Master's Program in Engineering

Nuclear Technology

Nuclear System Safety Engineering

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【校正時ご確認をお願い致します】
□修士・卒業論文の5行目「UO_2」の2を下付き文字に修正しました。ご確認を御願い致します。

1 Laboratory for Nuclear and Radiochemistry

Professor / Tatsuya SUZUKI　Assistant Professor / Yu TACHIBANA
Assistant Professor / Yoshinobu MATSUMOTO

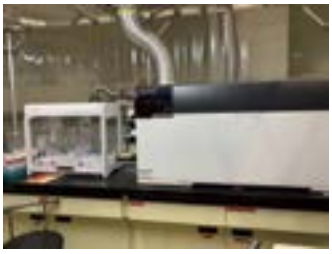
- Nuclear Energy Chemistry
- Isotope Science and Separation
- Study on Decommissioning of Nuclear Plants

Supervisor　Professor / Tatsuya SUZUKI

Prof. Suzuki is specialist in nuclear and radiochemistry. He has been studying on isotope separation science and nuclide separation related with spent nuclear fuel and radioactive waste management. He is often absent from NUT on business trip. However, he is dealing with the student's question kindly and he is a student - minded supervisor.

Research Content

In our laboratory, there are mainly 2 kind of topics; Isotops separation and elements separation.
The isotope effects in chemical reaction is studied, and the application of these effects to isotope separations or enrichments are carried out for the nuclear related field; nuclear medicine, fission fuel, and so on.
Nuclide separation from spent fuels or nuclear fuel debris generated from severe nuclear accidents(like FuKuShiMa accident) have been studying. Spent fuels and debris contain kinds of radioactive fission products (FP) and minor actinides (MA), Our aim of the above studies is a load reduction from radioactive waste into human environments by the suitable separation of FPs and MA. For the realization of this aim, the dissolution studies for spent fuels and debris through the chemical conversion by thermochemical reaction, and the nuclide separation by chromatographic separation using solid extractant are carried out.



Icp-ms was used to analyze trace elements in the solution after element separation by chromatography

A Day in the Lab

In our laboratory, we are conducting research on schedule decided by each student themself. Such as Literature research, design of experimental scheme, specific experimental progress, data analysis and reporting, there are also many opportunities to participate in the support work with companies, Japan Atomic Energy Agency(JAEA). Since many international students are enrolled in our laboratory,English ability will also be imperceptibly improved.

Weekly research meeting

Thesis Subjects

- (M) Synthesis of inorganic ion exchangers containing molybdenum, tungsten, and zirconium and adsorption characteristics of nuclides contained in spent nuclear fuel
- (M) Study on cross-linking effects and adsorption properties on multi element separation using N-vinyl-2-pyrrolidone resin
- (M) Fundamental Research on Oxidation-Induced Powderization of Solids Containing UO_2 Using Non-equilibrium Plasma

The number of PhD Graduates **1**

Major employers of Graduates

- Mako Corporation
- Japan Nuclear Fuel Limited
- TEPCO Design Co., Ltd.
- Japan Atomic Energy Agency
- Tokyo Electric Power Company Holdings, Incorporated

Writer : MA ZhuoRan, Energy and Environment Science
(University of South China)

教員名
SUZUK Tatsuya
TACHIBANA Yu
MATSUMOTO Yoshinobu

キーワード
Nuclear Energy Chemistry
Element Separation
Isotope Science and Separation
Nuclear Fuel Debris

2 Plasma Dynamics Laboratory

Associate Professor / Takashi KIKUCHI
Technical Specialist / Tetsu TANAKA

- The sun on the ground!
- Elucidation of the plasma physics using the pulse power
- From the space physics to the iPS cells

https://mhdlab.nagaokaut.ac.jp/

Supervisor Associate Professor / Takashi KIKUCHI

He is a former student from National Institute of Technology (KOSEN), Kushiro college. So he knows KOSEN students' circumstances. He always carries the enthusiasm in giving the students better knowledge. His field of expertise is a simulation of the nuclear fusion and the beam physics. We can get his great support for a theory and an experiment.

