CEIDS
大阪大学 OSAKA UNIVERSITY

CENTER FOR ENVIRONMENTAL INNOVATION DESIGN FOR SUSTAINABILITY, OSAKA UNIVERSITY

Newsletter

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No. 5

Osaka University Center for Environmental Innovation Design for Sustainability (CEIDS) Newsletter No. 5 reports on a symposium CEIDS held jointly with Suita City. This issue also introduces research presentations given at an international conference. Finally, among other topics, we introduce new open courses for working people, begun in the autumn of 2013. Osaka University is pursuing a variety of initiatives to further advance its original "meso-level" education and research, about which this newsletter will continue to cover, to bring this information to a wide audience.

1. Osaka University CEIDS/Suita City Joint Symposium

On Tuesday, November 12, 2013, Suita City and Osaka University CEIDS co-hosted a public symposium entitled "The Frontiers of Innovative Research in a Creative Technological Society: What Cooperative Community Research at CEIDS Aims at", at the Suita Campus Convention Center. More than 100 individuals participated, including university, local government, and business personnel, as well as ordinary citizens.

CEIDS works to strategically tie promising scientific and technological seeds to social visions, such as achieving a society that is low-carbon, recycling-based, and safe and secure. We pursue what we call "meso-level research", by which we mean practical research intended to promote environmental innovation. Regional partnerships and university–society collaboration are critical to further developing this new academic discipline originating at Osaka University They are also the key to promoting social practices to make society sustainable. With this understanding, CEIDS has proactively pursued regional partnerships. Part of the objective of the symposium was to give an overview of research, especially research that CEIDS has conducted with Suita City as its field, and to make the findings known to a wider audience. In addition, it

Participants at the symposium

1. Osaka University CEIDS/Suita City Joint Symposium (2)

Greeting by Hisanori Yamanaka, Vice Mayor of Suita City

Keynote speech by Yuji Sakakibara, Director, National Institute of Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science and Technology (MEXT)

sought to promote discussion and exchanges of opinion on how academic research and government policy should interact with each other, as this is a concern of increasing importance. (For detail about meso-level research, read page two of CEIDS leaflet at: http://www.ceids.osaka-u.ac.jp/english/img/CEIDS_leaflet_New.pdf).

Suita City Vice Mayor Hisanori Yamanaka and CEIDS Director Tomoyuki Kakeshita gave the opening addresses. Afterward, Yuji Sakakibara, Director General, National Institute of Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science and Technology (MEXT), gave the keynote speech entitled "Direction of Science and Technology Policies". He gave specific examples of the government's general strategy for science and technology innovation and the role that universities play in innovation. After the keynote speech, CEIDS and partnering faculty presented topics related to their research initiatives. In Lecture 1, CEIDS Associate Professor Keishiro Hara gave a talk entitled "What Is Meso-level Research That CEIDS Aims at?" In it, he introduced the approach and methodology of Meso-level research and gave specific examples of it. Lecture 2 featured Graduate School of Engineering Associate Professor Yutaka Nomaguchi and CEIDS Assistant Professor Yusuke Kishita giving a talk on "Scenario for Popularizing the Idea of Recyclable Energy in Suita City and Its Simulation." Here, the speakers reported on a questionnaire-based survey that they had taken to gauge the general population's awareness of implementing solar (PV) energy. They also presented results of their simulation on the future spread of PV energy in communities in Suita City. Graduate School of Engineering Associate Professor Satoshi Soda gave Lecture 3, entitled "Constructing Resource-Recovery Sewage Plants". He presented a specific methodology and technical response to constructing sewage systems that produce energy and recover resources. Graduate School of Engineering Professor Yoshiyuki Shimoda gave Lecture 4, "Research in and Implementation of Energy Efficiency at Osaka University". The detailed report covered an electric power visualization system on the Osaka University campus and policies and practices for concretely evaluating campus energy consumption and becoming more energy efficient. In Lecture 5, CEIDS Associate Professor Michinori Uwasu spoke on "Conceiving a Vision for the Future with an Eye to the Next Seven Generations". He addressed the need to build social systems that give future generations some influence in today's society, with the goal of building a sustainable society. He furthermore discussed a research approach and methodology aiming to build such social systems.

Following the lectures, a panel discussion took on the topic of "The Intersection of Scholarship and Policies: Research Frontier Based on Cooperation between Universities and Local Governments". The three panelists were Norio Hazama (Manager of the

Members of the discussion panel

Suita City Environment Department), Tatsuyoshi Saijo (Osaka University CEIDS Specially Appointed Professor, Professor of Kochi University of Technology), and Eko Yagi (Osaka University Center for Study of Communication-Design Associate Professor). Each panelist started by posing a problem and giving a presentation, then together they discussed the problems overall. The discussion was wide-ranging and particularly addressed forms of cooperation between various stakeholders seeking to build a sustainable society, social mechanisms that would include future generations in decision-making, and the role of universities and local governments in building such social systems. Finally, the symposium ended with a closing address by CEIDS Deputy Director Shinsuke Yamanaka, who expressed his desire to further expand collaboration and exchange with Suita City.

The symposium gave its participants the chance to think deeply about the best types of university–society and university-local government collaboration to advance interdisciplinary and practical environmental innovation research. CEIDS will continue to follow social issues and needs closely while emphasizing dialogue and cooperation with a variety of stakeholders as we conduct the distinctive research that Osaka University has originated.

