測定、東大理と共同研究

Contact:

Yukari SATO yukari-sato@aist.go.jp

Central 5, 1-1-1 Higashi, Tsukuba, AIST

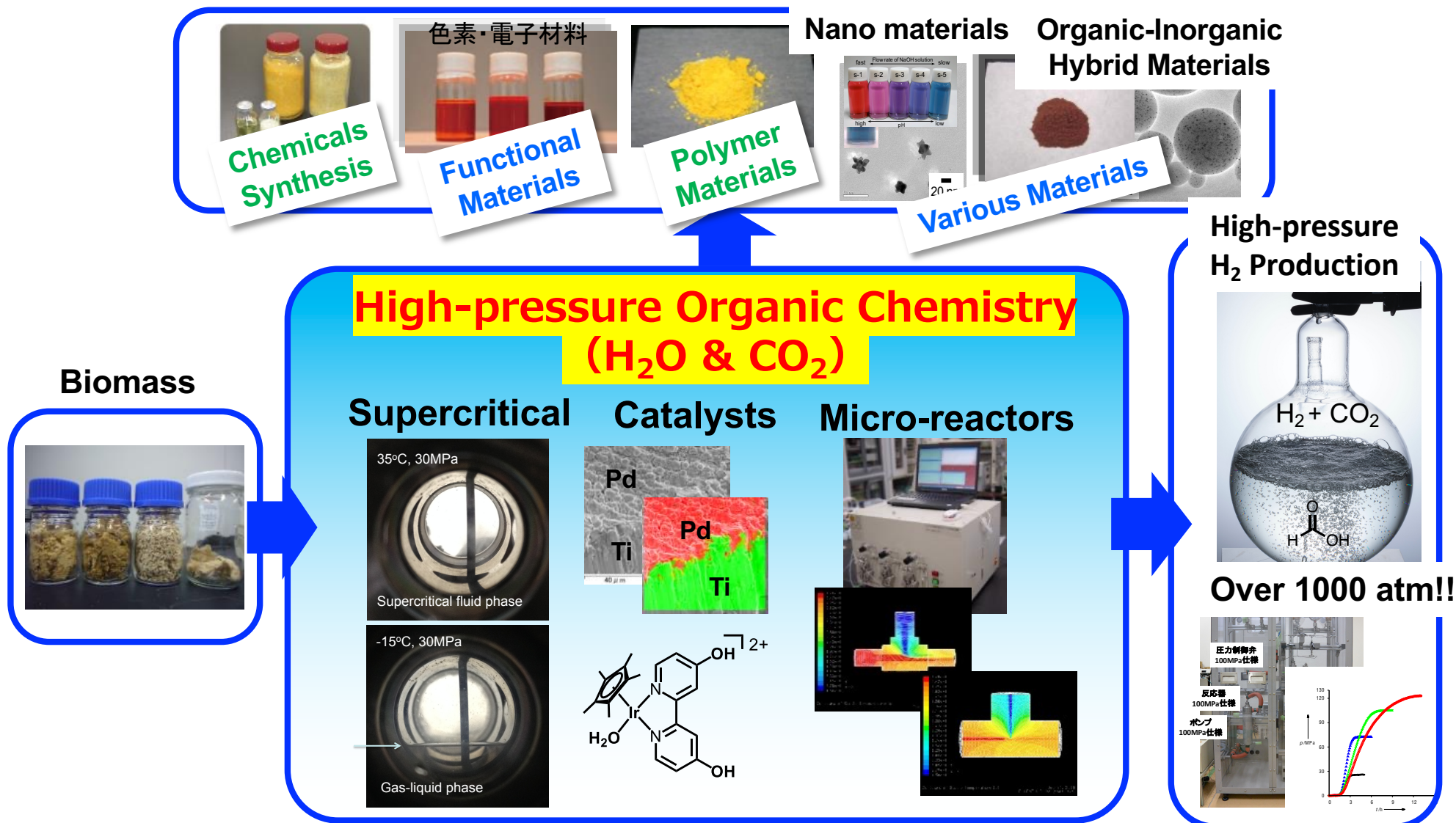
産総研つくば中央第5内 見学は随時可能です！

<https://unit.aist.go.jp/ieco/groups/index.html#esg>

<https://unit.aist.go.jp/ieco/est-2021/>

High-pressure Organic Chemistry Lab., Prof. Hajime Kawanami@AIST

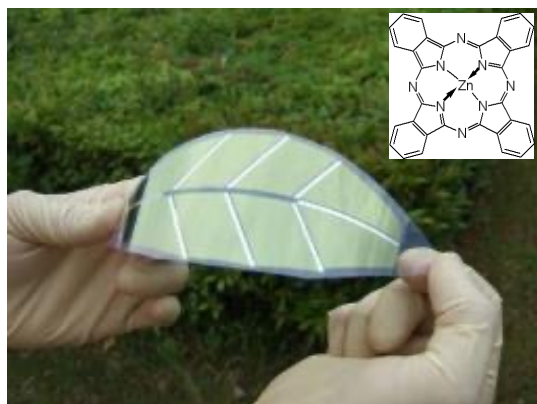
h-kawanami@aist.go.jp, <https://irc3.aist.go.jp/incorporate/team/functional-transformation/>



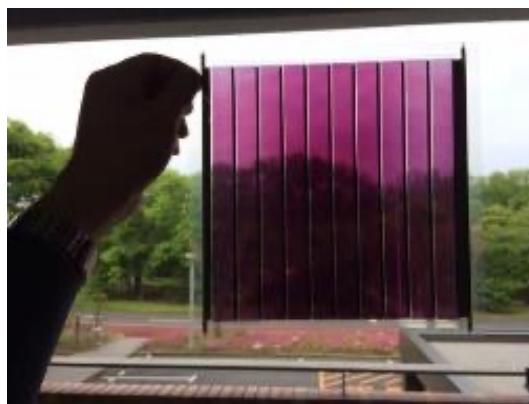
We are focusing on organic chemistry using **high-pressure such as supercritical fluids**. Recent topics are **high-pressure H₂ productions** over 100 MPa from formic acid, and **biodegradable polymer syntheses** from biomass.

