

MERIT Errantry Report

Kazutaka Shoyama
30th March 2016
Ph.D. candidate
Department of Chemistry
Graduate School of Science

Using the MERIT Errantry program, I visited Northwestern University (USA), University of Würzburg (Germany), and Max Planck Institute for Polymer Research (Germany) and gave research presentations in a total of four research groups during a period of 4th March 2016 to 16th March 2016. I talked about some of my research results on an organic-inorganic hybrid material, lead perovskites, which are in recent years extensively studied as an active-layer material of thin-film solar cells after their application as the sensitizer of solid-state dye-sensitized solar cells in 2009, and had discussions with researchers from various fields.

Northwestern University

Northwestern University is a private university located in the northeast of Illinois, USA. This university, as a research institute, is very active in the fields of chemistry or materials science. I visited the group of Prof. Mercuri Kanatzidis and the research team of Dr. Liam Palmer.

Prof. Kanatzidis majors in inorganic chemistry and a professional of crystallography. I was looking forward to talking with him since he wrote many papers that are important in the proximity of my research interest. Before giving my research presentation I talked with his co-workers about latest research results and researchers' life in the USA. It was particularly nice to me that I had a chance to learn some details of inorganic crystalline materials that are new to me and experimental techniques that are used to analyze these materials since I had worked mainly on organic synthesis and had not so much knowledge in inorganic materials. I had also a chance to look around research instruments in the laboratories in Northwestern University. One significant impression I had was that there are a number of common instruments such as SEM or TEM (there were a couple of SEM and TEM), which are usually expensive. In the discussions after my presentation I had several important questions such as atomic-level interactions in the crystallographic structures and expectation to applying my approach to different material systems, which are both helpful for me to decide the directions of my research.

Dr. Palmer is a research associate of the group of Prof. Samuel Stupp, and working on lead perovskite solar cells since 2 years ago. I expected by giving a research presentation in his group that I could get new views on the material interactions during the conversion process of lead perovskites because in the research group they study supramolecular chemistry. He eagerly asked a lot of important questions even during my presentation so that I could learn the way I talk with audience during presentation.

University of Würzburg

In University of Würzburg I gave a research presentation in the group of Prof. Frank Würthner, who majors in dye materials and their molecular assemblies. Since I have been impressed by the steady development of academic research in Germany, I asked to have discussions with three of the staff members of the group and had learned their experiences in academia. In the research presentation I was recommended to also work on the kinetics of

crystal growth using nucleation theory, which was lacking in my approach. This has directed me to study more from multiple viewpoints.

Max Planck Institute for Polymer Research

In the Max Planck Institute for Polymer Research I visited the group of Dr. Rüdiger Berger, with whom our group has a joint research project. Dr. Berger is a specialist in surface analysis (scanning probe microscopy, SPM), and has many measurement systems in his laboratory. They include an AFM system that can measure samples *in situ* under different conditions such as at certain humidity and an SPM system that can measure electric moment changes under external force. These measurement systems are proper systems to further advance the joint research project so that I'm currently working on the preparation for it. In the research presentation I received a difficult question on the effect of additives and realized that I needed to study more on my research topic.

Closing Remarks

Although the MERIT Errantry program is tough for students in the sense that they need to contact professors to get an appointment and arrange the whole trip, it is of great asset for them to complete this program since there are many things that they can through it. This time I experienced as many as four presentations in a short period of time. Although this was hard for me it gave me memorable lessons to do presentations that are 30 min or more long. It was also nice that I could have connections with researchers in various fields. I'd like to close this report by expressing thanks to Prof. Kanatzidis, Dr. Palmer, Prof. Würthner, and Dr. Berger, and their co-workers, as well as the MERIT program that supported this trip. I will strive to use what I learned in this trip in the best possible way and work harder in research projects.