2025 (April Admissions, Second Recruitment)

Doctoral Program
Guidelines for Applicants

(Including Special Admissions for Professionals and for International Students)

The information in the guidelines is subject to change due to the current situation regarding infectious disease. Any future changes will be posted on the website of the Graduate School of Energy Science or be announced individually. ＜Website：https://www.energy.kyoto-u.ac.jp/en/＞

Graduate School of Energy Science
Kyoto University

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I. Enrollment Capacity 21 students

Department of Socio-Environmental Energy Science	8	Department of Fundamental Energy Science	8
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		Total	21

II. Eligibility Requirements for Applicants

An applicant for a Doctoral Program must satisfy one of the following qualifications by the end of March, 2025

1) Possession of a Master's Degree, Professional Master's Degree or Juris Doctor Degree.
2) Completion of a program abroad equivalent to the Master's Program or the professional degree program of Kyoto University Graduate School.(Note 1)
3) Completion of the a program equivalent to a Master's Program or professional degree program of Kyoto University Graduate School by completing a correspondence course conducted by a graduate school of a university abroad while residing in Japan.(Note 1)
4) Completion of a foreign graduate school program (only if the program is equivalent to a Master's Program or professional degree program of Kyoto University Graduate School) in Japan at an educational facility that has been accredited as having an approved program under the educational system of said country and is so designated by the Minister of Education, Culture, Sports, Science and Technology. (Note 1)
5) Completion of a curriculum at the United Nations University (under the provisions of Paragraph 2 of Article 1 of the Act on Special Measures Incidental to Enforcement of the Agreement between the United Nations and Japan regarding the Headquarters of the United Nations University, Act No. 72 of 1976), and receipt of a degree equivalent to a Master's Degree.
6) Passing of a Qualifying Examination or equivalent assessment at an institution in another country, and recognition by Kyoto University as having academic ability on a par with or higher than that of a person with a master's degree.(Note 2)
7) Designation by the Minister of Education, Culture, Science, Sports, and Technology.(Note 2)
8) Recognition by the Graduate School of Energy Science of Kyoto University as having a scholastic ability on a par with or higher than that of a person eligible under Paragraph 1 as a result of an individual screening of qualifications, where the applicant is aged 24 or over. (Note 2)

Note 1: Applicants who qualify under requirement 2,3 or 4 must contact the School Affairs Office of the Graduate School of Energy Science by **December 5(Thu), 2024** to inquire about application documents.
Note 2: Applicants who qualify under requirement 6,7 or 8 must undergo a preliminary eligibility screening.

III. Eligibility Screening (**Applicants filing under eligibility requirement 6 , 7 or 8 only)**

i. Applicants filing under eligibility requirement 6

Applicants filing under eligibility requirement 6 above must submit the following documents for preliminary eligibility screening to the School Affairs Office of the Graduate School of Energy Science (Research Building No. 8, 1st floor) by 5:00 p.m. on **December 5(Thu), 2024**.
When mailing the documents, use registered mail and write "Application for Eligibility Screening for Doctoral Program of Graduate School of Energy Science (Secondary Application)" in red on the front of the envelope. The required documents must be received no later than 5:00 p.m. on **December 5(Thu), 2024**.

［Documents to be submitted for eligibility screening (Applicants filing under eligibility requirement 6)］

1. Application form for doctoral program eligibility screening. (**Use the designated form**)
2. Official certificate of passing a Qualifying Examination or equivalent assessment.
3. Documents which detail the examination procedure and qualifying criteria of the Qualifying Examination or equivalent assessment.
4. Academic transcript of a program equivalent to a master's program which the applicant has completed. (prepared and sealed by institution you last attended)
5. The curriculum details (course list and course outlines) of a program equivalent to a master's program which the applicant has completed.

1. Applicants may be requested to submit additional materials.
2. Screening results will be mailed to applicants on **January 7(Tue), 2025**.

ii. Applicants filing under eligibility requirement 7 or 8

Applicants filing under eligibility requirement 7 or 8 above must submit the following documents for preliminary eligibility screening to the School Affairs Office of the Graduate School of Energy Science (Research Building

No. 8, 1st floor) by 5:00 p.m. on **December 5(Thu), 2024**.

When mailing the documents, use registered mail and write "Application for Eligibility Screening for Doctoral Program of Graduate School of Energy Science (Secondary Application)" in red on the front of the envelope. The required documents must be received no later than 5:00 p.m. on **December 5(Thu), 2024**.

[Documents to be submitted for eligibility screening (Applicants filing under eligibility requirement 7 or 8)]

1. Application form for eligibility screening	**Use the designated form**.
2. Academic transcript (last institution attended)	Submit academic transcript prepared and sealed by institution you last attended.
3. Statement of research achievements	(Applicants filing under requirement 7) **Use the designated form**. Outline your research achievements (contribution to knowledge etc.) in your field of specialization.
4. Certificate of research participation	(Applicants filing under requirement 7) **Use the prescribed form.** This item must be prepared and sealed by institution to which you belong.
5. Research progress report	(Applicants filing under requirement 8) Describe the progress of your research project in your field of specialization. (Any format acceptable.)
6. Qualifications, licenses etc.	(Applicants filing under requirement 8) Submit photocopy of document that can be used as reference for eligibility screening, such as a license in your field of specialization

1. After document screening, there will be an oral examination to test applicant's academic ability (master's degree level).
2. Oral examination will be conducted at the Graduate School of Energy Science, Kyoto University on **December 20(Fri), 2024**.
3. Screening results will be mailed to applicants on **January 7(Tue), 2025**.

IV. Special Admissions for Professionals

Special selection will be available for individuals who meet one of the eligibility requirements noted in Section II, who are employed in a public agency or company at the time of application and intend to maintain their employment after enrollment, and who have been recommended by their managers.

V. Application for Admission

i. Application documents

1. Application form for admission , photograph card, examination voucher	**Use the designated form.**
2. Academic transcript or certificate of master's course completion (or expected completion)	Applicants who are enrolled in or have graduated from the Graduate School of Energy Science, and those who qualify under eligibility requirement 6,7 or 8 need not submit this item.
3. Master's thesis	Applicants who are enrolled in or have graduated from the Graduate School of Energy Science, and those who qualify under eligibility requirement 6,7, or 8 need not submit this item. Applicants who are expected to complete master's program may submit research report (A4-size; any format acceptable), instead of this item.
4. Letter of approval for entrance examination	If you are enrolled in another graduate school or are employed in public agency or company at time of application, submit letter of approval from the Dean of your graduate school or the head of your agency/company. (Any format acceptable.)
5. The certificate of residence or the photocopy of resident card	(Only international students) Submit a certificate of registered items in alien registration indicating residence status and permitted period of residence in Japan. If you cannot provide this item at time of application, submit photocopy of your passport (photo page). Proper certificate must be submitted by time of admission.
6. Application fee	**Use the designated form.** **(Japanese Government [Monbukagakusho]- sponsored international students and students expecting to complete Kyoto University's master's program need not submit this item.)** Application fee: 30,000 yen Payment period: **January 7(Tue), 2025 – January 16(Thu), 2025**

