Report on Long-term Overseas Dispatch

Toshiki Murayama
Department of Chemistry and Biotechnology

Outline

Hosting Institute: Center for Advanced Energy Studies (Idaho Falls, ID)
Period of stay: December 7, 2015 — March 18, 2016
Research project: One-pot conversion of syngas to gasoline by heterogeneous catalyst

I stayed at Prof. Haiyan Zhao's research group at Center for Advanced Energy Studies (CAES; Idaho Falls, ID, USA) for about three months supported by MOFA's program "Japan Internship for the Development of Young Leaders (Japan IDYL)." CAES is a joint research institute between Idaho National Laboratory, Idaho State University, University of Idaho, Boise State University, and University of Wyoming. Researchers and students from a wide variety of fields are working at CAES sharing several common laboratories in the building. Research interests of researchers at CAES are broad; including but not limited to energy, radiochemistry, nuclear engineering, transportation, and computer science. They don't have "laboratories" that are physically separated; they all share their office and laboratories. Therefore, they have many chances to interact with researchers and students from different field of science.

Research at CAES

At the University of Tokyo, I'm working on organic synthesis and polymer chemistry based on homogeneous catalysis with Prof. Kyoko Nozaki. On the other hand, Prof. Zhao at CAES obtained her Ph.D. in chemical engineering and now her research interest is heterogeneous catalysis. Therefore, I worked on a different field of chemistry at CAES.

When I started my stay at CAES, Prof. Zhao only gave me the desired reaction, one-pot conversion of syngas to gasoline, and I had to propose everything else including the catalyst system to use. As I had little knowledge in the field of heterogeneous catalysis, I started with reading a large number of references. I realized that I had been involved in limited area of chemistry.

After thorough literature survey, I proposed a hybrid catalyst of metal nanoparticle and zeolite nanoparticle supported on a certain kind of support, with larger surface area and higher stability, in order to improve the activity than other systems. Since my stay was only three-month long, I could not try the conversion with my catalyst. However, it was very valuable experience for my future research that I had an experience on the preparation of heterogeneous catalysts. Recently immobilized catalysts, in which originally homogeneous catalyst is fixed on a support, has been attracting broad attention since it offers advantages from both homogeneous and heterogeneous catalysis: well-defined active site, and high durability and recyclability, respectively. I believe I can develop my chemistry if I can enter this new field of chemistry utilizing knowledge and experience from my stay at CAES.

At CAES, since it is operated by Idaho National Laboratory, they need to obtain approval from safety officer for every single experiment. It sometimes takes about two weeks to get approval, and furthermore they cannot even place an order for reagents until the experiment plan is approved. Therefore, progress of research is relatively slow at CAES, especially in the case of chemical synthesis.

As mentioned above, CAES has researchers from a wide variety of fields, and they often invite experts in their own field. I had chances to hear lectures of various kinds of science.

Additionally, I had an impression that computer science is very influential today, and there are larger number of students majoring computer science, which is not the case for chemistry, in my opinion. I had the same impression when I visited MIT in September, 2016.

Life in Idaho Falls

State of Idaho is located in Rocky Mountains. Idaho Falls is the city in eastern Idaho, at the altitude of about 1400 meters, and it is very cold in winter down to –20 °C there. It was very exciting that nice skiing hills are only an hour away from downtown. Additionally, I enjoyed nature and wildlife in Yellowstone National Park, which is famous for geysers.

As the number of Japanese people in Idaho is less than 500, I never saw a single Japanese person while staying in Idaho Falls. I felt that my ability to communicate in English had improved by placing myself in an environment that only English was used.

About Japan IDYL Program

In order to cultivate young people to take leading roles in the relationship between Japan and the US, and to strengthen the relationship between two countries, Japan IDYL program was launched in 2015. About 50 students (undergraduate and master course students) and about 10 researchers (doctor course students and young faculties) were selected and dispatched. Students received financial support of 50–100k yen/month from MOFA, and researchers 300k yen/month.

This program has two stages of selection: first one carried out by JIPT, and second one by MOFA. After these selections, interview with Cultural Vistas (CV) will be held. Participants will tell CV about their interests, and CV will choose the appropriate host. However, some participants said that their interest and host didn't match well.

Japan IDYL is an attractive program for internships in the US. It seemed that, if a participant had an informal appointment with potential host organization, one would be able to intern at that organization. Therefore, it is highly recommended that a participant makes an informal appointment by oneself.

Concluding Remarks

I luckily had a chance to work on research in the US and to learn a new field of chemistry other than my specialty. I would like to make an effort to develop my research utilizing what I learned during my stay.

Acknowledgements

I gratefully acknowledge Prof. Haiyan Zhao for hosting me, JIPT, JTB Corporate Sales, and Cultural Vistas for supporting me during the program, and Japanese government and MOFA for this wonderful opportunity. I also acknowledge MERIT for financial support.