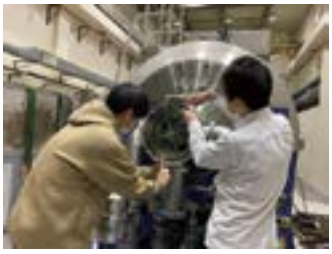
Research Content

Plasma is the fourth fundamental state (phase) of matter following solid, liquid and gas. Familiar plasmas are lightning, the Northern Lights and the sun etc.. In this laboratory, we conduct a wide range of study from the basic studies, which are ""Simulation experiment of space plasma"" and "Measuring plasma properties and analysis of numerical simulation to realize power generation by nuclear fusion", to the application studies, which are "Magnetohydrodynamics (MHD) power generator and thruster" and "Metal surface treatment and treatment of marine microorganisms by an atmospheric pressure plasma". We handle a wide variety plasma and that is this laboratory's feature.

intense pulsed power generator "ETIGO-II"

A Day in the Lab

This laboratory is joint with Sasaki laboratory of Electrical, Electronics and Information Engineering. No core time and we can manage the study schedule ourselves. Studies can be conducted by oneself, or in cooperation with laboratory members as a study group.
One day schedule for Mr. K in this Laboratory
10:00 Get to school
10:00 - 10:30 Check the e-mail
10:30 - 11:30 Experiment Preparation
11:40 - 12:20 Lunch
12:30 - 13:30 Play catch with friend
13:40 - 18:00 Experiment
18:00 - 19:00 Data analysis
19:00 Return home



Preparation for the experiment

Thesis Subjects

- (M) Study on Radiation Chemical Reaction of Refractory Organic Fluorine Compound using High Intensity Relativistic Electron Beam
- (M) Study on Plasma Cathode Electron Gun with Low Energy for Simulation Experiment using Electron Accelerator for Intense Deuteron Accelerator
- (M) Study of Radiation Transport in Warm Dense Matter Generation by High Intensity Pulsed Power Current Heating

The number of PhD Graduates **3**

Major employers of Graduates

- Canon Tokki Corporation
- Hitachi Aloka Medical, Ltd.
- Japan Nuclear Security System Co.,Ltd.
- Kansai Electric Power Co., Inc
- The Japan Atomic Power Company
- Hamamatsu Photonics K.K.
- Toshiba Plant System & Services Corporation.
- Tokyo Power Technology Ltd.
- Mitsubishi Electric Corporation
- NIPPON STEEL TEXENG.CO.,LTD.

Writer : Ryosuke KADO, Nuclear System Safety Engineering
(National Institute of Technology, Wakayama College)

教員名
KIKUCHI Takashi
TANAKA Tetsu

キーワード
plasma
nuclear fusion
particle beam
Theoretical and Numerical Simulation

3 Accelerator Applications / Novel Material Design Laboratory

Associate Professor / Tsuneo SUZUKI

- The world's top-level equipment for research
- Finding out new possibilities by the minority elites
- "Hard coating materials" are not so hard !

https://etigo.nagaokaut.ac.jp/people/tsuneolab/index.html

Supervisor Associate Professor / Tsuneo SUZUKI

Our leader is the specialist of material engineering. He is always thinking of his students. When we face troubles in our research, he always be there and helps us to solve it. Not only in the study, he is really close to students. That's why we can study without any worries.

Research Content

We mainly focus on seaching for new materials by PLD (pulsed laser deposition). In our group, we possess the world's top-level equipments for research such as electron microscope and accelerator (ex. various kinds of machine tools, experiment and evaluation equipment). It makes possible to create materials having novelty and evaluate these materials. Our motto is "we are not just making thin films. we are making our futures". We believe that our research contributes to the revolution of material fields in the future.

Electrostatic accelerator for material analysis

A Day in the Lab

Everyday life in our lab In our group, we have weekly meeting. it's one of the strong point of our lab. Basically, we disscuss what to do next at the meeting, and work towards to the goal. [One day of our member] 9:00 - Come to the lab and check e-mail.9:30 - Prepare for experiments 12:00 - Lanch time 13:00 - Start the experiments 17:00 - Organize the data

Pulsed laser deposition system

Thesis Subjects

- (M) Solid solution of lanthanide nitrides in quasi-binary transition metal nitrides and its
- (M) Preparation of thin film standard sample for high precision oxygen analysis by resonance nuclear reaction
- (M) Coexistence of stacking irregularity by oxygen and silicon solution in chromium nitride for its hardening

The number of PhD Graduates **2**

Major employers of Graduates

- The Japan Atomic Power Company
- The Steel works, Ltd.
- The Furukawa Electric Co., Ltd.
- METAWATER Co., Ltd.
- Advantest Corporation
- Mazda Motor Corporation
- Kao Corporation
- Daio Paper Corporation
- UNION TOOL CO.
- National Institute of Technology (KOSEN), Sendai College

Writer : SUGAI Takumi, Nuclear System Safety Engineering
(National Institute of Technology, Nagaoka College)

