

From Kyushu University to the world. Introducing research activities that will bring us to the realization of a carbon-neutral society.

Hello! I²CNER

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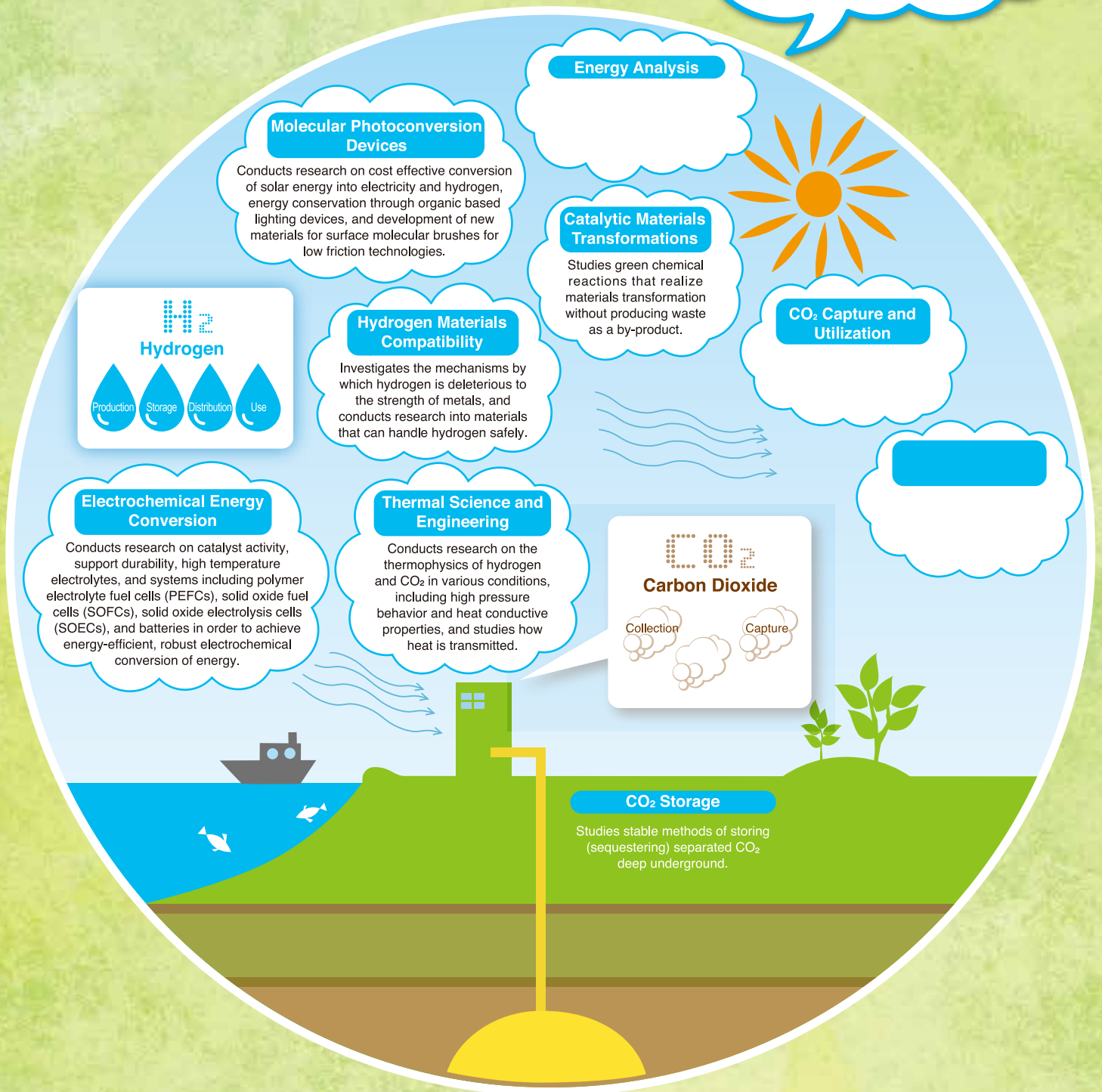
International Institute for Carbon-Neutral Energy Research

Introduction of I²CNER Buildings – Part I

I²CNER's State-of-the-Art Research Facilities to
Enable a Carbon-Neutral Energy Society

What is a carbon-neutral society?

This is a soci



Introducing the **research divisions of I²CNER**, which are engaged in cutting edge research to create a green and clean **carbon-neutral society** free of CO₂ emissions.

