

Bachelor's / Master's Program in Engineering

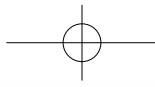
Materials Science and Engineering / Bioengineering

Materials Science and Technology

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Bioengineering

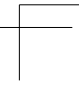
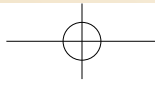
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Bachelor's / Master's Program in Engineering

Materials Science and Engineering / Bioengineering

Materials Science and Technology / Bioengineering



【校正時ご確認をお願い致します】

□扉の指示に合わせて、昨年のページをそのまま入れました。よろしかったでしょうか？

1

Opt-electronic ceramics Laboratory

Professor / Hidetoshi SAITOH Assistant Professor / Keiji KOMATSU

- ▣ Keen insights and broad knowledges for materials
- ▣ Synthesis of materials with high perfection and advanced analysis ability
- ▣ New life into the field of metal oxide film and DLC film and porous carbon materials

Supervisor Professor / Hidetoshi SAITOH

He will help students strictly and gently with advice from a multifaceted perspective that makes full use of a wide range of research fields. In addition, he is spreading the idea of "Ultimate" to the world as chairman of the society of water rescue and survival research.



Research Content

This laboratory is engaged in research on a wide range of materials such as synthesis and evaluation of various metal oxide films using proprietary technologies with atmospheric chemical vapor deposition (CVD) method and flame deposition method using metal complex and synthesis of diamond like carbon (DLC) film with diverse complex structure and structural analysis and classification with various approaches, Synthesis of porous carbon materials made from waste and evaluation of world's top gas adsorption characteristics and structure. In addition, lots of world's first materials and technologies were existed in this laboratory and we will continue to propose/inform various research results to the world.



This picture shows a scanning electron microscope(SEM) in the laboratory owns. You can use this anytime.

A Day in the Lab

The day of our laboratory starts from the morning seminar at 7:50 every morning. Although we start a little earlier than other laboratories, we can do experiments at our own pace because there is no core time. We are mainly discussing of English papers related to research and reporting of research result in the seminar. Students create and present slides on their own and answer questions to solve the problem between them. Students can gain new opinions through collaborative research with companies and join the society and learn the presentation method that is easily transmitted to listeners.



This is a photograph when the Ministry of Education, Culture, Sports, Science and Technology visited to our laboratory.

Thesis Subjects

- ▶ (M)Barrier coating of Gd-doped CeO₂ film synthesized with EDTA solution
- ▶ (M)Saccharide adsorption characteristic of amorphous carbon materials
- ▶ (D)Surface structure and hydrogen storage phenomenon of amorphous carbon

Major employers of Graduates

The number of
PhD Graduates

17

- Nissan Motor Co., Ltd.
- Panasonic
- Mitsubishi Heavy Industries, Ltd.
- COVALENT MATERIALS
- Toyo Kohan Co., Ltd.
- Dainippon Screen printing
- NOK CORPORATION
- OKAWARA MFG.CO., LTD
- Tokita CVD systems
- CVD products

Writer : KIKUCHI Taito , Department of Materials Science and Technology
(National Institute of Technology, Ichinoseki College)

89

教員名

SAITOH Hidetoshi
KOMATSU Keiji

キーワード

coating
diamond like carbon(DLC)
nano porous carbon(NPC)
chelate complex

Mechanical

Electrical

Management

Materials

Civil

Nuclear Technology

System Safety

Innovation

2

Supramolecular Solid State Chemistry Laboratory

Professor / Tatsuhiro IMAKUBO



- ▣ Novel organic conductors from Japan !
- ▣ Novel functions and physical properties on supramolecular arrangement !
- ▣ Development of single crystal devices !

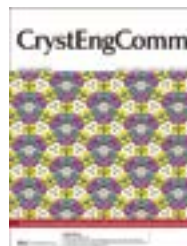
Supervisor Professor / Tatsuhiro IMAKUBO

He is very approachable and I can easily ask him about anything I don't understand, from daily life to research. When explaining to me how to perform experiments, operate equipment, and process data, he teaches me in an orderly and easy-to-understand manner, so I can work hard on my research with full understanding.



Research Content

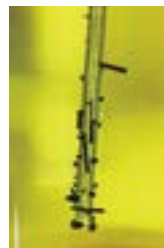
Our laboratory is conducting research to develop structural control methods for functional organic crystals, to control electronic properties based on these methods and to elucidate the mechanisms of property expression, and to discover new functions and properties that are expected to emerge in the future. Currently, our main research targets are organic materials that conduct electricity - "organic conductors". In particular, we are aiming to utilize the concept of "supramolecules," in which molecules are linked to each other by characteristic intermolecular interactions, to control crystal structures and electronic properties, and to discover new functions and properties.



Our work was selected as the front cover illustration of an academic journal.

A Day in the Lab

Because we value a sense of balance in our laboratory, lab members work hard on weekdays starting in the morning and do not conduct experiments on their days off or at night. In addition, the laboratory regularly holds round-table lectures and experiment reports. In the experiment reports, students report the results of their own research and discuss their future research plans with their professors and all students. Basically, the progress of research is left to each student, but if you have any questions, you can feel free to consult with your professor or senior students, so you do not have to worry alone and can proceed with your research efficiently.



Single crystals glowing on a platinum electrode.