	(Payment Procedure) ①Access "Kyoto University EX settlement service", then put the article which needed following the instruction and pay the application fee. URL：https://www3.univ-jp.com/kyoto-u/en/ens/ ②Print out the storage certificate from your confirmation screen, and submit it with other application documents. ※For households in regions where the Disaster Relief Act is effective and whose principal wage-earner has been adversely affected by the disasters listed in the website below, an exemption/refund may be made to the payment of Entrance Examination Fees for cases where a *risai shomeisho* (Disaster Victim Certificate) has been issued. For the list of the disasters and requirements of an exemption, refer to https://www.kyoto- u.ac.jp/ja/admissions/fees-exemption For further details, contact the administrative office at the Graduate School of Energy Science by January 6, 2025.
7. Self-addressed envelope for mailing examination admission card	**Use a designated envelope.** Write your name, address and postal code on the envelope and affix a 320-yen stamp (for express mail).) An examination voucher will be mailed to the applicant to the address provided by the applicant.
8. Address labels for further communication	**Use the designated forms.** *For further communication on the examination results and the admission procedures*, Write your name, address and postal code (for February – March, 2025) on the designated form. (If you change your address after applying, you must promptly inform the School Affairs Office of the new address.)

Note: The application fee shall not be refunded under any circumstances.

* Applicants for special admissions for professionals must submit the following documents in addition to those listed above.

1. Letter of recommendation	**Use the designated form.** (Submit letter of recommendation written by your department head or another person in a supervisory position.)
2. Research achievements report	Outline the research project you conducted in your field of specialization, during employment. (Any format acceptable.)

ii. Request for Admission Guidelines

To receive a copy of the Guidelines for Applicants and an application packet by mail, write to the address below enclosing a 510-yen stamped, and self-addressed (name, address and postal code) envelope (kakugata No. 2, 26 cm × 35 cm). Be sure to write “Request for Guidelines for Applicants: Doctoral Program of the Graduate School of Energy Science (Secondary Application)” in red on the front of the envelope.

iii. Application Procedures

Applicants must submit, in person or by mail, all required documents to the address shown below.
In mailing the completed application documents, write “Application documents for Doctoral Program of the Graduate School of Energy Science (Second Recruitment) enclosed” in red on the front of the envelope and send it by registered mail.

[Application period]

(In person)

January 16(Thu), 2025

Submission hours: 10:00 a.m. to 5:00 p.m.

(By mail)

Deadline: 5:00 p.m. on **January 16(Thu), 2025**

Your application documents must have arrived by the above deadline. The application documents postmarked no later than January 14 (Tue) and sent by registered express mail will also be accepted even if they arrive after the deadline.

[Address to which application is to be sent]

(In person)

School Affairs Office, Graduate School of Energy Science, Kyoto University
(Research Bldg. No. 8, 1F)
TEL: +81-75-753-9212

(By mail)
Graduate School of Energy Science, Kyoto University
Yoshida Honmachi, Sakyo-ku, Kyoto 606-8501, JAPAN

VI. Selection Methods and Examination Schedule

Entrance examinations are conducted as per the following schedule at the Graduate School of Energy Science, Kyoto University.

Examination Schedule (Exam schedule of each department shown below also applies to professionals and international students who apply for special selection.)

Date / Department	**February 5 (Wed) , 2025**	
	Time	Test subjects
Department of Socio-Environmental Energy Science	10:00 - 12:00 13:00 - 17:00	English and specialized subjects Oral exam
Department of Fundamental Energy Science	10:00 - 12:00 13:00 - 17:00	English and specialized subjects Oral exam
Department of Energy Conversion Science	10:00 - 12:00 13:00 - 17:00	English and specialized subjects Oral exam
Department of Energy Science and Technology	10:00 - 12:00 13:00 - 17:00	English and specialized subjects Oral exam

○ Instructions regarding examination will be mailed to all applicants, together with an examination voucher. Instructions will also be posted on the bulletin board in front of the School Affairs Office of the Graduate School of Energy Science (Research Bldg. No. 8, 1F) on **February 4(Tue), 2025**

VII. Examination Voucher

An examination voucher will be mailed to each applicant, using the envelope submitted by the applicant.

VIII. Announcement of Successful Applicants

February 14(Fri), 2025
Examinee numbers of successful applicants will be posted on the bulletin board in front of the School Affairs Office of the Graduate School of Energy Science at 3:00 p.m.
Examinee numbers of successful applicants will be listed on the website of the Graduate School of Energy Science at 3:00 p.m. (Visit https://www.energy.kyoto-u.ac.jp/)
A list of successful examinees' numbers will also be sent to applicants. To successful applicants, only the letter of acceptance will be mailed. (Telephone inquiries about the selection results shall not be accepted.)

IX. Admission Procedures

Detailed instructions regarding admission procedures will be mailed to successful applicants in Around the end of February 2025**.**

X. Admission Fees and Tuition

Admission fee: 282,000 yen (tentative)
Tuition (annual): 535,800 yen (tentative)

[No admission fee will be charged to students expecting to complete Kyoto University's master's program March, 2025.]
[No admission fee or tuition will be charged to Japanese government-sponsored international students.]

*The amounts indicated above are tentative and may be revised.
*If the above amounts are revised at or after the time of enrollment, the new amounts shall apply as of such revision.

XI. Other

1. Applicants with disabilities who require special arrangements for examinations should contact in advance the School Affairs Office of the Graduate School of Energy Science by phone or other means.
2. The contents of submitted documents may not be changed under any circumstances.
3. In accordance with "Kyoto University Regulations Regarding Personal Information Protection," personal information (including information relating to performance evaluation) provided in application documents is used only for the following purposes: ①entrance examinations, ②admission procedures, scholarship etc. and ③ preparation for accepting students.
4. Graduate School of Energy Science provides the long-term study program that allows students to extend their study period up to twice of the standard study period for completion under certain

circumstances/conditions such as work, childbirth, childcare, nursing to other family in special need and disabilities. If you wish to apply please confirm School Affairs Office by the end of December 2024.