(Keishiro Hara, Associate Professor, CEIDS)

2. "Environmental Innovation and Technologies for Sustainability" Working Group Meeting at Academic Exchange Seminar with Shanghai Jiao Tong University

The 16th Osaka University – Shanghai Jiao Tong University Academic Exchange Seminar took place on October 22-24, 2013 at Osaka University. The seminar series has taken place continuously, with the two universities taking turns as host, in accordance with an academic exchange agreement between the two institutions. Since it began in 1995 as an academic exchange event in the field of welding materials engineering, it has grown gradually to include more fields. Currently, the seminar is open school-wide, promoting exchange in a wide variety of fields, both the sciences and the humanities. This fiscal year, working groups formed to focus on the fields of materials, physics, global architecture, history, environmental innovation, and information. On October 23 on the Suita Campus, CEIDS held "Environmental Innovation and Technologies for Sustainability" as a meeting of the Environmental Innovation Working Group.

As the program shows, a total of nine persons from the two universities gave lectures at the working group meeting hosted by CEIDS. Moreover, about 40 people in total participated in the meeting of the working group throughout the day. Professor Zhang of Shanghai Jiao Tong University spoke primarily of case studies of recycling organic waste from the restaurant business. Food waste is a particularly important issue for China's food culture in terms of sustainability. Professor Wang discussed findings from her many years of research on mercury and introduced her current efforts. Initiatives against mercury, such as the Minamata Convention on Mercury, are bound to grow increasingly important. Associate Professor Zhao spoke about the Chinese government's effort against the nation's serious air pollution. Since last winter, Japan too has grown very interested in China's PM2.5 pollution. Reducing the air pollution emerging in China is essential for improving the atmospheric environment throughout East Asia. Lectures from the Osaka University side also

2. "Environmental Innovation and Technologies for Sustainability" Working Group Meeting atAcademic Exchange Seminar with Shanghai Jiao Tong University (2)

addressed a wide array of topics: the use of microbes to efficiently recover rare metals from wastewater; the use of plant functions to remove endocrine-disrupting chemicals; the use of a numerical model to evaluate the behavior of lead in the environment; the application of superconducting magnetic separation to treat wastewater and recover resources; the relationship between social needs and visions and the advancement of policy measures and technologies to environmental problems; and the relationship between policy instruments and society, the economy, and technology in regard to environmental problems. All together, these made up a very interdisciplinary working group meeting.

Shanghai Jiao Tong University will host the next academic exchange seminar in Shanghai. Various environmental pollution problems are emerging in China, and these will definitely affect Japan. It is easy to say that Japan has overcome serious pollution problems and so we can just use the same solutions in China. In reality, the obstacles to solving the problems are not just technical issues but other ones, such asdifference in social structures. Solutions are going to take sustained long-term efforts. We will make efforts to pursue international collaborative research in the field of environmental innovation through this academic exchange seminar, to build a foundation for international cooperation between China and Japan and to achieve social sustainability in both countries.

(Hikari Shimadera, Assistant Professor, CEIDS)

Table 1: Environmental innovation working group Program

9:00	Opening Address (Assoc. Prof. Keishiro Hara, CEIDS)
9:10–9:40	**Lecture 1: Rare Metal Recovery from Wastewater Using Microbes** (Prof. Michihiko Ike, Graduate School of Engineering)
9:40–10:10	**Lecture 2: Current Situation of Food Waste Being Utilized as Resources in China** (Prof. Zhang Zhenjia, School of Environmental Science and Engineering, Shanghai Jiao Tong University)
10:10–10:40	**Lecture 3: Elucidation of Mechanism to Degrade Endocrine-Disrupting Chemicals by Portulaca oleracea cv.** (Asst. Prof. Kazuo Harada, Graduate School of Pharmaceutical Sciences)
10:50–11:20	**Lecture 4: Introduction on Mercury Research in Shanghai Jiao Tong University** (Prof. Wang Wenhua, School of Environmental Science and Engineering, Shanghai Jiao Tong University)
11:20–11:50	**Lecture 5: Modeling the Environmental Fate of Lead in Lake Biwa-Yodo River basin of Japan** (Asst. Prof. Hikari Shimadera, CEIDS)
12:00–13:00	Lunch
13:30–14:00	**Lecture 6: Application of Superconducting Magnetic Force Control Technologies for Recycling** (Asst. Prof. Fumihito Mishima, Graduate School of Engineering)
14:00–14:30	**Lecture 7: The New Air Pollution Prevention and Control Plan in China – the Announcement and Future Compliance** (Assoc. Prof. Zhao Huiyu, KoGuan Law School, Shanghai Jiao Tong University)
14:30–15:00	**Lecture 8: How Pollution Abatement Technologies Evolved in Japan – Case Studies of Water Purification and Solid Waste Treatment Technologies** (Assoc. Prof. Keishiro Hara, CEIDS)
15:30–16:00	**Lecture 9: Policy Instruments for Environmental Pollution: Social, Economic, and Technological Implications** (Assoc. Prof. Michinori Uwasu, CEIDS)
16:00	Closing Address (Prof. Shuji Kurimoto, CEIDS)

At a seminar lecture

Lively discussions with Professors from Shanghai Jiao Tong University

3. Report on EcoDesign 2013 International Conference in Jeju Island, South Korea

Opening ceremony

The 8th International Symposium on Environmentally Conscious Design and Inverse Manufacturing (EcoDesign 2013) took place on December 4-6, 2013 at Shineville Luxury Resort in Jeju Island, South Korea. EcoDesign conferences are held every two years. The 8th conference was the first in South Korea, whereas the previous series of conferences have taken place only in Japan; from the first in Tokyo in 1999 to the seventh in Kyoto in 2011. The organizing committee announced that more than 300 individuals from 20 nations attended the conference, making up a very diverse crowd. A large share of the participants came from South Korea, Japan, Taiwan, and other East Asian locations for geographic reasons, but there were also many participants from European countries, such as Germany, the Netherlands, Sweden, and Austria, as well as from the US.