INTRODUCTION of I²CNER BUILDINGS



Welcome to the International Institute for Carbon-Neutral Energy Research (I²CNER), Kyushu University! I²CNER aims to enable a carbon-neutral energy society by conducting research that has the potential to advance relevant energy technologies.

Though I²CNER has 2 state-of-the-art buildings, in this issue, we will focus on I²CNER Building 1. Building 1, constructed in January 2013 on Kyushu University's Ito Campus, offers an open environment for domestic and international top-level researchers to collaborate and develop fusion research projects. The overhead view of I²CNER Building 1 portrays the Keeling Curve*, which rises over time. This curve was embedded in the structure of the building itself in order to intimate I²CNER's eventual contributions to the downward turn of this curve.

**In 1958, Charles David Keeling began taking daily measurements of the concentration of atmospheric carbon dioxide (CO₂) at the Mauna Loa Observatory on the Big Island of Hawaii. Keeling's measurements were the first significant evidence of rapidly increasing carbon dioxide in the atmosphere.*



Exterior of Building 1

1st Floor

■ Entrance & Exhibition Space

Just inside the entrance to the building is an exhibition space, which offers visitors the opportunity to hear a general summary of I²CNER's research. The space also enables visitors to learn about some of I²CNER's specific research interests, such as hydrogen production devices that use photocatalysts, the structure of molecules of catalysts, fuel cells, and CO₂ geological storage. There is also an interactive I²CNER PR video that describes each research division.



Main entrance of Building 1



Exhibition space

■ Lounge

This spacious, airy lounge features numerous floor-to-ceiling windows. The "open" atmosphere of the lounge is intended to augment the exchange of ideas and vigorous scientific debate. Seminars, parties, and other events are held here on a regular basis. Our researchers are also free to use the lounge for more informal meetings and interactions.



Downstairs Lobby & Lounge



Researchers mingle in the lounge

■ Hall

I²CNER Hall can accommodate more than 200 people. I²CNER Hall is used regularly for various events, such as symposia and international conferences. I²CNER Hall is also an extremely flexible space that can be divided with partitions for smaller symposia, division meetings, or research group meetings.



An international symposium in progress in I²CNER Hall

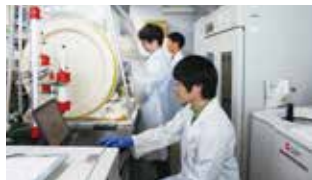


A panel discussion is held in I²CNER Hall

2nd Floor

■ Ogo Laboratory

Welcome to the laboratory of Prof. Seiji Ogo (Lead Principal Investigator of the Catalytic Materials Transformations Division) and Prof. Ki-Seok Yoon. The researchers in the Ogo-Yoon laboratory explore new theories of hydrogen activation using catalysts based on novel molecules called “Ogo Catalysts” that defy the common wisdom about fuel cells.



Prof. Yoon's team is hard at work



Prof. Yoon (left) looks in on his team

■ Yamauchi Laboratory

In the laboratory of Prof. Miho Yamauchi (Principal Investigator in the Catalytic Materials Transformations Division), researchers work on developing nano alloy catalysis for a carbon-neutral cycle, bridging efforts on energy conservation and new energy.



Prof. Yamauchi shows a group of students from the University of Illinois at Urbana-Champaign around her lab



Prof. Yamauchi (right) and Prof. Masaaki Sadakiyo hard at work in the Yamauchi Laboratory

■ Fujikawa Laboratory

The research in the laboratory of Prof. Shigenori Fujikawa (Lead Principal Investigator of the CO₂ Capture and Utilization Division) is focused on the development of the world's thinnest nano-membrane toward the goal of efficient, low-cost separation of CO₂ from mixed exhausted gas.



Prof. Fujikawa's team brainstorms for their next experiment



Prof. Fujikawa (third from right) engages with his team

■ Open Laboratories

In I²CNER, there are open laboratories which all researchers are free to use. A wide variety of equipment is installed in the open labs, including the “Raman Imaging Spectrometer System” (which irradiates a sample with laser light, and identifies the type and condition of materials based on generated Raman scattering light), the “Cold-Spray Ionization TOF MS System” (which works well in the mass analysis of labile compounds), and the “Ar Cluster Ion Beam XPS” (which analyzes the depth profile of organic films).