5. Graduates of university from outside of Japan wishing to enroll in a Kyoto University Graduate School as a research, master's, or doctoral student are required to contact the Admissions Assistance Office (AAO) for a preliminary review before submitting application documents.
Please refer to the following url for details:

https://www.kyoto-u.ac.jp/en/education-campus/education-and-admissions/graduate-degree-programs/how-to-apply/for-graduates-of-overseas-universities

6. In Kyoto University, Security Export Control for the purpose of maintaining the peace and security of Japan and the international community is conducted in accordance with "Foreign Exchange and Foreign Trade Act". International applicants who fall under any of the conditions set out in said regulations may be unable to enter their desired course or program.
Please refer to the following url for details:

https://www.kyoto-u.ac.jp/ja/research/rule/export

Kyoto University Graduate School of Energy Science
Doctoral Program Entrance Examination Guidelines

○ Department of Socio-Environmental Energy Science

Application and examination procedures for the Department of Socio-Environmental Energy Science are detailed below. Applicants should prepare required documents and take examinations in accordance with the following instructions.

I. The Department of Socio-Environmental Energy Science classifies applicants into three categories: ① general selection, ② working professional special selection and ③ international student special selection. Please note that the required documents and examination process vary by category.
II. Before submitting their applications, applicants to the doctoral program must obtain the informal consent of their desired supervisor.
III. In addition to the documents required of all applicants to Graduate School of Energy Science, applicants to the Department of Socio-Environmental Energy Science must submit a research plan via the designated form "Department of Socio-Environmental Energy Science – Doctoral Research Plan."

Entrance Examination

1. Written examination: English and specialized subjects
   (1) English exam: The exam comprises two questions: one English-Japanese translation and one essay in English on the specified topic. Questions are given in Japanese and English. Regarding the English-Japanese translation question, international students may summarize an English language text instead of translating it into Japanese. The use of dictionaries is not permitted.
   (2) Specialized subjects exam: One question is asked from each field. Answer the question from your chosen field.

2. Oral examination
   (1) Applicants must obtain informal consent from their desired supervisor in advance, then prepare a research plan using the designated form "Department of Socio-Environmental Energy Science – Doctoral Research Plan," and submit the completed form together with other application documents. Applicants should select a supervisor from among faculty members listed on the attached document "Graduate School of Energy Science - Research Fields and Topics of Faculty Members."

   (2) In the oral examination, the applicant will give a presentation on ① master's thesis or achievements of past research and ② doctoral research plan, using a projector and PDF slides (one page each for ① and ②, font should be embedded). Do not include animations in the PDF slides. The presentation is 15 minutes, followed by a 15 minute Q&A session. The applicant must bring the PDF file in a USB flash drive and 10 hard copies (A4 paper, duplex printing) of the two presentation slides on the examination day.

3. Exemption from written examination
   Those who are recognized through screening of the submitted documents as having a certain level of academic ability are exempted from the written examination.

○ Department of Fundamental Energy Science

1. In selecting a supervisor, refer to the "List of Research Sections/Laboratories by Department," included in the

Admission Guidelines, and the attached document "Research Fields and Topics of Faculty Members." Enter the name of your desired supervisor and other required information on the annexed "Notification of Desired Supervisor" form, and submit the completed form with your seal affixed to it, along with other required documents.
You should obtain the consent of your desired supervisor before submitting your application.

2. Written examination
A written examination will be given to determine whether the applicant has the basic academic ability in the desired field of specialization to pursue doctoral research.

3. Oral examination
In the oral examination, the applicant will make a PowerPoint or PDF presentation on ① master's thesis or achievements of past research and ② doctoral research plan. The presentation time is 30 minutes. Applicants must prepare four hard copies of the presentation slides and submit them to their prospective supervisor in advance.

4. Exemption from written examination
Those who are recognized through screening of the submitted documents as having a certain level of academic ability are exempted from a written examination.

○ Department of Energy Conversion Science

1. Documents to be submitted
Complete and submit the attached form "Notification of Prospective Supervisor in Doctoral Program" with other required documents. In selecting a supervisor, refer to the "List of Groups by Department" included in "Doctoral Program/Guidelines for Applicants", and the attached document "Graduate School of Energy Science: Research Content of Academic Staff by Group."

2. Entrance Examination
(1) Written examination: English and specialized subjects
A written examination will test the applicant's basic academic ability in English and the desired field of specialization.
(2) Oral examination
The applicant will make presentation on past research projects, reasons for pursuing a doctoral program, research plans, prospects etc. The presentation time is 20 minutes, followed by a Q&A session.

3. Exemption from written examination
Applicants who are recognized through screening of the submitted documents as having a certain level of academic ability may be exempted from a written examination.

4. Other
Before submitting their applications, applicants should obtain the informal consent of their prospective supervisors.

○ Department of Energy Science and Technology

1. In selecting a supervisor, refer to the "List of Research Sections/Laboratories by Department," included in the Admission Guidelines, and the attached document "Research Fields and Topics of Faculty Members." Enter the name of your desired supervisor and other required information on the annexed "Notification of Desired Supervisor" form and submit the completed form with your seal affixed, along with other required documents.

2. Entrance Examination
(1) Written examination: English and specialized subjects
A written examination will be given to determine whether the applicant has the basic academic ability in English and the desired field of specialization to pursue doctoral research.
(2) Oral examination
The applicant will make a PowerPoint presentation to describe past research projects, details of planned research (reasons for selecting the chosen theme, content etc.), expected outcome and future prospects.
The presentation time is approx. 30-minutes, followed by oral exam session.

3. Exemption from written examination
Applicants who are recognized through screening of the submitted documents as having a certain level of academic ability may be exempted from a written examination.

4. Other
Before submitting their applications, applicants should obtain the informal consent of their prospective supervisors.

List of Groups by Department

Department of Socio-Environmental Energy Science

Group Code	Keywords of Research Fields
S－1	Social Engineering, Recycle, Eco-Materials, Eco-Education, Effective Use of Energy and Resource
S－2	Energy Studies, Energy Economics, Systems Design, Microscopic and Macroscopic Viewpoints, Sustainability, Energy-X-Nexus, Resources
S－3	Biomass Energy, Biochemicals, Pyrolysis, Gasification, Supercritical Fluid, Low-temperature Plasma, Organic Chemistry of Biomass
S－4	Human Interface, Augmented Reality, Intellectual Productivity, Pro-Environmental Behavior
S－5	Atmospheric Environment, Aerosol, Hazardous Atmospheric Pollutants, Environmental Dynamics, Environemntal Impact Assessment, Environmental Remediation
S－6	Energy Policy, Nuclear Energy, Energy Security, Nuclear Security, Non-proliferation, Energy Best-Mix,
S－7	Materials Infomatics, Materials Science, Nucler Fuels, Thermoalectric Materials, Social Energy Education, Disaster Science, Hazard Evaluation, Earthquake Disaster Prevention Strategy