The conference featured four keynote speeches, 122 oral presentations during the parallel sessions, and 45 poster presentations. The parallel sessions included 10 presentations of research findings with CEIDS staff as speakers. Their participation greatly helped to spread the word about CEIDS research findings to the world and to exchange ideas and knowledge with researchers from various countries.

Following is a brief overview of the keynote speeches. In the first speech, Dr. Ferdinand Quella of Siemens (Germany) gave a presentation entitled “New Perspectives for EcoDesign.” Using the rare earth elements contained in flat-panel televisions as an example, he discussed product design strategies for lowering environmental burden. Regarding the second speech, since the original speaker was unable to attend because of a canceled flight, five persons were invited to an improvised panel discussion. Among the panelists, CEIDS Professor Yasushi Umeda (Professor in Department of Precision Engineering, Graduate School of Engineering, The University of Tokyo, and at the time of the symposium, Professor in Graduate School of Engineering, Osaka University) and CEIDS Visiting Professor Hideki Kobayashi (Director of the Environmental Technology Laboratory of the Corporate Research & Development Center, Toshiba Corporation) took the rostrum and introduced EcoDesign initiatives by Japanese manufacturing industries. Mr. Shingo Komatsu, President of Shin-Etsu Denso Co., Ltd., gave the third speech on an overview of a business that remanufactures automobile alternators and starters. He Discussed the remanufacturing work process in his factory by showing video clips so that the audience can easily understand the remanufacturing business. Particularly impressive was his point that work processes using skilled workers are more efficient than poorly automated processes. In the fourth speech, titled “EcoDesign of Electronics Industry in Korea,” Mr. Ki-Jung Kim of the Korea Electronics Association introduced guidelines for designing electric and electronic products from the viewpoint of recyclability.


Listening to an oral presentation at an parallel session

3. Report on EcoDesign 2013 International Conference in Jeju Island, South Korea (2)

- A : Sustainable Consumption
- B : EcoDesign Policy and Regulations
- C : Social Perspectives in EcoDesign
- D : EcoDesign of Products and Life Cycles
- E : Business Innovation
- F : Energy Management and New Energy Technologies
- G : Rare Metal Issue & 3R Technologies
- H : Asian Collaboration EcoDesign, Resilient Design, Biodiversity, Corporate Environmental Management, Eco-products in Korea
- I : Sustainable Manufacturing
- J : Life Cycle Assessment (LCA)
- K : Economics of EcoDesign
- L : Water Issues
- M : Sustainable Social Infrastructure Systems
- N : Combined Heat & Power System and Exergy Design
- O : Global Issues in EcoDesign
- P : Others
- Q : Uni-materials

While all the parallel sessions addressed EcoDesign, they covered a wide range of research topics as described above(A-Q). Among them are not only EcoDesign of products and product lifecycles, but also design that relates to social systems, lifestyles, energy systems, business, and more. It is well known that achieving sustainability of our society will require knowledge and experience from a wide range of specialties. In accordance with this, the scope of the EcoDesign 2013 conference has become more diverse than ever. This is in line with CEIDS's Meso-level research, which is to say, research that seeks to tie corporations' and universities' individual technological seeds with future visions for society, and which also seeks to design the "Meso-level" that exists between the two. Many participants took a great interest in CEIDS research and findings as presented by our staff. This helped build a network of researchers that will support international research collaboration in future. By participating in EcoDesign 2013, CEIDS staff members reconfirmed the significance of Meso-level research and became aware of the need to further develop it.

At the Closing Ceremony on the final day, Dr. Keijiro Masui of the National Institute of Advanced Industrial Science and Technology (AIST) announced that the EcoDesign 2015 conference is to be held back in Japan in 2015. CEIDS looks forward to taking our Meso-level research up a level in the meantime and presenting even greater findings at the next conference.

(Yusuke Kishita, Assistant Professor, CEIDS)

Korean dance at the social gathering


Participants enjoying pleasant talk at the social gathering

4. New Course "Practice of Environmental Innovation Design" Uses Suita City as Its Field

In the second half of the current fiscal year (2013), CEIDS started the new course "Practice of Environmental Innovation Design" as part of the Osaka University Graduate Program for Advanced Interdisciplinary Studies "Environmental Innovation Design Studies." The problem-based learning (PBL) class uses Suita City as its field. Students in the course do fieldwork in specific locations and environments (Suita City or the Osaka University Campus) and interact with other students in various fields, as well as with stakeholders. The aim of so doing is to develop in students the ability to integrate and practice design technologies (i.e., environmental innovation design skills) so that they can formulate visions and discover problems in the real world and the regional community. "Sustainable town planning" and "community" are particular themes of the course, which is given with help from the Suita City government. This year, the course drew participation from eight students from multiple departments, even though it was just the first year.

