

5. COLLABORATION WORKS IN THE LABORATORY FOR COMPLEX ENERGY PROCESSES

Collaboration Works in The Laboratory for Complex Energy Processes

1. Introduction

The laboratory was established for research on advanced energy by the collaborative projects among the researchers in the Institute of Advanced Energy to promote joint activity of our knowledge and wisdom to find solutions to these interdisciplinary energy/environmental problems. From such a viewpoint, the research targets of the laboratory are focused on two specific fields, (i) "advanced studies of science and technology on plasma energy and quantum energy" and (ii) "innovative studies of nano-bio functional materials for power generation". For this purpose, two sections (A2 and A3 mentioned below) are founded. In addition, A1 section promotes international or domestic collaborative research and assists activities such as academic meetings and seminars. In the fiscal year of 2022, although the pandemic of COVID-19 still had a significant impact on the actual implementation of the collaborative activity, strong advancement of the collaboration was achieved.

Despite the difficulty in organizing the cooperative research program, however, close connection between related research fields in the institute have yielded unique and interesting outcomes from the collaboration. The laboratory takes charge of organizing and promoting the cooperative research project as a center of research activity in the Institute. The research teams were formed by mostly young generation staffs and students in the institute lead by associate professor or assistant professor, and participated in specific projects to carry out their subjects. The cooperative research activities will be published in a publication edited in the laboratory at the end of the fiscal year. Management of the technical staffs for large scale equipment are also under the responsibility of the laboratory.

A1 Division of International and Industrial Partnership

This division promotes international collaborative research on advanced energy to lead the field of energy science and technology as a worldwide pioneer. For this purpose, the symposium and the workshop organized by institution member are supported.

Although reduction of the risk of the infection was given the highest priority, meetings or exchanges were begun to restart.

A2 Division of Plasma and Quantum Energy Research

This section promotes studies on advanced plasmas and quantum energy for realizing future energy systems, integrating plasma energy science and advanced energy material research. In particular, based on the results obtained in our related groups, we aim at extending the research fields and contributing to human society by utilizing the existing key devices such as Heliotron J, DuET, MUSTER and inertial electrostatic confinement (IEC) device, which have been developed in the institute.

A3 Division of Soft Energy Science Research

This division promotes studies on emergent materials and systems for realizing next generation soft energy system. In particular, functional nano- and bio-materials to efficiently utilize solar energy and bio-energy are studied by integrating laser science, nanotechnology, and bio-technology. We aim at extending our research fields by utilizing the existing devices such as System for Creation and Functional Analysis of Catalytic Materials, SEMs, SPM, Solar Simulator, KU-FEL and various laser systems.

2. The cooperative research program

In the fiscal year of 2022, two categories were set up: (1) "Cooperative Research" for cross sectional research and (2) "Sprouting Research" for challenging research proposal by Assistant Professor. The submitted proposals were evaluated by the selection committee organized by a center director, a program chair and three division chairs. One "Cooperative Research" proposal and four "Sprouting Research" proposals were approved. The number of research subjects is listed in Table 1 according to the division. A brief summary of the cooperative research subjects carried out in FY2022 is shown in the next page.

Table 1 Number of the accepted research subjects according to the division
The whole sum 5

| Category | | | Total |
|----------|----|----|-------|
| A1 | A2 | A3 | |
| 4 | 1 | 4 | 9 |

The individual research subjects are as follows.

Supporting Activities on International and Industrial Collaborative Research

A1

“Organization of the 22nd young research seminar on NMR”

- Y. Yamaoki, M. Katahira, T. Nagata, K. Kondo (Inst. Adv. Energy, Kyoto Univ.)

“Support of 11th International Workshop on Infrared Microscopy and Spectroscopy with Accelerator Based Sources (WIRMS2022)”

- H. Zen, H. Ohgaki, T. Kii (Inst. Adv. Energy, Kyoto Univ.)
- Y. Ikemoto (JASRI)
- S. Kimura (Osaka Univ.)
- E. Okamura (Kobe Univ.)
- A. Paarmman (Fritz Haber Institute)
- P. Dumas (Soleil Synchrotron)

“Support of the collaboration research on “Occurrence and Characteristics of Microplastic Waste from Surface Roadside Soil in Selected Areas of Mon State” invited by the JSPS Core to Core program, “Kansai-Asia Platform of Advanced Analytical Technologies (KAPLAT)”

- T. Morii, E. Nakata, L. Peng, H. Ohgaki (Inst. Adv. Energy, Kyoto Univ.)
- M.T. Tawng (Department of Chemistry, University of Yangon)

“Support for the collaborative activity on fusion plasma and energy science between Japan and Thailand”

- K. Nagasaki, H. Ohgaki, S. Inagaki (Inst. Adv. Energy, Kyoto Univ.)
- T. Onjun, S. Dangtip (Thailand Institute of Nuclear Technology).
- S. Pivsa-art, S. Pavasupree (Rajamangala University of Technology Thanyaburi)

Cooperative Research

A2

“Identification of polarization of radiation from energetic electrons in a laboratory magnetized plasma”

- S. Inagaki, S. Kobayashi, K. Nagasaki, H. Ohgaki, T. Kii (Inst. Adv. Energy, Kyoto Univ.)

Sprouting Research

A3

“Mechanistic aspects for the modulation of scaffolded enzyme activity on DNA nanostructures”

- L. Peng, T. Morii, E. Nakata (Inst. Adv. Energy, Kyoto Univ.)
- M. Nakabayashi, Y. Hui (Grad. Sch. Energy Sci., Kyoto Univ.)

“Energy flux control of nanocomposite materials for non-concentrated sunlight utilization”

- T. Nishihara (Inst. Adv. Energy, Kyoto Univ.)

“Improvement of in-cell NMR technique utilizing isotopic labeling and dynamic nuclear polarization”

- Y. Yamaoki, M. Katahira, T. Nagata (Inst. Adv. Energy, Kyoto Univ.)

“On- surface synthesis of asymmetric graphene nanoribbon at low temperature for energy conversion material”

- T. Kojima (Inst. Adv. Energy, Kyoto Univ.)

The Laboratory Seminars

Laboratory Seminars

The Laboratory promotes topical academic seminars in order to strengthen the research activities in each research section and to enhance the mutual cooperation among a lot of academic fields. In the fiscal year of 2022 the aims and progress reports of five cooperative researches were presented and discussed, as summarized below. The Laboratory also planned a symposium on April 7, 2023 for presentation of the cooperative research results in FY2022.

(1) July 25, 2022

S. Inagaki

“Understanding the Universe with Millimeter Waves Radiated by High-Energy Electrons”

Inst. Adv. Energy, Kyoto Univ.

(2) August 31, 2022

L. Peng

“Mechanistic aspects for the modulation of scaffolded enzyme activity on DNA scaffold”

Inst. Adv. Energy, Kyoto Univ.

(3) September 21, 2022

T. Nishihara

“Energy flux control of nanocomposite materials for non-concentrated sunlight utilization”

Inst. Adv. Energy, Kyoto Univ.

(4) October 19, 2022

Y. Yamaoki

“Improvement of in-cell NMR technique utilizing isotopic labeling and dynamic nuclear polarization”

Inst. Adv. Energy, Kyoto Univ.

(5) February 15, 2023

T. Kojima

“Vectorial on-surface synthesis of polar 2D graphene nanoribbon crystals”

Inst. Adv. Energy, Kyoto Univ.