Hello! I²CNER

International Institute for Carbon-Neutral Energy Research

vol. 6

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

Becoming a scientist to build a future

wpi World Premier International Research Center Initiative | I²CNER | KYUSHU UNIVERSITY | ILLINOIS University of Illinois at Urbana-Champaign

The New Building of the International Institute for Carbon-Neutral Energy Research

Construction of the new building of the International Institute for Carbon–Neutral Energy Research (I²CNER) of Kyushu University will be completed at the Ito Campus this year. This new I²CNER building, which will be divided between I²CNER on the left-hand side and the Next–Generation Fuel Cell Research Center on the right-hand side, will provide an attractive research environment for top researchers from Japan and overseas to work together in pursuit of multi-disciplinary, fusion research. I²CNER's mission is to contribute to the creation fusion of a sustainable and environmentally-friendly society by conducting fundamental research for the advancement of low carbon emissions, cost effective energy systems, and improvement of energy efficiency. Amongst the array of technologies that I²CNER's research aims to enable is the innovative, safe, and reliable production, storage, and utilization of hydrogen as a fuel in a hydrogen-based economy. Our research also explores the underlying science of CO_2 capture and storage technology or the conversion of CO_2 to a useful product..

The overhead view of the new I²CNER building portrays the Keeling Curve*, which rises over time, to indicate that I²CNER's research will eventually contribute to the downward turn of this curve.

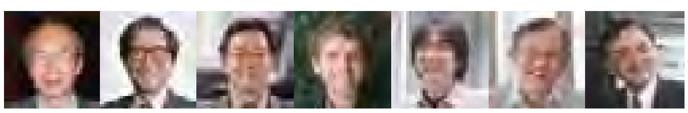
*In 1958, Charles David Keeling began making daily measurements of the concentration of atmospheric carbon dioxide (CO_2) at the Mauna Loa Observatory on the Big Island of Hawaii. Keeling's measurements are the first significant evidence of rapidly increasing carbon dioxide in the atmosphere.

REPORT

wpi World Premier International Research Center Initiative

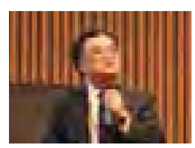
WPI Program: All-WPI Research Center Joint Symposium