I²CNER researchers work in one of I²CNER's open labs



A researcher analyzes his data

3rd Floor

■ Tsuji Laboratory

In Prof. Takeshi Tsuji's (Lead Principal Investigator of the CO₂ Storage Division) laboratory, experiments are focused on Carbon Capture and Storage (CCS) technology, wherein CO₂ that is emitted from power plants and factories is captured and stored in underground CO₂ reservoirs.



Prof. Tsuji (center) and Prof. Keigo Kitamura (right) exchange ideas



Prof. Kitamura demonstrates an experiment to high school students

■ Taniguchi Laboratory

Researchers in Prof. Ikuo Taniguchi's (CO₂ Capture and Utilization Division) laboratory strive to develop dendrimer membranes which are said to have the highest CO₂ separation performance in terms of efficiency. They also explore other next-generation CO₂ separation and capture technologies.



Prof. Taniguchi (second from left) works with his team in the lab



A group of high school students visits Prof. Taniguchi's lab

4th Floor

■ Energy Analysis Division

The Energy Analysis Division tracks and analyzes current and future energy technologies from the perspectives of CO₂ emissions, energy efficiency, and overall cost. The division formulates I²CNER's vision toward a carbon-neutral society, generates and updates various scenarios for a carbon-neutral society, and assists the research divisions in the development of their roadmaps, which are based upon the aforementioned scenarios. These efforts help ensure that I²CNER's research efforts have the potential to make a significant impact on reducing CO₂ emissions in Japan and globally.



Prof. Kenshi Itaoka (Acting Division Leader, EAD) works at his computer



Prof. Nguyen Dinh Hoa (left) and Andrew Chapman have a discussion

■ Director's Office

Welcome to the Director's Office! Since the Director is also a professor at the University of Illinois at Urbana-Champaign (UIUC), he spends about half of his year at I²CNER and the other half at the UIUC Satellite Institute. However, the Director's office is usually very busy since it is used for various purposes, such as meeting visitors, having discussions with I²CNER researchers, and holding video conferences with institutes all over the world.



Director Sofronis takes a short break in his office



Director Sofronis (right) takes part in a video conference



2016.
8.10-11

Super Science High Schools (SSH) Students Fair 2016



Students page through I²CNER's PR magazine



Students give their oral presentation



A student engages with an I²CNER staff member

I²CNER and 8 other World Premier International Research Center (WPI) Initiative institutes jointly ran booths at the “Super Science High Schools (SSH) Students Fair 2016,” held on August 10 and 11 at the Kobe International Exhibition Hall. Organized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japan Science and Technology Agency (JST), the SSH project is

designed to help produce globally competitive human resources in science and technology by supporting high schools that offer advanced education in the areas of science and mathematics. Around 3,000 students and teachers from 202 SSHs and 28 invited schools from Asia, the United States, and Europe related their latest findings, both in poster sessions and in oral presentations. I²CNER, which

shared a booth with the University of Tsukuba's International Institute for Integrative Sleep Medicine (IIIS), Nagoya University's Institute of Transformative Bio-Molecules (ITbM), and the Tokyo Institute of Technology's Earth-Life Science Institute (ELSI), introduced visitors to the WPI program and the wide range of research efforts it encompasses.

2016.
8.25-26

Innovation Japan 2016 – University Show



The entrance to the event



Prof. Taniguchi explains his research



Prof. Taniguchi's booth

The Innovation Japan 2016 – University Show, which was organized by the Japan Science and Technology Agency (JST) was held August 25-26, 2016 at Tokyo Big Sight in Tokyo. “Innovation Japan,” which typically hosts more than 20,000 visitors each year, is one of the largest industry-academia matching events in Japan. The main purpose of the event is to promote technology

transfer and the implementation of university research outcomes and inventions into society. Another mission of the event is to support industry-academia matching toward practical use. I²CNER Prof. Ikuo Taniguchi (CO₂ Capture and Utilization Division) ran a booth at the 2016 University Show in order to explain his research on “Low-temperature processable

degradable plastics from renewables.” At his booth, he conducted a plastic pressure molding test and demonstrated that it can be sharpened at room temperature. Many participants from industry and various research institutions visited his booth to explore the possibilities for future collaborative research.

