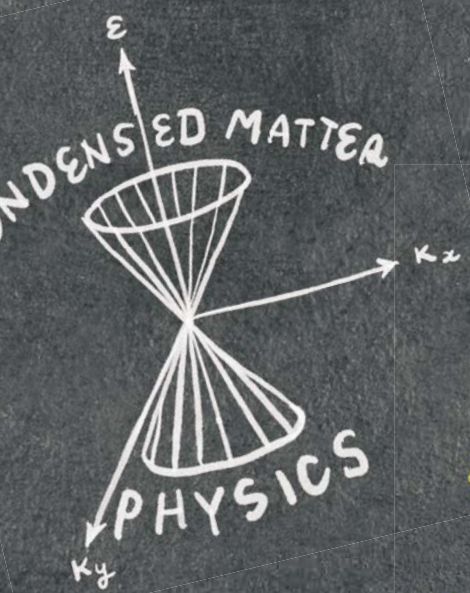
2019

NIMS NOW No. 5

NATIONAL INSTITUTE FOR MATERIALS SCIENCE

INTERNATIONAL



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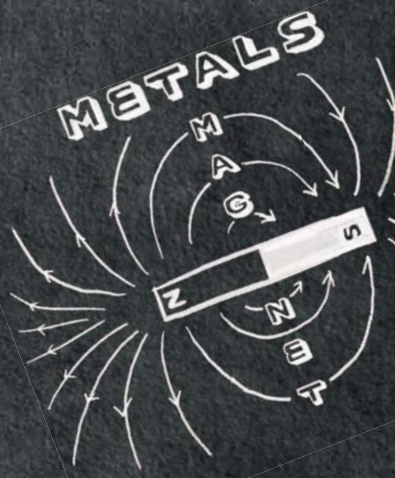
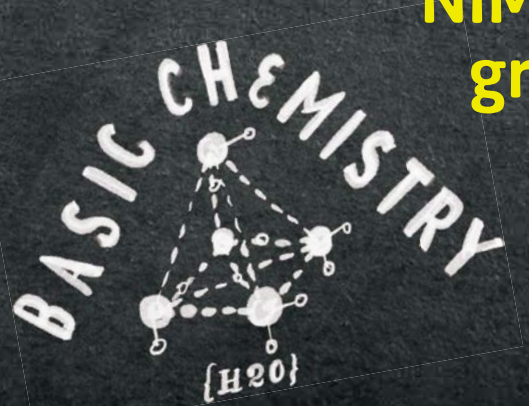


Become a materials scientist!

NIMS offers attractive graduate programs



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What's going on with college life at NIMS?

Q 1

How do the NIMS graduate programs work?

A: See the “NIMS Study Guide” on **p. 4.**

NIMS graduate programs

Q 2

What is students’ life like?

A: See “Close-up : Student Researcher’s Life” on **p. 6.**

Q 3

What research fields are available at NIMS?

A: See “Seven research fields” on **p. 10.**

Q 4

What options are available for students who complete the program?

A: See “Open talk with former participants” on **p. 14.**

A road to a materials scientist

NIMS Study Guide

In addition to commitment to advanced materials research,
NIMS also provides an effective learning environment for students.
We offer students a variety of programs,
ranging from internships of several weeks to multiyear programs.

For more details, please scan the QR codes below or go online and enter **"NIMS Student Programs"** in your search engine of choice.

Graduate/undergraduate/college students

Joint Graduate School Program

Master's Doctorate

Academic degree program that develops students into specialists under the NIMS researchers

Graduate studies offer students their first opportunities to gain vital experience when pursuing professional research careers. If you are passionate about becoming a researcher on the world stage, your best chance is to put yourself in a front-line research environment. The Joint Graduate School Program is designed to offer such an environment. Participants in this program have the privilege to study under the direction of NIMS researchers, who serve as their academic advisors from admission to graduation.

NIMS researchers who are faculty members at one of NIMS' partner universities (University of Tsukuba, Hokkaido Univ., Waseda Univ. or Kyushu Univ.) serve as academic advisors. Program participants can initially choose labs to join, and this automatically determines their home universities. They carry out their research primarily under the supervision of their advisors at NIMS. They also go to their universities to attend lectures and to have their theses reviewed.

This Program curriculum requires students to give research seminars in English. This environment makes it easier for international students to focus on their research. We also admits "adult graduate students"—workers interested in pursuing doctoral degrees. This program is for motivated students who develop high levels of research expertise.

【Duration】
From enrollment to graduation

【Support】
Hire for NIMS Graduate Research Assistantship and financial support (see p. 5)

See "Close-up: Students Researcher's Life" on p. 6.
See "Seven research fields" on p. 10.
See "Program for adult graduate students" on p. 12.

【Partner universities】

- University of Tsukuba — Master's, Doctorate
- Hokkaido Univ. — Doctorate
- Waseda Univ. — Doctorate
- Kyushu Univ. — Doctorate

【From application to enrollment】

STEP 1 Contact a potential supervisor → STEP 2 Apply for NIMS Graduate Research Assistantship (optional) → STEP 3 University application → STEP 4 University entrance exam → STEP 5 Result announcement → STEP 6 Enrollment

NIMS Graduate Research Assistantship

Support program that frees students to focus on research

In principle, participants in the Joint Graduate School Program are entitled to the NIMS Graduate Research Assistantship. This program pays students' living expenses, allowing them to concentrate on their research without financial concerns.