Thesis Subjects

- ▶ (B) Development of novel organic conductors based on Cu(CF₃)₄ anion
- ▶ (M) Development of novel organic conductors based on the iodine-bonded p-donor DIETSe and square planar M(CF₃)₄ [M = Au, Cu] anions
- ▶ (M) Synthesis and properties of new organic conductors based on ethylenedioxy-tetraselenafulvalene (EDO-TSeF)

Major employers of Graduates

The number of PhD Graduates

0

- TWINBIRD CORPORATION
- ISHI IRON WORKS CO., LTD.
- Endo Manufacturing Co., Ltd.
- The High Pressure Gas Safety Institute of Japan
- STARLITE Co., Ltd.
- TAKATA Pharmaceutical Co., Ltd.
- Momentive Performance Materials Inc.
- SHINTO PAINT CO., LTD.
- MST
- Toyo Kohan Co., Ltd.

90

Writer : Yuga YAMAZAKI, Materials Science and Engineering/Bioengineering
(National Institute of Technology, Ichinoseki College)

教員名

IMAKUBO Tatsuhiro

キーワード

Organic conductors
Iodine bond
Electronic properties

【校正時ご確認をお願い致します】

□執筆者欄「Collage」を「College」に修正しました。

3

Optic & Magnetic Materials Laboratory

Professor / ISHIBASHI Takayuki

- ▶ Make invisible magnetic fields visible !
- ▶ Develop new magnetic materials !
- ▶ Characterize magnetic materials utilizing light !


https://mst.nagaokaut.ac.jp/~t_bashi/en/

Supervisor Professor / ISHIBASHI Takayuki

Prof. Ishibashi is a very friendly teacher who can easily consult with you. He offers a variety of advice on research and takes his student issues seriously despite being very busy. Especially when proceeding with research activities, he provides many opportunities for consultation. Therefore, We can be convinced and work hard on their research.



Research Content

Our laboratory conducts some research about magnetic materials

1. Preparation of magnetic garnet thin films by the metal-organic decomposition (MOD) method and evaluating its magnetic properties. we can make a high quality garnet thin film. In addition, we develop new thin film fabrication technology. Laser crystallization method (optical MOD) can reduce the heating on the substrate. The ultrasonic atomization method can apply to arbitrary shapes
2. Development of evaluation technology using the garnet thin film by magneto-optical measurement
3. Development of magneto-optical imaging technology. It is possible to visualize the magnetic field by the garnet thin films.



Development of evaluation technology using the garnet thin film by magneto-optical measurement.

A Day in the Lab

In Ishibashi Laboratory, his students will divide into groups according to major research themes and proceed with experiments. Seminars are held every Thursday. We will be presented with a weekly report on their research that a week and an English dissertation on their research. Ishibashi Lab. have cooperative relationships with domestic research institutes and overseas universities. We can actively interact with overseas researchers and learn about cutting-edge research. You are able to feel free to consult with the teacher or seniors. Therefore you can proceed with your research efficiently.



Preparation of magnetic garnet thin films by the metal-organic decomposition (MOD) method.

Thesis Subjects

- ▶ (M) Preparation of rare earth iron garnet and evaluation by ferromagnetic resonance measurements
- ▶ (M) 3D magnetic field vector measurement by magneto-optical imaging
- ▶ (M) Spectroscopic analysis of Bi substituted magnetic garnet films

Major employers of Graduates

The number of PhD Graduates

4

- TDK Corporation
- FDK Corporation
- Riken Seiki Co., Ltd.
- Hitachi High Tech Corporation
- Hitachi Metals , Ltd.
- Jamco Corporation
- Asahi Intecc Co., Ltd.
- Off-Diagonal Co., Ltd.
- Colorlink Japan, Ltd.
- The National Police Agency

Writer : ISOMJURA Keitaro, Materials Science and Technology
(National Institute of Technology, Numazu College)

91

教員名

ISHIBASHI Takayuki

キーワード

Bi substituted magnetic garnet film
Metal-organic decomposition method
Magneto-optical imaging
Magnetic field vector

4

Surface and Interface Chemistry

Associate Professor / Asami FUNATSU

- ▣ Creation of new inorganic nanosheets
- ▣ To pursue of surface and interface of materials
- ▣ Find your favorite things !

Supervisor Associate Professor / Asami FUNATSU

I was just assigned to NUT at March 1st, 2021. I will strive to create new inorganic nanosheets by using surface and interface chemistry approaches such as structural control and mechanism elucidation of materials with NUT's students.



Research Content

We are aiming to propose new materials for ultra-thin two-dimensional materials called nanosheets. Nanosheets are characterized by a thickness of about 1 nm and it can be said to be materials consisting only of the surface. Therefore, nanosheets make it increasingly clear that it exhibits new properties structurally-derived properties, and it is expected to be used in various fields. We would like to advance our research from the aspects such as the surface and interface, which are the characteristics of this material, and lead to the creation of new materials and the development of functions.

A Day in the Lab

I would like to make the rules for our laboratory with my students. I would like to provide support tailored to each student's individuality in our laboratory. I would like to encourage student so that they can think for themselves, find out what they like, and finally choose the path they believe at the time of graduation through in the laboratory life. To that end, I will give many environments which they can thoroughly pursue their favorite things and interests in various aspects of their daily life. And I would like to cultivate it through discussions and presentations there.

Thesis Subjects

- ▶ No data due to newly established laboratory

Major employers of Graduates

- No data due to newly established laboratory

The number of
PhD Graduates

0

92

Writer : Associate Professor Asami FUNATSU, Materials Science and Technology

教員名

FUNATSU Asami

キーワード

nanosheet
surface
interface
layer compound

5

Laboratory of Polymer Materials Science

Professor / TAKENAKA Katsuhiko Assistant Professor / TODA Tomoyuki
 Technical Staff / MIYA Masamitsu

- ▣ Creating new polymer materials that never exist
- ▣ From synthesis of monomer to polymerization
- ▣ Polymerization using self-made glass apparatus



<https://mst.nagaokaut.ac.jp/polymer/>

Supervisor Professor / TAKENAKA Katsuhiko

Professor Takenaka is very kind and caring towards his students. Despite his busy schedule, he always has the time to visit us in the laboratory, and we can always freely ask for his opinions regarding our research. He enjoys outdoor activities and loves barbecue. He has a cute pet dog that sometimes joins our online discussion.



