MERIT domestic internship report

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■Overview

Place	日本電気株式会社システムプラットフォーム研究所
Period	From Oct 9th, 2018 to Nov 30th, 2018
Theme	Development of thermoelectric conversion devices

■Background

　I have been studying the physical properties of the thin film interface at the Institute of Solid State(ISSP) and have been exploring various analytical methods that can successfully process the obtained data. In MERIT colloquium 2, I also have experienced RHEED image analysis using machine learning, but I thought that I would like to acquire a more specialized calculation and analytical method. I got a chance to get information about companies that receive the internship students through Professional development Consortium for Computational Material s Scientists: PCoMS of the ISSP. System platform research institute of Nippon Electric Co., Ltd. (NEC) conducts a study to analyze huge amounts of data related to spin materials. After adjustments about theme and period, I got a chance to work as a research intern for two months in NEC.

■Contents

　The research topic of the internship is to search for a material with better conversion efficiency by measuring the thermoelectric conversion coefficient through the spin-Seebeck effect [1].

　In recent years, there has been intensive research on ways to effectively utilize the heat wasted in the world due to the increasing consumption of energy. Since the thermoelectric conversion using spins of magnetic materials was a relatively new concept proven in 2008[2], there was few previous studies and lack of novel materials explored yet.

Fig. 1 Thin film sample[3]

Throughout these two months internship, I set my aim to measure the
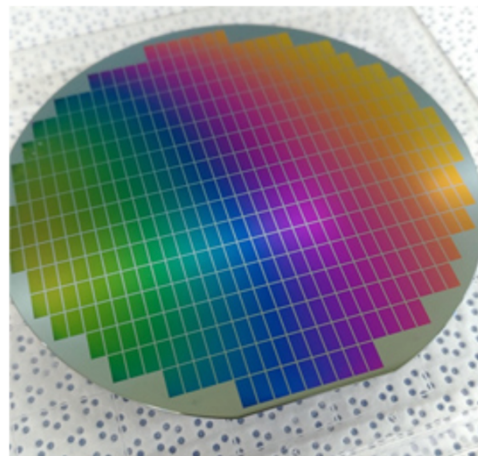
anomalous Hall coefficient of various materials and to examine the relationship between the anomalous Nernst coefficient and the mechanism of electron spins in magnetic materials.

At first, I developed a device for measuring the Hall coefficient together with other employees of NEC and checked whether the device was working by using the known bulk material. Next, we measured the thin film samples and analyzed using machine learning technique and nonlinear-analysis tools to find what kind of tendency was observed by the material. In the final week, I held a seminar in the company and introduced the data obtained so far.

■Impressions

While participating in research for two months with the employees of NEC, I was able to feel the commonalities and differences between the researches of universities and companies. Although I had heard in advance that the system platform research institute of NEC is one of the closest facilities to academics, I felt that the company life is different regarding the efficiency with the business systems, information security, and device management with detailed manuals. All employees have the skills and knowledge to cover a wide range of physics or calculations, and I was able to learn a neural network using R, first-principles calculations using python, and many other analysis techniques. By experiencing research life in the industry, I could reconfirm how I want to contribute to society in the future.

■ References
[1] NEC 技報／Vol.66 No.1／社会的課題解決に貢献する NEC の事業活動特集 pp.39-41
[2] K. Uchida et al.: Observation of the spin Seebeck effect, Nature 455, 2008, pp.778-781
[3] NEC プレスリリース：NEC と東北大 AIMR、AI による新材料開発に成功, 2018.2 https://jpn.nec.com/press/201802/20180209_04.html