# 2020 (April Admissions)

# Doctoral Program
# Guidelines for Applicants

**(Including Special Admissions for Professionals and for International Students)**

## Graduate School of Energy Science
## Kyoto University

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# Contents

## I. Enrollment Capacity 35students

| | | | |
|---|---|---|---|
| Department of Socio-Environmental Energy Science | 12 | Department of Fundamental Energy Science | 12 |
| Department of Energy Conversion Science | 4 | Department of Energy Science and Technology | 7 |
| | | Total | 35 |

◎Enrollment capacity for the Special Admissions for Professionals and International Students: a few for each department

## II. Eligibility Requirements for Applicants

An applicant for a Doctoral Program must satisfy one of the following qualifications by the end of March, 2020

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 June 7 (Fri), 2019** 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 May 17 (Fri), 2019.**
When mailing the documents, use registered mail and write "Application for Eligibility Screening for Doctoral Program of Graduate School of Energy Science (April Admissions)" in red on the front of the envelope. The required documents must be received no later than 5:00 p.m. **on May 117(Fri), 2019.**

［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 June 28 (Fri), 2019.**

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 June 14 (Fri), 2019.**

When mailing the documents, use registered mail and write “Application for Eligibility Screening for Doctoral Program of Graduate School of Energy Science (April Admissions)” in red on the front of the envelope. The required documents must be received no later than 5:00 p.m. **on June 16 (Fri), 2017.**

[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 June 21 (Fri), 2019.**
3. Screening results will be mailed to applicants **on June 28 (Fri), 2019.**

## 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 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 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. Form for affixing evidence of payment for 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: **July 8 (Mon), 2019 – July18(Thu), 2019** (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.<br><br>※For households in regions where the Disaster Relief Act is effective and whose principal wage-earner has been adversely affected by the March 2011 Great East Japan Earthquake (Tohoku earthquake), the April 2016 Great West Japan Earthquake (Kumamoto earthquake), an exemption may be made to the payment of Entrance Examination Fees for cases where a risaishomeisho (Disaster Victim Certificate) has been issued. For further details, contact the administrative office at the Graduate School of Energy Science by June 18 (Tue), 2019. |
| 7. Self-addressed envelope for mailing examination admission card | **Use a designated envelope.**<br>Write your name, address and postal code on the envelope and affix a 252-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.**<br>*For further communication on the examination results*<br>Write your name, address and postal code (for August. – September, 2019) on the designated form.<br>*For further communication on admission procedures*<br>Write your name, address and postal code (for February, 2020) on the designated form.<br>(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.**<br>(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 400-yen stamped, and self-addressed (name, address and postal code) envelope (kakugata No. 2, 24 cm × 33.2 cm). Be sure to write “Request for Guidelines for Applicants: Doctoral Program of the Graduate School of Energy Science (April Admissions)” 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 (April Admissions) enclosed” in red on the front of the envelope and send it by registered mail.

**[Application period]**

**(In person)**

**July 17 (Wed) and 18 (Thu), 2019**

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

**(By mail)**

Deadline: 5:00 p.m. **on July 18(Thu), 2019**

Your application documents must have arrived by the above deadline. The application documents postmarked no later than July 16 (Mon) 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.)

| Department \ Date | August 7 (Wed) | |
|---|---|---|
| | Time | Test subjects |
| Department of Energy Conversion Science | 10:00 - 12:00<br>13:00 - 17:00 | English and specialized subjects<br>Oral exam |
| Department of Energy Science and Technology | 10:00 - 12:00<br>13:00 - 17:00 | English and specialized subjects<br>Oral exam |

| Department \ Date | August 20 (Tue) | |
|---|---|---|
| | Time | Test subjects |
| Department of Socio-Environmental Energy Science | 10:00 - 12:00<br>13:00 - 17:00 | English and specialized subjects<br>Oral exam |
| Department of Fundamental Energy Science | 10:00 - 12:00<br>13:00 - 17:00 | English and specialized subjects<br>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 August 6(Tue), 2019 for two Departments (Energy Conversion Science, Energy Science and Technology), and on August 19 (Mon), 2019 for two Departments (Socio-Environmental Energy Science, Fundamental Energy Science).