【Application】
once a year (4-5 months before the university application period, see above step2-3)

【Duration】
1 year (a one-year contract that is renewable, subject to a yearly evaluation)

【Financial for international students】
Master's about 160,000yen*
Doctorate about 180,000yen*

Degree

NIMS Internship Program

The internship is perfect for the first step before committing

Some students may be interested in the Joint Graduate School Program or in joining a lab as a professional researcher in the future, but may also want to get a sense of actual research and the NIMS research environment before making a final decision. This program may fit their needs. Undergraduate and graduate students can apply for this program and participate for up to 90 days. The internship application can be sent to any NIMS groups. In addition, qualified applicants may receive financial support to cover their accommodation fees during the program. Many students of the Joint Graduate School Program use this internship.

【Application】
once a year (January)

【Duration】
up to 90 consecutive calendar days

【Financial support】
daily allowance, accommodation fee (if selected)

Graduate students

International Cooperative Graduate Program

Master's Doctorate

Students from globally renowned graduate schools are accepted to NIMS

NIMS concludes an International Cooperative Graduate Program (ICGP) agreement to carry out collaborative researches with overseas universities. NIMS accepts doctoral students through ICGP. Students can conduct part of their thesis work at NIMS with the co-supervision by NIMS researchers.

NIMS Joint Research Hub Program

NIMS makes its state-of-the-art facilities available to groups of researchers

This program targets groups of researchers—a Japanese faculty member acting as a principal investigator* and his/her students—and gives them the opportunity to work with NIMS researchers in a well-equipped research environment. NIMS also provides financial support to cover their accommodation costs and fund their research. This program is mutually beneficial to both participants and NIMS. Research groups benefit from access to sophisticated equipment, enabling them to carry out advanced experiments and research. While, NIMS benefits from valuable opportunities to network with highly skilled researchers.

* A principal investigator is a faculty member affiliated with a university, inter-university research institute or college of technology in Japan.

【Duration】
Schedules vary depending on the project, but the program must be completed by the end of the fiscal year in which the application is approved.

【Financial support for each group】
A maximum of 1 million yen for travel expenses (transportation and accommodation fees) and a maximum of 500,000 yen for research expenses

New CUPAL* funding category

A special funding category to support young researchers (faculty members under 40 years of age as of April 1, 2019 who have earned doctoral degrees within the previous 10 years) was established in FY2019. This is different from existing funding categories in that it covers the costs of travel to places other than NIMS (e.g., scientific conferences) if the trip is justified as a necessary part of the research project. This category strongly supports career advancement by young researchers.

* CUPAL (Nanotech Career-up Alliance) is a human resources development consortium supported by the MEXT for the past five years. Starting in FY2019, the consortium is being self-supported by its member organizations. NIMS has adopted the CUPAL funding category.

Norihiko Sasaki

Third-year doctoral student
Kyushu Univ.-NIMS
Joint Graduate Program

What's it like to study at NIMS?

Close-up: Student Researcher's Life

The lives of college students studying
at a research institute may be difficult for most people to imagine.
We shadowed a graduate student for two weeks to provide a real-world example.

DAY 1 Orientation
DAY 2 Experiment, etc.
DAY 3 Experiment at the NIMS open facility
DAY 4 Experiment, etc.
DAY 5 Day off (lab BBQ)
DAY 6 Day off
DAY 7 Sample preparation and transport
DAY 8 Collaborative research @Kyoto Univ.
DAY 9 "
DAY 10 "
DAY 11 Discussion of new equipment
DAY 12 Day off (Dinner with other students)
DAY 13 Day off
DAY 14 Group meeting

Only the most notable activity for a given day is listed. Unlisted activities include experiment at NIMS, writing research papers and library research.

DAY 1

Orientation

An orientation is held annually at NIMS for students joining the Kyushu Univ.-NIMS Joint Graduate Program. Curriculums, academic credit systems and other details are explained. The orientation also has a gathering of faculty members and students to deepen engagement.

Associate Professor,
Kazunori Sugiyasu

"The entire group was surprised by Norihiko's discovery*. We look forward to his dissertation."

*See the boxed text on the opposite page.

DAY 3

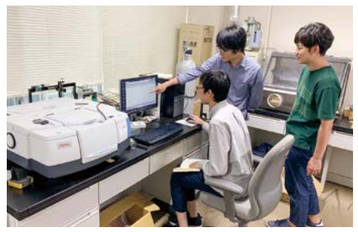
Experiment at the NIMS open facility

Norihiko conducts experiments using the equipment available both in his lab and at the NIMS open facility. A diverse array of advanced equipment is conveniently accessible in the nearby buildings. On this day, he used a confocal laser scanning microscope at the NIMS Molecule & Material Synthesis Platform.

DAY 8~10

Collaborative research at Kyoto Univ.

He brought molecular samples synthesized in advance to the collaborator's lab at Kyoto Univ. They carried out in-depth molecular structural analysis using MAIR spectrometry developed by Prof. Takeshi Hasegawa. He is conducting three joint research projects with other groups at NIMS and external research organizations.