Inspiring Insights into Pioneering Scientific Research



Sat, 24 Nov. 2012

Tsukuba, Ibaraki

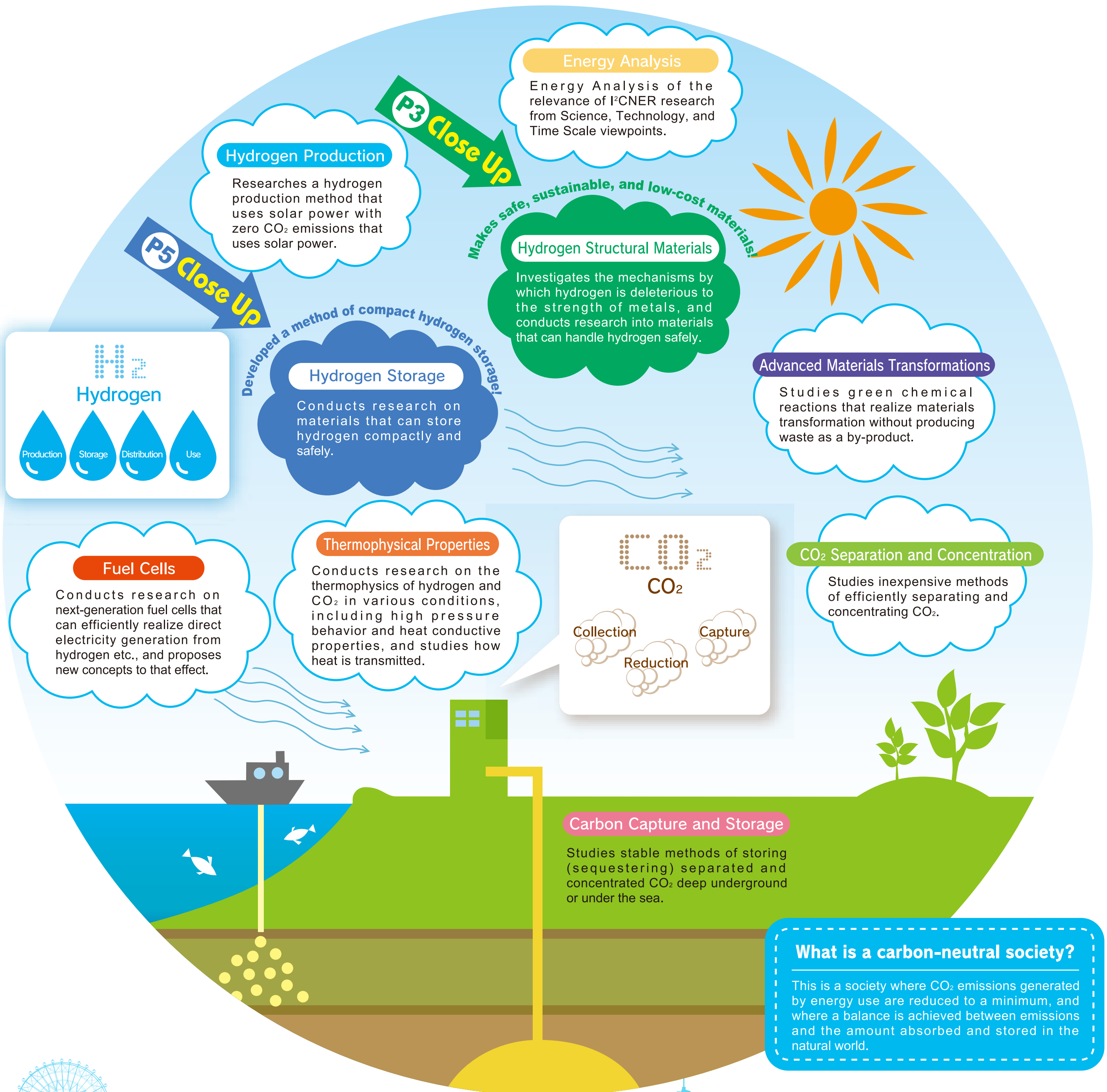


On November 24th 2012, the second All-WPI Research Center Joint Symposium titled "Inspiring Insights into Pioneering Scientific Research" was held at the Tsukuba International Congress Center. Last year, Kyushu University's International Institute for Carbon-Neutral Energy (I²CNER) hosted the first symposium. This year's symposium was organized by the International Center for Materials Nanoarchitectonics (MANA). The program included lectures from five WPI research center presenters who each introduced their center's research. They also expressed hopes and dreams for the young peoples' future. In addition, young participants had a chance to try challenging science quizzes while learning about science in a fun and humorous way. I²CNER's Associate Director, Prof. Tatsumi Ishihara, gave a lecture with the theme of "Dream Artificial Photosynthesis; challenge to the creature." After reporting on the current energy situation of the world, he presented the latest research on the method of extracting hydrogen by water splitting with photocatalysts. The day concluded with an opportunity for the participants to view the booths that each center developed, and for the high school students to personally meet and engage with the WPI speakers and staff.

Introducing the nine research divisions of I²CNER,

who are engaged in cutting edge research to create a green and clean Carbon-Neutral society free of CO_2 emissions.

I²CNER was established to help achieve the realization of a low carbon society. It consists of the following nine research divisions, which deal with space and time scales, and pursue research using a cross-disciplinary approach to solve numerous challenges.



What is a carbon-neutral society?

This is a society where CO_2 emissions generated by energy use are reduced to a minimum, and where a balance is achieved between emissions and the amount absorbed and stored in the natural world.

Interviewers ▶▶▶ Interviewers are students of Fukuoka Prefectual Jonan High School !

I am excited to interview the Professors at the University!!

First year at Fukuoka Prefectual Jonan High School
Mayu TSUHATA
□DREAM:
〈Interested in pharmaceutics〉

Even if it's just one thing, I hope to learn something.

First year at Fukuoka Prefectual Jonan High School
Kazuya KODAMA
□DREAM:
〈Researcher〉

I am interested in the New Energy System.

Second year at Fukuoka Prefectual Jonan High School
Yuki FUKATA
□DREAM:
〈Chemistry teacher〉

I hope it will be helpful for choosing my own path in the future!!