Organic Electronics Chemistry Laboratory, Cooperative Graduate School (AIST) Professor Yuji YOSHIDA

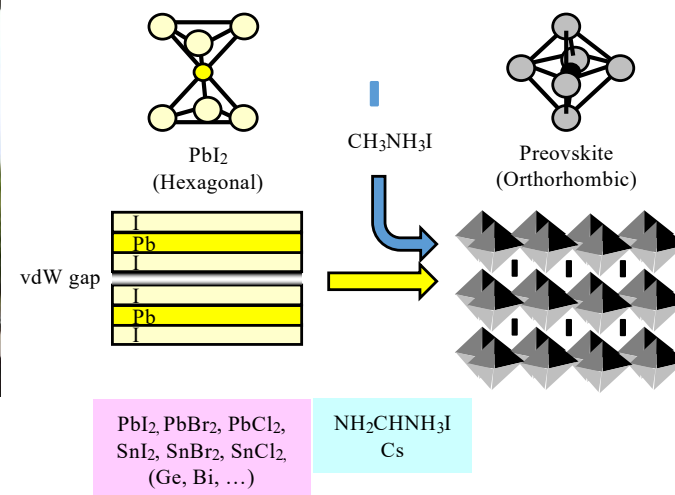
Our research aim is to solve the world's CO₂ reduction and energy problems with light and flexible solar cells. With conducting polymers (polythiophene), molecular dyes (phthalocyanine), and inorganic semiconductors (perovskite compounds) that can be painted, we are creating new concepts of solar cells with excellent design that can be installed on windows and walls or mounted on mobility vehicles.