## VII. Examination Voucher

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

## VIII. Announcement of Successful Applicants

1. Departments of Energy Conversion Science, and Energy Science and Technology
   **August 16 (Fri), 2019**
   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 http://www.energy.kyoto-u.ac.jp/)
   A list of successful examinees' numbers will also be sent to all applicants. (Telephone inquiries about the selection results shall not be accepted.)

2. Departments of Socio-Environmental Energy Science, and Fundamental Energy Science
   **August 29 (Thu), 2019**
   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 http://www.energy.kyoto-u.ac.jp/)
   A list of successful examinees' numbers will also be sent to all applicants. (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 **late February, 2020.**

## X. Admission Fees and Tuition

Admission fee: 282,000 yen (tentative)

**[No admission fee will be charged to those who are expected to complete master's program of Kyoto University in March 2020.]**

Tuition (annual): 535,800 yen (tentative)

**[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. Notes

1. Applicants with physical 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.

## XII. 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. 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 Study, Energy Economics, Systems Design, Microscopic and Macroscopic Viewpoints, Sustainability |
| S－3 | Biomass Energy, Supercritical Fluid, Pyrolysis, Bioethanol, Biodiesel, Biochemicals, Biorefinary |
| S－4 | Human Interface, Augmented Reality, Intellectual Productivity, Pro-Environmental Behavior |
| S－5 | Aerosol, Environmental Input-output Analysis, Atmospheric Environment, Environemntal Impact Assessment, Life Cycle Thinking |
| S－6 | Energy Policy, Nuclear Energy, Energy Security, Nuclear Security, Non-proliferation, Energy Best-Mix, |
| S－7 | Social Energy Education, Disaster Science, Hazard Evaluation, Earthquake Disaster Prevention Strategy |
| S－8 | Communication, Information Network, Public Sphere, Reflexive Modernization, Risk Society |

**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 |
| K－3 | Inorganic materials chemistry, Solid state chemistry, Electrochemistry, Secondary batteries, Fuel cells, Biomaterials, Bioceramics |
| K－4 | Nuclear Fusion and plasma theory, nonlinear and non-equlibrium plasma physics, hierarchical simulation, laser-matter interaction |
| 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 salt, Ionic liquid, Silicon solar cell, Secondary battery, Genetic engineering, Bioenergy |
| K－10 | Nanoscience, Nanomaterials, Organic Synthesis, Solar Energy, Theoretical Biophysics, Statistical Mechanics of Liquids |
| 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 |

**Department of Energy Conversion Science**

| Group Code | Keywords of Research Fields |
|---|---|
| H－1 | Thermal Engineering, Power Engineering, Internal Combustion Engine, Pollutant Emission Control, Alternative Fuels |
| H－2 | Conversion Systems, Thermo-Fluid Science, Combustion Science and Engineering, Laser Diagnostics and Image Analysis, Computational Fluid Dynamics |
| H－3 | Strength of Materials, Fatigue, Statistical analysis on strength, Ceramics, Glass substare for devises |
| 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 |
| 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, Magnetic Alignment, Superconductors |
| O－2 | Applied supercondcutivity energy apparatus, Power system Engineering, Cryogenic Engineering, Thermal hydraulics |
| O－3 | Materials processing, Electrochemical processing, Functional materials, Thin films |
| O－4 | Thermochemistry, Environmental-friendly Processes, Recycling Processes |
| O－5 | Energy-saving materials, Multi-scaling materials, Rock engineering |
| O－6 | Computational Physics, Working Process, Thermal Fluid Engineering, Process Simulation, Advanced Processing of Eco-materials |
| O－7 | Resources Circulation, Mineral Processing, Geochemistry, Ocean Resources and Energy |
| O－8 | Quantum Beam, Photophysics, Nuclear Security Technology, Biomass Energy, Renewable Energy System/Policy/Implementation Study |
| O－9 | Opto-Nano Science and Technology, Functional Composit Nano-Materials, Solid State Physics, Light Energy Utilization, Ceramic matrix composites, Nuclear material |
| O－10 | Laser Application, Nanomaterials, Thin Film, Laser Processing,Nonlinear Optics, Spectroscopy |