Research Content

Our laboratory conducts research from monomer synthesis to polymerization. With 1,3-diene as the keyword, we synthesize 1,3-butadiene derivatives containing the functional group and polymerize them using anionic polymerization, free radical polymerization, and coordination polymerization using metal complex catalyst to produce the polymer. Since the microstructure and molecular weight of the obtained polymer differ depending on the monomer and the polymerization method, the physical properties of the polymer also differ greatly. Through synthesis and polymerization, we are taking on the challenge of developing new polymer materials with the aim of creating something that was not in the world until yesterday.



Assemble of glass apparatus which is essential for anionic polymerization.

A Day in the Lab

Our laboratory starts with a short morning assembly on Monday morning. We report on the progress of research from the week before and the planning for that week, so we can clarify what we should do and work on the experiment. In addition, English seminars and journal meetings on the principles of polymer chemistry and analytical instruments used in research are held regularly. All teachers and students can have discussions to deepen their understanding of their experiments. Those interested in polymer synthesis, complex catalysts, and those who want to do laboratory glass blowing should definitely visit our laboratory.



Group photo taken during barbecue party

Thesis Subjects

- ▶ (M) Synthesis of a new Zr complex with [NPN] ligand and evaluation of its olefin polymerization activity
- ▶ (M) Effect of alkyl chain length on the polyaddition of 4-(ω -hydroxyalkyl)- α -methylstyrene and CO
- ▶ (D) Study on Anionic Polymerization Behavior of Phenyl-Substituted [3]Dendralene Derivatives

Major employers of Graduates

The number of
PhD Graduates

9

- Denka
- NOK Corporation
- MATSUI CHEMICAL CO., LTD
- Japan Atomic Energy Agency
- Tokuyama Dental
- KOATSU GAS KOGYO CO., LTD.
- TOYO TIRES
- Sumitomo Chemical
- Hioki E.E. Corporation
- Mitsui Chemical

Writer : NUR QURRATU AINI BINTI KASSIM, Materials Science and Engineering/Bioengineering
 (National Institute of Technology, Fukushima College)

93

教員名

TAKENAKA Katsuhiko
 TODA Tomoyuki
 MIYA Masamitsu

キーワード

Monomer synthesis
 Polymerization
 1,3-butadiene derivatives
 Glass blowing (glass work)

6

Laboratory of Physical Chemistry for Molecules and Plasmas

Associate Professor / Haruhiko ITO



- ▶ Open up the future of materials with plasma !
- ▶ Possibility of plasma
- ▶ New material made with plasma

Supervisor Associate Professor / Haruhiko ITO

We are studying the synthesis of thin films using plasma CVD processes. In addition, we are investigating the formation mechanism of thin films in detail by detecting the free radicals generated by plasma with a precise method using the laser spectroscopy.



Research Content

This laboratory is investigating the spectroscopic properties of unstable molecular species (free radicals) generated in the discharge plasma flow with detail by high resolution laser spectroscopy. In addition, this laboratory studies the synthesis of amorphous carbon nitride thin films by using discharge plasma. Features of amorphous carbon nitride thin film are high hardness, field emission characteristics and others. Therefore, it is expected to be put into practical use as a next-generation high-performance material. Actually, this laboratory synthesizes amorphous carbon nitride thin films, and investigates their formation mechanism and characteristics based on the plasma spectroscopic measurements.

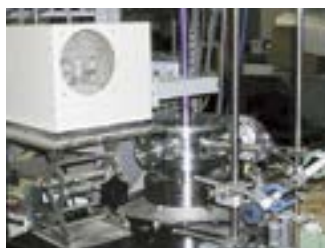


Laser equipment and microwave plasma CVD equipment

A Day in the Lab

When we arrive at the laboratory, we turn on the vacuum pumps to prepare the experiments.

Until the vacuum is reached, we are talking with other members and preparing seminars in the laboratory. The time to go home will vary from member to member, as experiment times vary by device. Sometimes, we go out for dinner after the experiment. I think that it is a good laboratory to cultivate autonomy because the schedule in the laboratory is left up to each person.



Microwave plasma CVD equipment

Thesis Subjects

- ▶ (M)Formation and structural analysis of the carbon nitride thin films with high-nitrogen content using radio-frequency plasma CVD.
- ▶ (M)Analysis of the chemical bonds of the a-CN_x:H thin films formed from the plasma CVD of the C₂H₂/N₂ gas mixture.
- ▶ (M)Synthesis and structural analysis of the carbon nitride thin films with high mechanical hardness using dissociation reaction of cyanides.

Major employers of Graduates

The number of PhD Graduates

2

- DIAMET CORPORATION.
- UNION TOOL CO.
- TANKEN SEAL SEIKO CO.,LTD.
- Furukawa Electric CO.,LTD.
- FUJITSU COMPONENT LIMITED

- NIIGATA PREFECTURAL POLICE
- FURUKAWA MAGNET WIRE CO.,LTD.
- Kobe Material Testing Laboratory Group.
- RIKEN SEIKI CO.,LTD.
- Tamura Corporation.