Second year at Fukuoka Prefectual Jonan High School
Kotaro KINOSHITA
□DREAM:
〈Scientist of the Fisheries System〉

Division Introduction

Hydrogen Structural Materials Research Division

Interview 01

Principal Investigator, Prof. **Setsuo Takaki**

International Institute for Carbon-Neutral Energy Research (I²CNER), Kyushu University

Fascinated by steel for more than 30 years

Developing materials which carry hope for the future

One of the best material engineering researchers in the world is supported by cutting-edge equipment and a first-class staff. We visit Professor Takaki's lab and experiment room, where he is working on the development of materials that are resistant to extreme environments.

Section 01 - Barriers to a hydrogen society - Transporting hydrogen is not easy!

Prof. Takaki We are studying materials that are used in hydrogen storage tanks and in the pipes needed for distribution. One familiar example would be a hydrogen vehicle. In order to drive 400 km, we need 315.4 kℓ of hydrogen at 0.1 MPa. A 7×7×7 meter tank would be needed to store it, and this obviously cannot be mounted on a standard automobile.

Tsuhata How about compressing it?

Prof. Takaki Exactly! However, when this is done, the materials need to be lightweight, thin, and resistant to high pressure. It is also essential that they have excellent ductility* to avoid explosions in a collision. Such tough materials have not been developed yet.

Kinoshita What about making the hydrogen liquid?

Prof. Takaki Yes, hydrogen is indeed much more compact in a liquid form than in gas form. But hydrogen liquefies at -253℃, so the materials would need to be resistant to extremely low temperatures.

Section 02 - Guide to problem solving - Old and new steel is a key player for the future

Prof. Takaki So there are two methods, namely compression and liquefaction. In either case, we need to develop new materials to secure safe and economical storage and transportation. The materials we are seeking should have properties that are strong, ductile, non-deteriorating even with long term use, and recyclable. In addition, as the materials will be used for practical goods, they must be something that can be manufactured cheaply. After considering these conditions, we settled on iron and steel.

Tsuhata Are there any other materials except for iron and steel?

Prof. Takaki Although there are lighter and stronger materials, such as titanium, they are expensive to produce. Therefore, steel is the best, as there are abundant resources and it is recyclable. That's the reason why we are surrounded by numerous steel goods.

Section 03 - Research conducted at the present - The enemies in research are low temperature fracturing and hydrogen embrittlement

Prof. Takaki Now, one of the problems in handling steel is low-temperature fracturing*. Steel becomes amazingly fragile at low temperatures. The sinking of the Titanic is believed to have been caused by low-temperature fracturing. The body of the ship floating on a sea of -5℃ was almost as brittle as glass, and it leaked and sank because of a crack made when it struck an iceberg and snapped short.

Such things will not occur to currently used steels, but the more troublesome problem is hydrogen embrittlement*. Hydrogen absorbed in steel decreases the steel's toughness* and causes delayed fractures. We are repeatedly carrying out experiments, accumulating data and making prototypes... we are using trial and error to develop new materials.

Section 04

- Blueprint of the future we are aiming for -

Controlling hydrogen embrittlement will open a new door to space

Prof. Takaki The fabrication of materials that have strong resistance against hydrogen embrittlement and against the extreme environment of absolute zero would be a big step toward realizing a hydrogen society. Such materials would be applicable not only on earth but also in space.

Kodama A space explorer named "Curiosity" is currently on Mars. Will this explorer crack someday?

Prof. Takaki The materials used for space exploration are very expensive and specially made, so it will not crack so easily. But as you know, it is believed that water existed on Mars, and if steel is used in an environment with water, hydrogen embrittlement will occur naturally. In other words, overcoming hydrogen embrittlement of steel materials will open a new door to space exploration!

All That's great!

Prof. Takaki The current level of steel technology in Japan is extremely high, and materials resistant to use at -50℃ are on the market. However, in space, the environment without sunlight is a world colder than -100℃. So we need more research to achieve the safe use of steel in outer space.

Although hydrogen is undoubtedly a dream energy, there are many hurdles to be overcome before we can be assured of its safe use. Our research is currently among the best in the world in the field of iron and steel materials. Although we have the most advanced research equipment available, what we really need for the world's best research is simply good researchers. I expect that you will become excellent researchers who will play a leading role in the future, and support pioneering research.