Department of Fundamental Energy Science

Group Code	Keywords of Research Fields
K－1	Energy chemistry, Electrochemistry, Fluorine chemistry, Molten salt, Ionic liquid, Na secondary battery, Li secondary battery
K－2	Organic Molecular Materials, Inorganic Semiconductors, Photochemistry, Solid State Physics, Photophysics, Photovoltaics, Light-Emitting Devices, Chirality
K－3	Inorganic materials chemistry, Solid state chemistry, Electrochemistry, Secondary batteries, Fuel cells, Biomaterials, Bioceramics
K－4	Magnetically Confined Fusion Plasma, Laser-Driven High Energy Density Plasma, Space Plasma, Nonlinear Physics, Large-Scale Simulation
K－5	Fusion energy, Data analyses of plasma experiments, Measurements and diagnostics, Theory and numerical simulation
K－6	Microwave spherical torus experiment, Plasma wave physics, Equilibrium, Stability and transport, Plasma diagnostics
K－7	Heliotron J, Control of High Temperature Plasma, Plasma Heating, Plasma Diagnostics, Boundary Plasma Physics and Elementary Processes
K－8	Nanoscience, Nanotechnology, Solid State Physics, Solar Cell, Quantum Electronics, Data Driven Science
K－9	Electrochemistry, Molten Salts, Ionic Liquids, CO_2 Conversion, Silicon Solar Cell, Li Secondary Battery, Na Secondary Battery, K Secondary Battery
K－10	Nanoscience, Nanomaterials, Organic Synthesis, Solar Energy
K－11	Artificial Photosynthesis, Protein Engineering, Synthetic Biology, Chemical Biology, Bioenergy
K－12	Biomass, Bioethanol, Environment-friendly, NMR, AIDS, Cancer
K－13	Nuclear Reactor Experiment and Analysis, Criticality Safety, Development of Radiation Detection System
K－14	Energy Conversion, Thermal-hydraulics, Multiphase Flow, Neutron Radiography, Computational Fluid Dynamics, Reactor Physics, Nuclear Data

Department of Energy Conversion Science

Group Code	Keywords of Research Fields
H－1	Plasma Assisted Ignition, Laser Diagnostics and Image Analysis, Heat transfer in the small scale space craft, Pollutant Emission Control, Alternative Fuels
H－2	Conversion System, Thermo-Fluid Science, Laser Image Diagnostics, Power Engineering, Computational Fluid Dynamics, Internal Combustion Engine, Alternative Fuels
H－3	Nano-/micro-materials, Strength of Materials, Fatigue, Multiphysics, Metamaterials, Fracture mechanics
H－4	Mechanics of Functional Materials, Nonlinear continuum mechanics, Elastoplasticity, Nondestructive Evaluation by Ultrasonics, Electromagnetic Methods, and Thermography
H－5	Plasma Science and Technology, Fusion Technology, Fusion Energy Conversion, Fusion Application, Fusion Energy System Design, Socio-Economic Evaluation of Energy System, Social and Environmental Sustainability Evaluation, Material Science and Engineering for Energy Conversion
H－6	Plasma Physics, Fusion Science, Heating and Current Drive, Plasma Diagnostics, Microwave Technology, High power neutral beam technology
H－7	Energy System Maintenology, Nuclear Material Science, Radiation damage, Corrosion, Structural Integrity Analysis, Risk Analysis, System Safety

Department of Energy Science and Technology

Group Code	Keywords of Research Fields
O－1	Crystal Alignment Techniques, Energy Materials, Thin Film Growth, Superconducting wires
O－2	Thin Film Growth, Solid-State Battery, Energy Materials and Device Processing, THz spectroscopy
O－3	Materials processing, Electrochemical processing, Functional materials, Thin films, Aluminum batteries
O－4	Thermochemistry, Crystal Growth, Metallurgy, Eco-friendly Processes, Energy Materials
O－5	Energy-saving materials, Multi-scaling materials, Rock engineering
O－6	Plasticity, Forming Simulation, Advanced Processing of Eco-materials, Material Modeling
O－7	Thermal Fluid Engineering, Resources Circulation, Mineral Processing
O－8	Mid-Infrared and THz Laser, Photophysics, Nuclear Safety and Security, Renewable Energy System/Policy/Implementation
O－9	Nanomaterials, Quantum Materials, Materials Science, Energy Functional Materials, Solar Energy Utilization, Thermal/Optical Engineering
O－10	Laser Application, Nanomaterials, Thin Film, Laser Processing, Hydrogen Energy, Spectroscopy

Graduate School of Energy Science: Research Groups

2024/10/1

Department of Socio-Environmental Energy Science

Group Code: S－1　　Group Name: Engineering for Social Systems

Academic Staff: Assoc. Prof. Hideyuki OKUMURA, Assoc. Prof. Takaya OGAWA

What is the progress of a society, and what kind of society is desirable and achievable? Our research examines the sustainable use of energy and resources, which is vital from the perspective of our future society. Energy and resources are indispensable for social activities, and our research is to systematically evaluate the production, storage, and distribution of both of these components, based on an integrated view of the technological and sociological aspects. Our projects include, for instance: the energy and environmental assessment of recycling and industrial manufacturing; the research and development of functional environmental materials; and the effectiveness of energy and environmental education. Our final goal is to propose a social system, in which social activities and use of energy and resources are harmonized with the environment.

Group Code: S－2　　Group Name: Energy Economics

Academic Staff: Prof. Benjamin C. MCLELLAN, Assoc. Prof. Seiichi OGATA

Understanding the current state and ongoing transition of the energy system requires the incorporation of social science and humanities` perspectives, as well as those of natural science and technology.　This research group focuses on the design and evaluation of energy systems and policy from multiple perspectives, particularly on the equitable distribution of costs and benefits (economic, environmental, social) in a “just” transition. Various approaches are used, including　modeling and design, scenarios, lifecycle assessment (LCA), resource criticality, energy justice, micro and macro perspectives, and social acceptance of target systems including economics, statistics and systems studies.

Group Code: S－3　　Group Name: Energy Ecosystems

Academic Staff: Prof. Haruo KAWAMOTO, Assoc. Prof. Eiji MINAMI

Our research focuses on biorefinery technologies for the effective utilization of renewable biomass resources as biofuels, biochemicals, and biomaterials. Our laboratory studies the molecular mechanisms involved in the chemical and thermochemical conversion of woody biomass (lignocellulose). Based on the knowledge gained from this fundamental research, we are developing new biomass conversion technologies using advanced pyrolysis, supercritical fluids, and low-temperature plasma. Our ultimate goal is to contribute to a carbon-neutral society.

Group Code: S－4　　Group Name: Energy and Information

Academic Staff: Prof. Hiroshi SHIMODA, Assoc. Prof. Hirotake ISHII, Assist. Prof. Kimi UEDA

This group aims at studying (1) artificial system and (2) social system, where information & communication technology is utilized in order to construct sustainable energy system in the 21st century. As the studies of (1), human interface systems such as application of augmented reality and measurement of human information behaviors are studied aiming at safe and efficient operation of large-scale energy systems. As the studies of (2), social information environment systems such as environment design coping with both environmental load reduction and improvement of productivity, and environment e-learning systems are studied aiming at establishing our future social systems. We welcome the students who are interested in not only energy and environment but also human interface and information technology.