94

Writer : KARO Yoshinori, Materials Science and Technology
(National Institute of Technology, Nagaoka College)

教員名

ITO Haruhiko

キーワード

Plasma CVD
Amorphous carbon nitride
Laser spectroscopy
analysis plasma chemical reaction

7

Molecular Function Simulation Laboratory

Associate Professor / UCHIDA Nozomu



- ▣ Covering inorganics and organics by quantum chemistry calculations
- ▣ Making computer technology more accessible
- ▣ Bringing artificial intelligence to the manufacturing site

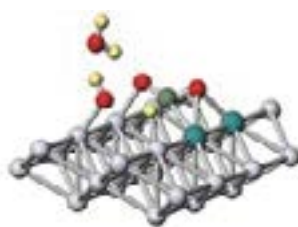
Supervisor Associate Professor / UCHIDA Nozomu

He is an associate professor who values student independence. He gives students the knowledge they need for research and the future with his experience-based advice. He offers a variety of fun topics that comes from a wealth of reading.



Research Content

We analyze material physical properties and phenomena caused by materials by simulation using computer technology. Our goals are to analyze and predict the characteristics and behavior of atoms and molecules based on the systems and assumptions that can be realized by using a computer. We use molecular orbital method and density functional theory to analyze the characteristics of molecules from electronic states, and molecular dynamics method to analyze dynamic change of systems over time. We are approaching phenomena and issues using machine learning, which is often talked about recently.



Structural optimization of carbon dioxide adsorbed on Pt-Ru catalyst

A Day in the Lab

In our laboratory, emphasis is placed on seminars. There are English seminars held every day at noon, thermodynamic seminars held on Tuesday, and paper seminars held on Thursday. In the English seminar, in addition to the basics such as grammar and pronunciation, you will be taught what is necessary for understanding English sentences such as sentence structure and tone of article, so your English reading comprehension ability will improve. In the thermodynamics seminar, we practice thermodynamics problems using textbooks, and in the paper seminar, we will present papers on research themes.



Group picture

Thesis Subjects

- ▶ (M) Study of hydrogen storage characteristics in multi-layer graphene using computer chemistry
- ▶ (M) Study of adsorbed chemical species on the platinum surface in carbon dioxide reduction using computer chemistry
- ▶ (M) Analysis of the early biosynthetic process of natural rubber using computer chemistry

Major employers of Graduates

The number of PhD Graduates

1

- Central Japan Railway Company
- KIMURA FOUNDRY CO.,LTD.
- NIKKEI MC ALUMINIUM CO.,LTD.
- KURARAY CO.,LTD
- TOPPAN INC.

Writer : Sawamura Kensuke, Materials Science and Technology
(national Institute of Technology, Gifu College)

95

教員名

UCHIDA Nozomu

キーワード

quantum chemistry calculations
molecular orbital method
density functional theory
molecular dynamics method

8

Laboratory of Organic Reaction Design and Synthesis

Professor / Hirofumi MAEKAWA Assistant Professor / Tianyuan ZHANG
 Technical Staff / Natsue KAWAHARA

- ▶ Enjoy synthetic reactions like puzzles of compounds !
- ▶ Design your original reactions and make them true !
- ▶ Synthesize complicated compounds with your high techniques !



<http://mst.nagaokaut.ac.jp/carbon/>

Supervisor Professor / Hirofumi MAEKAWA

Prof. Maekawa is very serious and strict in research, but he is quite friendly. Our conversation with him is always fascinating and a variety of topics are taken up. The knowledge of chemistry and his attitude towards research that he suggests to us are great help for us in advancing our research.



Research Content

In recent years, eco-friendly and efficient reactions have been required with no harmful substance and less amount of reagents. In our laboratory, novel synthetic organic reactions characterized by high selectivity, low cost, and easy method are designed, tried and developed by use of magnesium metal with low toxicity and high reducing potential. In these reactions, coupling reactions between electrophilic carbon atoms can be achieved because one electrophilic carbon atom is converted into a nucleophilic one, which cannot be found in textbooks for beginners. Application of our reactions to preparation for organic materials may greatly shorten synthetic reaction steps.



Typical apparatus of a reductive coupling reaction by magnesium metal

A Day in the Lab

In our laboratory, students start to have experiments every morning around 9 am. There is no core time and students proceed on their experiments at their own pace. However, self-management ability and autonomy will be strongly cultivated because superior planning of experiments is required. Every week, we hold a seminar to discuss the latest papers and a seminar to study organic reactions and recent topics in organic synthesis. One of the purposes of the latter seminar is learning how to make questions and how to answer the questions. All members are friendly and we often talk about our research topics each other.



TOF high resolution mass spectrometer can be used to decide the structure and composition of organic compounds.

Thesis Subjects

- ▶ (M) Reduction of azulenes to introduce a functional group to the seven-membered ring
- ▶ (M) Magnesium-promoted reductive coupling of benzoylsilane and methyl acrylate
- ▶ (M) Reductive coupling reactions of α -silylstyrenes with silylating agents by calcium

Major employers of Graduates

The number of
PhD Graduates

11

- IVY Cosmetics
- Osaka Gas Chemicals Co., Ltd.
- Nippeco Ltd.
- Kyoeisha Chemical Co., Ltd.
- Fujifilm Wako Pure Chemical Corporation
- Fujifilm Wako Chemical Corporation
- Toray Industries, Inc.
- Orient Chemical Industries Co., Ltd.
- Howa Sangyo Co., Ltd.
- Kawaken Fine Chemicals Co., Ltd.

