

Report of MERIT Long-Term Dispatch  
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### Overview

I visited Dr. Clifford Hicks Group at Max Planck Institute for Chemical Physics of Solids from 2018.9.14 to 2018.12.8, who is famous for precise measurements under uniaxial strain induced by piezoelectric actuators. During my stay, I worked on the transverse resistivity measurement under uniaxial strain to learn about the technique. Below, I summarize what I have done during the stay.



Max Planck Institute for Chemical Physics of Solids

### Research

In this research, I worked on measuring the resistivity  $\rho_{yy}$  under uniaxial strain  $\epsilon_{xx}$  to learn about the technique to apply uniaxial stress by using piezoelectric actuators. In order to induce homogenous  $\epsilon_{xx}$  in a sample, the sample need to be a bar along the x axis. In this case, it is easy to measure  $\rho_{xx}$  by conventional four-terminal method, whereas it is difficult to measure  $\rho_{yy}$  because the sample should be short in y direction. Besides, even if we can align four contacts in y direction, current contacts and voltage contacts cannot be far away from each other, resulting the contamination of  $\rho_{zz}$  component.

In order to overcome the difficulties, I arranged the current and voltage contacts accurately by using a focused ion beam machine. By simulating an electric potential distribution in a sample by the finite element method, I tried to calculate  $\rho_{yy}$  based on measured voltages.

In fact, it took much time to prepare samples to be measured. I also needed to setup a cryostat for my measurement. At last, I managed to measure the transverse resistivity  $\rho_{yy}$  as a function of uniaxial strain in x direction at low temperatures, and I observed an anomaly in the resistivity. Although the measurement was not solid, and the measured data is not publishable as it is. A postdoc researcher in the group keeps to study about it.

I learned how to design a system for high accuracy measurement of ac resistivity, how to mount a sample without the strain from a substrate as well the technique to apply uniaxial strain. They are useful to measure dielectric constant and ac susceptibility, so I would like to make use of them.

#### Life during the stay

Dresden, which is located in the east area of Germany, is popular for famous museums and classic buildings rebuilt after the World War II . On the other hand, in addition to the Max Planck Society, it has many research institutes such as the Fraunhofer Institute, the Helmholtz Society, and the Leibniz Society, and it also has an aspect as a research university town. There are not only research institutes but also universities such as Dresden Institute of



Photograph of a hiking trip with doctoral students and postdoctoral researchers in the group

Technology, and the exchange of students between institutes and universities is very active. Thanks to this, many doctoral students and postdocs have joined the research institute since around September, when I arrived there, and I was able to go to the surrounding tourist spots on weekends to refresh myself. At the beginning of the stay, I was also worried about communication in English, but it was fortunate that the people I visited were so sociable that they talked to me a lot and that such anxiety quickly disappeared. The group I visited had a surprisingly large number of people of various nationalities, and I think it was a great achievement to be able to experience various cultures firsthand. As described above, the stay was very satisfactory in terms of life.

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