Group Code: S－5　　Group Name: Energy and Environment

Academic Staff: Prof. Takayuki KAMEDA, Assoc. Prof. Ka Man AU, Assist. Prof. Nozomu TSUCHIYA

Environmental impacts associated with human activities, especially energy production and utilization are assessed from the viewpoint of atmospheric environment ranging from local to global scale. Laboratory, field, modeling and theoretical studies are conducted, especially focusing on aerosol impacts on the environment. Specific topics are transformation process of air pollutants adsorbed on international impact of long-range transported secondary pollutants and regional radiative effect of aerosols. In addition, in order to realize a safe and secure society, we are conducting research to assess the health effects of air pollutants such as PM2.5 as well as to contribute to the improvement of air quality and environmental remediation via the design and synthesis of new functional materials.

Group Code: S－6　　Group Name: Energy Policy (Institute for Integrated Radiation and Nuclear Science)

Academic Staff: Prof. Hironobu UNESAKI, Assist. Prof. Yoshiyuki TAKAHASHI

The technical and sociological aspects of primary energy and electricity demand/supply are investigated, including resource availability, environmental impact, cost, energy security, and the best mix of various energy resources. Our main interests are focused on the following two topics: 1) energy security and relevant energy policy evaluation, where quantitative evaluation of energy security is conducted by analysis of energy/environmental statistics data and relevant energy policies, and 2) technical and sociological aspects arising from the use of nuclear energy, where comprehensive analysis on the impact of nuclear-related specific issues (nuclear non-proliferation, nuclear security, safeguards, nuclear material transport, etc.) as well as impact of advanced nuclear technology (advanced and innovative nuclear reactors) to the future of energy utilization is conducted by combining both engineering and sociological studies.

Group Code: S－7　Group Name: Societal Energy Education (Institute for Integrated Radiation and Nuclear Science)

Academic Staff: Prof. Ken KUROSAKI, Assoc. Prof. Hirotoshi UEBAYASHI, Assist Prof. Yifan SUN

Conducts materials science research for various nuclear fuels/materials as well as thermoelectric materials based on fundamental academics such as solid state physics and thermodynamics. We are also working on “Materials Informatics” which is an integrated area of information science and materials science. Social consensus regarding energy problems is essential to the sustaining development of humankind. In our laboratory, the strategy of disaster prevention is studied to construct safety nuclear system focusing upon anti-earthquake procedures. Current research topics are 1) estimation of hazards, 2) strategy of earthquake disaster reduction for stable energy supply, 3) systematization of disaster prevention system.

Department of Fundamental Energy Science

Group Code: K－1　　Group Name: Energy Chemistry

Academic Staff: Assoc. Prof. Kazuhiko MATSUMOTO, Assist. Prof. Jinkwang HWANG

We are studying materials, devices and systems which are directly related to conversion and utilization of various kinds of energies such as electrical and chemical energies based on physical and inorganic chemistry and electrochemistry. The specific topics are as follows:

(1) Development of new chemical compounds and their characterization (ionic liquids, intercalation compounds, fluoride compounds, etc.)
(2) Conversion and storage of energy by electrochemical methods (sodium secondary batteries, lithium secondary batteries, electrochemical capacitors, etc.)
(3) Development of next-generation industrial processes using molten salt and ionic liquid (Electrolytic fluorine gas generation)

Group Code: K－2　　Group Name: Quantum Energy Processes

Academic Staff: Prof. Takashi SAGAWA, Assoc. Prof. Kan HACHIYA, Assist Prof. Yutaka Okazaki

We are interested in the development of energy conversion systems utilizing light. We design new materials and processes for highly efficient light-emitting, power generation, and/or other outputs via the relaxation process from the photoexcited state to the ground state of organic molecular materials and inorganic semiconductors. In particular, studies are focused on the fundamental science for demonstrating important functions of light-harvesting, polarization, photoelectron conversion, charge transport, storage, and light-emission through the development of nanosized structures made of organic and inorganic materials as follows:

(1) Materials designed of nanosized structures made of organic and inorganic composites
(2) Electronic structural analyses of materials and characterization of their optical properties
(3) Applications for photovoltaics (solar cell, photocatalyst, and so on), light-emitting device, and/or others.

Group Code: K－3　　Group Name: Functional and Solid State Chemistry

Academic Staff: Assoc. Prof. Shigeomi TAKAI, Senior Lecturer Takeshi YABUTSUKA

We are devoted to the analysis, design and synthesis of functional solid material useful for the production, conversion and application of energy with high efficiency, and for sustainable environmental concinnity. We pay special attention to electrochemical energy, which is effective for the use of limited resources with high energy conversion efficiency and for protection of the environment. With this in mind, we are developing materials for rechargeable lithium ion batteries, and solid oxide fuel cells, often categorized as solid state ionics materials. We conduct precise structural analysis and designing of functional solid material based on the theory of crystal chemistry using X-ray diffraction, X-ray absorption, etc. We are also studying the synthesis of functional ceramic thin film from aqueous solution noticed as soft energy process, and its application to nano scale patterning. We develop biomaterials for utilizing advanced functions with the environmental concinnity of living matter.

(1) Analysis and design of ceramic energy materials.
(2) Studies on rechargeable lithium ion battery materials.
(3) Development of solid state ionics material and its application to solid oxide fuel cells.
(4) Synthesis of functional thin films from aqueous solution and its nano structure design.
(5) Development of biomaterials for environmental consciousness.

Group Code: K－4　　Group Name: Plasma and Fusion Science

Academic Staff: Prof. Akihiro ISHIZAWA, Assoc. Prof. Kenji IMADERA, Assist. Prof. Ryutaro MATSUI

Aiming at the advance of nuclear fusion as a carbon-neutral energy resource, and space/astrophysics dominated by plasma dynamics, we are researching the following topics by means of numerical simulations on super computers and statistical/turbulence/chaos theories in physics.

(1) Theory and numerical simulations for turbulence and spontaneous structure formation in fusion plasmas

(2) Theory and numerical simulations for burning fusion plasma confinement

(3) Theory and numerical simulations for MHD phenomena in fusion and space plasmas

(4) Modelling based on data-driven science / Experiment and simulation for laser-produced plasmas

Group Code: K－5　　Group Name: Electromagnetic Energy

Academic Staff: Prof. Yuji NAKAMURA, Assoc. Prof. Akinobu MATSUYAMA

Research aimed at elucidating the complex characteristics of high-temperature plasma for the realization of magnetic confinement fusion reactors is being comprehensively advanced through theoretical analysis, numerical simulations, and experimental data analysis.