96

Writer : Akihiro MORI, Materials Science and Technology
 (national Institute of Technology, Gunma College)

教員名

MAEKAWA Hirofumi
 ZHANG Tianyuan
 KAWAHARA Natsue

キーワード

Magnesium
 Electron transfer
 Reduction
 Umpolung

9

Ceramic Materials Design Laboratory

Associate Professor / Satoshi TANAKA

- ▣ Highly reliable ceramics
- ▣ Ceramic science begins from observation
- ▣ Build the foundation for the ceramics manufacturing process



<https://mst.nagaokaut.ac.jp/ceramsci/index%20-%20eng.html>

Supervisor Associate Professor / Satoshi TANAKA

Tanaka sensei values communication with students and gives enthusiastic guidance. He politely answers our questions and occasionally talks with us mixing a gentle joke. When we are having a trouble for planning the next experiment or interpreting research data, he helps us to solve them.



Research Content

Our laboratory has studied the method of manufacturing ceramics to improve properties. Ceramics is widely used for electrical, environmental and energy fields which is indispensable for everyday life. The philosophy of this laboratory is to contribute to improving the status of ceramics by solving many problems occurring during manufacturing. A major goal of our research is to systematize the manufacturing process of ceramics and to develop advanced ceramics.



This is a scene to make granules

A Day in the Lab

You can free to use your time to proceed with your research. We are experimenting by voluntarily deepening our knowledge and making plans. Also, Students are actively exchanging opinions with each other, and they are conducting research from various perspectives. Seminars are held every Thursday and Friday afternoon to introduce the latest articles related to research and the latest research results. There is lively discussion here. In addition, occasionally various events such as a welcome party, a cherry-blossom viewing, a ski trip etc. are planned.



graduation ceremony

Thesis Subjects

- ▶ (M) Fabrication of cathodes for oxide-based all-solid-state lithium-ion batteries and their co-sintering with solid electrolytes
- ▶ (M) Fabrication and structural evaluation of alumina ceramics by micro-extrusion molding
- ▶ (M) Fabrication of porous alumina ceramics by gel casting method and evaluation of mechanical properties

Major employers of Graduates

The number of
PhD Graduates

15

- JAPAN FINE CERAMICS CO., LTD.
- Nippon Electric Glass Co. ,Ltd.
- Mizusawa Industrial Chemicals, Ltd.
- Nitolex Corporation
- AGC Inc.
- Hitachi Chemical Company
- TAIHEIYO CEMENT CORPORATION
- TAIYO YUDEN CO.,LTD.
- CoorsTec, Inc.
- Fukui Murata Manufacturing. Co., Ltd.

Writer : Kotaro YOKOO, Materials Science and Technology
(National Institute of Technology, Tsuruoka College)

97

教員名

TANAKA Satoshi

キーワード

manufacturing process of ceramics
functional ceramics
engineering ceramics
application of strong magnetic field

10

Photoenergy Conversion Materials Laboratory

Associate Professor / Nobuo SAITO



- ▣ Dream technology to produce next generation energy
- ▣ Photocatalyst realizes clean society
- ▣ Hydrogen production by water splitting

Supervisor Associate Professor / Nobuo SAITO

Associate professor Saito is a friendly teacher. So, we feel free to discuss about research with him. In addition, he has a wealth knowledge about analytical equipment. He teaches us how to use it and some measurement principles.



Research Content

Our research theme is to develop new photocatalysts. It is one of approach to solve energy issues and environmental problems. Photocatalyst can convert photoenergy to chemical energy by some chemical reaction on its surface due to production of electron and hole generated by light irradiation. We have investigated about improvement of photocatalytic activity, response for visible light or elucidation of reaction mechanism. And, our main themes are "H₂ production by water splitting", "Removal of heavy metal in water" and "Organic compound decomposition".



Order made apparatus by Prof.Saito for water splitting

A Day in the Lab

We have weekly seminars to report about our research and introduce an English paper. In these seminars, we discuss about them with assoc.prof.Saito and laboratory members. Our laboratory has a core time, 9:00am to 4:30pm on Monday to Friday. So we should come laboratory and work by ourself. On the other hand, we can enjoy student lifes and some events with laboratory members such as "Cherry-blossom viewing party" and "Nagaoka Fireworks". In addition, we often accept some exchange students. So we have many opportunities to spend time with them.



In a excursion with a exchange student

Thesis Subjects

- ▶ (M)Arsenic adsorption and photocatalytic effect for arsenic desorption in water by cerium oxide
- ▶ (M)Fabrication and water splitting activity of pn composited GaN photocatalyst with p-type nanoregion
- ▶ (M)Photocatalytic overall water splitting on CeO₂ photocatalyst with nano heterogeneous doping structure

Major employers of Graduates

The number of
PhD Graduates

1

- Furukawa Electric Co., Ltd.
- UNIPRES CORPORATION
- Nihon Parkerizing Co., Ltd.
- J-Power Systems Corporation
- TAIYO YUDEN Co., Ltd.
- Gun Ei Chemical Industry Co., Ltd.
- Unicharm Corporation
- Kao Corporation
- NAMICS CORPORATION
- Dexerials Corporation

98

Writer : KONDO Mayu, Materials Science of Technology
(Niigata Konan High school)

教員名

SAITO Nobuo

キーワード

photocatalyst
water splitting
organic compound decomposition
environmental purification

11

Environmental Nanomaterials Laboratory

Associate Professor / Yukiko TAKAHASHI

- ▶ Research on the emergence of ultratrace element analysis methods and environmental purification technologies.
- ▶ Repel viruses with nanopower!
- ▶ The world of nano opens up the future!



<https://mst.nagaokaut.ac.jp/~nanodye/index.html>

Supervisor Yukiko TAKAHASHI

Dr. Takahashi is an energetic and powerful teacher. He values the enjoyment of his research. She is kind to her research and study advice. She loves events, so events are often held in her laboratory.



