Internship Report

School of Science, Department of Physics

PhD student, Murakawa Lab.

MERIT 8th

Shohei Takimoto

Summary

Zeon Corporation, R&D Center, Production Technology Laboratory

2021/10/4 to 2021/12/3

Theme: Development of LIB Electrode Production Process by Powder Molding Method

I developed production process of lithium-ion battery (LIB) electrodes at Production Technology Laboratory of Zeon Corporation.

Details

Lithium-ion batteries (LIB) have been widely installed in smartphones, laptop PCs, and electric vehicles. It is crucial to increase the battery storages to enhance the battery's usefulness. A standard method to produce the LIB electrodes is coating anode (cathode) active material paste on a substrate and then drying them, but we cannot produce the thick electrodes by this method. That is a bottleneck of increasing the battery storage. In order to solve this problem, Zeon Corporation is developing the powder molding method.

In this internship, I worked on the following two tasks:

1. Evaluation of Powder Fluidity on Substrates

2. Analysis of Causes of Deviation of the Target Weight by Unit Area by Machine Learning Method

1. Evaluation of Powder Fluidity on Substrates

There is a molding defect in which the mottled pattern called cross-hatch appears during the pressing process, and the powder fluidity on substrates is the critical factor of this phenomenon. I evaluated the powder fluidity on substrates and studied whether this fluidity was related to the cross-hatch or not.

I found that two powder fluidity patterns depended on the substrates-powders combinations. Furthermore, I also found that we could expect whether the cross-hatch

appeared or not by these two patterns. From these results, we can estimate whether the cross-hatch appears or not without a trial production which costs hours and efforts, which leads to accelerating the development cycles.

2. Analysis of Causes of Deviation of the Target Weight by Machine Learning Method

The target weight of active materials per unit area after molding depends on the types of active materials used. It is required to reduce the deviation from the target weight per unit area. I wrote a machine learning program in Python to analyze the causes of that deviation. The machine learning algorithm used was XGBoost. The precision of machine learning is expected to be improved by adding production data.

Impression

I experienced how to research and develop in an enterprise through this internship. Because the research theme is a part of a big project in the enterprise, I thought it was important to recognize what role the research theme plays in the big project. Also, I recognized the importance of communication skills to communicate with other departments because many teams took part in the R&D in the company.

Acknowledgement

I appreciate the members of the Production Technology Laboratory for acceptance of this internship. I also appreciate that the team members instructed me in the experiment and discussed the results. I thank my supervisor, Prof. Murakawa, and vice-supervisor, Prof. Hasegawa, for providing me with an opportunity to participate in this internship.