教員名
SUZUKI Tsuneo

キーワード
Pulsed laser deposition system (PLD)
Chemical analysis by electrostatic accelerator
Material characteristics of transition nitride
Ultra high hardness coating

4 Environment Disaster Prevention Laboratory

Professor / Satoru OHTSUKA

- Research on leading environment disaster countermeasures
- Comprehending the essential concepts of Civil and Environmental Engineering
- Maintaining a balance between research and extracurriculars

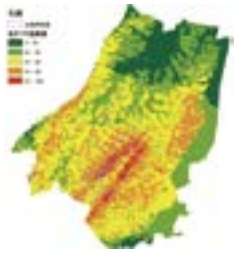
https://whs.nagaokaut.ac.jp/edpl/

Supervisor Professor / OHTSUKA Satoru

Both professors are very friendly and welcoming. They always enlighten the students based on academic principles and engineering best practices. Further, they help and encourage students to develop a sound engineering understanding of natural phenomena. Moreover, our professors strongly believe in freedom of expression and therefore give due importance to the students' opinions on research matters, which leads to healthy technical discussions.

Research Content

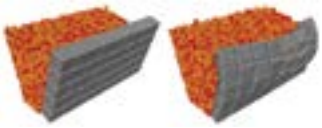
The environment disaster prevention laboratory is aimed at conducting research to solve the latest engineering challenges to prevent the catastrophic outcome of natural disasters such as earthquakes and rainstorms. Model tests and field studies are conducted to investigate the effective liquefaction countermeasures. Wide area risk assessment methodology for slopes is conducted with GIS and AI technologies against earthquakes and rainstorms (see the right figure). Moreover, stability analysis of footings is also part of the research theme. In addition, we develop particle-based numerical simulation models to reproduce the complex soil behaviors such as the deformation of sand, the internal erosion of soil and weathering of mudstone.



Wide area slope failure risk assessment

A Day in the Lab

Everyday in this lab is full of energy and opportunities. Students carry out their designated research activities and report its progress to the professors. Weekly group and individual seminars are conducted to keep pace with the annual research targets. All students put their best efforts into achieving their intended research goals. Preparing for the seminars is quite demanding; however, as you come to the laboratory, you feel motivated as there are colleagues who work hard along with you. Besides, Nagaoka is a peaceful city and there are activities round the year to make you feel lively such as Nagaoka fireworks.



Large deformation analysis of ground and soil structures by particle simulation

Thesis Subjects

- (M) Development of Wide-Area Hazard Assessment for Slope by Combining Machine Learning and Image Recognition
- (M) Laboratory and Field Tests on the Compaction Effcet of Gravel Piles on Sandy Soil
- (M) Advanced Measurement of Three Dimensional Velocity Components of Seepage Flow in the Soil Using Refractive Index Matching Scanning
- (M) Numerical Modeling of Fracture Behavior of Geomaterials Based on Perdynamics-DEM

The number of PhD Graduates **8**

Major employers of Graduates

- Fujita Corporation
- Obayashi Corporation
- Japan Railways
- Penta-Ocean Construction
- Sakami Tetsudo
- Shimizu Corporation
- Taisei Corporation
- Sumitomo Mitsui Construction
- Fukken Engineering
- Fudo Tetra Corporation

Writer : Tahir Iqbal, Integrated Bioscience and Technology
(Nagaoka University of Technology)

教員名
OHTSUKA Satoru

キーワード
Environment disaster
Disaster prevention
Civil engineering
Environmental engineering

5 Radioactive Environmental Dynamics Engineering Laboratory

Associate Professor / Tomoko OHTA

- Make a radioisotope-scale clock using dating!
- Know the risk of future earthquakes!
- Let's face the voice of the earth in nature!

Supervisor Associate Professor / Tomoko OHTA

Ohta-sensei is a very kind teacher. She is a student-minded teacher who is kind enough to ask basic questions and give advice on her usual student life and employment. She loves animals, and her dog, Shiba Inu, Mikan-chan, has become an idol in our laboratory. In fact, martial arts are one of the special skills.

Research Content

We aim to contribute to issues such as water resource conservation / development and radioactive waste disposal by conducting groundwater dating development and future prediction of nuclides in the environment..
1) Water resource conservation and development
We are developing a groundwater dating method for groundwater flow evaluation, which is the key to water resource development and safety evaluation of radioactive waste disposal.
2) Radioactive waste disposal
We are elucidating the dynamics of nuclides in forests and groundwater through research on the circulation of anthropogenic pollutants and the prediction of their distribution in the environment.