Research Content

Our laboratory is conducting research on the themes of "environment" and "nanomaterials". As a typical example, the "nano-thin film test paper" currently under development is capable of detecting harmful heavy metal ions lurking in the environment with high sensitivity of ppb level. The concept of this test strip is "Easy, anyone, anywhere." It is possible to visually confirm the content of the target element without performing a complicated operation like an analyzer. In addition, we are developing an air purification system using singlet oxygen, aiming to establish a new air purification system.

Element	Test strip sensitivity	Minimum detectable amount
Cd	3 ppb	30 ppb
Pb	10 ppb	100 ppb
Cr(VI)	50 ppb	500 ppb
Hg	5 ppb	5 ppb
Ni	70 ppb	—
Mn	—	—
Mn	—	10 ppm
Zn	—	2 ppm
Cu	2 ppm	3 ppm
Fe	—	10 ppm
Sr	40 ppb	100 ppb
B	2.4 ppm	Non-coastal 10 ppm Coastal 250 ppm
F	1.5 ppb	Non-coastal 8 ppm Coastal 15 ppm
As	10 ppb	100 ppb

Fig. Dye nanoparticle-coated test strips for ultra trace harmful ions.

Dye nanoparticle-coated test strips for ultra trace harmful ions.

A Day in the Lab

Our laboratory has no core time, but several meeting a month. We have to report our research progress there and decide experimental plan ourselves. We hold a meeting once a week for each research group. Additionally, there is a monthly meeting for all members to show progress reports with summarized data. Practicing questions and answers is one of the purposes of this meeting. We also plan events such as party, so you can have fun doing an activity. Our laboratory is fit for those who learn by themselves.



Last group photo after graduation

Thesis Subjects

- ▶ (M) Investigation of synthesis conditions of metal organic framework Cu-BTC in gelatin solution
- ▶ (M) Development of a touch test device for tin as a dissolution test for alloy surfaces
- ▶ (M) Detection of trace silver using dithizone nano-thin film test paper

The number of
PhD Graduates

0

Major employers of Graduates

- MIURA co.,LTD.
- OGURA CLUTCH co.,LTD.
- OILES CORPORATION
- SINTOKOGIO, LTD.
- JAPAN QUALITY ASSURANCE ORGANIZATION
- TOYO RIKAGAKU KENKYUSHO co.,LTD
- Riken CORPORATION
- NAMICS CORPORATION
- Takasago Thermal Engineering co., Ltd.
- NICHICON CORPORATION

Writer : Taiyu SHIMOZATO, Materials Science and Technology
(National Institute of Technology, Okinawa College)

99

教員名
TAKAHASHI Yukiko

キーワード

Organic nanoparticles
Metal-Organic Frameworks
Singlet Oxygen
Organic pigment

12

Functional Glass Engineering Laboratory

Associate Professor / HONMA Tsuyoshi

- ▶ Glass and glass-ceramics provides infinite potential.
- ▶ Development of new functional materials for next-generation batteries.
- ▶ Experiments are more important than overthinking.



<https://mst.nagaokaut.ac.jp/amorph/>

Supervisor Associate Professor / HONMA Tsuyoshi

Dr. Homma entered our university from a technical college and worked for a company. After that, he returned to our university and taught us in his laboratory. He is an amiable professor and actively participates in laboratory events.



Research Content

Glass has been an essential material for human society since B.C. In modern days, glass is used not only for glass containers and sheet glass but also for displays and optical fibers that support the latest digital society. In our laboratory, we are engaged in research based on the creation and process development of new functional glasses and glass-ceramics that contribute to constructing a future society. Recently, we have succeeded in developing an all-solid-state sodium-ion battery composed of oxide ceramics without using rare metals in an industry-academia collaboration.



Glass preparation by melt quenching method (top)
Battery making (middle) Electric fan powered by all solid-state Na-ion battery (bottom)

A Day in the Lab

Prof. Homma respects the independence of his students. Therefore, in this laboratory, students proceed with their studies at their own pace. If students manage themselves well, they can have a meaningful study life. Seminars include:

- A progress report (once every two weeks).
- A paper introduction seminar (once a week).
- A machine learning seminar (once a week).

Progress reports on the study are given one-on-one with the professor, allowing for in-depth discussion. Our lab holds various events, and students get along very well.



Marathon (top), discussion in the lab. (bottom)

Thesis Subjects

- ▶ (M) Preparation of Magnesium-Manganese-Phosphate Crystallized Glasses with Guest Ions of Sodium
- ▶ (M) Crystallization mechanism of pyrophosphate glass containing alkali ions
- ▶ (M) Formation and Functionality of Highly Dispersed Bismuth Nanoparticles in Bismuth Iron Silicate Glasses

Major employers of Graduates

The number of
PhD Graduates

0

- Hitachi Power Solutions Co., Ltd.
- Bosch Japan
- TAIYO YUDEN Co., Ltd.
- AGC Inc.
- Central Glass Co., Ltd.

- Hino Motors, Ltd.
- TOYODA GOSEI Co., Ltd.
- Sharp Corporation
- DOWA HOLDINGS Co., Ltd.
- ALPS ALPINE Co., Ltd.

100

Writer : HIRATSUKA Masafumi, Energy and Environment Science
(National Institute of Technology, Gunma College)

教員名

HONMA Tsuyoshi

キーワード

glass materials science
crystallization
all-solid-state battery
sodium-ion battery

【校正時ご確認をお願い致します】

□キーワードはなしで良いでしょうか？

13

Materials Science for Energy Laboratory

Associate Professor / SHIRONITA Sayoko

- ▶ Effective use of chemical energy
- ▶ For stable storage of energy
- ▶ Everything goes positive


<https://mst.nagaokaut.ac.jp/acl/>

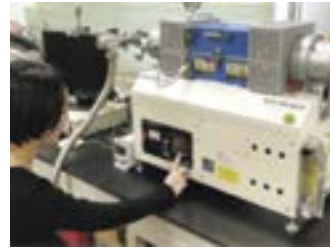
Supervisor SHIRONITA Sayoko

Dr. Shironita is easy to talk to and familiar with us. She is a reliable teacher who will help us cordially if we have any problems with our research. In addition to the research content, the teacher talks to us.



