

# MERIT Report for Overseas Dispatch

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Sent to: Prof Emanuel Schneck, Technical University of Darmstadt

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## ◆ Introduction

In Sugihara laboratory, research is conducted on a substance called polydiacetylene, which is made from lipid monomers with a diacetylene structure. In Sugihara lab, we use atomic force microscopy to measure mechanical properties such as force sensitivity in thin films of polydiacetylene, while Professor Emanuel Schneck's group uses X-ray/neutron scattering and other techniques to analyze the structure of soft matter. This report describes what I have gained through research activities and cultural exchanges in Schneck group. I participated in the Continental Academic Exchange Program between UTokyo-IIS and Technical University of Darmstadt, which was conducted under the support of Continental Automotive Corporation.

## ◆ Research activities

Previous research by Sugihara laboratory has confirmed that the polydiacetylene changes its force sensitivity at pH and in the presence of Na ions. The change in force sensitivity is thought to be caused by the breakdown of hydrogen bonds and repulsion due to deprotonation of the lipid head group, but this is still unclear. As polydiacetylene is a substance with potential medical and health applications, it is necessary to investigate the effects of ions present in vivo. My research focuses on determining the effects of K and Ca ions on polydiacetylene.

During my stay in the Schneck group at the Technical University of Darmstadt, X-ray reflectometry was performed on samples brought from Japan; X-ray reflectometry allows the analysis of the electron density in the vertical direction, thereby measuring the degree of deprotonation of the lipid head groups. By using complementary grazing-incidence X-ray diffraction and total-reflection X-ray fluorescence analysis at the synchrotron, it is also possible to analyze the planar direction of the thin film, whereas X-ray reflectometry alone could only analyze the perpendicular direction. Detailed discussions will be held in the future as the data is currently being analyzed, but Dr Emanuel's experience seems to indicate that good data has been obtained.

After the analysis and discussion, the data will be combined with experimental data from Japan and presented at an international conference and in a paper.

### ◆ Culture and exchanges

In Schneck group, there were no specific events, but there were recreational activities with other research groups every Wednesday and other days after school. We had drinks while watching football at a pub, went out to eat at a restaurant, rented a room in the institute and played Mario Kart, and there was a culture of everyone going out for ramen for lunch every Friday, so I felt that I had good opportunities to get to know a lot of people. On holidays in Germany, most shops are not open, but we had fun memories of Mr. Joshua from the Schneck group inviting us to his house to make focaccia together and going to Frankfurt.



**Fig. 1 Focaccia**

In the research institute, there is a specialist in experimental equipment who was very helpful when there was any trouble or when I needed advice on equipment, and this was the most enviable aspect of the German research environment when comparing Japan and Germany. It was refreshing to see that they frequently opened windows for ventilation and worked without much lighting.

### ◆ Everyday life

The weather was mostly cloudy, with occasionally sunny spells. The stay was from January to March, which basically gave the impression of being colder than Tokyo, but the temperature did not drop below freezing so it was not as cold as I had imagined. Prices themselves were low compared to Japan, with



**Fig. 2 Weather in Darmstadt.**

carrots, tomatoes, onions, potatoes, grapes, strawberries and wheat products available at supermarkets for less than half the price in Japan. Basically, English was not spoken in town, and it was not uncommon to be spoken to in German.

### ◆ Acknowledgements

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