Message to students

The achievement of a low carbon society will require research not only of materials, but also of various other fields. Unless we solve all of the problems entailed in hydrogen usage, the age of hydrogen will never arrive. In the world of research, one does not have to be well-rounded in every field. Being number one, or the only one in the field of one's choice, is important. I chose the course of material engineering because I was fascinated by steel materials. I hope you will contribute to the world by making the best use of your own specialty. Improve your skill in the field that attracts you, and increase your enjoyment of it.

Glossary

【Ductility】
A property that allows expansion, and which can endure a load. With high ductility, a material expands and deforms even under a heavy load, and does not easily break.

【Fracturing/Embrittlement】
This refers to a state where a metal material becomes fragile due to a decrease in temperature or the absorption of hydrogen.

【Toughness】
The property of material strength. In other words, not easily broken under external pressure.

Laboratory Tour

where state-of the art materials are produced

Experiment room

Students visited the experiment room to observe a demonstration of experiments and to see state-of-the-art equipment. The engaging experiments conducted before their eyes were a source of delight and inspiration.

Experiment Navigator

Daichi Akama

Teaching staff of the Department of Materials Sciences and Engineering of the Faculty of Engineering, Kyushu University

Experiment Scene No.1 Experience low temperature enbrittlement of steel with a dynamic impact experiment

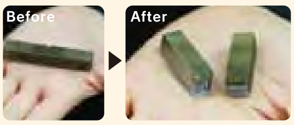
Watching steel snap like ice.

First, the students observed a demonstration of a Charpy impact test. This test measures the strength of materials against an impact. A 30 kg pendulum is dropped down to impact a rectangular test specimen with a notch cut into it, and the energy absorption rate of the test specimen is indicated by the height the pendulum rises to after impact. The mechanism is simple, but the obtained measurements are very accurate. For this experiment, ordinary steel test specimens were used. Steel at room temperature (A) was compared with steel at an extremely low temperature (B). The results are as indicated on the right. The low temperature specimen snapped easily, like ice, at the moment the pendulum struck it. The result elicited a gasp of amazement from the four students.

Charpy impact test

A: Amplitude of steel stored at room temperature
B: Amplitude of steel chilled to -196℃ by liquid nitrogen
After impacting steel A and steel B, the heights the pendulum reached on the follow through swing were compared. Specimen B, with low temperature embrittlement, readily snapped when the pendulum struck, and the pendulum swung twice as high as A after impact.

【Steel B: cut surface】



The cut surface of steel A, which gave a short, dull sound, was characterized by asperity. On the other hand, when steel B (with low temperature embrittlement) snapped, it made a clanging, clear and high-pitched sound, and its cut surface was smooth.

This is an important point!

The test specimen must be completely chilled using liquid nitrogen

A test specimen must be chilled to -196℃ with liquid nitrogen in order to simulate the extreme environment involved in storing low temperature hydrogen. As you can see, the temperature is so low that plants become crisp.

Experiment Scene No.2 Structural analysis with an electron microscope

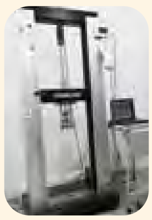
Explore the nano-world!

To reveal the secrets of strength and ductility in materials, nano-level (1/1 billionth of 1m) structural analyses are essential. At Takaki Lab, students can observe minute structures at the atomic level by using a transmission electron microscope. On this visit, the four students had an opportunity to observe how the atoms of iron are arranged.

Experiment Scene No.3 Demonstration of a tensile testing machine

Power of hydrogen Instant measurement of strength and ductility

The most important measurement device for material strength and ductility is a tensile testing machine. The students used a monitor to observe loads gradually being added to a test specimen while strength and stretch were measured.



Division Introduction

Hydrogen Storage Research Division

Interview 02

Assistant Prof. **Huaiyu Shao**

International Institute for Carbon-Neutral Energy Research (I²CNER), Kyushu University

A great future can grow from a desktop

Assistant Professor Shao is a specialist on hydrogen storage, which is a key to renewable energy applications. We will focus on his unique approaches, which he developed in collaboration with researchers in a wide range of fields around the world.

Section 01

- Problems facing modern society -

Is it true that there is not enough energy on earth?

Assist.Prof.Shao Let me ask you a question. Do you think there is enough energy on the earth for human beings to live now?

Kodama I think we have enough now, but it will run out someday.