(1) Development of integrated simulations and the enhancement of theoretical analysis for understanding multiscale and multiphysics behavior of fusion plasmas

(2) Research on confinement properties and operational control schemes in collaboration with worldwide experiments such as ITER, JT-60SA, and Heliotron J.

(3) Research and exploration of computational physics, information and AI technologies, virtual reality, and digital twin technology used in fusion reactor design, simulation, and plasma operation.

Group Code: K－6　　Group Name: Plasma Physics

Academic Staff: Prof. Hitoshi TANAKA, Assoc. Prof. Masaki UCHIDA

We study magnetohydrodynamic and kinetic behaviors of toroidal plasmas generated by electron cyclotron heating and current drive in the Low Aspect ratio Torus Experiment device. Especially we are developing the Microwave Spherical Torus experiment, in which spherical torus is started-up and maintained solely by microwave power without central solenoid. This concept is a key to realize cost-effective compact magnetic fusion reactor. Major activities include;

(1) Start-up of spherical torus by microwave

(2) Wave physics and plasma kinetics in electron cyclotron heating and current drive

(3) Complex phenomena involved in magnetic field line topology, wave physics, equilibrium and transport.

(4) Plasma diagnostics(X-ray PHA, X-ray tomography, heavy ion beam probe, interferometer, spectroscopy)

Group Code: K－7　　Group Name: High-Temperature Plasma Physics (Institute of Advanced Energy)

Academic Staff: Prof. Shigeru INAGAKI, Assoc. Prof. Shinichiro KADO, Assist. Prof. Fumiyoshi KIN

The Heliotron-J experiment is used to investigate the diverse and complex behaviors of high temperature plasmas for nuclear fusion. We develop advanced diagnostic tools and observe magnetic field topological effects, impurity transport, turbulence, plasma boundary layer phenomena, etc. In collaboration with theories and simulations, we try to understand the macroscopic characteristics of ultra-high temperature plasmas as collective phenomena of microscopic charged particles, and progress our research toward prediction and control of fusion plasma.

（1）Plasma transport in the Heliotron-J

（2）Development of high-precision electron temperature and density measurement methods.

（3）Plasma heating and control

（4）Spectroscopic diagnosis of plasma emission

（5） Time-series data analysis of turbulence and nonlinear phenomena
（6） Atomic and Molecular process in boundary plasma
（7） Advanced plasma diagnostics

Group Code: K－8　　Group Name: Energy Optical Properties (Institute of Advanced Energy)

Academic Staff: Prof. Kazunari MATSUDA, Assist. Prof. Keisuke SHINOKITA

The research objectives in our group are “development of novel optical science and energy application based on nano-science and nano-technology”. We are trying to open new horizon on the energy science by introduction of nano-materials, quantum optical physics, and device application. The understanding of physics of emerging quantum optical phenomena in extreme low-dimensional materials are important issues toward next generation light energy sciences. Followings are current research subjects in our group.

(1) Elucidation of quantum optical phenomena in nano-carbon materials (carbon nanotube, and graphene).
(2) Application of thermal management and bio-imaging using nano-carbon materials
(3) Development of novel optical science (valley-spin photonics) in atomically thin materials
(4) Development of next generation solar cell devices using novel materials (perovskite and atomically thin materials)

Group Code: K－9　　Group Name: Interfacial Energy Processes (Institute of Advanced Energy)

Academic Staff: Prof. Toshiyuki NOHIRA, Assist. Prof.Takayuki YAMAMOTO, Assist. Prof. Yutaro NORIKAWA

We are studying materials and systems to realize a carbon neutral society based on renewable energy. We are conducting innovative researches that cover the phases from basic research to applications mainly based on electrochemistry and molten salt chemistry. Followings are major research subjects in our group.

(1) Novel methods for the conversion of CO_2 into valuable materials using electrochemical reactions in molten salts
(2) Novel methods for the production of silicon films for solar cells using the electrodeposition in molten salt
(3) Novel electroplating methods of titanium and tungsten in molten salts
(4) Development of novel ionic liquid electrolytes for rechargeable batteries with high safety for power storage
(5) Development of positive and negative electrode materials for Li/Na/K secondary batteries using ionic liquids

Group Code: K－10　　Group Name: Energy Nano Engineering (Institute of Advanced Energy)

Academic Staff: Prof. Hiroshi SAKAGUCHI,Assist. Prof. Takahiro KOJIMA, Assist. Prof. Shunpei NOBUSUE

Nanometer-scale technology and science are so important to produce the unprecedented materials for energy. Our group studies the basics of assembling small molecules into the advanced materials and devices in energy sector with high efficiency. Studies related to theoretical biophysics are also in progress.

(1) Chemical vapor growth of graphene nanoribbons
(2) Atomic resolved imaging of carbon-based nanowires
(3) Field effect transistor and photovoltaic cell using organic materials
(4) Organic synthesis of functionalized molecules

Group Code: K－11　　Group Name: Biofunctional Chemistry (Institute of Advanced Energy)

Academic Staff: Assoc. Prof. Eiji NAKATA, Junior Assoc. Prof. Arivazhagan RAJENDRAN, Assist. Prof. Peng LIN

The research projects ongoing in the Biofunctional Chemistry Laboratory take approaches based on synthetic chemistry, biochemistry, and protein engineering to understand the highly efficient biological energy utilization systems. Followings are the research topics actively investigated in the laboratory:

(1) Nanoassembly of enzymes and receptors to realize artificial photosynthesis & metabolic systems
(2) Protein-nucleic acids hybrid materials that realizes efficient utilization of sunlight energy and materials conversion
(3) Utilization of CO_2 via enzymatic and/or chemical approaches
(4) Design of fluorescent sensors to monitor cellular environment change and dynamics of targets

Group Code: K－12　　Group Name: Bioenergy (Institute of Advanced Energy)

Academic Staff: Prof. Masato KATAHIRA, Assoc. Prof. Takashi NAGATA, Assist. Prof. Yudai YAMAOKI

We explore the way how biomass and biomolecules function at atomic resolution by structural biology with NMR. On the basis of the obtained knowledge, we develop the new environment-friendly way to extract energy and valuable compounds from the biomass. We also elucidate the structure-function relationship for enzymes linked to AIDS and cancers to develop new drugs. The following projects are now in progress in our laboratory;

(1) Development of the new environment-friendly way to extract energy and valuable compounds from biomass
(2) Development of the way to monitor all the valuable compounds in biomass in real time
(3) Development of the efficient production system of biofuel such as bioethanol
(4) Elucidation of the structure-function relationship for enzymes linked to AIDS and cancers
(5) Elucidation of the structure-function relationship for functional DNA/RNA against diseases

Group Code: K－13　　Group Name: Fundamental Neutron Science (Institute for Integrated Radiation and Nuclear Science)

Academic Staff: Prof. Tsuyoshi MISAWA, Assoc. Prof. Yasunori KITAMURA

The scientific principle and the neutronics design of nuclear systems are investigated to develop innovative high-performance systems for the nuclear energy utilization in the next generation. Specifically, 1) basic studies on the nuclear characteristics of next generation reactors such as accelerator driven system and thorium fueled reactor 2) nuclear criticality safety study 3) development and utilization of reactor noise analysis method and 4) development of new type of radiation detection system used for reactor experiment or illicit material detection system are performed mainly through reactor physics experiments using a critical assembly (low power research reactor, KUCA).