Students divided into two teams to do group training according to their own interests. Team A took on the theme "Small home appliance recycling in Suita City," while Team B addressed "Redeveloping an international exposition site." Team A conducted interviews with the Global Environmental Policy Section of the Environment Policy Bureau of Kyoto City (the city has been continuously engaged in and a pioneer in recovering small home appliances, starting when it ran a model project prior to the enforcement of the Home Appliance Recycling Law, and continuing to the present day). The team also conducted stakeholder analysis. Of all their results, they focused on "recovery methods" in particular and put together a suggestion for applying the same type of project in Suita City. Team B conducted surveys with some major stakeholders in redevelopment: Suita City, Mitsui Fudosan Co., Ltd., the Gamba Osaka Co., Ltd., and officials from monorail and bus mass transit systems. By so doing, the students learned about these stakeholders' redevelopment plans in detail and studied the problems expected to arise over them. Out of all the impacts these stakeholders would face as a result of redevelopment, the students chose to focus on the traffic problem so that they could offer suggestions from their perspective. On the final day of the eight classes, they presented their final outcomes to an audience that included Fumio Akasaka and Naoki Kusumoto (director and general manager of the Suita City Environmental Policy Office, respectively), Tomomi Honma (of the Gamba Osaka business office), and coordinating teachers from CEIDS. The question-and-answer session gave everyone a chance to check the facts from industry, government, and academic perspectives. The guests gave their appraisal of the feasibility of the students' proposal, also pointing out some problems with it. The students learned by practice that in order to solve problems in the real world and the regional community, they have to do more than analyze problems and use the problem-solving techniques that students ordinarily use in their research. Rather, they must also partner with the stakeholders and take an economic perspective. In addition, Mr. Kusumoto from the Suita City and Ms Honma from Gamba Osaka expressed their appreciation for the findings from the students' training and said that they looked forward to hearing more from this course.

The course this year featured group work, with students from graduate courses in engineering and human science working together. By working with students from different fields, and bringing the best from their own

Discussion focuses on a diagram showing how the issues relate to stakeholders

4. New Course "Practice of Environmental Innovation Design" Uses Suita City as Its Field (2)

individual fields (e.g., their analysis techniques and ways of assembling issues), the students brought the discussion to a deeper level. Courses offered by CEIDS emphasize assembling people with different backgrounds and letting them discuss the issues together as a way to acquire wide-ranging knowledge, join the variety of knowledge, and use it to solve problems. The leaders hope the course will continue to attract students from different fields and trigger innovation next fiscal year and beyond.

(Yukari Fuchigami, Project Researcher, CEIDS)

Presentation of final outcomes

5. Open Courses "Society and Energy" and "Local Revitalization for Creating Regional Innovation" Begin

CEIDS has begun two new open courses at the Co-creative Design Laboratory for Sustainability, a facility that opened in the Grand Front Osaka KNOWLEDGE CAPITAL in May 2013. The courses are "Society and Energy" (running November 8, 2013 through February 28, 2014) and "Local Revitalization for Creating Regional Innovation" (November 6, 2013 through January 22, 2014).

"Society and Energy" puts the spotlight on resource and energy problems. Osaka University researchers from a range of fields present leading-edge research and case studies on the efficient use of fossil fuels and building a society not dependent on them. Participants and researchers then get the chance to trade views on the topic. (See Table 1 for program details.) Course lectures have included the following topics: potential for converting wastewater treatment facilities so that they are energy self-sufficient or producers of energy; the latest measures and technologies for creating an energy revolution in urban areas with concentrated energy demand; measures and technologies at the source against air pollution created by the use of fossil fuels; measures against transfrontier pollutants PM 2.5 and ozone; and the role of materials in enhancing energy efficiency in energy generation, storage, carrying, and usage processes. Each of these topics provokes a lively exchange of views. Lectures planned going forward include one by Professor Saijo of Kochi University of Technology, who will speak on the relative merits and demerits of current emissions trading systems and the feasibility of intergenerational energy emissions trading. Professor Umeda of the University of Tokyo will discuss how to design scenarios as a tool for debating preferred social visions and energy systems for the future. Professor Tokai of the Osaka University Graduate School of Engineering will talk about urban metabolic systems, which consist of the flow and stock of resources, energy, products, and waste, from a risk management point of view, and ways to make such systems self-sufficient.

The course "Local Revitalization for Creating Regional Innovation" was led by both Osaka University researchers and guest lecturers who are active on the front lines of enterprise and government. These speakers introduced their own points of view on urban and regional business management, research, education, and more, and gave an overview of the latest initiatives. (See Table 2 for program details.) Guest lecturers

5. Open Courses "Society and Energy" and "Local Revitalization for Creating Regional Innovation" Begin (2)

from private enterprise and nonprofit organizations used case studies to introduce features and issues of real estate businesses, community businesses, and social businesses that have mechanisms for creating community. From the government sector, the course invited the vice mayor of Ikoma City to discuss the state of government–private sector partnerships for local revitalization in that city. The second half of the program took as its theme Grand Front Osaka, which opened last year. Representatives from government (Osaka City) and the Grand Front Osaka development and management group spoke about the position of the Umekita district and initiatives taking place at Grand Front Osaka. Osaka University faculty presented topics from their own research and projects, offering the university's research and educational point of view. Workshop time has been set aside in the final session, so that participants can trade views with each other on local revitalization policies and initiatives taken in the heart of urban Osaka.

Each program had enough applicants to fill the designated number of spots, and participation was strong despite the weekday time slot. The programs are still ongoing, but our hope is that the courses will prove useful to participants' future endeavors. CEIDS will continue to hold workshops, lectures, and more at Co-creative Design Laboratory for Sustainability. Information is available through our mailing list, website, and other means. We hope that you will take an active part in future.