Assist.Prof.Shao You are talking about the fossil fuels, right? To be sure, approximately 85% of the world's energy consumption relies on fossil fuels, and petroleum sources are projected to face depletion in 40 or 50 years. However, the energy we need already exists on the earth in sufficient quantities. A major example would be a renewable energy such as solar or wind power. We consume roughly 500EJ (exajoules) of energy each year. However, the earth receives 3,850,000EJ from the sun each year. That means the sun supplies about 8,000 times more energy than we need.

All That's great!!

Assist.Prof.Shao Yes, but we cannot make the best use of this abundant energy supply with current technologies. In addition, we are concerned about environmental issues such as air pollution and the emission of greenhouse gases caused by fossil fuels. So, we are pursuing research toward the realization of a hydrogen energy society.

Kinoshita I understand the advantages of hydrogen as clean energy, but I have doubts about its safety. Is it really safe?

Assist.Prof.Shao I am pleased that you have asked such a frank question. There are lots of people who have a negative impression of the safety of hydrogen. However, it is much lighter than air, and it disperses much more quickly—it shoots up in a second and scatters away. Because it is a fuel, we will of course be very careful when handling it, as we are with gasoline or kerosene. In other words, there is little difference between these fuels and hydrogen in terms of safety, and we can say that hydrogen can be used safely in our daily life.

Section 02

- Challenge at present -

Integrated and interdisciplinary research conducted all over the world

Assist.Prof.Shao Let me introduce a hydrogen storage system using renewable energy. Firstly we decompose water into hydrogen and oxygen using the electricity generated from solar and wind power. Of course we can use the electricity generated at this stage, but we can store electricity energy by storing the decomposed hydrogen and using the hydrogen to generate electricity later. We need a technology that can store the electricity in certain means and get the electricity back whenever it is needed in an easy and cheap way. I²CNER is carrying out research on almost all of these parts of this energy route, with researchers from various research divisions, including hydrogen production, hydrogen structural materials, hydrogen storage, thermophysical properties, fuel cells, and evaluation of safety and costs. I have built a model of an energy storage system that even an elementary school student can understand.

Section 03

- Details of Assist. Prof. Shao's research -

Experience hydrogen's power by seeing it and touching it

Assist.Prof.Shao Here is the actual model. (Column in the upper right.) Can someone use his hand to stop the light from striking the solar panel?

Tsuhata Like this?

Assist.Prof.Shao Yes, like that. Look at the monitor. Can

Demonstration System

Model using renewable energy

Assembled by Assistant Prof. Shao, this model converts renewable energy into hydrogen and then stores it. With this model, he proposes a method of energy storage from renewable power.

⑩ Hydrogen storage cylinder

Approximately 60ℓ of hydrogen can be stored in this small cylindrical bottle after absorption. Hydrogen storage is Assistant Prof. Shao's research field.


⑨ Pressure/flow rate control panel

⑧ Buffer tank (4 - 5bar)

⑦ Press pump

⑥ Buffer tank (0.5 - 1bar)

⑤ Gas drying unit

④ Electrolyzer

This decomposes water into hydrogen and oxygen using the electricity obtained from ① and ②

Q.Tsuhata: What do you do with the oxygen obtained?

A.Assist.Prof.Shao: Now, we just release it into the air. We think it is possible to use it in medical or other fields in the future.

⑫ Pressure/flow rate control panel

⑬ Vacuum generator

⑭ Fuel cell system

This generates electricity with hydrogen as fuel.

⑪ Temperature control bath

This system adjusts the temperature to desorb the hydrogen that has been absorbed and stored in a hydrogen storage alloy (an alloy with properties that allow it to absorb and store hydrogen), and to return it to its gaseous state.

Q.Kinoshita: Why are temperature adjustments needed?

A.Assist.Prof.Shao: In this model, it's because heat releases the stored hydrogen.

⑮ Lamp

Lights are in an ordinary house (miniatures), representing consumers of electricity.

② Windmill for wind power generation

This generates electricity by using wind from a fan.

① Solar generation panel

This generates electricity from the sunlight. You can reproduce the conditions of night or a rainy day (when power generation stops) by blocking the lamp light with your hand.

