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GSCN was established in 2000 to promote research and development for the Environment and Human Health and Safety, through the innovation of Chemistry .

GSC Network: The Next Ten Years

2010 GSCN Chairman Shuichi Omiya

The finiteness of the world's natural environment, natural resources, and food supply have become evident as a result of the rapid economic growth of the BRIC countries in recent years. To address these issues, broad-range discussions, particularly about how to combat global warming, have come to the fore.

Along with their rise to power, BRIC countries have shown remarkable progress in technology and industry that has continually exposed the decreasing industrial competiveness of Japan.

But in its efforts to contribute to preserving the environment, Japan's chemical industry was able to reduce its greenhouse gas emission by around 15.5 million tons CO2 compared to that of 1990. Thus, Japan can be considered to posses the most advanced capability to counter global warming. There is therefore a growing expectation for Japan's chemical industries to take the lead in creating a low-carbon and recycle-oriented society.

The new growth strategies that the government has recently announced advocate Japan's becoming a major power in environment and energy through green innovation. I believe that GSC plays an important role to achieve this goal by contributing to the realization of green innovation strategies in chemistry.

The Green & Sustainable Chemistry Network (GSCN) was launched in March 2000 with the aim of contributing to the realization of a sustainable society through innovative chemical technologies. For ten years, the organization has been making consistent achievements by organizing symposia, issuing publications, and establishing and presenting the GSC Awards. Through these activities, the concepts and thrusts that GSC has stood for have taken their root at the core of technological developments in our nation's academia and chemical industry.

As the new Chairman of GSCN, I hope that we will together be able to rethink what directions GSCN must take in the next ten years, paying particular attention to how we can incorporate sustainable growth, in order to further promote GSCN's goals. Let's all work together for this.

Green and Sustainable Technology Education in Shinshu University

Department of Environmental Science and Technology,
Faculty of Engineering,
Tsuneo Fujii

With the great help of students, the Nagano (Faculty of Engineering) campus of Shinshu University was the first faculty at a National University to acquire ISO14001 certification. In 2010, the university's medical school and hospital are planning to acquire certification. This will result in the completion of certification of all university faculties. In the applicable areas of our university, management systems to centrally keep track of laboratory chemicals and high pressure gases have been introduced. It is compulsory for first-year students to take two credits of an environmentally related course. Also, "Advanced Scientific Technology" in the Department of Environmental Science and Technology is a compulsory subject. All staff in the department give a lecture on "Green technology – study from a chemical approach" or "Environmentally friendly materials and natural energy". A G-MOT program is being offered by the Institute of Innovation Management (Nagano Campus) in cooperation with the Interdisciplinary Graduate School of Science and Technology.

1 Safe management of chemicals

To build a sustainable society in the 21th century, it is necessary for all branches of science and technology to have a green concept. With ISO14001 certification and the adoption of the Tokushoku GP, "Educating persons to have an environmental mind", two credits of an environmentally related course is compulsory for first-year students. Since the university changed to a public corporation, many laws require safe handling of chemicals. One characteristic feature of environmental education is to use the management systems for laboratory chemicals and high pressure gases in all applicable facilities, from attached schools to graduate school. This system is effective in the education of students and safe treatment of chemicals. All kinds of information about a chemical, which is required for use by students, are recorded in a computer using a bar-code reader. What, how much, who and when a chemical was used are recorded in the computer server. A user can read the MSDS, and know the hazards and safe treatment methods of the chemical simultaneously. When excess storage of gases in a limited space is detected by the management system, a message to take corrective action is shown.

2 Application to professional education

Green chemistry and sustainable chemistry mean that chemistry in the 21th century must be able to contribute to sustainable development. Today, the limit of fossil resources is obvious, so it is necessary that new technologies for safety, peace of mind, resource reduction, energy reduction and new energy are developed together with recycling and re-resource technologies to create a sustainable social system. The

treatment of GSC is a necessary condition to build a sustainable society where catalysis and function play important roles. The content of a lecture on advanced scientific technology in the Department of Environmental Science and Technology is as follows. Chemical technology for a sustainable society, catalyst promotion of chemical reactions, adsorption and separation technology, green technology in the design and synthesis of catalysts and adsorbents, environmental technology using catalysts, photocatalysts, and an approach to green technology learnt from nature. After learning the basic use of instruments, students in the department also study: measurement of TOC, adsorption by active coal and clay, decomposition of organic compounds by titanium oxide, fixation of CO_2 (crystallization of calcium carbonate), preparation of hydrophobic surfaces, surface free energy of a solid, infrared spectra of polymers and analysis of water (BOD, total nitrogen, and total phosphorus).

3 Development to doctoral course and citizens

G-MOT program is being offered by the Institute of Innovation Management (Nagano Campus) in cooperation with the Interdisciplinary Graduate School of Science and Technology. Doctoral students in the Interdisciplinary Graduate School of Science and Technology study at night and on weekends. When they pass the final examination, they receive the Ph.D. and Master of Management degrees. The students in the G-MOT course also work. The jobs the students hold are not only engineering related, but also managerial. Questions from the students in the G-MOT course are more frequent than those from other students in the department. However, most of these students graduated with humanities degrees which limit the depth of the course. Though there are some issues now, we look forward to the results 10 years from now.