DAY 12

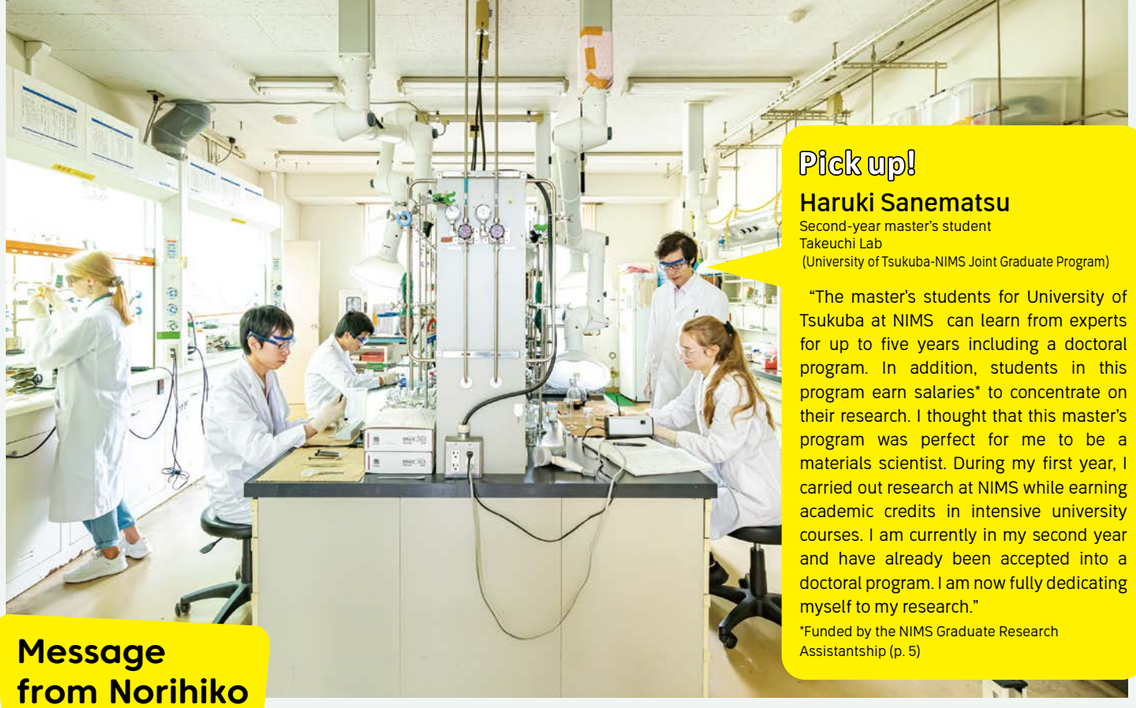
Dinner with other students

He went to the dinner with students he had met the orientation. He had a great time talking with them about research and general daily activities.

DAY 14

Group meeting

The NIMS Molecular Design & Function Group includes the Sugiyasu Lab where he works, the Takeuchi Lab (University of Tsukuba-NIMS Joint Graduate Program) and other researchers. This monthly group meeting affords him an opportunity to consult with experts.



Norihiko (front left) carrying out his experiment. Lab's student researchers are a diverse group.

Pick up!

Haruki Sanematsu
Second-year master's student
Takeuchi Lab
(University of Tsukuba-NIMS Joint Graduate Program)

"The master's students for University of Tsukuba at NIMS can learn from experts for up to five years including a doctoral program. In addition, students in this program earn salaries* to concentrate on their research. I thought that this master's program was perfect for me to be a materials scientist. During my first year, I carried out research at NIMS while earning academic credits in intensive university courses. I am currently in my second year and have already been accepted into a doctoral program. I am now fully dedicating myself to my research."

*Funded by the NIMS Graduate Research Assistantship (p. 5)

Message from Norihiko

I became interested in the NIMS Joint Graduate School Program while working on my master's degree at a different university, when I was looking for a doctoral program. One day I visited NIMS to use its open facility and happened to pick up a NIMS pamphlet. I read about the Sugiyasu Lab and found it very attractive because it was researching supramolecular polymers.

A supramolecular polymer is a type of polymer that consists of a group of molecules were connected though non-covalent linkages. These polymers have unique properties due to reversible monomer to polymer transitions. I learned that the Sugiyasu Lab had designed a number of unique functions using this polymeric property. As a master's student, I had been researching organic synthesis of sugar chains composed of a series of monosaccharides, such as glucose and glucosamine, for possible medical and agricultural chemical applications. My fascination with the fact that supramolecular polymers can afford greater freedom in molecular design than sugar chains led me to take the Sugiyasu lab entrance exam.

When I applied for the doctoral program, I encountered some difficulties associated with changing the subject of my research. One of the requirements was to prepare a research proposal, which was challenging because I had no experience handling supramolecules. Despite this difficulty, I did not give up, believing I had a golden opportunity to pursue what I really wanted to study. In retrospect, my life might have been easier if I had had a clear career vision before taking my university entrance exams. However, people generally develop broader interests as their knowledge increases. In my case, the right time to make a critical career decision came when I applied for the doctoral program. I was confident that NIMS would be a perfect environment for me based on my experiences using its facilities and communicating with Professor Sugiyasu. In fact, a wide array of advanced equipment is readily available at the NIMS whenever I want to test out new techniques. Moreover, compared to universities, students at NIMS have greater access to faculty, making it easier to get advice.

I am about two-and-a-half years into my doctoral program now and my career plans have gradually changed. I previously planned to work for a private company, but the leading researchers I study closely with at NIMS have inspired me to become a professional researcher. I would like to use the intellectual curiosity the stimulating environment at NIMS helped me develop to further build my expertise.

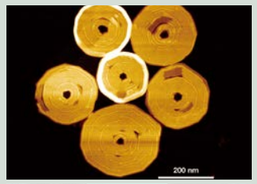
Joint Graduate School Program on p. 4

Pick up!