# Graduate School of Energy Science: Research Groups

## Department of Socio-Environmental Energy Science

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

Academic Staff: Prof. Keiichi ISHIHARA, Assoc. Prof. Hideyuki OKUMURA,Assist 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. Tetsuo TEZUKA, Assoc. Prof. Benjamin C. McLellan,　Assoc. Prof.Seiichi OGATA

Research in the field of Energy and Environment, e.g. design of energy supply-demand systems and policy making for environmental protection and sustainability, needs to incorporate the viewpoints of social science and humanities as well as those of natural science and technology. The international energy situation, microscopic and macroscopic system behavior, infrastructure, regulations and decision-makings of stakeholders are examples of important factors in the discussion of energy supply-demand systems. In this research group, energy and environmental issues are studied through investigation, analysis, modeling and design of target systems based on energy studies including economics, statistics and systems studies.

**Group Code: S－3　　Group Name: Energy Ecosystems**

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

Biorefinary has been studied for effective utilization of biomass and waste biomass as renewable resources. The research topics include its conversion into biofuels, useful biochemicals and biomaterials through supercritical fluid and pyrolysis technologies. A novel ethanol-production from lignocellulosic biomass through acetic acid fermentation, non-catalytic conversion of vegetable oil into biodiesel fuel and molecular mechanisms of lignocellulose pyrolysis are specially focused.

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

Academic Staff: Prof. Hiroshi SHIMODA, Assoc. Prof. Hirotake ISHII

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**

Assoc. Prof. Takayuki KAMEDA, Assist. Prof. Kouhei YAMAMOTO

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 risk assessment of PM2.5, transformation process of air pollutants adsorbed on mineral particles, international impact of long-range transported secondary pollutants and regional radiative effect of aerosols.

**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 on primary energy and electricity demand / supply are investigated from the viewpoint of resource availability, environmental impact, cost, energy security and best-mix of various energy resources. Our main interest is focused on technical and sociological aspects arising from the use of nuclear energy; comprehensive analysis on the impact of nuclear-related specific issues (nuclear non-proliferation, nuclear safeguards, nuclear material protection, transport, public acceptance etc.) 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

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.

**Group Code: S－8　　Group Name: Energy and Communication (Graduate School of Human and Environmental Studies)**

Academic Staff: Prof. Jun YOSHIDA

While basing on Habermas, Giddens and others, regarding the relationship between the macro structural transformations and the micro changes of action, social relation and communication in modern society, we conduct research on the public sphere as the space mediating the micro and the macro. In this research what we stress most in particular is the point of view of perceiving “informatization” and “networking” as the result of the reflexive modernity, as Giddens and others called, and connecting them to the theory of risk society.

Department of Fundamental Energy Science

**Group Code: K－1　　Group Name: Energy Chemistry**

Academic Staff: Prof. Rika HAGIWARA, Assoc. Prof. Kazuhiko MATSUMOTO

We are studying materials, devices and systems which are directly related to conversion and utilization of various kinds of energies such as solar, electrical and chemical energies. 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)
(4) Chemistry of lanthanides

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

Academic Staff: Prof. Takashi SAGAWA, Assoc. Prof. Kan HACHIYA

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. Particularly, studies are focused on the fundamental science for showing important functions of light-harvesting, photoelectron conversion, charge transport, storage, and light-emitting through the development of nanosized structures made of organic and inorganic materials as follows:

(1) Materials designs of nanosized structures made of organic and inorganic composites
(2) Electronic structural analyses and characterizations of optical properties of them
(3) Applications for photovoltaics (solar cells, photocatalysts, and so on), light-emitting devices, and/or others.