③ Voltage/current/power monitor

This records various data for the electricity obtained from① and ②.

you see that the amount of power generation decreases when the hand makes a shadow? Because the output of a renewable energy such as solar power fluctuates depending on the climate and time of day, maintaining a stable supply is a challenge. By storing the obtained energy as hydrogen and saving it for electricity, we can realize a stable energy supply.

Here is a hydrogen storage device for that purpose. We can store about 60 ℓ of hydrogen in it.

Fukata In such a small bottle! That's amazing!!

Assist.Prof.Shao Storage is made possible by reaction with hydrogen inside special materials.

Section 04

- Blueprint for our future -

Seeking ultimate energy with environmental consideration

Assist.Prof.Shao We are currently developing a method to collect and recycle the waste heat produced when electricity is generated from fuel cells. Currently, people may use waste heat from fuel cells to produce hot water or just release it into the air. In our new concept, we are thinking to use the waste heat for reaction in the hydrogen storage system. It is called cogeneration, and it is an idea that is attracting attention as an integrated energy supply system that will enhance overall energy efficiency. While adding incremental improvements in this way, we are aiming at the realization of a hydrogen society that is independent of fossil fuels. Finally, I repeat what I said earlier—please do not forget that, with correct use, hydrogen can be the ultimate environmentally friendly energy!

Message to students

Whatever you do in the future, respect yourself and others and have an open mind and a loving heart. An open mind helps you deepen your understanding of people of different countries, cultures and values. A loving heart can help you always get strength. These are very important in this increasingly globalized world, and it may expand the range of possibilities before you.

Students' impressions

After the interviews of Prof.Takaki and Assistant Prof.Shao –After the Interview–

First year at Fukuoka Jonan High School

Mayu Tsuhata

I was repeatedly awed by the academic power of the university.

I was totally awed by the knowledge of the professors and the wonderful facility at the university. They were kind enough to teach us many things, and I hope I can make good use of this opportunity in my future.

First year at Fukuoka Jonan High School

Kazuya Kodama

University level research isn't so incomprehensible after all.

At first, I was worried about being able to understand difficult research conducted at the university. But many of the contents of the interviews were related to what I already knew, and were easy to understand.

Second year at Fukuoka Jonan High School

Yuki Fukata

I was thrilled by the experiments.

I was very impressed to get such a close look at these sophisticated machines, and to experience spectacular experiments (like nothing we can do in high school classes), which was such a valuable experience. I will keep thinking about the energy issue in my own way.

Second year at Fukuoka Jonan High School

Kotaro Kinoshita

This will be most useful for my future research.

The energy issue has a deep connection with the fishery field, which I would like to pursue in the future, so it was very fruitful. I got to hear several interesting topics explained and I had a meaningful experience. Thank you very much for the easy-to-follow explanations.

Welcome to I²CNER

Introduction of New Researchers

Ikuo Taniguchi

Associate Professor : CO_2 Separation and Concentration

I am engaged in research on the polymer material science based on macromolecule composition and the CO_2 separation membrane for the purpose of an efficient separation and capture of CO_2, which causes global warming. In addition, I have carried out the study of materials, such as biodegradable materials which are moldable at room temperature, and environmental issues involved in the research. In my free time, I am devoted to cart racing or the Rover mini race. I also like traveling and skiing. Since there are a lot of hot springs in Kyushu, I would also like to visit them. I am enjoying the delicious food in Fukuoka! I hope to enjoy life in here.

Kim Chung Sik

Post-doctoral Research Associate : Advanced Materials Transformations

My research goal at I²CNER is to develop 'Green' chemical reactions for materials transformations and to synthesize 'Nobel' catalyst for challenging reactions. Specifically, my daily research is focused on how to synthesize diverse asymmetric aziridines, biologically and pharmaceutically important intermediates, and produce less byproduct. When I have free time, I usually spend it watching movies and reading books. My hobby is to play soccer and dodge ball with my two sons. On weekends, I try to visit famous places such as shrines, temples, and museums near Fukuoka city in order to get a chance to learn Japanese culture and history.