Award for an original supramolecular polymer

Norihiko developed a supramolecular polymer with an Archimedes' spiral structure. The polymer is composed of double-stranded nanofibers in a spiral arrangement. This unique structure has the potential to generate new electrochemical and optical properties. Norihiko was awarded the "Best poster presentation award" at an international conference* held in Italy in June 2019 for his originality.

*14th International Symposium on Macrocyclic and Supramolecular Chemistry



Cem Eren Özbilgin

First-year doctoral student,
Waseda Univ.-NIMS
Joint Graduate Program

What's it like to study at NIMS?

Close-up: Student Researcher's Life

International student

DAY 1 Experiment
DAY 2 Japanese language Class @NIMS
DAY 3 Experiment
DAY 4 Japanese language Class @NIMS
DAY 5 Experiment
DAY 6 Day off
DAY 7 Day off
DAY 8 Collaborative research @Osaka Univ.
DAY 9 "
DAY 10 Seminar Preparation
DAY 11 Presentation at Joint Seminar in Shizuoka
DAY 12 "
DAY 13 Day off
DAY 14 Day off

Only the most notable activity for a given day is listed. Unlisted activities include experiment at NIMS, writing research papers and library research.

DAY 1~5

Experiment (photo on opposite page)

Cem's group controls the crystals' orientation of a polycrystalline ceramic by using a strong magnetic field. This allows them to achieve the highest performance possible for a wide range of ceramic materials. His study focuses on developing high-performance solid electrolytes for next-generation secondary batteries. When students join his lab, he teaches them experimental procedures.

Professor,
Tohru Suzuki

"Cem is a reliable person who researches with deep thought and ingenuity, and takes care of other students."

DAY 2, 4

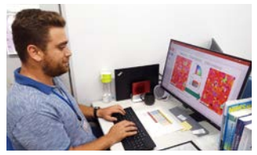
Japanese language class

Japanese language classes are offered at NIMS for international students and researchers. Although English is used during research, he is learning the conversational skills needed for everyday life.

DAY 10

Seminar preparation

He returned from Osaka Univ., where he had been participating in a joint research project, and began preparing for his seminar presentation scheduled for the following day.



EVERY DAY

Lunch

He usually has lunch at the NIMS cafeteria, where he often enjoys lively conversations with students working in other labs.

DAY 11

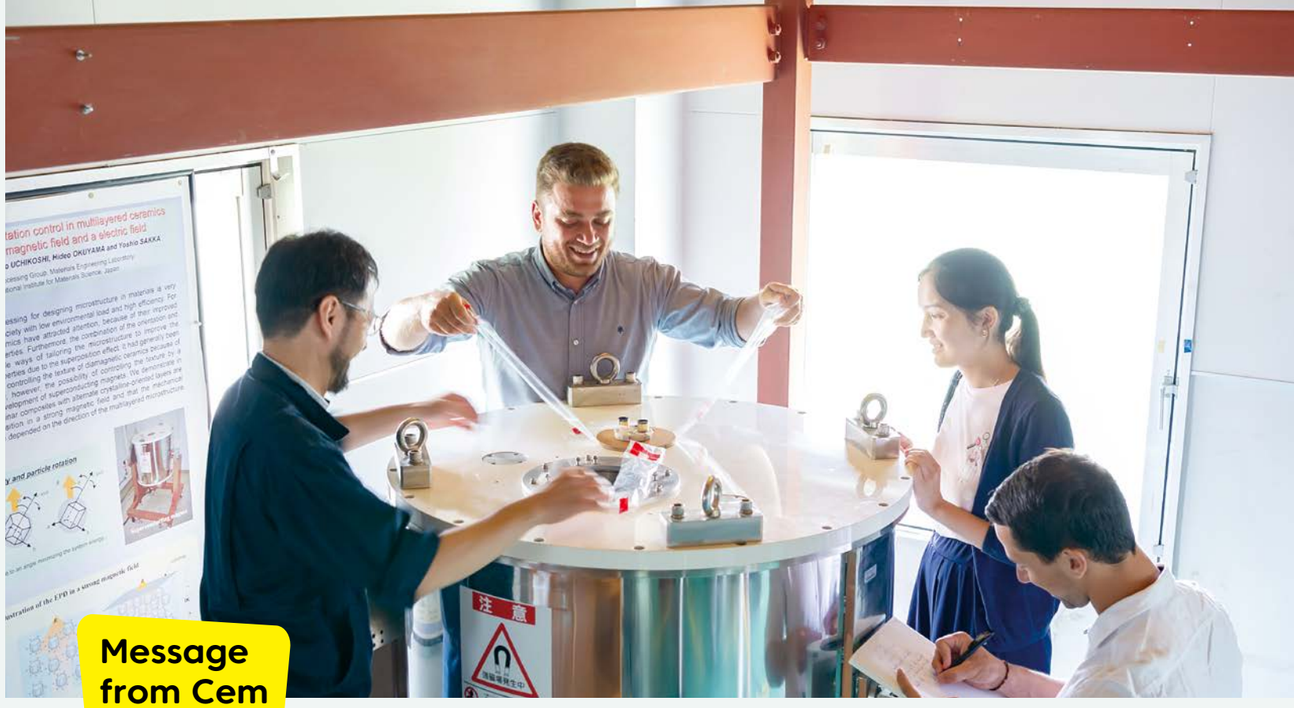
Seminar in Shizuoka

This seminar is an annual joint seminar on ceramics that consisted of several research groups from universities and institutions. He presented the latest research results on behalf of the Suzuki Lab.