Fieldwork
(Collection of groundwater for snow-melting pipes)

A Day in the Lab

There is no core time. You can proceed with your research freely. We also go to field work for groundwater sampling and forests in various places. We receive samples from nature, chemically separate the nuclides in the samples in the laboratory and measure them to face the voice of the earth every day.
The seminar introduces papers and reads textbooks once a week in collaboration with the Laboratory for Nuclear and Radiochemistry and the Nuclear Materials and Conservation Engineering Laboratory. In addition, the student room is also combined with these laboratories, and it looks like a large laboratory.

Student room

Thesis Subjects

- (M) Impact of geographic conditions on groundwater radon concentration

The number of PhD Graduates
0

Major employers of Graduates

- No data due to newly established laboratory

Writer : Ryo Takeo, Nuclear System Safety Engineering
(National Institute of Technology, Kisarazu College)

教員名
OHTA Tomoko

キーワード
Environmantal Radioactivity
Groundwater dating
Hydrology
Fieldwork

6

Nuclear System Design Engineering Laboratory

Associate Professor / Hiroki TAKEZAWA

- Sustainable society based on energy mix strategy.
- Nuclear batteries for utilizing and reducing nuclear waste.
- Decomissioning of Fukushima Daiichi nuclear power station.

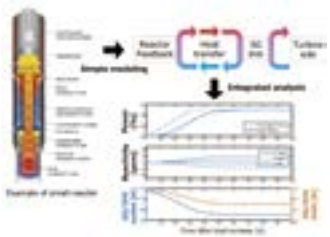
https://www.facebook.com/TakezawaLab/

Supervisor Associate Professor / Hiroki TAKEZAWA

Nuclear System Design Engineering Laboratory was launched on Jan. 1st, 2022 to explore innovative applications of nuclear energy with focus on small/micro modular reactors and nuclear batteries. Also, the laboratory has been contributing to an international research collaboration in the field of criticality safety and control for Fukushima Daiichi fuel debris removal.

Research Content

Lab's three missions:
(1)For contributing to the development of sustainable society based on energy mix strategy,
we have been studying the feasibility of small/micro modular nuclear energy systems that are multipurpose and work togehter with renewable energy technologies by load following and/or cogeneration. (2)For contributing to the reduction of nuclear waste, we have been developing nuclear batteries for powering infrastructures located underground, deep sea, or far remote areas. (3)For contributing to the decomissioning of Fukushima Daiichi nuclear power station, we have been developing a criticality impact analysis code in an international collaboration to be utilized for preparing safety measures for fuel debris removal workers.



From modeling of nuclear reactors to a load following performance calculation.

A Day in the Lab

Performance analyses of small nuclear energy systems and nuclear batteries, and criticality impact analyses of fuel debris are available by coupling criticality, kinetic, burnup, radiation-transport, thermal-hydrauric calculations. These calculations are available by using codes and programs which are developed by national/international institutes or our laboratory and run on cluster servers. We are also interested in developing advanced parallel computation methodologies using massive GPU cores and high performance computation technologies. In addition to these numerical studies, experimental research on nuclear batteries will be initiated in NagaokaTech's Radioisotope Center together with national/international collaborators.

Laboratory's main cluster server.

Thesis Subjects

- No data due to newly established laboratory

The number of PhD Graduates

0

Major employers of Graduates

- No data due to newly established laboratory

Writer : Associate Professor Hiroki TAKEZAWA, System Safety Engineering

教員名
TAKEZAWA Hiroki

キーワード
Nuclear reactor
Numerical analysis
Criticality safety
Nuclear battery

7 Pulsed Power Laboratory

Professor / Weihua JIANG　Visiting Associate Professor / Akira TOKUCHI
Assistant Professor / Taichi SUGAI

- Pulsed power technology is the future
- Maximizing pulsed power efficiency, optimal pulse for application
- Strengthening language proficiency for research and daily life

https://etigo.nagaokaut.ac.jp

Supervisor　Professor / Weihua JIANG

Professor JIANG is an influential professor in fields of pulsed power technology and plasma science. Professor received award of the Fellow for Institute of Electrical and Electronics Engineers (IEEE) in January 2014. Professor is very friendly with student, despite of being very busy, Professor always supports student enthusiastically and gives some kindly advice on your research.

Research Content

Pulsed power technology can be meant simply as adding lots of small electrical energy and releasing them together in very short time-nanosecond. Pulsed power is applied in plenty of fields such as military and industry. Here, we are developing pulse generators such as LTD, Marx, SOS, all of which have lots of unique function. Applications of these pulse generator are also being investigated actively for laser excitation, water treatment and killing harmful bacteria. Beside of compact pulse generator, huge and powerful generator named ETIGO-IV, which is considered as only 1 in Japan, is being investigated and developed in this laboratory.