(Hiroyuki Takeda, Assistant Professor, CEIDS)

Participants taking in a lecture

Table 1: Program A: Society and Energy
(Note: All lectures were given in Japanese)

1	Nov. 8 (Fri.) 18:30-20:00	**"Wastewater Treatment Systems in a Low-Carbon Age: Can Wastewater Treatment Plants be Energy-Self-Sufficient?"** Prof. Michihiko Ike, Osaka University Graduate School of Engineering
2	Nov. 22 (Fri.) 18:30-20:00	**"Future Cities and Energy"** Prof. Yoshiyuki Shimoda, Osaka University Graduate School of Engineering
3	Dec. 20 (Fri.) 18:30-20:00	**"Energy and Air Pollution"** Prof. Akira Kondo, Osaka University Graduate School of Engineering
4	Jan. 10 (Fri.) 18:30-20:00	**"Energy and Materials"** Prof. Shinsuke Yamanaka, Osaka University Graduate School of Engineering
5	Jan. 24 (Fri.) 18:30-20:00	**"How Can We Overcome Human Myopia? The Light and Shadow of Emissions Trading"** Prof. Tatsuyoshi Saijo, Kochi University of Technology School of Management (Specially Appointed Professor Professor at CEIDS)
6	Feb. 14 (Fri.) 18:30-20:00	**"Scenarios for Social Sustainability"** Prof. Yasushi Umeda, The University of Tokyo School of Engineering (Professor at CEIDS)
7	Feb. 28 (Fri.) 18:30-20:00	**"Thinking about Environmental and Energy Problems from a Risk Management Perspective"** Prof. Akihiro Tokai, Osaka University Graduate School of Engineering

Table 2: Program B: Local Revitalization for Creating Regional Innovation
(Note: All lectures weregiven in Japanese)

1	Nov. 6 (Wed.) 18:30-20:30	**"Past, Present, and Future of Urban and Regional Management"** Prof. Masanori Sawaki, Osaka University Graduate School of Engineering
2	Nov. 20 (Wed.) 18:30-20:30	**"Creating Future Visions through Industry-Academic-Government Partnerships"** Assoc. Prof. Nobuhiko Matsumura, Osaka University Graduate School of Engineering; Vice Mayor Masashi Komurasaki, Ikoma City
3	Nov. 27 (Wed.) 18:30-20:30	**"From Extraction of Regional Issues to Community Development Applications"** Asst. Prof. Hiroyuki Takeda, CEIDS; Mr. Naoyuki Aoki, COPLUS Co., Ltd.
4	Dec. 4 (Wed.) 18:30-20:30	**"Regional Management and Social Businesses"** Prof. Atsuko Kaga, Osaka University Graduate School of Engineering; Mr. Ei Nagasawa, Community Business Support Center (a non-profit organization)
5	Dec. 18 (Wed.) 18:30-20:30	**"Revitalizing the Heart of Urban Osaka and Grand Front Osaka"** Mr. Norio Uemizo, Osaka City Urban Planning Bureau; Mr. Yuji Takahashi, Osaka City Urban Planning Bureau
6	Jan. 15 (Wed.) 18:30-20:30	**"Local Revitalization and Area Management through Grand Front Osaka"** Mr. Shuichi Yamaguchi, Mitsubishi Estate Co., Ltd.; Mr. Hiroyuki Uematsu, Grand Front Osaka TMO General Inc. Association
7	Jan. 22 (Wed.) 18:30-20:30	**"Revitalization Policies for the Umeda District and a Vision for Umekita' s Future (workshop)"**

6. International Symposium on "Interfacial Joining and Surface Technology" (IJST 2013)

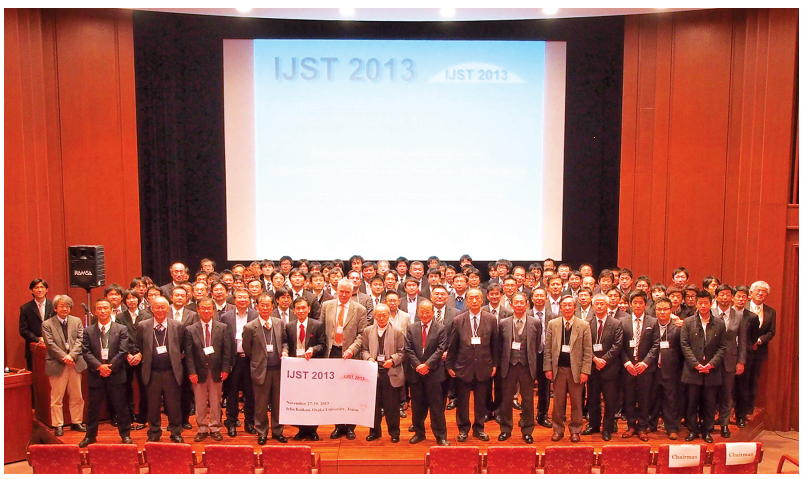
CEIDS engages in leading-edge basic research and technological innovation in a wide range of green technologies, environmental management, and environmentally conscious materials processing. Moreover, we pursue initiatives to fuse these into meso-technologies useful to society. CEIDS also conducts education and research activities that put this experience to use in university education. In addition, through partnerships with a large number of public agencies from Japan and abroad, we aim to contribute to society through outreach initiatives. This symposium, co-hosted by CEIDS, likewise is consistent with the center's slogan.

