4. JOINT USAGE/RESEARCH PROGRAM

Joint Usage/Research Center Program
“Zero Emission Energy Research”

It is an urgent task to find out the best solutions against the energy and environmental problems for ensuring the sustainable society on the earth. The new energy system for this purpose must be environmentally friendly or ecological one. Here, we should consider not only the energy sources but also the efficiency in each phase of energy usage. The former should be good quality and enough quantity. The latter should be considered including the so-called “three Rs (Reduce, Reuse and Recycle)” in the energy system.

- Reduce of energy consumption, environmental pollutants such as greenhouse gas, waste-heat, hazardous waste, etc.
- Reuse of waste heat/energy, etc.
- Recycle fuel, etc.

To realize them, only the extension of the present technology is not enough. Interdisciplinary studies with innovative ideas are indispensable to realize the energy system for the next generation.

We propose a new concept of Zero Emission Energy as a typical model of Advanced Energy. IAE Zero Emission Energy Research aims at the realization of environmentally friendly energy system for sustainable society with minimum emission of environmental pollutants and with maximum utilization of energy and resources. Since FY2011, we had operated a project, “Joint Usage/Research Program on Zero Emission Energy”, which is the program authorized by the MEXT. We started the second term of the Program from FY2016 and the third phase in FY2022. Here, we aim to (1) promote interdisciplinary joint usage/research studies for Zero Emission Energy Science & Technology, (2) promote education & practical training for young researchers and (3) explore future horizons of Advanced Energy System for sustainable development. IAE provides many unique & attractive facilities for Joint Usage/Research not only in the field of advanced plasma & quantum energy but also in the field of soft energy.

Many researchers have participated in this program. In FY2024, there were 81 Joint Usage/Research collaboration subjects (including 5 workshops) on Zero Emission Energy, with more than 300 visiting participants, including graduate and undergraduate students, from 40 universities and institutions all over Japan. Researchers from 8 foreign universities also participated in the program. The results of these collaborations are summarized in the report "IAE Joint Usage/Research Program on Zero Emission Energy 2024". If you are interested in this collection, please contact the office of Zero Emission Energy Research.

In addition to the Joint Usage/Research collaborations, we organized “The 15th International Symposium of Advanced Energy Science - Toward the Realization of Advanced and Carbon Negative Energy” from December 10 to 12, 2024. This symposium was held on a larger scale than usual in collaboration with the affiliated Integrated Research Center for Carbon Negative Science (ICaNS). Additionally, the oral sessions were simultaneously streamed on YouTube to accommodate remote participants. This symposium consisted of an oral session, ZE poster session, student poster session, and parallel seminars. The oral session was attended by 250 participants and the parallel seminars by 60 researchers, attracting many participants. In total, 310 scientists and students, including 6 foreign and 9 domestic invited speakers, participated in the symposium. At the symposium poster session, awards were given for outstanding presentations.

We are also operating “Zero Emission Energy Network” to share the knowledge of Advanced Energy and Zero Emission Energy with researchers in the fields of energy science and technology, because world-wide activities for Zero Emission Energy Research are indispensable for the realization of sustainable society.

In FY2024, the intermediate examination by MEXT was conducted for all the Joint Usage/Research Center Programs. Our program gave an "A" evaluation. Since then, we have been continuing the effort to keep this high evaluation with the researchers of the related communities.

Poster of the 15th International Symposium

List of Zero Emission Energy Joint Usage/Research Subjects in FY 2024

(Subject, Principal Researcher, IAE Key Person)

Structural analysis of lignocellulosic biomass by NMR spectroscopy toward decarbonized society, Hiroshi Nishimura, Masato Katahira

Degradation mechanism of high melting point materials for heat exchanger applications, Keisuke Mukai, Juro Yagi

Development of anode/electrolyte interface for advanced Na-ion battery, Hiroki Sakaguchi, Toshiyuki Nohira

Development of Interfacial Strain Relaxation Methods in Multimaterials for Fusion Reactor Components, Ryuta Kasada, Kiyohiro Yabuuchi

Emission properties and photoinduced electron-transfer reactions of photosensitizers bound to the reaction site of enzyme, Hiroshi Takashima, Eiji Nakata

NMR analysis of artificial biomolecules that control the growth of plants or microorganisms, Taiichi Sakamoto, Takashi Nagata

Electrocatalysis of graphene nanoribbons: Utilization for surface processing of silicon and energy conversion, Kazuhiro Fukami, Hiroshi Sakaguchi

Fermentative production using hydrogen sulfide and food processing by-products as energy sources, Minoru Takeda, Masato Katahira

Precise control of mode-selective phonon excitation on energy material, Kyohei Yoshida, Hideaki Ohgaki

Changes in atomic density distribution in tritium breeding material Li_8ZrO_6 sintered body due to Li_2O evaporation, Kiyoto Shinmura, Juro Yagi

Structural basis of G-quadruplex recognition by the replication initiator ORC, Shou Waga, Yudai Yamaoki