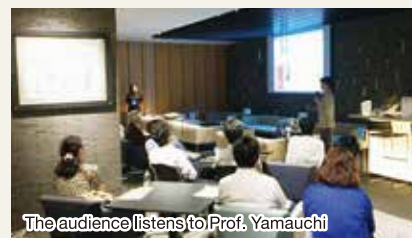


2016.
8.26

40th Science Café @ Fukuoka



Prof. Yamauchi gives her lecture



The audience listens to Prof. Yamauchi



Participants exchange ideas during the roundtable discussion

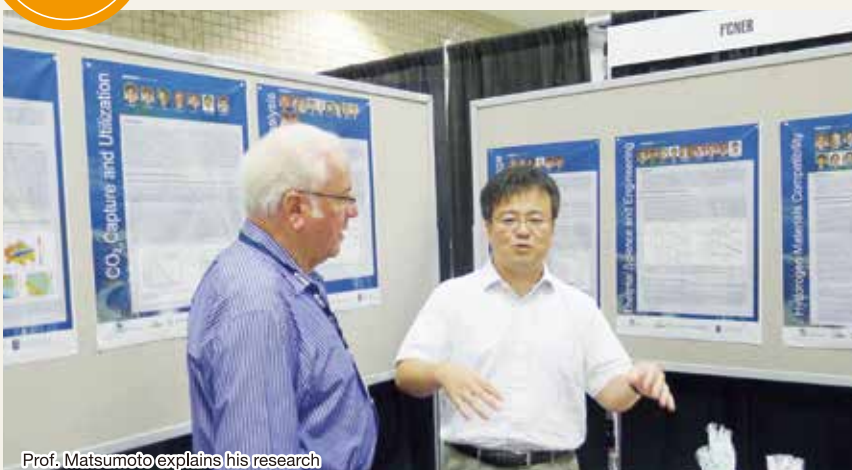
Prof. Miho Yamauchi (Catalytic Materials Transformations Division) gave a lecture at the “40th Science Café @ Fukuoka,” which was held in a business event space in the heart of the city at 7 p.m. on August 28, 2016. The 40th Science Café @ Fukuoka drew an audience of about 30 people, including many office workers who were able to attend because the

event was scheduled after normal working hours. The event, which is intended to offer opportunities for scientists and average citizens to communicate casually, has been held on a monthly basis since August 2012. In her presentation titled, “Approach to Nanoparticle Chemistry: Catalytic Chemistry for Sustainable Society,” Prof.

Yamauchi talked about her research on nanoalloy catalysts for the realization of a highly efficient carbon-neutral energy cycle. The lecture was followed by a roundtable talk, in which participants discussed their views on immediate energy issues and showed keen interest in the development of the latest eco-conscious technologies.

2016.
10.2-7

Pacific Rim Meeting on Electrochemical and Solid-State Science 2016 (PRiME 2016)



Prof. Matsumoto explains his research



Dr. Kwati gives his lecture



I²CNER PI Nakashima's Group

From October 2-7, the Pacific Rim Meeting on Electrochemical and Solid-State Science 2016 (PRiME 2016) was held in Honolulu, Hawaii, USA. PRiME 2016 was co-hosted by the US Electrochemical Society, the Electrochemical Society of Japan, and the Korean Electrochemical Society, and attracted around 3,000 visitors. Prof. Hiroshige Matsumoto (Lead Principal Investigator,

Electrochemical Energy Conversion Division) and Dr. Leonard Kwati (same division) presented their latest findings at the event. I²CNER also ran a booth where many participants dropped by to learn about the I²CNER project. The I²CNER booth was also visited by research collaborators, who took advantage of the opportunity to exchange ideas about future research. Overall,

PRiME 2016 was an excellent opportunity for I²CNER to increase its international visibility.

AWARDS

2016 JSAP Fellow Award

Prof. Chihaya Adachi (Molecular Photoconversion Devices Division)

Prof. Chihaya Adachi won the JSAP Fellow Award for his contribution to the progress of applied physics from the Japan Society of Applied Physics, Japan. His research on "Creation of Organic Semiconductor Materials and Their Application for Organic Light-Emitting Diodes" is regarded as a distinguished achievement in research, technological development, and educational and public-interest activities. (Sep. 13, 2016)

Murakami Memorial Award

Prof. Zenji Horita (Hydrogen Storage Division)

Prof. Zenji Horita received the Murakami Memorial Award from the Japan Institute of Metals and Materials for his research on "Developing high-performance materials through microstructural control by severe plastic deformation." This prize is given to those who have made remarkable achievements in pioneering research and development in the field of metal engineering. (Sep. 21, 2016)