The event took place November 27 through 29 on the third floor of Osaka University's Icho Kaikan. CEIDS's co-hosts for this symposium were the Osaka University Joining and Welding Research Institute (JWRI), the Japan Welding Society Interfacial Joining Research Committee, the Japan Welding Engineering Society, and the Smart Processing Society for Materials, Environment & Energy. Participants numbered 138, with 26 from outside Japan. The program included 56 oral presentations and 36 poster presentations. There were a large number (42) of young people and graduate students, whose lively participation in discussions was impressive. As its name indicates, the symposium concerned surface and interface processing and joining technology and environmentally conscious materials processing techniques, but all types of environmentally conscious technologies were presented.

To describe the purpose of the event simply, interfacial joining is a general term for technologies that join two surfaces in ways that avoid as much as possible melting the parent materials. Interfacial joining has some outstanding characteristics not shared by the better-known fusion welding. For example, it allows materials to be joined even at low temperatures, so it is widely used as an environmentally conscious joining technology. Surface technologies such as thermal spraying, plating, and coating are also essential environmental technologies. The recent international symposium was planned in part to nurture young researchers in this field. Hosting this event is also significant for advancing "environmentally conscious joining technology innovation," a field of collaborative research between CEIDS and Osaka University's JWRI.

Every presentation concerned surface and interface processes and technologies, but the content of papers presented on environmentally conscious processes can be broadly divided into the following five categories.

(1)Low-temperature joining (brazing and soldering), solid-state joining (HIP; hot isostatic pressing, ultrasonic bonding, friction stir welding, etc.), and energy-conservation processes.
(2)Power electronics and electronics packaging (enhancement of power control and energy efficiency)
(3)Environmentally conscious processes (green technologies, surface treatment technologies, smart processes, catalysts, reversible joining, etc.)
(4)Thermal analysis, thermal management, reliability inspection (enhancement of thermal efficiency, energy conservation, proof stress, and product life), measuring technologies
(5)Application of technologies with lower environmental burden, e.g., harmful-substance-free joining



Group photo (Osaka University Icho Kaikan, November 28, Thur.)

Brazing as in (1) is used to join heat exchangers, so it is strongly concerned with the heat problems of (4). When the parts that one is trying to join have large surface areas, joining technologies that use a heat source such as a laser or arc are not practical. Interfacial joining is used to join panels with large surface areas. Ultrasonic bonding uses ultrasonic and mechanical energy instead of thermal energy. As such, this technology can join materials such as aluminum wire at ordinary temperatures. Friction stir welding uses a drill-like tool to cause solid friction and stirring of pieces in order to join them. It is fair to say that this technology is a very recent innovation in the field of joining. Recently, it has become possible to join several meters of material per minute, depending on the material. This technology is also used for surface modification. The recent symposium features many presentations of friction welding research. The power electronics packaging noted in (2) is used to manufacture drive control devices for electric vehicles. In other words, it is related to (5), since it is used to manufacture environmentally conscious products. Thus, some presentation content belonged to multiple categories. However, the impression created by the presentations, when considered from the environmental innovation point of view, is that there really are no technologies that can be developed to the meso-level without taking the environment into account. There were also presentations on the spraying of powders and particles of metal, ceramics, and the like onto a substrate. Until now, "thermal spraying" was a general term for technologies that use plasma or gas heat to melt a substance. More recently, a technology called "cold spraying" has been developed that sprays and applies substances at room temperatures. There was also a presentation about this. When anatase (TiO2) is sprayed onto plastic tiles and then irradiated with ultraviolet light, bacteria and harmful substances are decomposed. This is a so-called photocatalytic reaction. Spraying is a surface treatment technology, but if used well, it can also be an environmental technology.

The impression that the symposium gave was that technology can be combined into meso-technologies. The photo in this article was taken on the second day of the symposium and shows all the participants. With the strong participation, the symposium was both meaningful and successful.

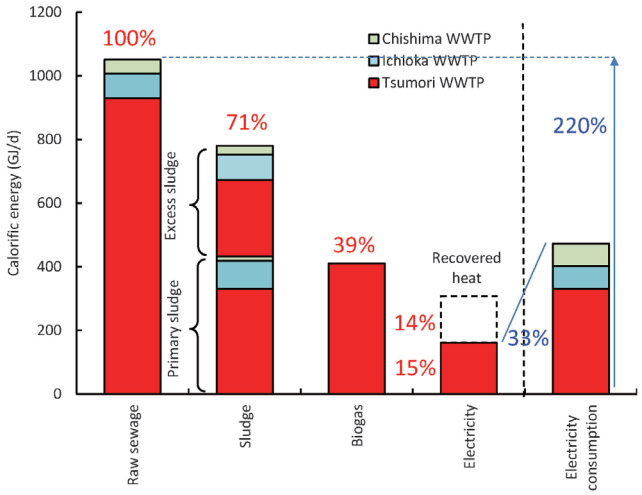
Yasuo Takahashi (Professor, Joining and Welding Research Institute, Osaka University)

7. CEIDS Research 3: Meso-Level Research to Develop Energy-Producing WastewaterTreatment Systems

Wastewater treatment systems are a vital part of the social infrastructure maintaining a sound water environment. Unfortunately, the technical development required to provide high-quality water is often very costly and energy intensive. Our research group thinks of sewage as a biomass resource, not just something to treat. In line with visions of a future low-carbon society and recycling-based society, we aim to redesign wastewater treatment systems those as energy-producing systems. We are developing multifactor evaluation methods and technological seeds to this end.