Energy location of Ce3+ 4f and defect levels in multicomponent garnet oxide crystals determined by photo-induced free carrier plasma transient absorption spectroscopy, Mamoru Kitaura, Heishun Zen

Mechanism of changes in mechanical strength properties of lithium-ion electrolyte due to ionic conduction, Kazuya Sasaki, Juro Yagi

Study on development of compound-based anode for K-ion battery and on compatibility with ionic liquid electrolyte, Yasuhiro Domi, Takayuki Yamamoto

Elucidation of interactions between TLS and long non-coding RNA that regulates liquid-liquid phase separation caused by TLS, Riki Kurokawa, Masato Katahira

Design of Electrode/Electrolyte Interface for All Solid-State Battery by Photo-Induced Chemical Solution Process, Ikuma Takahashi, Juro Yagi

Improved techniques for manipulating magnetized cells, Motonari Uesugi, Hideaki Ohgaki

Innovative Approach for Lignin Utilization: Reactivity Analysis through Selective Stable Isotope Labeling Method, Yasuyuki Matsushita, Masato Katahira

Experimental verification of hydrogen adsorption and desorption behavior for advanced neutron multipliers, Jae-Hwan Kim, Juro Yagi

Development of Fluorophores Directed toward Application in Luminescent Solar Concentrators, Masaki Shimizu, Hiroshi Sakaguchi

Determining the conditions of heat treatments for extending the lifetime of nuclear reactors (3), Yoshitaka Matsukawa, Kiyohiro Yabuuchi

Elucidation of the highly efficient energy production system utilized by intracellular organelle, Reiko Sakaguchi, Eiji Nakata

NMR Structural Analysis of Cell Growth-Related Protein in Complex with Viral Protein-Derived Peptide, Hideki Kusunoki, Takashi Nagata

Study of Hydrogen Isotope Separation Technology by Molten Salt, Hisayoshi Matsushima, Toshiyuki Nohira

Investigation on molecular structure changes of polylactide and polylactide-based materials induced by mid-infrared free electron laser, Sakhorn Rimjaem, Hideaki Ohgaki

Development of the crystalline cellulose degradation system consisting of the psychrophilic fungus-type hybrid enzymes., Masataka Horiuchi, Takashi Nagata

Characterization of E. coli derived G-quadruplexes which can regulate gene expression., Yoichiro Tanaka, Takashi Nagata

Investigation of Fast Charge Extraction in Perovskite Solar Cells with QDs-enhanced Electron Transfer utilizing MIR free-electron laser, Sukrit Sucharitakul, Hideaki Ohgaki

Fluorescent biosensor for visualizing nuclear localization signal of transcription factor Sp1 for regulating metabolic reactions, Shunsuke Tajima, Eiji Nakata

Novel pulsed terahertz source by super-radiance free electron laser oscillator, Kazuyuki Sakaue, Heishun Zen

Study of Chemical Reactions in the processing of super engineering plastics, Jun Fujioka, Heishun Zen

Development of strong superconducting bulk magnets with high shape-flexibility, Takanori Motoki, Hideaki Ohgaki

Python-Based LV Microgrid Planning Strategies: Clustered Topology and PV Hosting Capacity, Vannak Vai, Hideaki Ohgaki

Experimental research on the sophistication of advanced information infrastructure for the operation and maintenance of complex energy systems, Hidekazu Yoshikawa, Kazunori Morishita

Carbon Capture - Bioenergy System Design and Biofuel Readiness Analysis for Urban Communities, Pulungan Muhammad Almaududi, Hideaki Ohgaki

Biochar Production from Cocoa Byproducts for Rural Application, Juniza Md Saad, Hideaki Ohgaki

(Tentative Title) Achieving Carbon-Neutral Organic Coffee Cultivation through Biocontrol, Keonakhone Khounvilay, Hideaki Ohgaki

Proposing a Green Energy Ecosystem through Solar and Wind Energy in Indonesia, Anugerah Yuka Asmara, Hideaki Ohgaki

Life Cycle Assessment of Rural Electrification in Malaysia, Chia-Kwang Tan, Hideaki Ohgaki

Study of damage rate effects on mechanical properties and microstructural evolution in reactor pressure vessel model alloys., Ken-ichi Fukumoto, Kiyohiro Yabuuchi

In-situ measurement of periodic nanostructures on semiconductor surface induced by mid-infrared free electron lasers, Masaki Hashida, Heishun Zen

Description of free-electron laser interaction based on observation of coherent edge radiation, Norihiro Sei, Hideaki Ohgaki

Developing a new optical technique to determine the ratio of hydrogen bubbles to the total evolved hydrogen during water electrolysis, Kota Ando, Takashi Nakajima

Structural studies on hierarchical molecular architectures created in microfluidic devices, Munenori Numata, Eiji Nakata

Neutronics feasibility and compatibility of Li-Br/F/I based molten salt applied for fusion reactors' liquid blanket, Yasuyuki Ogino, Juro Yagi