Group Code: K－14　Group Name: Heat Transport System (Institute for Integrated Radiation and Nuclear Science)

Academic Staff: Prof. Yasushi SAITO, Assoc. Prof. Cheol Ho PYEON, Assoc. Prof. Kei ITO, Assist. Prof. Daisuke ITO, Assist. Prof. Naoya ODAIRA

This laboratory pursues safe and efficient use of high-density thermal energy produced in various next generation nuclear energy systems, such as an advanced fission nuclear reactor, fusion reactor and an accelerator-driven system. The research activity covers basic studies on the neutronics of fission reactors and the accelerator-driven system, and the characteristics/control of thermal-hydraulic phenomena under various extreme conditions which are encountered in the next generation nuclear energy systems. Ongoing research subjects are as follows:

1) Mechanism and control of boiling heat transfer and critical heat flux (CHF),
2) Development of quantitative method for fluid measurement using a neutron beam and X-ray,
3) Development of multi-phase flow CFD method and study on liquid-metal thermal-hydraulics,
4) Development of fluid flow measurements using a Wire-Mesh method and ultrasonic probe,
5) Development of computational methodologies in reactor physics and validation of nuclear cross-section data.

Department of Energy Conversion Science

Group Code: H－1　　Group Name: Thermal Energy Conversion

Academic Staff: Prof. Jun HAYASHI

In order to design and control sustainable energy conversion systems with high efficiency and safety we are investigating the thermo-fluid dynamics with combustion reactions. Current research subjects are as follows.

(1) Plasma assisted ignition and combustion of homogeneous and heterogeneous mixtures,
(2) Formation mechanism of pollutant in a combustion process,
(3) Laser diagnostics and image analysis for combustion research,
(4) Heat transfer and phase change in the thrusters of small-scale space craft, and
(5) Fundamentals of high temperature reacting fluid.

Group Code: H－2　　Group Name: Conversion Systems

Academic Staff: Prof. Hiroshi KAWANABE, Assoc. Prof. Naoto HORIBE

Toward the realization of a carbon neutrality, our research interests focus on the improvement of thermal efficiency, the effective utilization of new fuels such as hydrogen and synthetic fuels, and the mitigation of pollutant emissions in combustion systems. Current research subjects are as follows.

Research on the improvement of thermal efficiency and control of processes of combustion and harmful species formation of diesel engines, spark-ignition engines, gas engines, and engines using new fuels,

(1) Research on improvement of thermal efficiency and reduction of exhaust emmision of engines using new fuels such as hydrogen and synthetic fuels.
(2) Combustion processes Mechanisms of emission (PM, NOx, etc.) formation of diesel engines and spark-ignition engines.
(3) Research on emission reduction technology by combustion improvement and exhaust after-treatment
(4) Development and validation of a combustion model to predict heat release rate and emissions.
(5) Fundamental Study on Thermo-Fluid Dynamics in Turbulent Flames

Group Code: H－3　　Group Name: Materials Design for Energy Systems

Academic Staff: Prof. Takashi SUMIGAWA, Assoc. Prof. Masataka ABE

In order to design new function materials used in energy conversion systems, we are conducting experimental and analytical researches focusing on the mechanical properties of nano- and micro-sized materials, multiphysics characteristics related to ferroelectric and magnetic properties, and mechanical properties of metamaterials. Current research subjects are as follows.

(1) Deformation, fracture, and fatigue behavior of nano- and micro-sized materials,
(2) Fatigue fracture properties of nano-thickness metal films,
(3) Elucidation of multiphysics properties of nano-sized components and development of new devices, and
(4) Development of mechanical metamaterials.

Group Code: H－4　　Group Name: Design for Functional Systems

Academic Staff: Prof. Shoji IMATANI , Assoc. Prof. Katsuyuki KINOSHITA

Advanced energy conversion systems consist of various functional materials as well as structural materials. For optimal design of the systems, mechanical, electromagnetic and thermal behavior of the functional and advanced structural materials are analyzed. For structural integrity of the systems, nondestructive evaluation techniques are also studied by use of ultrasonic, electromagnetic and thermal phenomena. Current research subjects are as follows.

(1) Modeling of complex materials with internal structures.
(2) Nondestructive evaluation techniques of flaws and material degradation using ultrasonics, electromagnetic methods and infrared images by thermograph.
(3) Evaluation of material properties by hybrid measurement techniques.
(4) Modeling of mechanical/electromagnetic behavior of functional materials and its application to optimal device designs.

Group Code: H－5　　Group Name: Advanced Energy Conversion (Institute of Advanced Energy)

Academic Staff: Assoc. Prof. Juro YAGI, Assist.

Fusion is expected as a promising future energy source because it is free from constraints of resource and environment. Particularly fusion has a potential capability to solve the problem of global climate change while supplying energy for sustainable society. For this purpose, we are carrying out the research and development of advanced fusion energy system, as well as integrated assessment as a part of future energy system from the aspect of society and environment. The results are reflected in the reactor design. We are studying the design of fusion device and its system based on the advanced energy conversion system composed of liquid metal and advanced materials for high temperature blanket and plasma facing components. Large scale experiment of blanket and divertor attracts attentions from international collaborators. Tritium behaviors inside the reactor and in the environment is evaluated to assess reactor safety. We are also investigating hydrogen production process and propose gaseous and liquid fuel supply that is free from the carbon dioxide emission. This is a biomass-fusion hybrid concept that enables fusion to be applicable earlier to drastically replaces fossil fuel. We also develop a unique small compact fusion neutron beam device that can be used for analytical, medical and various applications. Thus this section covers entire fusion energy study from its generation, application and assessment based on the innovative energy conversion systems.