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

Academic Staff: Assoc. Prof. Shigeomi TAKAI, Assist. Prof. 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. Yasuaki KISHIMOTO, Assist.Prof.Kenji IMADERA

Our overall goal is to elucidate the underlying mechanisms of various complex nonlinear and non-equilibrium dynamics and structure formation due to the turbulent transport and magneto-hydrodynamic (MHD) process in high-temperature fusion plasmas and promote the theoretical and computational study of plasma physics aiming at actualizing the nuclear fusion energy. We are also devoted to academic and applied research of fundamental plasma properties in basic plasmas, laser plasmas, space and astrophysical plasmas as well as the plasma discharges. Moreover, our research interests are directed towards the development of the state-of-the-art methodology of various numerical simulations in plasmas. Specific aspects are as follows

(1) Illustration of nonlinear magneto-hydrodynamics (MHD) phenomena in fusion plasmas
(2) Elucidation of plasma fluctuations and turbulence as well as anomalous transport in fusion plasmas
(3) Development of state-of-the-art computational algorithm and methodology for massively parallelized particle and fluid simulations in plasmas.
(4) Study of nonlinear and non-equilibrium statistic physics and transport phenomena in hierarchical complex plasmas dominated by atomic/molecular process and relaxation processes, such as thunder and lightning process.
(5) Remote collaboration system using internet communication based on large scale simulation.

**Group Code: K－5　　Group Name: Electromagnetic Energy**

Academic Staff: Prof. Yuji NAKAMURA, Assoc. Prof. Akihiro ISHIZAWA

Complex physical properties of high temperature plasmas, which are necessary to realize magnetically confined fusion reactors, are investigated by data analyses of plasma experiments, measurements and diagnostics of plasma, and theory and numerical simulations. Optimizations of advanced helical system for magnetically confined plasmas are also studied by integrated points of view.

(1) Plasma properties, such as transport or magnetohydrodynamics (MHD) properties, are investigated for the Heliotron J device or the Large Helical Device (LHD) to improve plasma confinements
(2) Local properties of plasmas are studied by various measurements and diagnostics
(3) Plasma confinement properties, which exhibit spatio-temporal hierarchy, are studied by developing an integrated transport simulation code
(4) Advanced plasma confinement configurations are optimized by the transport analysis, the particle orbit analysis, and the MHD equilibrium/stability analysis.

**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, ion beam probe, interferometer, spectroscopy)

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

Academic Staff: Assoc. Prof. Hiroyuki OKADA, Assoc. Prof. Takashi MINAMI, Assoc. Prof. Shinnichiro KADO, Assist. Prof. Shinsuke OHSHIMA

The members of this group study high temperature plasma physics in complex electromagnetic fields and develop advanced methods for plasma control from the viewpoint of fusion energy science.

Relating fields are as follows;

（1）Plasma confinement study in the Heliotron device
（2）Heating and flow control of plasma in the Heliotron device
（3）Control of plasma transport
（4）Control of particle and heat flux to/from high temperature plasma
（5）Boundary plasma physics
（6）Plasma diagnostics
（7）Atomic and Molecular process in boundary plasma

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

Academic Staff: Prof. Kazunari MATSUDA, Assoc. Prof. Yuhei MIYAUCHI

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, Assoc. Prof. Tsutomu KODAKI, Assist. Prof.Takayuki YAMAMOTO

We are studying materials and systems to realize renewable energies like photovoltaics and bioenergy as the major primary energy source for human beings. We are conducting innovative researches that cover the phases from basic research to applications mainly based on electrochemistry and biochemistry. Followings are major research subjects in our group.