Solar cell in the shape of a green leaf using phthalocyanine



See-through solar cells on windows



Effect of passivation on the interface between perovskite and donor-acceptor copolymer-based hole-transport layer in **perovskite solar cells**, Chem. Lett., 49, 1341, 2020

Investigation of the electron transport layer in **semitransparent organic photovoltaic cells** using near-infrared light-absorbing materials J.pn J. Appl. Phys., 60, 071004-1-6, 2021

Organic-inorganic hybrid perovskite crystal structure that can be solution coated (power conversion efficiency is comparable to silicon)

Yoshida's Lab.

Cooperated with organic-inorganic hybrid PV team, Global zero emission research center, AIST

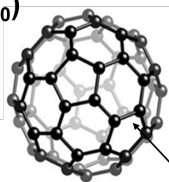
【Contact address】E-mail: yuji.yoshida@aist.go.jp / URL: <https://staff.aist.go.jp/yuji.yoshida/>

Cooperative Graduate School (AIST) Toshiya Okazaki's lab (Associate Professor)

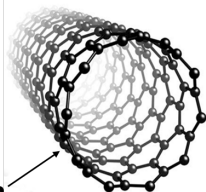
Nano Carbons

Fullerene (C₆₀)

Nobel Prize in Chemistry 1996

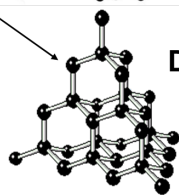


Carbon Nanotube (CNT)



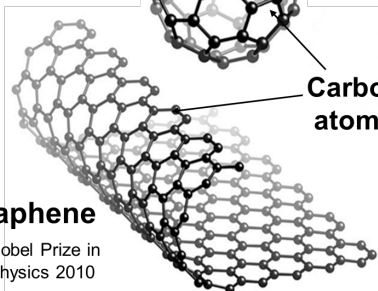
Carbon atoms

Diamond



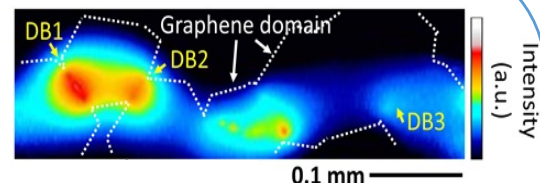
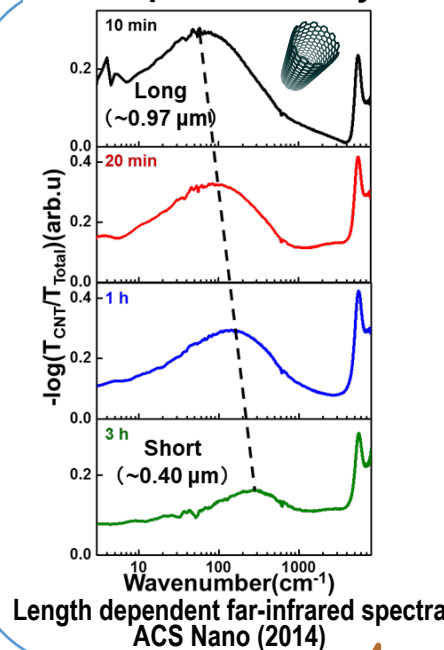
Graphene

Nobel Prize in Physics 2010

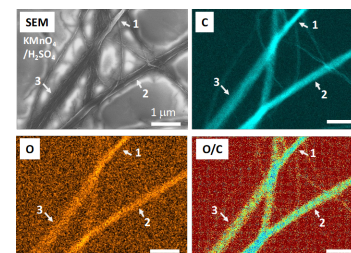


- Light weight and mechanically strong
- Chemically stable
- Electrically and thermally conductive
- Nano scale in size and high specific surface area

Development of analytical and characterization methods



Visualization of graphene grain boundaries by lock-in thermography
Science Advances (2019)



Elemental mapping images of CNT surface
Nanoscale (2019)