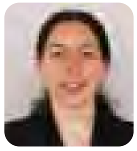
Limin Guo

Post-doctoral Research Associate : Hydrogen Production

After two years of post-doctoral research at Tohoku University, I joined the Hydrogen Production Division of I²CNER. The aim of my research in I²CNER is to synthesize new highly active photocatalysts, which can efficiently promote the conversion of solar energy into the chemical energy of H_2 by overall water splitting. H_2 as an energy carrier is sustainable and environmental friendly. If H_2 could be finally and commonly used as energy resource, it would greatly benefit society and the planet. I am very happy to carry out this research in I²CNER, and look forward to achieving some meaningful research results. In Japan, I like one hundred yen shops and really enjoy hot springs. In my spare time, my two and a half year old son always wrestles with me.

Nicola Perry

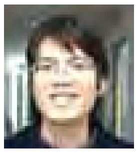
Post-doctoral Research Associate : Fuel Cells



I research ceramics that conduct electricity and are used in clean energy conversion devices like fuel cells and solar cells. At I²CNER, I work on developing new materials that will make solid oxide fuel cells cheaper, more efficient, and potentially useable in portable devices. Before moving to the Fukuoka area in September, I worked as a postdoctoral fellow near Chicago, in the US. In Fukuoka I really appreciate the great variety of things to see and do, from the natural scenery to the bustling urban areas. One of my favorite places to visit is Ohori Park, but I am sure that as I live here longer I will find other sites to enjoy too. In my spare time I enjoy exercise, music (I occasionally play piano), and talking with friends and family.

Wei Ma

Post-doctoral Research Associate : Hydrogen Production



After getting my PhD and a subsequent one year post-doctoral working experience at Kyushu University, it is a great pleasure for me to join I²CNER. The aim of my new research will focus on developing a highly-efficient system for hydrogen production through water splitting by using photocatalysts and sunlight. I hope to have a good beginning in my new position and will do as much as I can for a successful year.I have studied in Japan for more than four years, and I enjoy everyday here. Fukuoka is a nice place to live in with beautiful sea, mountains, and a pleasant climate. In my free time, I like to travel by train, bicycle, and on foot, to record beautiful things in photographs and my memory.

AWARDS

Prof. Tatsumi Ishihara
I²CNER Hydrogen Production Division, Lead Principal Investigator

Prof. John A. Kilner
I²CNER Hydrogen Production Division, Principal Investigator (Imperial College London, UK)

Prof. Harry L. Tuller
I²CNER Fuel Cells Division,
Principal Investigator (Massachusetts Institute of Technology, USA)

◇ **Won the 2012 Somiya Award** ◇

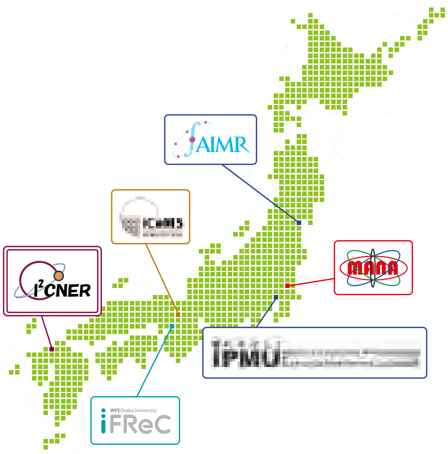
Prof. Setsuo Takaki
I²CNER Hydrogen Structural Materials Division, Principal Investigator

◇ **Won the 10th industrial education prize** ◇

What is WPI?

wpi World Premier International Research Center Initiative

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 which maintain high research standards, and will attract leading researchers from all over the world.



Kyushu University
International Institute for Carbon-Neutral Energy Research (I²CNER)

Toward the realization of a low-carbon society, I²CNER aims to resolve the challenges of the use of hydrogen energy and CO_2 capture and sequestration by fusing together sciences from an 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

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.

Osaka University
Immunology Frontier Research Center (IFReC)

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

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.

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.

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.

Editors' Postscript

- I²CNER holds a variety of events.
  For details, please see: ➡ http://i2cner.kyushu-u.ac.jp/en/results/seminar.php (I²CNER Event Information)
  I2CNER Search
- At this time we would like to announce the simultaneous publishing of our new "Energy Outlook" newsletter along with "Hello! I²CNER", not only within Japan, but throughout the world. There were many difficulties encountered along the way, but that is precisely why we are so pleased to bring you this finished product. We eagerly await your comments and opinions.

Hello! I²CNER vol.6 February 2013

[Published by] International Institute for Carbon-Neutral Energy Research (I²CNER)
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