ONE DAY

BBQ

He attended a BBQ hosted by the NIMS Ceramics Processing Group of which the Suzuki Lab is a part and other groups. Everyone seemed to have a great time.



Cem sets the sample(second from the left in the photo).

Message from Cem

I joined the NIMS Internship Program in 2017. At the time I was a graduate student in Turkey researching solid electrolytes for all-solid-state lithium-ion batteries. I was looking for the ways to achieve crystal orientation in ceramics to benefit the anisotropic nature of ionic conduction in my compounds. During my research, I learned that NIMS was one of the few research organizations in the world conducting state-of-the-art research using high-intensity magnetic fields. Since I had been interested in Japanese culture and lifestyle, this also motivated me to pursue the internship opportunity at NIMS.

During the internship, I was privileged to have Prof. Suzuki—a world-class researcher in the field—as an adviser. Dr. Suzuki was friendly and accessible, consulting with me on experiments and reviewing my research papers even when he was very busy. My three-month internship was a rewarding experience. I enjoyed interacting with researchers from other countries and working in the cozy atmosphere of our lab. After completing the internship program, I returned to Japan as part of the Joint Graduate School Program in the hope of continuing my research at NIMS. I am delighted to have this opportunity to work in the stimulating environment NIMS affords.

I believe that NIMS is an exceptional research organization internationally. Our lab is equipped with all of the tools necessary to smoothly perform a series of experimental steps, such as materials synthesis, sample preparation and evaluation. We are also allowed to use the equipment owned by other labs if needed. Additional advantages of working at NIMS include the experts knowledgeable about the scientific equipment available and maintenance services capable of quickly fixing equipment problems when they occur. We can conduct research efficiently without falling behind in the global competition. I have been able to fully dedicate myself to my research since coming to Japan, partly because I am enjoying life here.

NIMS has cafeterias, cafés and sports facilities. Also Tsukuba City, where NIMS is located, has all the amenities for a comfortable life, including stores, parks and medical facilities. In addition, it offers convenient access to Tokyo. My wife and I enjoy Japan to the fullest by going sightseeing and visiting nature-rich areas.

I am currently developing ceramic solid electrolytes with enchanced ionic conductivity. I hope to take advantage of the favorable research environment to make safe, high-capacity, and powerful next-generation secondary batteries a reality.

NIMS Internship Program on p.4
Joint Graduate School Program on p. 4

Pick up!

A married couple working at NIMS

Irem, Cem's wife, is also a graduate student working at NIMS. She has been researching bioimaging using semiconducting quantum dots in the Shirahata Lab as part of the Hokkaido University-NIMS Joint Graduate Program. Although they are still unfamiliar with Japanese customs, they are enjoying life here thanks to the support of the people around them.

Cem and Irem attended the local "Matsuri Tsukuba" festival on their day off. They greatly enjoyed this cultural event, including the traditional summer kimonos they wore.

Joint Graduate School Program

Seven research fields

Any student interested in materials research is likely to find a stimulating research lab at NIMS!

For detailed information on each lab

https://www.nims.go.jp/students/en/research/

*"NIMS Internship Program" and "International Cooperative Graduate Program" accept students in other NIMS laboratories. For details, please access the QR code on p. 4.

Condensed matter physics

Our research goals are to understand the origins of unique material properties (e.g., thermal, electrical, magnetic, optical and mechanical) at the atomic or quantum level, derive new physical laws and develop novel materials. We consider all possible approaches to materials research (e.g., condensed matter theory, computational science, structural analysis and experiments) and develop new materials with scientific theory.

New Lab!

Uchida Lab (University of Tsukuba-NIMS Joint Graduate Program)
Spintronics, Thermoelectric conversion

Ishii Lab (University of Tsukuba-NIMS Joint Graduate Program)
Nanophotonics, Optical materials

Tateyama Lab (Waseda Univ.-NIMS Joint Graduate Program)
Computational materials science, Electrochemistry

Basic chemistry

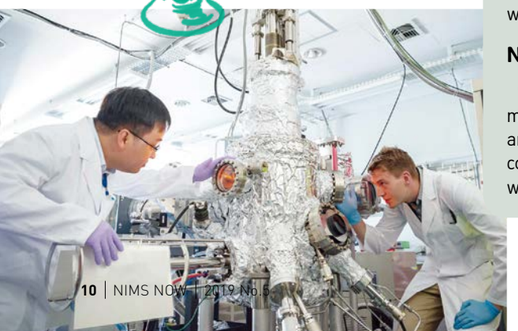
Key chemical reactions in energy conversion devices (e.g., batteries and catalysts) take place at the boundaries (surfaces and interfaces) between materials. We aim to create material surfaces and interfaces with high energy conversion efficiency. You can participate in the development of sophisticated measurement techniques that enable real-time observation of surface/interfacial changes. You will also be able to study the use of these techniques in the development of next-generation energy materials.

Ceramics

Ceramics composed of inorganic compounds, such as carbon and metal oxides are widely used as optical and electronic materials. In order to significantly increase the performance of ceramics, their crystalline structures need to be precisely controlled. Accordingly, we attempt to develop new ceramics by considering a broad range of approaches, from precision analysis of crystalline structures and individual particles to the development of crystal synthesis processes.

New Lab!