Physical properties of large-scale structure of atomic layer materials, Susumu Okada, Kazunari Matsuda

Development of Highly Bioactive Zirconia Ceramics and Surface Control Technology, Takeshi Yabutsuka, Kiyohiro Yabuuchi

Basic study on pulse water surface discharge with needle electrodes and its improvement, Hiroto Matsuura, Shinichiro Kado

Exploring Quantum Materials for High-Efficiency and High-Performance Energy Conversion, Satoru Konabe, Yuhei Miyauchi

An artificial-nucleic-acid probe for live-cell imaging of energy metabolism, Shinichi Sato, Eiji Nakata

Development of ratiometric optical thermometry based on thermal properties of photoluminescence in single-walled carbon nanotubes, Shun Aota, Yuhei Miyauchi

Tunneling ionization with ultrafast intense infrared pulses, Ryoichi Hajima, Heishun Zen

Fabrication of multi-scale target using nano-material technology for the structured plasma generation for hydrogen-boron nuclear fusion using high intensity laser, Yasuaki Kishimoto, Hiroshi Sakaguchi

Analysis of insulin ball in mice given infrared free electron laser-irradiated insulin, Kazuhiro Nakamura, Heishun Zen

Optical properties of high-quality two-dimensional heterostructures, Wenjin Zhang, Yuhei Miyauchi

Highly efficient laser-induced photochemical processes by using machine-learning approach combined with quantum optimal control, Yukiyoshi Ohtsuki, Takashi Nakajima

Development of novel guanine-tethered antisense oligonucleotides, Masaki Hagihara, Eiji Nakata

AFM/EM imaging of intracellular metals with nanostructures constructed via signal amplification systems, Ippei Takashima, Eiji Nakata

Effect of the metal-insulator transition temperature of vanadium dioxide film on its refractive index, Kazuma Isobe, Taishi Nishihara

Development of RNA editing technology to control metabolic enzyme genes, Masatora Fukuda, Eiji Nakata

Development of a New Method for Controlling Thermal Radiation by Quantum Metamaterials, Atsushi Sakurai, Yuhei Miyauchi

Bactericidal effect of Gram active bacteria an infrared free electron laser, Toshizo Toyama, Heishun Zen

Study of spacial property of excitons in atomically thin layered materials, Masaru Sakai, Kazunari Matsuda

Development of 3-dimensional radiative distribution measurement system using incoherent digital holography in Heliotron J., Hayato Kawazome, Shinichiro Kado

Whole genome analysis and culture method development of Thai coffee leaf rust fungus, Rampai Kodsueb, Yumiko Takatsuka

Systematic study of selective desulfation phenomena in glycosaminoglycans using infrared free electron laser, Takashi Honda, Heishun Zen

High-temperature oxidation properties of oxide dispersion strengthened alloy powder in argon atmosphere, Noriyuki Iwata, Kiyohiro Yabuuchi

Developing the technique to monitor the spatial size distribution of radioactive micro/nano fragments during laser decontamination, Atsushi Kosuge, Takashi Nakajima

Application of Model Inclusive Learning to Fusion Plasma Science - Equilibrium Reconstruction of Plasma -, Yasuaki Kuroe, Shinji Kobayashi

Study and experiment of the high-energy electron generation by the high-power laser-irradiation to the structured target, Ryutaro Matsui, Kazunari Matsuda

Development of New Semiconductor Power Control Devices Aiming for Carbon Neutrality, Kensho Okamoto, Kazunori Morishita

Analysis of direct energy conversion method using charge separation by cyclotron motion, Nobuhiro Nishino, Shinichiro Kado

Study on ultrafast measurement of relativistic electromagnetic fields, Masato Ota, Heishun Zen

Investigation of Intrabacterial Calcification due to FEL Irradiation on Human Oral Resident Bacteria, Tetsuro Kono, Hideaki Ohgaki

Radial Correlation Analysis on Edge Plasma Turbulence in a Toroidal Plasma and its Dependence on Plasma Configuration, Yoshihiko Nagashima, Shigeru Inagaki

Study on the mechanism of direct conversion of cellulosic materials into glucose under microwave irradiation conditions, Sadatsugu Takayama, Juro Yagi

Study on emission process and evaluation of light outputs for novel scintillator and dark-matter search using the one electron beam, Shunsuke Kurosawa, Hideaki Ohgaki

Distributed Workshop on "Physics and control of non-linear and non-equilibrium plasma based on the concept of broad-band energy science", Yasuaki Kishimoto, Kazunari Matsuda

The 3rd International Symposium of Biofunctional Chemistry: Towards the understanding of biological energy systems, Reiko Sakaguchi, Lin Peng

The Japanese Society for Biomaterials, Kansai Block 2024, Tetsuya Adachi, Eiji Nakata

4th Switzerland-Japan Biomolecular Chemistry Symposium (SJBCS2024), Nobutaka Fujieda, Eiji Nakata