An increasing number of wastewater treatment plants recently are attempting to recover energy from sewage sludge. Tsumori wastewater treatment plant (WWTP) in Osaka City is one such plant. It takes sludge from the nearby Ichioka and Chishima WWTPs and converts it to biogas using a thermophilic anaerobic digestion process. Tsumori Energy Center was established in 2007 as a Private Finance Initiative project. It has operated a cogeneration system, in which

gas engines burn methane, which makes up about 60% of the biogas, to produce electricity and heat. Tsumori WWTP consumes 920,000 kWh to treat about 240,000 m3 of sewage per day, but the energy generated from sludge provides 50% of this. To evaluate the feasibility of further increasing the energy self-sufficiency of this WWTP, the chemical energy in the sewage was measured by calorimeter. Measurements showed that the sewage contained more than twice as much energy as the WWTP consumes. On the other hand, as the figure shows, 30% of the chemical energy in the sewage is released to the atmosphere along with carbon dioxide at the biological reaction tank. At the primary settling tank and secondary settling tank, 38% and 33% of the energy respectively transitions into sludge. By the time this goes through anaerobic digestion and the cogeneration system, only 15% of the energy is recovered as electric power. The thermal energy that is recovered is equivalent to about 14%. In other words, increasing the amount of sludge produced and making anaerobic digestion more efficient could make it possible to use more of the chemical energy in the sewage. Moreover, some WWTPs have aging equipment or are not necessarily managed well enough. In those WWTPs, there is great potential



Sewage chemical energy flow in a WWTP
(Created from materials presented at the 5th IWA-ASPIRE Conference & Exhibition)

for reducing energy consumption with thoroughgoing steps to conserve energy. If WWTPs were to exceed 100% energy self-sufficiency, they could become energy producers and help to realize a low-carbon society.

(Satoshi Soda, Associate Professor, Division of Sustainable Energy and Environmental Engineering, Graduate School of Engineering, Osaka University)

8. Researcher Interview No. 3, "Design Theory and Environmental Innovation Design"

Prof. **Yasushi Umeda** (Professor, Department of Precision Engineering, School of Engineering, The University of Tokyo)
(At the time of the interview, Dr. Umeda was a Professor at the Department of Mechanical Engineering, Graduate School of Engineering, Osaka University)
Visited: November 15, 2013
Visited by: Keishiro Hara, Yukari Fuchigami

Hara: Tell us about your specialty, and about your research up to now.

As a graduate student, I researched design methodologies for self-repairing machines. My work was somewhere between design studies and maintenance engineering. After graduate school, I researched methods of design for machines that could adapt flexibly to the surrounding environment.

To give an example, I researched intelligent control of machines, using artificial intelligence, which was a popular idea at the time.

Later, in the mid-90s I think, environment-related topics suddenly got lots of attention, in part because of the social landscape. That was when manufacturing had

to start considering the environment. My research theme shifted from "designing against failure" to "designing for the environment and recycling." I was at The University of Tokyo at the time, where a project had just gotten underway on "inverse manufacturing". I became deeply involved on that theme too. Inverse manufacturing is kind of like the "theory of manufacturing", or manufacturing as a process of resource circulation. One important element of that is ecodesign, that is, the design component of inverse manufacturing. Design for disassembly was the primary task of product ecodesign in those days. That means, for example, designing a product to make it easy to recycle and disassemble. But eventually it emerged that it was necessary not only to design products with the environment in mind, but to design the entire product life cycle, including the flow of recirculation. The Home Appliance Recycling Law was established, and the idea of a recycling-based society, founded on the three Rs (reduce, reuse, and recycle) became an important issue. Although I am deeply involved in product life cycle design research, those events caused me to have doubts about the "mass production + mass recycling" model, which was becoming a mainstream model at the time. By this I mean, it seemed as if we were just trying to recycle as much as possible without regard for quality. For example, although I knew that recycling should not work against building a low-carbon society, it was not clear to me to what extent recycling and recirculation policies were actually contributing to that low-carbon society. What future does manufacturing have in an age when we have to build a low-carbon society by greatly reducing greenhouse gases? Can the materials industries continue into the future? These were the types of problems I had become aware of. This background and this awareness of problems led to the development of the research field I am in now, which is social sustainability scenario design. Presently, my research is primarily on life cycle design and social sustainability scenario design. The term "life cycle engineering" is fairly common in other countries, but it was still not used very much here in Japan. However,

our trailblazing in this field of research has allowed it to expand in Japan too now.

Hara: Tell us more about the research you are doing now in scenario design.

People are now proposing all sorts of visions and future scenarios for building sustainable societies, but you have to have tools for discussing these scenarios scientifically and logically. First you have to clarify which parts of those scenarios you can believe in and which are based on leaps of logic, and which parts contain hypotheses and predictions. Scenarios become more useful scientific tools when you lay them out precisely and give them more meaning in this way. Up to now, we have represented the logic of scenarios on a computer (that is, we built a representation theory), and run them through various simulators. This allows us to create a procedure for scenario design. The next thing we have to do is give concrete support for scenario design. The issue here is the user interface. It is important to strengthen functionality so that when large numbers of people get together to debate the scenarios they will create, they can make use of the tools developed up to now. If there is a function that lets discussion content immediately be constructed into scenarios, it could fundamentally support scenario design. Of course, there are a number of issues that have to be overcome to achieve this state of affairs. But we should really think about support mechanisms that will ultimately let ordinary people and citizens easily create future scenarios and run simulations.