(1) Development of new production process of solar grade silicon utilizing the electrolytic reduction of silica in molten salt
(2) Development of new production process of silicon film for solar cells utilizing the electroplating in molten salt
(3) Development of secondary battery for power storage using molten salts and ionic liquids as electrolytes
(4) Improvement of enzyme function by genetic engineering
(5) Development of the efficient production system of biofuel such as bioethanol

**Group Code: K－10　　Group Name: Nanotechnology for Energy (Institute of Advanced Energy)**

Academic Staff: Prof. Hiroshi SAKAGUCHI, Prof. Masahiro KINOSHITA, 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) Molecular wires: assembling on surface
(2) Bottom-up synthesis of new nanocarbon materials
(3) Field effect transistor and photovoltaic cell using organic materials
(4) Theoretical elucidation of microscopic mechanisms of protein folding, denaturation, and functioning
(5) Statistical mechanics of liquids at surfaces

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

Academic Staff: Prof. Takashi MORII, Assoc. Prof. Eiji NAKATA, Junior Assoc. Prof. Arivazhagan RAJENDRAN, Assist. Prof. Shun NAKANO

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 assembly that recognizes and senses biologically important ligands
(3) Artificial enzymes
(4) Design of fluorescent biosensors to assess cellular second messenger dynamics
(5) Design of fluorescent probes to monitor cellular enzymatic activity

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

Academic Staff: Prof. Masato KATAHIRA, Assoc. Prof. Takashi NAGATA, Assist. Prof. Tsukasa MASHIMA

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, Assist. 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 SystemEnergy Transport (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

This laboratory pursues safe and efficient use of high-density thermal energy produced in various next generation nuclear energy systems, such as an advanced nuclear reactor, fusion reactor and an accelerator-driven system. The research activity covers basic studies on the characteristics and the 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) Application study of liquid-metal for advanced energy system,

4) Development of fluid flow measurements using a Wire-Mesh method and ultrasonic probe.

Department of Energy Conversion Science

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

Academic Staff: Prof. Takuji ISHIYAMA, Assist. Prof. Naoto HORIBE

Our research interests focus on the improvement of thermal efficiency and the mitigation of pollutant emissions in thermal engine systems. To this end, we are conducting studies on an analysis of performance of thermal energy systems, control of fuel-air mixing and combustion processes, and reductions of combustion products which affect environment. Current research subjects are as follows.

(1) Elucidation and control of processes of combustion and harmful species formation in diesel, gasoline and gas engines,
(2) Development of technologies for reducing pollutant emissions from engines,
(3) Utilization of alternative fuels for combustion systems, and
(4) Experimental and numerical investigations for fundamentals on ignition and combustion of fuel sprays and jets.

**Group Code: H－2　　Group Name: Conversion Systems**

Academic Staff: Prof. Hiroshi KAWANABE　Prof. Assoc. Prof. Jun Hayashi

In order to design and control energy conversion systems with high efficiency and safety while protecting the environment, the investigation of physical and chemical processes in thermo-fluid substances is made to establish optimum systems. Current research subjects are as follows.

(1) Ignition and combustion of homogeneous and heterogeneous mixtures,
(2) Chemical reaction kinetics of pollutant formation,
(3) Kinetics and fluid dynamics of turbulent diffusion flames,
(4) Laser diagnostics and image analysis for combustion research, and
(5) Numerical simulation of turbulent flows and combustion.

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

Academic Staff: Prof. Toshihiko HOSHIDE, Assoc. Prof. Masataka ABE

The function, deformation and strength characteristics of materials and machinery, which are applied to the energy conversion systems, are adequately assessed, and theoretical and experimental investigations are also carried out to establish the most suitable methodology for the design of such materials and machinery. Current research subjects are as follows.

(1) Strength analysis based on fracture mechanics,
(2) Biaxial fatigue properties and simulation procedures for biaxial fatigue behavior,
(3) Experimental study on static and fatigue strength of high performance thin-film coated materials, and
(4) Statistical analyses of strength in porous ceramics.