Thermal Engineering Achievement Award

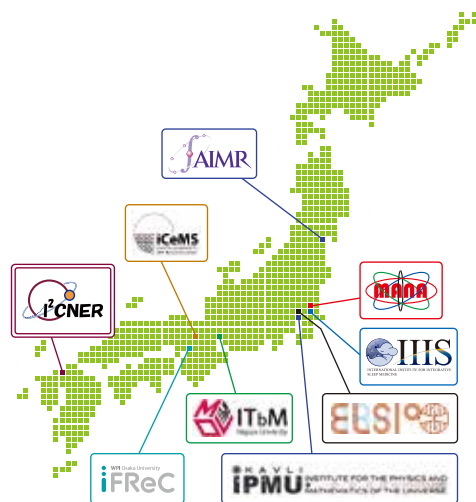
Prof. Koji Takahashi (Thermal Science and Engineering Division)

Prof. Koji Takahashi won the Thermal Engineering Achievement Award from the Thermal Engineering Division of the Japan Society of Mechanical Engineers for his outstanding research achievement. (Oct. 21, 2016)



What is WPI?

The World Premier International Research Center Initiative (WPI) is a project that was launched by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2007. The WPI seeks to form an ideal research environment within visible research centers that maintain high research standards, where leading researchers will be attracted from all over the world.



IFCNER Kyushu University
International Institute for Carbon-Neutral Energy Research (IFCNER)

Toward the realization of a low-carbon society, IFCNER aims to resolve the challenges of the use of hydrogen energy and CO₂ capture and sequestration by fusing together sciences from the atomic level to the global scale.

Refer to:
MEXT Website http://www.mext.go.jp/english/research_promotion/1303822.htm
JSPS Website <http://www.jsps.go.jp/english/e-toplevel/index.html>

IAIMR Tohoku University
Advanced Institute for Materials Research (AIMR)

Integrating physics, chemistry, materials science, bioengineering, electronics and mechanical engineering, AIMR is striving to create innovative functional materials. A mathematical unit joined the team in 2011 to help establish a unified theory of materials science, aiming at the realization of a global materials research hub.

iFReC WPI Osaka University
Osaka University
Immunology Frontier Research Center (IFReC)

An innovative research center, which pursues the goal of comprehensive understanding of immune reactions through the fusion of immunology, various imaging technologies, and Bioinformatics.

MANA National Institute for Materials Science International Center for Materials Nanoarchitectonics (MANA)

A major focus of our activities is the development of innovative materials on the basis of a new paradigm "nanoarchitectonics," ground-breaking innovation in nanotechnology.

iCeMS Kyoto University
Institute for Integrated Cell-Material Sciences (iCeMS)

Established to integrate the cell and material sciences, the iCeMS combines the potential power of stem cells (e.g., ES/iPS cells) and of mesoscopic sciences to benefit medicine, pharmaceutical studies, the environment, and industry.

IPMU Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), Todai Institutes for Advanced Study, The University of Tokyo

With accumulated research on mathematics, physics and astronomy, this research core works to bring light to the mysteries of the universe, such as its origin, and to provide an analysis of evolution.

ELSI Tokyo Institute of Technology
EARTH-LIFE SCIENCE INSTITUTE (ELSI)

ELSI focuses the origins of Earth and life. Both studies are inseparable because life should have originated in unique environment on the early Earth. To accomplish our challenge, we establish a world-leading interdisciplinary research hub by gathering excellent researchers in Earth and planetary sciences, life science, and related fields.

IHS University of Tsukuba
International Institute for Integrative Sleep Medicine (IHS)

IHS seeks to elucidate the fundamental mechanism of sleep/wakefulness, to develop strategies to regulate sleep, and to contribute to the enhancement of world health by combatting sleep disorders and associated diseases.

ITbM Nagoya University
Institute of Transformative Bio-Molecules (ITbM)

The goal of ITbM is to develop innovative functional molecules that make a marked change in the form and nature of biological science and technology (transformative bio-molecules). ITbM will connect molecules, create value, and change the world, one molecule at a time.

Editor's Note

■ IFCNER holds a variety of events.
For details, please see: <http://i2cner.kyushu-u.ac.jp/en/>



■ This issue's special feature, "Introduction of IFCNER Buildings — Part I" is the first of a 2-part series intended to familiarize our readers with IFCNER facilities. All IFCNER researchers are housed in IFCNER Buildings 1 and 2. In this issue, we focus on IFCNER Building 1. Both IFCNER buildings were designed to accommodate top-level researchers (and their corresponding laboratory equipment) from a variety of scientific fields from all over the world. As always, we would welcome any feedback.

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