Research Content

Materials that do not react with chemical substances are required for stable storage of chemical energy. Therefore, surface treatment of stainless steel is performed using nitrogen heat treatment and sputtering. Evaluate corrosion resistance by electrochemical measurement and use various analytical instruments to search for optimal conditions for surface treatment. Due to the high stabilization of stainless steel, it is expected to be used for stable storage of energy, specifically for current collector materials of lithium-ion cells and bipolar plates for polymer electrolyte fuel cells.



Infrared furnace for heat treatment

A Day in the Lab

We have English seminars that read and present English papers and general seminars that report the progress of research. At the seminar, we discuss with laboratory members and teachers. We sometimes discuss our research plan with teacher and decide on a research direction. We get along well regardless of our grade and enjoy drinking and playing sports.



Group photo of laboratory members

Thesis Subjects

- ▶ (M) Research on degradation mechanism and thermal characteristics of lithium-ion secondary cells charged and discharged at low temperature
- ▶ (M) Evaluation of corrosion resistance of Cr-based film produced by reactive sputtering method and examination of high corrosion resistance mechanism
- ▶ (M) Evaluation of performance degradation by charge and discharge of lithium-ion secondary cells at high temperature

Major employers of Graduates

The number of PhD Graduates

0

- AGC Inc.
- Nippon Chemi-Con
- Dainichi Co.,Ltd
- HOKUETSU METAL Co.,Ltd

Writer : TOKORO Daichi, Materials Science and Technology
(National Institute of Technology, Gifu College)

101

教員名

SHIRONITA Sayoko

キーワード

Mechanical

Electrical

Management

Materials

Civil

Nuclear Technology

System Safety

Innovation

14

Bio-sustainable Environmental Material Engineering Laboratory

Professor / Takaomi KOBAYASHI Assistant Professor / Siriporn TAOKAEW

- ▣ Sustainability!!! Biomass usability for economic purpose
- ▣ Green Technology toward Environmental Sustainability
- ▣ International Friendly Laboratory

Supervisor Professor / Takaomi KOBAYASHI

Prof. Kobayashi is a senior professor with deep insight knowledges about his field of work which is valuable for the research orientation. Beside the academic standard that each student have to archive, "Manner" and "Interpersonal Relationship" for him also stand a significant point for the future success of his students.



Research Content

With the "Bio-sustainability" as the main aim, our laboratory mainly focuses on the development of bio-interfacial and environmentally friendly material as the mean to solve any possible problems. With biochemistry and material science expertise, material structure and its nature from micro to macro-scale of the researched materials are carefully considered for the optimal utilization to tackle the practical issues. Our laboratory has a wide range on interesting on material, namely polymers, inorganic and organic, composite, and industrial waste. With the wide connection of our professor, students have wide options for their internship, from domestic like company, Kosen or University in Japan or in other countries like Thai, Vietnam, Germany, Malaysia...



Cosmetic products containing moisturizing ingredients "Porphyra" extracted from Seaweed and Limonite-PES composite fiber

A Day in the Lab

The most unique point of our lab is more than a half of the students are international students whom coming from variety of background and culture like: Vietnam, Thailand, Malaysia, China, Mexico. In such a multiple-culture laboratory, we have valuable chance for understanding the culture and the people from different countries. Both English and Japanese are encouraged for daily communication in our laboratory. Not only in culture, but we also have many different backgrounds from material science, medical, bioscience to environmental technology, so we can support each other in research with many different points of view. Beside research, annual event like Hanami, Hanabi, Halloween, Christmas Party, Bonen-kai and some international cooking exchange party.



Seminar ending party of the year 2021

Thesis Subjects

- ▶ (M) Application Zeolite Polymer Composite Fiber in Bioreactor for Land-based aquaculture of Rainbow Trout cultivation
- ▶ (D) Study on Ultrasound Technologies Concerning with Nitrogen for Decomposition of Organic Compound and For Soil Washing Application.
- ▶ (D) Study on Mordenite Zeolite-nylon Composite Membranes Used for Functional Adsorbents.

Major employers of Graduates

The number of
PhD Graduates

27

- Nitto Denko. Co. Ltd
- Daikin Industries. Co. Ltd
- Takasago Thermal Engineering. Co. Ltd
- Nippon Paint Co. Ltd
- Fuji Electric. Co. Ltd
- Dow Chemical Japan
- Sakai. Co. Ltd
- Oji Paper Co. Ltd
- Toyo seikan. Co. Ltd
- Unicharm Corporation

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Writer : PHAN Phuoc Tri, Science of Technology Innovation
(University of Science - Vietnam National University Ho Chi Minh city)

教員名

KOBAYASHI Takaomi
TAOKAEW Siriporn

キーワード

Bio-chemistry
Sonochemistry
Environmental Technology
Fish Cultivation

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Green chemical resources laboratory

Professor / KAWAHARA Seiichi

- ▶ Green Technology as a material to natural rubber
- ▶ International exchange is abounded many in laboratory
- ▶ Manufacturing and social contributions



<https://mst.nagaokaut.ac.jp/organic/kawahara/>

Supervisor Professor / KAWAHARA Seiichi

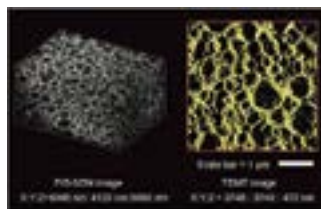
Prof. Kawahara leads study on natural rubber science and technology at the forefront. Despite his busy schedule, he directly supervises us in the laboratory. He always has a smile on his face and is always ready to give us research tips when we are in trouble, which is very reassuring.