Structure
Dispersion state

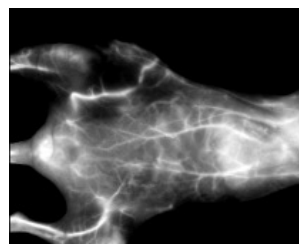
Relationship

Properties
Functions

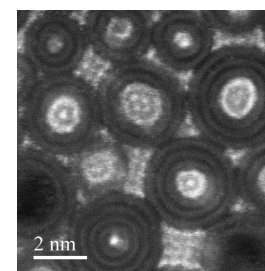


2020 Lab Members

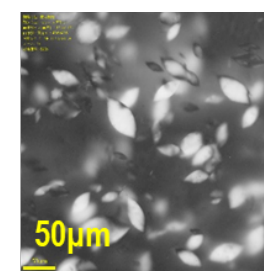
Nano Carbon Based Functional Materials



NIR imaging probe
Sci Rep (2014)



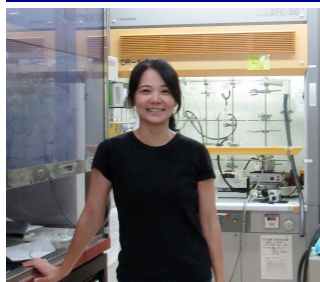
I₂ doped CNT fiber



CNT liquid crystal

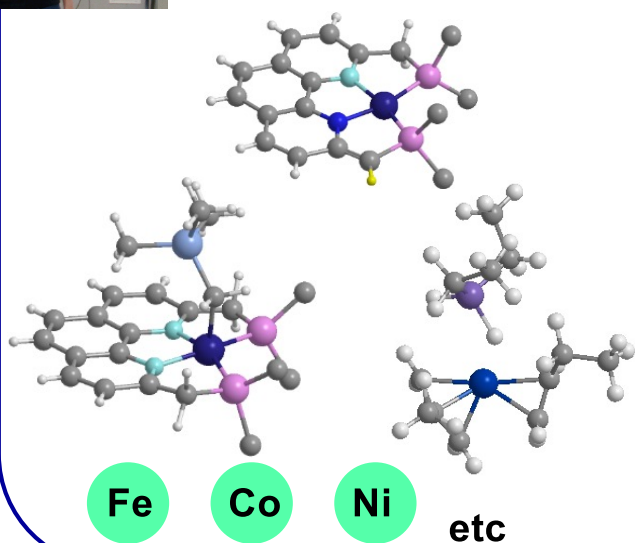
Organometallic Chemistry Laboratory_ Cooperative Graduate School

Dr. NAKAJIMA, Yumiko@AIST

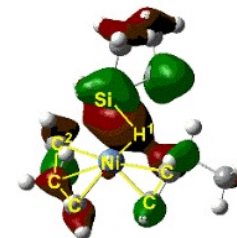
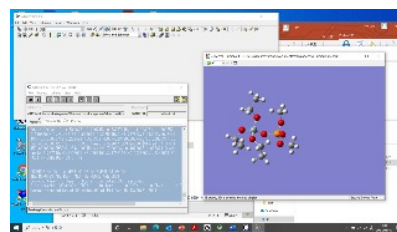


Development of New Catalytic Reactions towards Development of High-Performance Materials

Organometallic Catalysts



Synthetic Chemistry Labworks



Theoretical Calculations

Analysis Using High-Performance Equipments



Efficient synthesis of high-performance materials



Fiber-reinforced plastic



Eco-tire



Encapsulant of devices

Financial supports are available

¥200,000 JPY/month for Doctor course students

¥100,000 JPY/month for Master course students

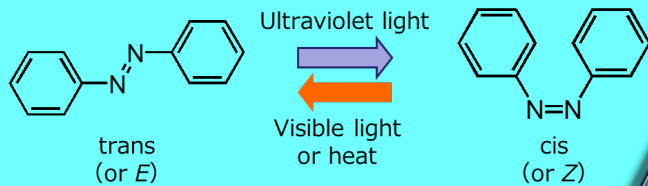
(contact) yumiko-nakajima@aist.go.jp, URL: <http://irc3.aist.go.jp/team/organosilicon-chemistry/>

Photofunctional Materials Lab.