**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: Prof. Satoshi KONISHI, Senior Lecturer Juro YAGI, Assoc. Prof. Keisuke MUKAI

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. Kai MASUDA, Assist. 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 in fusion plasmas are being conducted on the Heliotron J device originally developed in Kyoto University. 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 neutronirradiation, 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 , Assoc. Prof. Yoshiaki KASHIWAYA

Our group focuses on high-performance devices based on utilization of renewable energy and highly efficient utilization of energy, and aims to the establishment of various crystal alignment techniques as production processes of materials for fully maximizing their functionalities. Currently, our targets are electronic materials containing superconductors and functional compounds for power generation. Novel crystal alignment processes, such as ion-beam technology, epitaxial thin-film growth and magnetic alignment, are investigated for precise and three-dimensional arrangement of crystalline grains like a single crystal.

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

Academic Staff: Prof. Yasuyuki SHIRAI

Main research targets are applied superconductivity and thermal hydraulics for advanced energy systems, such as high energy superconducting magnet for fusion reactor, superconducting power apparatuses and so on. Heat transfer characteristics of cryogens, such as liquid nitrogen, hydrogen and helium (including superfluid helium) for coolants of superconducting energy devices are studied. Next generation energy-infrastructure, especially electric power systems including advanced power devices are investigated.

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

Academic Staff: Prof. Tetsuji HIRATO, Assoc. 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) aqueous synthesis of semiconductor films, and 3) mist chemical vapor deposition of metal and semiconductor films.

**Group Code: O－4　　Group Name: Thermochemistry**

Academic Staff: Assoc. Prof. Masakatsu HASEGAWA

Research interest is focused on the application of thermo-chemistry to the production and recycling of advanced materials and the utilization of waste materials. The current research subjects in our laboratory are as follows; (1) recycling of lithium batteries and alkaline dry batteries, (2) utilization of organic wastes, (3) chloride capacity of oxide melts, (4) heterogeneous fluxes for metal refining and (5) electrochemical sensors for process control.

**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 nanocrystallines, 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. Hirohiko TAKUDA,  Assoc. Prof. Takayuki HAMA,

Materials for all products are supplied by resources, and energy is consumed in the process between material and product. The “advanced processing of resources and energy” deals with the total processing of resources and energy from a theoretical as well as practical perspective, using a mainly numerical simulation based on computational physics. Current research subjects include the design of materials processing and workings, such as continuous casting, rolling and sheet forming, etc.

**Group Code: O－7　　Group Name: Mineral Processing**

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

Resources and energy processing in harmony with the environmental and the construction of recycling systems are necessary so that we can continue to live safely in the future. Our group investigated mineral processing considering the protection of the environment and resources from the following various points of view. 1) Basic Properties of Methane Hydrate and CO2 Hydrate, 2) Utilization of the Methane Fermentation Technology, 3) Environmental Purification, Resource Recycling, Mineral Processing

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

Academic Staff: Prof. Hideaki OHGAKI, Assoc. Prof. Toshiteru KII, Assist. Prof. Heishun ZEN.

Generation and application of the mid-infrared free electron laser (KU-FEL) and compact THz radiation source to develop high efficiency energy conversion materials are studied. Fundamental photophysics is studied by developing new measurement techniques. Laser-Compton backscattering gamma-ray has also been studied for nuclear security application.  Biomass and low rank coal upgrading by using solvent degradation method has been developed. Evaluation of renewable energy system and policy, implementation methodology are investigated as well.

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

Academic Staff: Assoc. Prof. Tatsuya HINOKI, Assist. Prof. Kouichi JIMBO

Scientific principle and applications of highly efficient photoelectric conversion processes are studied for the next-generation solar cells toward realization of sustainable society. We focus on the creation of new nano-materials (carbon nanotube, graphene, semiconductor, metal nanoparticles and these complex nano-materials) with potential applications and the understanding of physical properties in these nano-materials using advanced laser spectroscopy. Advanced ceramic matrix composites are also developed for aerospace and nuclear fusion applications.

**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.