Ma Lab (Waseda Univ.-NIMS Joint Graduate Program)
Nanosheet, Nanotube



Pick up!

Nagao's Lab (Hokkaido Univ.-NIMS Joint Graduate Program)
Orjan Sele Handegard (left) : second-year doctoral student

"The goal of our research is processing electrically conductive ceramic materials into nanostructures using high vacuum systems—including a molecular beam epitaxy machine—and apply these products to the development of sensors and heaters capable of detecting and generating infrared radiation. We recently made a series of modifications to the epitaxy machine in the hope of increasing the level of vacuum it can produce, thereby facilitating the attainment of thin films with the intended structures. As a result, we achieved an ultra-high vacuum of 10^{-8} Pa."

Ngo Hai Dang (right) : second-year doctoral student

"Our lab members work as a team, support one another and are eager to bring new materials and devices into the world. Dr. Nagao assigns us stimulating research projects and actively encourages us to participate in joint research with other universities/companies and to attend international conferences. This lab is a perfect environment in which to gain valuable experience and grow as a researcher."

Biomaterials

Biomaterials are used to compensate for impaired bodily functions resulting from injuries and illness and to promote healing. Scaffolds a foundation material that enables complete regeneration of biological tissues have been actively researched in recent years, while artificial joints and stents have long been in practical use. We investigate the impact of biomaterials on the body parts in which they are directly applied and develop highly functional biocompatible materials.

Pick up!

Chen's Lab (University of Tsukuba-NIMS Joint Graduate Program)
Linawati Sutrisno: first-year doctoral student

"Our lab specializes in research on biological tissue regeneration. We have been developing scaffold materials designed to promote cellular proliferation and differentiation by fully exploiting materials synthesis and microfabrication techniques. My research specifically focuses on scaffold materials intended for cancer treatment. I am working to design scaffold materials capable of encapsulating metal or inorganic nanoparticles lethal to cancer cells that are activated by external stimuli, such as magnetic fields and light. My experiments sometimes result in failures, but Dr. Chen always offers me encouragement and helpful advice."

Semiconducting materials

Semiconducting materials play a vital role in electronic devices because the electrical current that flows through them can be easily controlled. The properties of semiconductors are determined by the so-called electronic band structure and are closely related to their microstructures. Focusing on this, we aim to develop materials with new principles by manipulating their microstructures (e.g., using quantum dots) and search for new semiconducting materials as alternatives to silicon.

Organic materials

Organic materials composed mainly of carbon and hydrogen with certain molecular networks and higher order structures have been found to exhibit a wide range of functions. These include an ability to recognize specific molecules and an ability to respond to light or electrons. We explore the vast potential of organic materials in their application to molecular design and in the development of molecular synthesis techniques, sensors and medical materials, etc.

Metals

Metals are commonly used as structural materials due to their high workability and durability. Certain metals also play critical roles in various devices due to their magnetic properties and superconductivity. We have been attempting to more fully exploit the potential of metals by designing metal microstructures, developing processing techniques, searching for new metallic materials and developing next-generation information devices while controlling electron spin. You can learn these advanced techniques.

New Lab!

Takahashi Lab (Waseda Univ.-NIMS Joint Graduate Program)
Magnetic materials, Magnetic recording

Kawagishi Lab (Waseda Univ.-NIMS Joint Graduate Program)
Stracutual materials, Thermodynamics

Hiromoto Lab (Waseda Univ.-NIMS Joint Graduate Program)
Biomaterials, Corrosion

COLUMN

Program for adult graduate students

Katsuya Nakano
Steel Research Laboratory, Nippon Steel Corporation
Second-year doctoral student, Ohmura Lab
Kyushu–NIMS Joint Graduate Program

Adult graduate students aim to pursue doctoral degrees while continuing to work. What are their everyday lives like? What makes this program attractive? We asked Katsuya Nakano, who has been participating in a joint research project with NIMS while studying as a graduate student in the Joint Graduate School Program.

Could you describe your work at the Nippon Steel Corporation?

I am engaged in steel research, mainly focusing on the development of steels for automobiles. In order to reduce the impact of automobiles on the environment, their CO_2 emissions need to be reduced by increasing their fuel efficiency. This can be effectively achieved by decreasing the thickness of the steels used in automobiles, thereby reducing their mass. However, this approach will obviously compromise their collision safety. I am therefore researching and developing steels that remain very strong even when their thickness is reduced and that can be processed into complex shapes.

What inspired you to pursue a doctoral degree at NIMS?

Industrial firms usually focus on applied research in order to meet their product development demands. However, the deep, fundamental knowledge that underlies applied research is indispensable. For this reason, Nippon Steel Corporation encourages its employees to further develop their expertise by pursuing doctoral degrees. Six years after joining the company, I began considering a doctoral degree. Around this time, NIMS and three steel manufacturers, including Nippon Steel Corporation, launched an MOP (Materials Open Platform) initiative to jointly carry out basic research. I was selected to participate in the MOP as a representative of my company. Because I found the subject being studied in the MOP very interesting, I decided to develop this learning opportunity into a doctoral program using the Joint Graduate School Program NIMS offers. I actually had used this program previously while working on my master's degree. Professor Takahito Ohmura, my current Ph.D. advisor, also served as my academic advisor during my master's program. Professor Ohmura is an authority on material strength research and I'm delighted to have another opportunity to conduct research under his supervision.

Please describe your activities as an adult graduate student.

