

Report on MERIT Overseas Dispatch Program

1st generation student of MERIT

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1. Abstract

Period: 2015/5/5~7/4 (2 months)

Hosting research institute: Eindhoven University of Technology, The Netherlands

Supervisor: Prof. N. A. J. M. Sommerdijk

Research project: Direct observation of inorganic crystallization processes controlled by biomolecules

2. Research

Biominerals are hard tissues produced by living organisms, which attract much attention as a model for environmental-friendly materials. For example, the exoskeletons of crustaceans are chitin/CaCO₃ hybrids exhibiting superior physical properties derived from its hybrid structures. The formation of those structures are precisely controlled by biomolecules. In Kato Lab, inorganic crystallization and organic/inorganic hybrid materials using synthetic polymers and natural peptides have been studied, inspired by the formation processes of biominerals. However, the effects of molecules in the aqueous solution on the hybrid formation have been unrevealed. It is important to explore the effects in order to achieve the formation of more sophisticated structures.

Prof. Sommerdijk's group has been studying the crystallization process in solutions using cryoTEM. CryoTEM is a technique to observe the assembled structures of biomolecules in the solution. The samples are fixed inside the amorphous ice by rapid freezing of the solution. They are observed by illuminating the electron beam at extremely low temperature.

Herein, we aimed at exploring the processes of the organic/inorganic hybrid formation by cryoTEM. We succeeded in direct observation of the processes in the solution, which showed the interactions between polymers and inorganic components resulting in the hybrid formation. The results in the present study may contribute to the better understanding of biomineralization and the development of synthetic hybrid materials in the future.



Fig. 1. Picture of CryoTEM (TU/e Center of Multiscale Electron Microscopy: <http://www.cryotem.com/about/instrumentation.html>)

3. Daily life in the Netherlands

Because almost all Dutch people can speak English, I could easily communicate with each other during my stay. Therefore, I felt very comfortable to live in Netherlands, as compared with other countries in Europe. I usually bought groceries at the supermarket and cooked a meal at home because it is relatively expensive to eat outside. Dutch people typically eat breads for breakfast, sandwiches for lunch, and several dishes for dinner with their family. In addition, there is a coffee break time between the breakfast and lunch. In the laboratory, there is also a coffee break time at 10:30 am every day, in which we chat with our colleagues, drink coffee, and eat snacks. It is noteworthy that bicycle is a major transportation in Netherlands. There are an exclusive cycle roads in all streets, and there are many distinctive rules and cultures about bicycles.

In the laboratory, it is impressive that all the experimental setups are shared in the department and every person is responsible for some of those equipment. When I would like to use the equipment, I had to take contact with the responsible person and ask for his cooperation. Dutch people are all friendly and very kind to give me advice, however they did nothing at all unless I ask them to do so with clear explanation. I always explained about my research plans and ideas, asked them for their cooperation and advice. It was a very beneficial experience for me to aggressively communicate with each other and do many discussions in English in order to promote my own project.

4. Acknowledgements

I really appreciate MERIT office, Prof. Takashi Kato, and Prof. Yuichi Ikuhara for their all support to proceed this program. I also thank Prof. Sommerdijk and his colleagues for taking care of me and giving me many knowledge and precious experiences.



Fig. 2. Picture of drinking after work at the bar inside the campus.