Report on Long-term Overseas Dispatch

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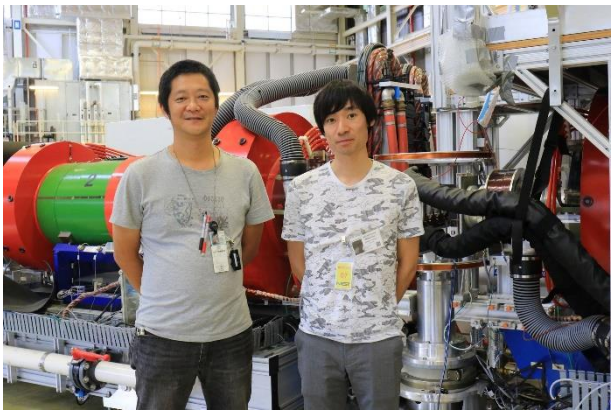
Abstract

I have conducted the long-term overseas dispatch at National Institute for Standard Technology, Washington D. C., USA (July 26th to July 30th) with Dr. Nagao and at University of Minnesota, Minneapolis, Minnesota, USA with the research group of Prof. Lodge. In this report I describe the background, research, life in Washington D. C. and Minnesota.

Background

It is well known that there are many research groups in the field of polymer chemistry, especially about block copolymer at University of Minnesota. Among them, Lodge group is known for the detailed analysis for the specific physical property of block copolymers, and research on dynamic process for microphase separation behaviors of block copolymers. In contrast, my research project for Ph. D. thesis is for functionalization of block copolymers. The purpose of my visit is to widen my research field to be able to evaluate detailed polymer physics property, because my research was somehow overemphasized for qualitative evaluation to realize aimed function.



with Dr. Nagao, at NIST

In Lodge group, one of my research collaborator, Dr. Takeshi Ueki (NIMS) visited as a post-doc. This time, Dr. Ueki, Prof. Yoshida sent an e-mail to Prof. Lodge, and he kindly accepted my dispatch. Furthermore, Prof. M. Mitsuhiro Shibayama (ISSP, The University of Tokyo) introduced Dr. Nagao (NIST) for further investigation of my research project. I decided to visit NIST before arriving at Minnesota to widen my eyes for my research career.

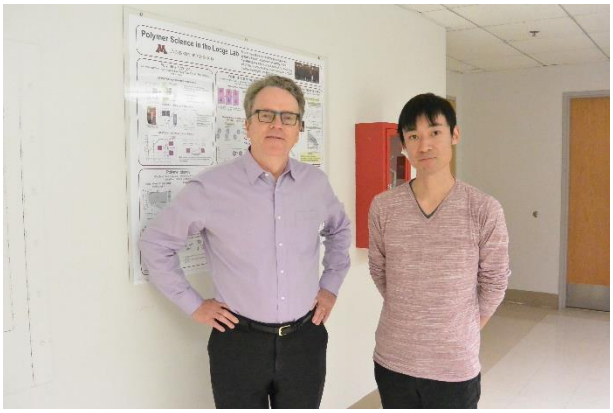
Research and life at NIST

At NIST, I had deep discussion with Dr. Nagao about my research project at Japan and the research project at Minnesota, seeking the possibility of collaborative research with NIST.

In this visit, I stayed at Dr. Nagao's house, and I had many conversations with Dr. Nagao about the research system at US and my/his career. It was good opportunity to think about my research direction.

Research at Minnesota

At Minnesota, I conducted my research project entitled "Control of the rheological property and gelation temperature just by mixing two ABC triblock copolymers".



with Prof. T. Lodge, at Minnesota.

In our everyday life, thermally reversible sol-gel transition is common behavior, as observed in a jelly (gelatin). When we heat up gelatin, it is turned from gel to sol at around 25 °C. If we aimed to control this sol-gel transition temperature, mainly we have to control 1. Chemical structure, 2. pH of the solution, 3. Irradiation of UV light. In this process, the total rheological property is likely to change. In this research project, we hypothesized that it is possible to control gelation temperature just by mixing two or more polymer solutions, and aimed to realize such a system. The realization of this system has a great potential for tuning gelation property with easy-to-prepare method.

Prof. Lodge visited Japan for conference on May, so I had a chance to have a discussion. After the discussion, I designed the polymer architecture and conducted syntheses beforehand which make me possible to concentrate on evaluation of the rheological property of the polymer solution. As a result, I founded that the gelation temperature and rheological property is strongly affected by interaction of different polymers and shift of intermediate structure of the gelation process. I am planning to continue the research and submit as a paper in this year.

Also, I also conducted anionic polymerization from September to widen my research skill. It was very challenging schedule in terms of my time-limit, but I successfully synthesized well-defined block copolymer with target molecular weight. I am now planning two research projects based on this polymer.

Life in Minnesota

Since my stay at Minnesota for two months was very short, I always ask myself that what is the only thing I can conduct here, and what should I obtain. It was a very productive days.The

main instruments for my research project were likely to be booked in the day-time, so during August, I mainly studied about the rheology, and I concentrated on my analysis in the night and weekends. From September, I had a day-time for synthetic experiment, and conducted analytical experiment at midnight and weekends. I had these days very efficiently with the great help of the members at Lodge group. Also, my host family prepared my all meals for me to concentrate on my research.

Seminar for Polymer group, Minnesota.

As I mentioned in background, there are many polymer research groups at the University of Minnesota. There was a great atmosphere for the polymer research, and there was a seminar almost every week inviting researchers from outer side. I also had a chance to talk about my research at Japan for 60 min. It was a good opportunity for me to have a seminar.

Acknowledgement

I appreciate Dr. Nagao and Prof. T. Lodge kindly accepting my long-term dispatch, and Ms. Cecilia Hall, Mr. Aaron Lindsay, Mr. Yiming Zeng, Dr. Dan Zhao, and all the members at Lodge group for the great support of my research project. I also appreciate Ms. Marie Brandt for the support of everyday life. Finally, I specially thank teachers in MERIT program, Prof. Yoshida and Dr. Akimoto for giving me a great opportunity.