Y. Norikane, Ph. D
@ AIST Tsukuba

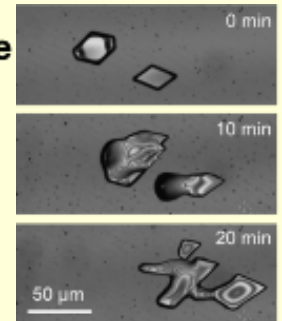
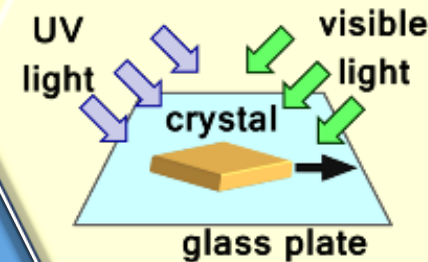
y-norikane@aist.go.jp

Changing molecular structure by light



Isomerization of azobenzene

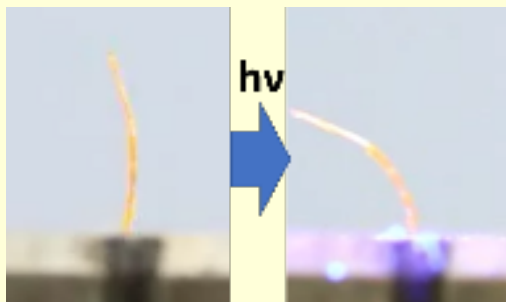
Crawling crystal



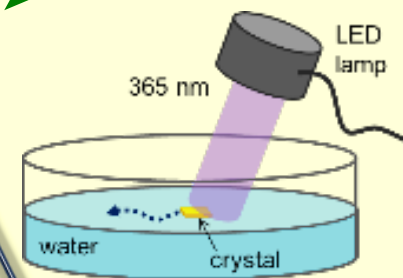
Amplifying molecular-level changes into macroscopic phenomena

- ✓ Molecular design
- ✓ Synthesis
- ✓ Mechanism
- ✓ Application

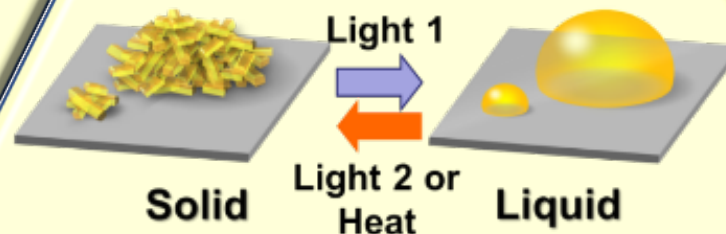
Photo-actuating polymer & Soft Robotics



Swimming crystal



Melt / solidify by light



- **Study on Soft Actuators**

Development of soft actuators in microchannels driven by chemical reactions, electric field, pH, etc.

- **Study on Capillary Gel Electrophoresis**

Development of novel gels that can accurately, quickly, and easily separate DNA fragments.

- **Study on process informatics by machine learning**

By applying machine learning to flow synthesis, we improve and optimize the process of the flow synthesis method.

Degree Programs in Pure and Applied Sciences,
Graduate School of Science and Technology,
University of Tsukuba

Master's/Doctoral Program in Chemistry

<https://program.chem.tsukuba.ac.jp/>

Online Admission Consulation
2022.5.28. 13:00~17:00



【Contact】

Tel : 029-853-6505 (Office)

E-mail : chkyomu@chem.tsukuba.ac.jp (Office)
: sasamori@chem.tsukuba.ac.jp (Prof. Sasamori)