

Report on MERIT Long-term Overseas Dispatch

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Outline

I stayed in Leipzig from 2018/4/1 to 2019/3/13 and conducted a research in Prof. Grundmann's group (Felix Bloch Institute, Leipzig University) for one year. I report the background and the progress of this long-term overseas dispatch.

Background

It was when I participated in international conference for the first time that I decided to go abroad and carry out the research. I saw people from all over the world (Europe, America, Asia and so on), who discussed and talked to each other on the same research topic, which impressed me a lot.



Felix Bloch Institute

Research project

Transparent conductive oxides (TCO) are of high importance due to their variety of applications such as transparent conducting electrodes of flat panel displays and solar cells. n-type TCOs, such as SnO_2 , ZnO and In_2O_3 , have been extensively investigated to date and very high quality films exhibiting excellent electronic properties have been synthesized. On the other hand, few studies have been reported on p-type TCOs and their electrical properties were rather poor compared with n-type TCOs. Based on this situation, I tried to fabricate and evaluate new p-type TCO films in Prof. Marius Grundmann's group in Leipzig University. Prof. Grundmann's group have achieved many good results in the field of transparent conducting material, not only the fabrication of TCO films, but also the evaluation of the device comprising of TCO films.

Life in Leipzig

By taking part in this program and staying in the foreign laboratory for one year, I learned a lot not only as a researcher, but also as an inhabitant in Leipzig. From the viewpoint of research, I found the difference in research system and low barriers between each European country.

There are some steps for fabrication of TCO samples: film fabrication, evaluation of electrical and optical properties, device fabrication. In this laboratory, some groups are cooperating with each other and in charge of each experimental step. Technical staffs maintain the expensive and complicated machines such as scanning electron microscopes and undertake some measurements which the laboratory members ask them to do. I was in charge of fabrication of thin films, so I

did not need to consume time for measuring physical properties of the films. I could spend time planning next experiment and fabricating new samples.

In this laboratory, group seminar is held on every Wednesday and professors from other European universities are invited to this research seminar. This seminar sometimes brings an opportunity of international joint research project with other laboratory, which made me think that geographical closeness of each European country is a big advantage producing many chances to cooperate with foreign laboratories unconstrained by the international boundaries.

In everyday life, I felt some difficulty in communicating with people by foreign language. Generally speaking, people in Germany can speak English very fluently. But some of the residents in Leipzig cannot speak English at all, which impelled me to speak in German. The experience of speaking in German in such a situation made me overcome the awareness that I was not good at speaking foreign language. In addition, I happened to have an opportunity to talk to some researchers from completely different research field. It was very exciting experience to talk with them and listen to their story, which stimulated my various kinds of curiosity.

Acknowledgement

My research work in Leipzig was supported by many people and institutions. I would like to express my gratitude to them. First of all, I would like to show my appreciation to Prof. Marius Grundmann, who gave me an opportunity to conduct the research in his group. I am also grateful to Prof. Michael Lorenz, Dr. Chang Yang, who have provided me considerable support in every moment of this research. Their advice was full of fruitful inspirations. I would also like to thank my supervisor, Prof. Tetsuya Hasegawa, who encouraged me to go abroad.



The entrance of "Auerbachs Keller"
(the most famous restaurant in Leipzig)