Research Content

We are conducting daily research to create a new chemistry to produce various substances and materials from natural rubber: that is, natural rubber chemistry.

We believe that we can establish a sustainable society that does not depend on petrochemicals by using natural rubber, which is a green resource and has excellent physical and mechanical properties, as a raw material. We have developed novel soft materials with a nanomatrix structure by graft copolymerization of monomers onto natural rubber. In particular, we expertise analyses of natural rubber through chemical structural analysis with a nuclear magnetic resonance (NMR) spectrometer and higher order structural analyses with a transmission electron microscope (TEM) and focused-ion microbeam-scanning electron microscope (FIB-SEM).



3DTEM image of natural rubber which has nanomatrix structure

A Day in the Lab

The use of time in the laboratory is flexible but we are mainly active between 9:00 and 19:00.

As for the flow of the day, students start studying and working in the laboratory around 9:00 a.m., and then go home as soon as they finish research.

Seminars include journal meetings, English textbook study seminars, and Japanese textbook study seminars. Recreational activities are held throughout the year, although they are often cancelled due to the COVID-19. We have flower viewing (Hanami) party in the spring, fireworks viewing (Hanabi) party in the summer, Christmas party and ski trip in the winter, and other activities to deepen friendship with all members.



graduation ceremony

Thesis Subjects

- ▶ (M) Structural analysis of vulcanized natural rubber using rubber state NMR spectroscopy
- ▶ (M) Preparation and properties of natural rubber-nanodiamond composites
- ▶ (M) Structural analysis of vulcanized chloroprene rubber by rubber state NMR spectroscopy

Major employers of Graduates

The number of
PhD Graduates

20

- THE YOKOHAMA RUBBER. , LTD.
- NOK CORP.
- KOKOKU INTECH CO. , LTD.
- Fuji Latex Co. , LTD.
- SUMITOMO RIKO CO. , LTD.
- YAMASHITA RUBBER CO. , LTD.
- NAMICS CORP.
- OKAMOTO INDUSTRIES, INC.
- NICHIAS CORP.
- Chemical Evaluation and Research Institute

Writer : WATANABE Ryota, Materials Science and Technology
(National Institute of Technology, Kobe College)

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教員名

KAWAHARA Seiichi

キーワード

Natural rubber
Rubber state NMR spectroscopy
Nanomatrix

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Nanobio Materials Laboratory

Associate Professor / Motohiro TAGAYA



- ▶ Contributing to the world with novel NanoBiomaterials!
- ▶ Changing the conventional concept of bioceramic synthesis!
- ▶ Exploring the essence of "biocompatibility" based on ceramics!


<http://mst.nagaokaut.ac.jp/nanobio/>

Supervisor Associate Professor / Motohiro TAGAYA

Profesor TAGAYA integrates bioceramic research for the industry-academia fusion. He enjoys teaching his students how to proceed with research planning and preparation of nanobioceramics with enthusiasm and kindness. He always provides accurate advice and takes care of his students' careers.



Research Content

The purpose of our laboratory is to prepare nanobioceramics and design the interfaces towards "Cellular Therapeutics" in biomedical fields. We emphasize the technologies for artificially synthesizing and controlling nano-scale architectures based on nature phenomena in living organisms. The technology for skillfully combining inorganic and organic materials is very important for the nanostructural control. We have recently focused on the studies of "the nanobioceramic-induced control of cell functions through the interfacial material-cell interactions" and "the effective cellular uptakes of ligand-modified nanobioceramics". In the future, these technologies can effectively encourage/improve the natural healing abilities of the patients.



Experimental laboratory for (upper) material synthesis and (lower) cell culture (insert: actual research photo).

A Day in the Lab

We carry out everything from material synthesis, characterization, analysis and evaluation of cell growth. It is a heavy work but challenging and very rewarding. There is a friendly atmosphere where seniors and juniors can discuss and share research information without distinction. Since we are frequently talking with Prof. TAGAYA about research results and future plans, we can experiment at our own pace. There are many opportunities to present research results in academic conferences. Because the laboratory is equipped with biotechnology equipment for cell cultures, we clean laboratory every week in order to always study in a clean room.



(Upper) group photo and (lower) photos of conference presentation awards.

Thesis Subjects

- ▶ (D) Study on Preparation of Hydroxyapatite Nanoparticle Films and Their Cytocompatibility Evaluation for Biomedical Applications
- ▶ (D) Study on Synthesis of Luminescent Hydroxyapatite Nanoparticles and Their Surface Functionalization for Cell Labeling Applications
- ▶ (D) Study on Surface Modification of Hydroxyapatite Particles and Evaluation of Their Hydration States and Protein Interactions

Major employers of Graduates

The number of PhD Graduates

3

- CoorsTek, KK
- Graduate School of Interdisciplinary Science and Engineering in Health Systems, Okayama University
- National Institute of Technology, Nagaoka College
- JSPS Research Fellowships for Young Scientists
- Nippon Micrometal Corporation
- Uenotex Co., Ltd.
- Rigaku Corporation
- I C Engineering Corporation
- Shinsei Financial Co., Ltd.
- NIIGATA-SEIKI CO., LTD.

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Writer : Zizhen LIU, Energy and Environment Science
(Zhengzhou University)

教員名

TAGAYA Motohiro

キーワード

Nanobioceramics
Biocompatibility
Hydroxyapatite
Silica