Although Nippon Steel Corporation encourages its employees to acquire doctoral degrees, we are still required to completely fulfill our responsibilities at work. Fortunately, I am allowed to independently and flexibly manage my work schedule. Therefore, I am trying to find time to devote my research on doctoral program and the MOP project. I visit Professor Ohmura at NIMS to discuss experimental results and research papers once every few months.

In order to earn a doctoral degree from Kyushu University, I need to write about three research papers for publication in scientific journals during my doctoral program. Although it is not easy to keep up with both my graduate studies and my job, the effort is very rewarding. I particularly enjoy the academic opportunity to study fundamental subject matter in depth, as it affords me the chance to gain a deeper understanding of basic technologies and develop greater expertise as a materials researcher. In addition, I can force myself to practice writing research papers, which are given a lower priority at work than my occupational duties. These experiences are definitely helping me grow as a researcher. Being an adult graduate student is very challenging, however, I appreciate the environment where I can work and study while encouraging with my coworkers who are willing to build knowledge and skills.

(by Akiko Ikeda, Sci-Tech Communications)

Nakano and Professor Takahito Ohmura, his advisor at NIMS, engaging in a discussion

DATA

Statistics: NIMS graduate programs

Various programs available: number of participants

The "A road to a materials scientist: Study at NIMS!" on page 4 describes a variety of programs NIMS offers. Every year, many students and young researchers participate in research at NIMS as part of these programs.

Total number of program participants in FY2018

661

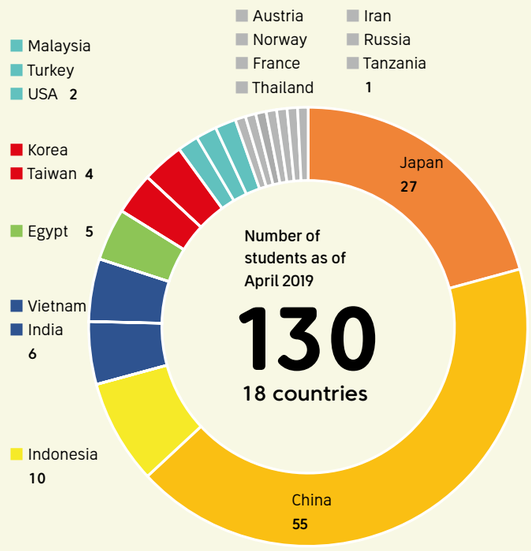
No. of international students in parentheses

Participants in the Joint Graduate School Program	**125** (101)
Participants in the Cooperative Graduate Program	**67** (34)
Interns, etc.*	**469** * (145)

*Including participants in the NIMS Joint Research Hub Program

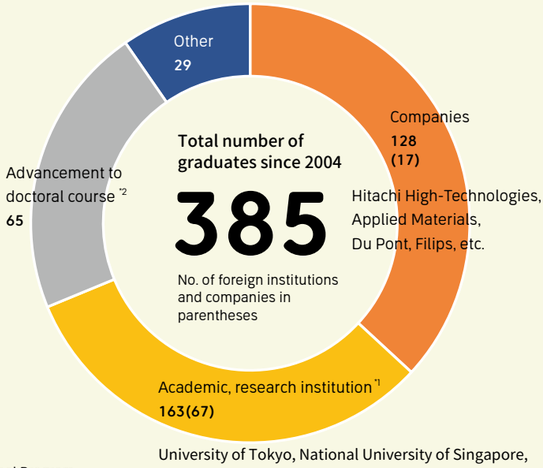
Joint Graduate School Program attracts diverse nationalities

The Joint Graduate School Program attracts students from many different countries, with Asian countries being the primary sources. Currently 130 students are participating in this program, of whom 100 have attained "NIMS Junior Researcher" status.



Careers after completing the Joint Graduate School Program

A total of 385 students from 24 countries have successfully completed the program since its 2004 launch. Having gained special skills and experience at NIMS, they are now playing active roles in various organizations around the world.



*1 Includes 4 NIMS permanent researchers and 2 permanent engineers
*2 Master's degree graduates of the NIMS-Tsukuba Univ. Joint Graduate School Program

Open talk with former participants

My days at NIMS, My starting point as a researcher

We invited three materials scientists who completed the NIMS Graduate School Program. They are now actively involved in their respective research fields. They discussed their experiences as graduate students at NIMS.

Shunsuke Yamashita
Fundamental Technology Research and Development Division 2
R&D Center
Sony Corporation
【2013.10-'16.9: The Kyushu univ.-NIMS Joint Graduate Program (doctoral), electron microscope-based measurement techniques at the Kimoto Lab】→【Post-doctoral researcher at the Kimoto Lab】→【'18.6~: Sony Corporation】

Yoshikazu Mizuguchi
Associate Professor
Superconducting Materials Lab
Tokyo Metropolitan University
【2008.4-'10.7: The University of Tsukuba-NIMS Joint Graduate Program (doctoral), superconducting materials research at the Takano Lab】→【Postdoctoral researcher at the Takano Lab】→【'17~: Tokyo Metropolitan University】

Tomoya Nakatani
Senior Researcher
Research Center for Magnetic and Spintronic Materials
NIMS
【2006.4-'11.3: The University of Tsukuba-NIMS Joint Graduate Program (master's and doctoral), magnetic materials research at the Hono Lab】→【Postdoctoral researcher at the Hono Lab】→【A hard disk manufacturer in the United States】→【'16.1~: NIMS】

What motivated you to study at NIMS?

