

Analysis of the Mixed State of Slurry Battery Materials

Introduction

Lithium ion battery (LiB) electrodes are fabricated by mixing active material particles and conductive agents in a dispersing solution, then coating the uniformly mixed slurry on a metal current collector and drying it.

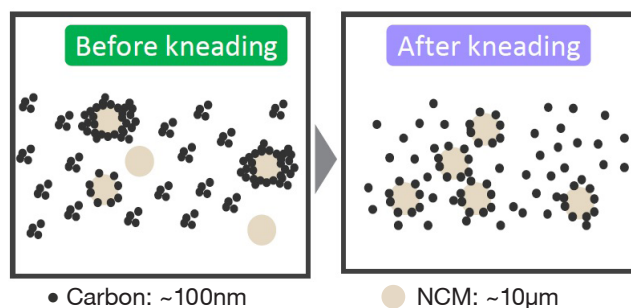
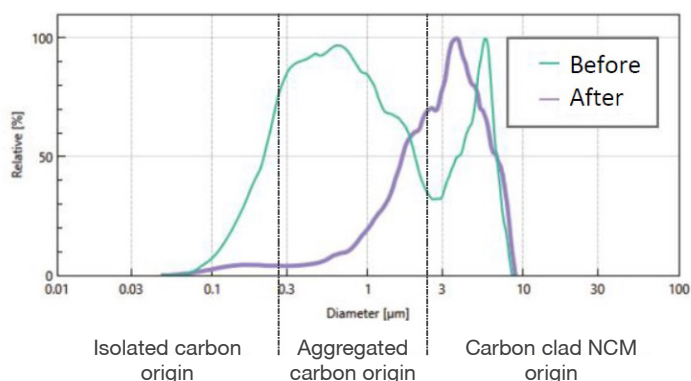
Since the dispersion of the active material and the conductive agent contributes to the performance of the battery, it is important to understand and control the mixing and kneading conditions, but until now the actual dispersion conditions have not been known because they have been controlled by the viscosity of the slurry.

We analyzed two slurry battery materials containing active material (NCM) and conductive agent (carbon) before and after kneading using Partica CENTRIFUGE, a nanoparticle analyzer. FILMIX from PRIMIX Corporation was used for kneading.

Measurement Condition

Sample	<p>NCM-based LiB battery cathode material slurry (NCM: 60%, PVDF: 1.9%, Carbon: 1.9%)</p> <ul style="list-style-type: none"> Dilute the above NMP solution 10 times with NMP. Two types: before and after kneading. Calculated using the parameters for carbon. (Density: 2100kg/m³, RI: 2.000-1.000i)
Dispersant	Water (Density: 996 kg/m ³ , RI: 1.333)
Method	<p>Line start</p> <ul style="list-style-type: none"> 8-24% sucrose density gradient solution Sample volume: 10 μL
PSD Basis	Volume
Calculation Setting	QC

*This material was provided by Primix Corporation, and the kneading process using FILMIX was supported by PRIMIX Corporation.



Before kneading, a particle size distribution (PSD) with two peaks was observed: a broad peak around 500 nm that seems to be derived from carbon aggregates, and a peak that seems to be derived from NCM with carbon attached.

On the other hand, after kneading, a small peak at around 100 nm, which is thought to be derived from isolated carbon, and a distribution derived from NCM with carbon were obtained. This is thought to be due to the stabilization of the carbon coating on the NCM while the aggregation of carbon was loosened and became isolated by kneading.

Conclusion

By using Partica CENTRIFUGE to analyze battery materials before and after kneading, results with distinctly different distributions were obtained, which enable us to infer the dispersion state of the battery materials. Partica CENTRIFUGE will contribute to the research and development of lithium-ion batteries and quality control.