Laboratory members with high repetition pulsed power generator ETIGO-IV

A Day in the Lab

Daily routine begins with Coffee and English-C&E, we can drink coffee freely and watch interesting English content-daily news or anime. C&E is very useful for improving English skill. Then, we will do experiment or read science papers for more understanding or finding new idea for our research. Especially, Professor always encourages student to improve language skill-English and Japanese, which is very useful for our future. Along with research activity, we have lots of interesting events such as seeing cherry blossom, fireworks festival and mountain climbing. Pulsed power laboratory is very interesting and active for us to study and enjoy in.


Experiment with new generation of LTD

Thesis Subjects

- (M) Application of excimer laser excitation used LTD
- (M) Elemental Technology of MARX-type Pulsed Power Generation Circuit
- (D) High power microwave generation by double-anode virtual cathode oscillator

The number of PhD Graduates **7**

Major employers of Graduates

- DENSO
- Toshiba Corporation
- Suzuki
- Bosch Japan
- TDK-Lambda Corporation
- Mitsubishi Electric Corporation
- Daikin Industries Ltd
- Kao Corporation
- Texas Instruments Japan Ltd
- Renesas Electronics Corporation

Writer : PHUNG Nhat Thanh, Energy and Environment Science
(Nagaoka University of Technology)

教員名
JIANG Weihua
TOKUCHI Akira
SUGAI Taichi

キーワード
Pulsed power
Pulse waveform
Plasma
Electron beam

8

High Power Laser Development and Application Engineering Laboratory

Professor / Hisayuki SUEMATSU　Assistant Professor / Do Thi Mai Dung
Technical Staff / Akio SHIDA

- Breaking your limits by creativity challenge!
- Building your communication skills with multinational students!
- Developing your presentation skills in Japanese and international conferences!

https://etigo.nagaokaut.ac.jp/suematsu/

Supervisor　Professor / Hisayuki SUEMATSU

If you are a "work hard, play hard" person, this is your place because so is our professor. In study, he requires student's effortness and supports students diligently. With hobbies such as fishing, road bike, and glider, he is very excited to participate in activities with students.

Research Content

At EDI center of this laboratory, the world's top-level research environment with electron microscopes, accelerators, etc. make it possible to carry out the fabrication and characterization of new materials in the world.

With major research contents including preparation of ultrafine particles by pulsed wire discharge, synthesis of superconductors by ultrahigh pressure method, etc., we have sent out various new materials to the world.

Moreover, by using the particle accelerator and the pulse electron accelerator, we have conducted composition analyses and particle irradiation experiments, as a result, contributed to material manufacturers, medical institutions, domestic and foreign nuclear research institutes.

Professor Suematsu and international students in front of the ETIGO-III

A Day in the Lab

With the slogan "laboratory is family", in various activities such as traveling, sports, fishing, cooking, members are deeply tied together. In addition, laboratory's characteristic is the rich international atmosphere with international students from various countries and Japanese students studying abroad. There is no core time. Research is conducted on their own with a progressing report every week.

One day in the laboratory is like:

9:00 Good morning to the laboratory. Lightly chatting and turning the motivated switch ON !
9:30 is time to start an experiment, isn't it?
12:00 -13:00 Lunch and relax time (golf, badminton, gym)
13:00 Well it's time for a fun experiment
18:00 A working hard day finished. Let's go to have some ramen? !

Golf during lunch break

Thesis Subjects

- (M) High pressure growth of $Sr_2Ca_{n-1}Cu_nO_y$ superconductor single crystal and its structural analysis
- (M) Introduction of color center into NaCl at low temperature by pulsed high intensity relativistic electron beam irradiation
- (M) Development of hydrogen recombiner using porous geopolymer

The number of PhD Graduates **18**

Major employers of Graduates

- National Institute of Technology
- Electric Power Company (Tokyo, Tohoku, Hokuriku)
- Sumitomo Electric
- Toshiba Corporation
- Toyohashi University of Technology
- JX Nippon Mining &Metals Corporation
- Shin-Etsu Chemical Co.,Ltd
- Panasonic Corporation
- Hitachi Power Solutions Co.,Ltd
- Mitsubishi Electric Corporation

Writer : Yang Yaru, Energy and Environment Science
(Nagaoka University of Technology)

教員名
SUEMATSU Hisayuki
Do Thi Mai Dung
SHIDA Akio

キーワード
MoO3
ETIGO-III
High-Tc Superconductivity
pulsed wire discharge