Hara: You have been closely involved with research and education at CEIDS. What is your view of CEIDS research?

A major feature of CEIDS research is that it takes a meso-level perspective. CEIDS has advocated a model that introduces the meso-level concept between social visions and technical/research seeds, and ties the two (society and technical/research seeds) together well. Another feature of CEIDS research is that it incorporates the element of action, that is, practice. Similar research models that try to achieve a vision exist in the United States and Europe. Compared to them, however, meso-level research is characterized by the high value it puts on technological seeds. From the Japanese point of view, that is its strength. On the other hand, an important point about meso-level research is that the necessary seeds are drawn out from the vision side, and systems are built by selecting and combining the appropriate seeds (technologies) to be used. When you look at things from the vision and social needs side, you find diverse ways of using technological seeds. In that sense, I hope that researchers who conduct their research from a macro perspective such as a social vision will take an even more active role in CEIDS research. I believe that this will allow their visions to expand within the context of CEIDS research.

Hara: What is the key to getting researchers from different fields to collaborate on interdisciplinary research?

First we need to make the vision/meso/seeds model philosophy and research techniques more omnipresent. Meso-level research has a so-called meta-engineering aspect. We need to make this idea and its usefulness understood more widely. Once they have understood that, many kinds of researchers will recognize the importance and meaning of collaboration, and concrete partnerships and collaborative research will arise. Those of us working within CEIDS have a unified awareness of meso-level research, so researchers from various fields are already working together. Going forward, we have to better spread the word to outsiders so that they understand it too. Researchers who work primarily with specific research and technological seeds are eager to connect those seeds to macro visions for society and to show more clearly how to make a contribution. Vision design researchers need concrete and advanced research seeds that can make visions come true. In that sense, matching seeds to visions is extremely important. One of CEIDS's most vital missions is to be a kind of platform to make that happen.

Hara: What do you think about the educational program and professional development taking place at CEIDS?

Developing professionals in the fields of the environment and sustainability requires a balance of deepening specialization and expanding specialization in our relationship with society. That means that we have to have a firm knowledge of science basics and at the same time we have to know precisely the significance and place that research has in society. We also have to make sure our students fully understand that. In the case of CEIDS, by invoking a vision/meso/seeds model, it can spell out the position of each researcher's research and field of specialty in society. CEIDS, moreover, uses educational methods that help students understand the growth potential and role of each line of research. In addition to discussing issues at the vision/meso/seeds level, it is crucial to apply our lessons to the real world, to go out into the world and put principles into practice there. Then students will be learning in the real world, not some laboratory. You cannot reproduce the real world, where problems are intertwined in complex ways. Insofar as we are developing not just experts but professionals and researchers with a wide field of vision, CEIDS's educational initiatives will be essential to Osaka University.

CEIDS also has some very distinctive advanced subprograms, such as Frontiers of Sustainability Science (an English language lecture course jointly implemented by Osaka University, The University of Tokyo, Kyoto University, Hokkaido University, and Ibaraki University). By weaving together different

formats such as discussion-based exercises, the participating students, who come from various fields, use the vision/meso/seeds model to produce some very concrete output. These will be interesting if we keep them growing. Ultimately, we want enterprises and others to tell us they get the impression that specialists educated by CEIDS are really useful to society. This fiscal year CEIDS began practice-based exercises that use places like Suita City as their field. Local governments, such as that of Suita City, have cooperated in research before, but now there is finally collaboration in educational programs and professional development as well. (See the article about “Practice of Environmental Innovation Design” on page XX of this Newsletter.) I look forward to seeing how this develops in future.

Hara: Do you have anything to say to CEIDS in closing?

I hope that “meso-level” education and research expands with a long-term perspective. To do that, it is going to be important to increase the number of researchers and students doing research together and to make sure that CEIDS has very diverse research partners. That is an effort that will have to be made over the long term — I would estimate at least 10 or 20 years. Make yourself sustainable as an organization; get partners from far and wide who have different perspectives; foster young researchers. These are very important for CEIDS to expand meso-level research.

(Keishiro Hara, Associate Professor, CEIDS; Yukari Fuchigami, Project Researcher, CEIDS)

9. Announcements from CEIDS

①Contribution to an international conference/ side event organized by UNEP-IETC

“International Conference on Future of Cities” was held in Kitakyushu-city on Oct 20, 2013, under the auspicious of the Ministry of Foreign Affairs and Organisation for Economic Co-operation and Development (OECD). As the side event of the conference, UNEP-IETC organized a session entitled “Resource Efficiency and Waste Management in Future Cities,” in which Assoc. Prof. Keishiro Hara of CEIDS made an invited talk on evolution of waste management technologies and policies in Japan. CEIDS aims to expand its activities in research and education in a global sense in close collaboration with such international organization, such as UNEP IETC

②CEIDS researchers won “Reviewers' Favourite Award” at International Conference on Engineering Design(ICED)2013

Yusuke Kishita, Naoto Kurahashi, Yohei Yamaguchi, Yoshiyuki Shimoda, Shinichi Fukushige and Yasushi Umeda, "Scenario Design Approach to Envisioning Regional Electricity Networks with Photovoltaics and Electric Vehicles," Proc. of International Conference on Engineering Design 2013, Paper #492, Seoul, Korea, Aug 19-22 (2013) 10 pages.

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