Green Chemistry in Australia

Dr. Kei Saito, Centre for Green Chemistry, Monash University, Australia

Centre for Green Chemistry at Monash University, Australia, is a recognised world leader in research, industrial collaboration and teaching in the field of Green Chemistry and to harness this expertise to enhance the international competitiveness of industry. In this letter, the recent green chemistry researches in Australia will be discussed.

Consistent with the guiding principles of Green Chemistry, the strategic approach in here Monash Centre has taken into consideration the imperatives of risk/ waste reduction, not only in synthesis and product application, but also to couple these activities to improvements in process step efficiencies and the development of novel monitoring technologies. Development of new types of separation materials, including monolithic systems, involving new uses of chelating compounds and other classes of immobilized chemical ligands for application in biotechnology and other fields is currently underway within the Monash Centre. Figure 1 illustrates an example of the different formats in which these new monolithic systems, which form part of these developments, can be made. Synthesis of novel molecularly imprinted polymers and their use in the food, pharmaceutical and environmental industries are also currently studied within our Centre.

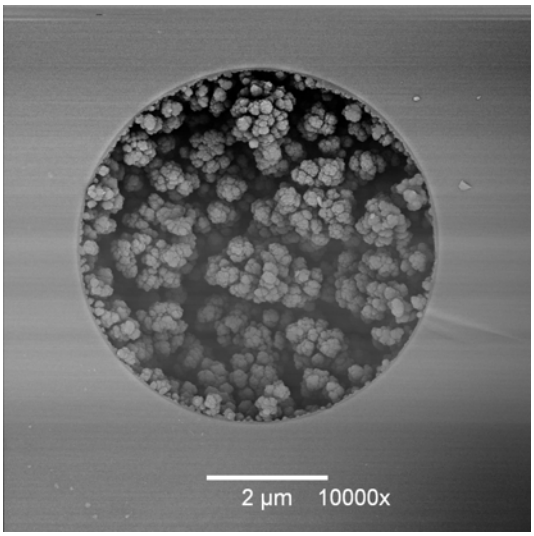

Fig.1

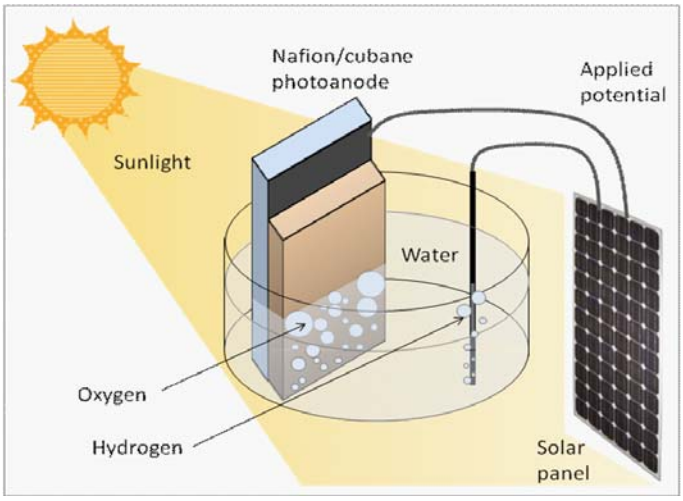

Figure 2: A tandem device combining a photovoltaic device

Synthesis of reactive ionic liquids and their industrial applications is one of the key areas in Australia. The aim of this research is to radically improve materials and processes within the manufacturing, mining and building industries by paradigm shift in chemical methodology. Electrochemistry in ionic liquids is also studying with significant potential for application in process monitoring, sensor development and other analytical uses. Corrosion is a very dangerous silent enemy to our daily life. The inevitable phasing out of chromate based corrosion inhibitors has seen a major drive in the quest for 'greener' alternatives. Development of green corrosion inhibitors using rare earth carboxylates as potential cleaner, safe and cheap alternatives to the chromates is also one of the active research areas. Australia contains among the world's largest deposits of rare earth ores thus making it a major resource. There are extensive selections of relatively simple and cheap carboxylates that have low toxicity and suitable for use as corrosion inhibitors. Among these, glycolates, anthranilates and salicylates have been investigated by our group as rare earth compounds. The rare earth salicylate compounds have shown very promising inhibition properties at relatively low concentration in neutral aqueous environments. Biomass can provide an alternative source for many chemicals presently derived from petroleum and coal and possibly lead to the replacement of these chemicals with new, renewable materials. Work at here Australia is focusing on a process that may potentially serve as a preliminary treatment which will provide energy-dense liquid material that is cheaper to transport to a Biofine plant. This study uses fast pyrolysis rather than acid catalysed hydrolysis with the aim of finding conditions where optimum yields of liquid products are obtained.