Group Code: H－6　　Group Name: Plasma Energy Conversion (Institute of Advanced Energy)

Academic Staff: Prof. Kazunobu NAGASAKI, Assoc. Prof. Shinji KOBAYASHI

Emphasis is put on studies of interactions between charged particles and electromagnetic fields. Intensive investigations of heating / current drive and plasma diagnostics using microwaves, lasers and high energy neutral beam in fusion plasmas are being conducted on the Heliotron J device originally developed in Kyoto University. The current research subjects are as follows:

(1) Plasma production, heating / current drive and control of high-performance plasmas
(2) Development of advanced plasma diagnostic systems
(3) Development of high power microwave system
(4) Utilization of neutral beam injection system in magnetically confined fusion plasmas
(5) Control and diagnostic for plasma equilibrium and stability

Group Code: H－7　　Group Name: Functional Energy Conversion Materials (Institute of Advanced Energy)

Academic Staff:　Assoc. Prof. Kazunori MORISHITA, Assist. Prof. Kiyohiro YABUUCHI

Our primary concerns are the system safety and related maintenance engineering of nuclear fission and fusion reactors. Multiscale modeling studies on microscopic and macroscopic behaviors of nuclear component materials under very severe conditions such as energetic neutron irradiation, corrosion, and cyclic loading, are the major topics. To do the challenge, a wide variety of theoretical and experimental tools are utilized, and the multi- time and length scales structures of phenomena occurred in materials and systems are interpreted. Current challenges are as follows:

(1) Multiscale modeling of radiation damage processes in nuclear materials using theoretical and experimental techniques
(2) Fluid-structure interaction analysis to understand complicated behavior of nuclear plants
(3) Ageing management of nuclear component materials, quantitative risk assessment
(4) Development of blanket structural materials, lifetime evaluation of nuclear component materials
(5) Public acceptance of nuclear energy, energy education

Department of Energy Science and Technology

Group Code: O－1　　Group Name: Devices Physics

Academic Staff: Prof. Toshiya DOI

Our group is developing material and device processes that maximize the functionalities of devices in order to realize high-performance energy devices that contribute to utilization of renewable energy and highly efficient utilization of energy. Currently, our targets are electronic materials containing superconductors, oxide semiconductors, and functional compounds for power generation. Novel crystal alignment processes such as ion-beam assisted deposition and epitaxial thin-film growth are used to create precise and three-dimensional arrangement of crystalline grains.

Group Code: O－2　　Group Name: Process and Energy

Academic Staff: Assoc. Prof. Iwao KAWAYAMA

Our research group engages in the investigation and advancement of fabrication and evaluation technologies for high-functional and high-performance energy materials and devices based on solid-state science, thin-film technologies, and optics. Specifically, we will endeavor to enhance the performance of energy devices, such as rechargeable batteries, solar cells, and wide-bandgap semiconductors, through the development of optimized fabrication processes. Furthermore, we conduct research on non-invasive material and device evaluation using advanced analytical techniques, such as terahertz spectroscopy and imaging.

Group Code: O－3　　Group Name: Materials Process Science

Academic Staff: Prof. Masao MIYAKE, Assist. Prof. Takumi IKENOUE

Our research interest focuses on the development of environmentally-friendly production processes for various functional materials used in energy devices such as solar cells and batteries. Current research topics include: 1) electrodeposition of less noble metals and alloys using non-aqueous solutions,2) mist chemical vapor deposition of metal and semiconductor films , and 3) development of aluminum batteries.

Group Code: O－4　　Group Name: Thermochemistry

Academic Staff: Assoc. Prof. Masakatsu HASEGAWA, Assoc. Prof. Sakiko KAWANISHI

Our research aims to provide eco-friendly metallurgical processes and to develop energy materials for applications in solar cells and power semiconducting devices. We believe that the key to achieving the goals is to controlling high-temperature processes, through thermodynamic and kinetic aspects. Our research topics include: 1) Ferrous and non-ferrous metallurgy, 2) New slag design for desulfurization and dephosphorization, 3) Solution growth of energy materials and their application, and 4) Elucidation of high-temperature processes by novel in-situ observation technique.

Group Code: O－5　　Group Name: Resources and Energy Systems

Academic Staff: Prof. Mamoru MABUCHI, Assoc. Prof. Masataka HAKAMADA, Assist. Prof. Youqing CHEN

The aim of our laboratory is to develop resource- and energy-saving technologies in next generation society, based on materials science and rock engineering. The main subjects of research are high performance superlight materials such as magnesium alloys and nanocrystalline metals, their up-grade recycling and fracture and crack analyses in rocks. In particular, we focus on synergistic science of the real experiments, *e.g*. dealloying and electrodeposition processing, and the virtual experiments, *e.g.* molecular dynamics simulations and first principles calculations.

Group Code: O－6　　Group Name: Advanced Processing of Resources and Energy

Academic Staff:　Prof. Takayuki HAMA, Assist. Prof. Naoki MIYAZAWA

The objective of our group is to proceed resource and energy savings for sustainable society using advanced computational mechanics and experiments, especially focusing on modeling of difficult-to-deform materials. Our recent research interests include: 1) crystal plasticity modeling for various materials, such as advanced high-tensile strength steel, Al alloy, Mg alloy, and Ti alloy, 2) characterization of springback during sheet metal forming, and 3) modeling of time-dependent deformation behavior of various metals.

Group Code: O－7　　Group Name: Mineral Processing

Academic Staff: Prof. Hitoshi FUJIMOTO, Assoc. Prof. Hiromu KUSUDA, Assist. Prof. Eishi KUSAKA

Our group focuses on various issues related to material processing, development of resource-circulation technology, and construction of environmental purification system. Our current research interests are as follows: 1) Heat and Mass Transport Phenomena of Multiphase Flow in Material Production Process 2) Utilization of the Methane Fermentation Technology 3) Environmental Purification, Resource Recycling, and Mineral Processing.

Group Code: O－8　　Group Name: Quantum Radiation Energy Science (Institute of Advanced Energy)

Academic Staff: Prof. Hideaki OHGAKI, Assoc. Prof. Heishun ZEN

Generation and application of the mid-infrared free electron laser and compact THz radiation source to develop high efficiency energy conversion materials are studied. Laser-Compton backscattering gamma-ray for nuclear security application have been studied. On the other hand, Socio-Technical aspect on renewable energy is also studied.

Group Code: O－9　　Group Name: Physics of Energy Materials (Institute of Advanced Energy)

Academic Staff: Prof. Yuhei MIYAUCHI, Senior Lecturer Taishi NISHIHARA

Our research focuses on the physical properties, functions, and energy applications of nanoscale and/or quantum materials such as carbon nanotubes. The aim is to create new technologies for highly efficient use of solar light and thermal energy using these materials. Toward this goal, we are promoting interdisciplinary research that covers condensed matter physics and materials synthesis, as well as thermal, mechanical, electronic, and optical engineering along with the fabrication of integrated materials.

Group Code: O－10　　Group Name: Photon Energy Science (Institute of Advanced Energy)

Academic Staff: Assoc. Prof. Takashi NAKAJIMA

Half century has passed since the invention of lasers, and they are not a special device for a specialist anymore. Indeed lasers are used in a variety of areas ranging from basic science to industrial applications. Our research group is working on various subjects with nanomaterials, thin films, nanobubbles, atoms, molecules, etc. are the targets to understand the novel nonlinear phenomena, to optically control the associated dynamics, and eventually to utilize them in energy-related science.