Nakatani: I am currently working at NIMS as a magnetic materials researcher. When I was a student, I became fascinated with this subject first and decided to pursue it. My main focus at present is developing materials for magnetic sensors to be used to measure the strength of magnetic field,

Mizuguchi: I direct the Superconducting Materials Lab at Tokyo Metropolitan University. It's been my life-long dream to create the first-ever room-temperature superconductor, and I've been searching for new materials to make it a reality.

Yamashita: I work at Sony, where my role is to observe and evaluate the atomic structures of semiconductor device materials under an electron microscope. Before participating in the Joint Graduate School Program, it was my job to analyze materials under an electron microscope for our clients. At the time, I felt that my knowledge of electron microscopes was inadequate. This led me to decide to study at NIMS, which had both a reputation for successfully developing many new measurement techniques and an array of state-of-the-art equipment. What inspired the two of you to study at NIMS?

Nakatani: I had already decided to pursue a doctoral degree when I entered university and began considering my graduate school options. Around that time, I had the opportunity to attend a special lecture by Professor Kazuhiro Hono. I learned from his remarks that cutting-edge research is conducted at NIMS by researchers from around the world using the most advanced research facilities. This became a life-changing event for me.

Mizuguchi: Unlike Dr. Nakatani, I was planning to enter the workforce after completing my master's program. However, when I attended what I thought would be my last scientific conference, I saw presentations by other students who were about the same age as me. I was so impressed by these presenters that I changed my mind and decided to extend my research career into a doctoral program. I searched for research groups that might accept a doctoral student interested in superconductivity research. I then heard a rumor that NIMS was recruiting student researchers. As I tried to confirm this information, to my surprise, I found that NIMS had scheduled a student recruitment information session the following day. When I went to the session, I met and talked with Professor Yoshihiko Takano and found that we shared an interest in making room-temperature superconductors a reality. This was a fateful encounter for me.

Enjoying student life: working hard, playing hard

Nakatani: Dr. Mizuguchi and I began our doctoral programs in the same year. I remember often seeing Mizuguchi striding excitedly around the hallways carrying quartz tubes to be used to synthesize test samples (Nakatani laughs).

Mizuguchi: At the time I was diligently preparing test samples every day. Because I wanted to run the electric furnace continuously to synthesize the samples, I routinely placed raw materials in the furnace even on my days off despite having personal plans. We had a reason to work hard: iron-based superconductors had just been discovered by Japanese scientists in January of the year in which I decided to participate in the NIMS Joint Graduate School Program. Labs around the world did not want to fall behind in superconductivity research, which was expected to intensify after this Nobel Prize-worthy discovery.

Yamashita: During my doctoral program, I was happy to have the opportunity to allocate time for study. The day-to-day demands of my previous job had made studying impossible. I had access to a superb research environment equipped with a rich array of advanced equipment. In addition, Professor Koji Kimoto, my advisor, had the skills to take amazingly beautiful microscopic images, which inspired me to bring my microscopy techniques up to his level. I still remember the excitement I felt when I was able to see carbon atoms in graphene for the first time under a transmission electron microscope.

Mizuguchi: I must say that the most exciting moment for me came when I thought I had accomplished something great but later found out that I had failed (Mizuguchi laughs). As a novice researcher, I thought I had succeeded in synthesizing a superconductive material and was extremely thrilled; I might have joined the ranks of the elite discovers. However, to my bitter disappointment, I later found that an impurity was involved in the superconductivity. This taught me that research is never that easy. After this setback, I began conducting research more systematically in the hope of experiencing that initial feeling of exhilaration again. The most valuable aspect of NIMS for me was the opportunity to meet many outstanding researchers in chemistry, condensed matter physics and applied science. I tried to exploit this opportunity as much as I could by making plans to collaborate with them on many ambitious projects. Consequently, I was able to produce 10 research papers before completing my program.

Nakatani: Because the lab where I worked frequently carried out joint research with industries, my research was largely influenced to the direction of industrial applications of magnetic materials. I always felt joy in fulfilling this responsibility and I still feel the same enthusiasm today. As a student, I also engaged in activities other than research. I enjoyed cooking and eating curry with students from India and my interactions with them helped me substantially improve my English skills. I also joined a local mountaineering club and had a great time climbing the beautiful mountains in the Tsukuba area.

Valuable experiences for future endeavors

Yamashita: Considerable experience and knowledge are both vital in preparing samples for electron microscope observations and in collecting data. What I learned at NIMS as a student has been very useful to me professionally. I have also tried to maintain the creativity I developed as a researcher at NIMS—by inventing new measurement techniques, for example.

Mizuguchi: I was initially appointed as an assistant professor in the engineering department at my current university. I believe that the experiences I had at NIMS interacting with so many scientists helped me find my niche in the engineering department, even though my expertise was in physics. I cannot think of any other place that offers opportunities to learn about materials as extensively and intensively as NIMS. I encourage future students studying at NIMS to actively seek advice from the various scientists there and expand their potential.

Nakatani: Student researchers at NIMS tend to develop a sense of independence relatively early because they are treated as colleagues by their superiors. The NIMS Joint Graduate School Program definitely had a very positive impact on my career path and I hope to see the many students take full advantage of this program.

Yamashita: I urge students interested in the program to contact and consult with faculty members associated with it. I myself directly contacted Professor Kimoto by email to make an appointment despite never having met him. Students should actively explore all of their possible options.

(by Akiko Ikeda, Sci-Tech Communications)

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