Hydrogen has long been considered an ideal fuel that is both energy-rich and carbon-neutral. The production of hydrogen from water and sunlight offers the possibility of an abundant, renewable, green source of energy. The water oxidizing complex in photosynthesis is being used as a blueprint for the development of manganese clusters which use sunlight to catalyse the oxidation of water to oxygen (Figure 2). The protons and electrons generated by this photo-electrochemical process can then be combined to form hydrogen gas, currently being touted as an ideal clean, green and renewable fuel.

For more detail information, please visit our website http://www.chem.monash.edu.au/green-chem/and download our Annual Report. Next GSN Asia-Oceania Conference (AOC-3) will be held in Australia early 2012. We are looking forward to seeing you all in Australia.

Remarks by 10th GSC Symposium Poster Award Recipients

1.Kenji Kakiage Gunma University Faculty of Engineering

I consider it a great honor to be chosen to receive the 6th GSC Poster Award during the 10th GSC Symposium. The goal of our research is to increase the efficiency of dye-sensitized solar cells, which have recently gained attention as the next-generation high capacity dispersed-type solar cell, through the novel approach of applying organosilicon chemistry to the sensitizing dye component. We have so far succeeded in increasing their durability and efficiency. I believe the knowledge that I have gained in the GSC Symposium will be useful in my research and I hope that through our efforts we will be able to eventually succeed in putting dye-sensitized solar cells into practical use as an innovation that can help solve environmental and energy problems, and thereby contribute to the development of a sustainable society.

2. Takuya Kubo Graduate School of Environmental Studies, Tohoku University

First of all, I was really glad to be awarded a poster prize in GSC symposium. Our project group has focused on the development of efficiency for analytical systems of water pollutants, which is supported by Ministry for the Environment. We have already achieved simplification, rapidly and automatization of the quantitative analysis system, and we will focus on final stage for commercialization of product. Also, the newly developed “molecular template”, which was based on nanotechnology, has been utilized in this system. As results, this study was contributed the resource saving which is one of the GSC policies, and the poster prize was awarded. By this prize, we will be able to advance this study and promise to establish the new technique resolving the environmental problems. Finally, we really appreciate for the committees of this symposium and Ministry for the Environment.

3. Yasutaka Kuwahara Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University

It’s my great honor to be selected as a poster award in 10th GSC symposium.

I’ve been studying on conversion processes of steel slag, which is discharged in iron-manufacturing process, into value-added materials and their application to green chemistry for the establishment of recycling-oriented chemical process.

I’ve attempted optimization and simplification of the process and found that the steel slag is convertible into an adsorbent for environmental remediation and a useful solid catalyst by utilizing the chemical nature of the synthesized materials and the chemical components.

Based on the valuable experience that I obtained in the meeting, I'd like to continuously make an effort toward development of a process which will meet the requirement of recycling-oriented society and commit myself to the development of the sustainable chemistry.

4. Kazuya Koseki Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology

I am very honored to be awarded GSC symposium poster prize. Electrochemical modification of conjugated polymer film has been developed as a green method in our group. I presented the cathodic reduction of conjugated polymers using zinc cathode. It was found that the optoelectronic properties of the

polymers were tunable by electrochemical method. I thank the participants for their valuable suggestions and fruitful discussions in this symposium. I would like to make the best use of the experience and the advices obtained in this symposium for further improving my research. I also wish that a piece of the work may contribute to chemistry and technology.

5. Satoshi Suganuma Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology

It is great honor for me to be presented with the prize. In this symposium, I heard newest research progresses relevant to GSC. The content of my presentation was sulfonated mesoporous carbons derived from resins show high selectivity in the industrial valuable reaction. In the case of the prepared material, the catalyst can be used repeatedly and shows higher selectivity than conventional solid acids, resulting in efficient formation of the desired products. Therefore, the prepared material enables to realize environmentally sustainable processes. In my presentation, I discussed with many participants and obtained much advice. I will utilize the suggestions as references and synthesize novel catalysts.

6. Hajime Nakajima Kyoto Institute of Technology

I am honored to be chosen to receive the Poster Award and to have our research concept recognized. Our goal is to enhance the efficiency of the biobased polymer polylactate by looking at various approaches to control its crystallization. In this study we did a nano-order analysis of the effect of nucleating agents to crystallization of polylactate. Addition of nucleating agents is known to be an effective method to promote crystallization but so far there have been few reports on the nano-order analysis of the state of dispersion so I am grateful for the comments and suggestions I received during my presentation. I hope to continue my research and contribute to the improvement of the usefulness of polylactate.

7. Norihisa Fukaya Molecular Catalysis Group, Advanced Industrial Science and Technology

I feel highly honored to be selected for the GSC Symposium Poster Prize. The development of immobilized molecular catalysts has been a very active area of research because immobilized catalysts have the advantage in terms of catalyst separation and recycling. We have developed a new linker unit that enables uniform and robust immobilization of molecular catalysts onto silica supports. Using this new linker unit multipodal anchoring of molecular catalysts moieties onto silica can be realized. We believe that the present linker unit becomes a powerful tool for the development of various immobilized catalysts.