

# SEM Observation of an LIB Positive and Negative Electrodes

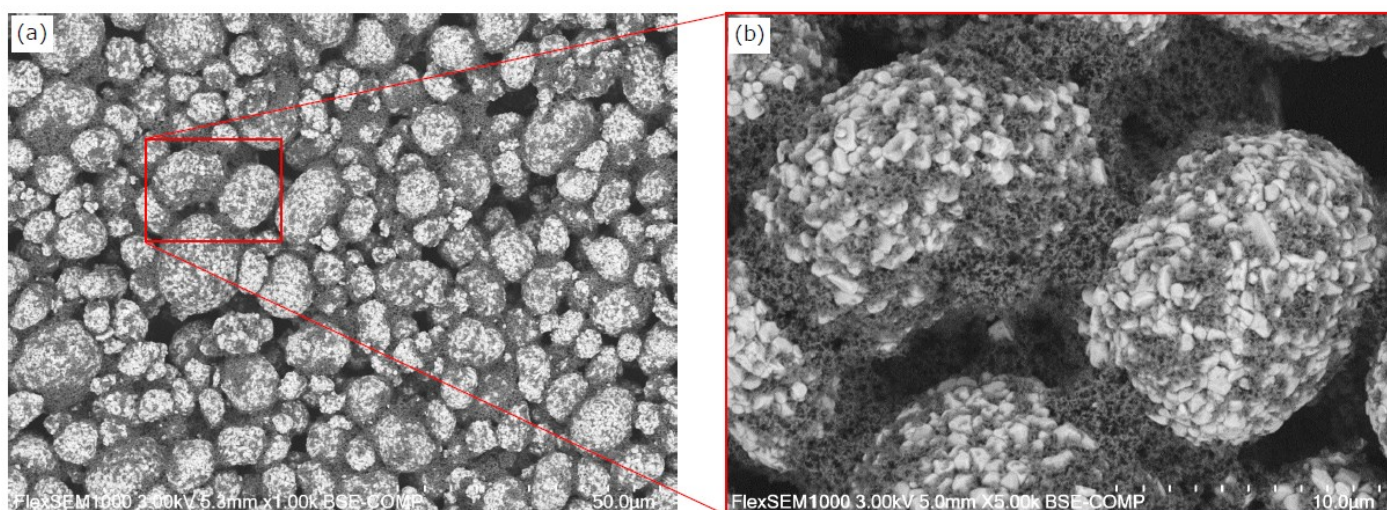


Figure 1. SEM images of a positive electrode

The lithium-ion battery (LIB) consists of several components, such as a positive electrode, a negative electrode, a separator and electrolyte mixture. SEMs are widely used to evaluate various materials and to analyze their structures for improvement of battery performance. This data sheet introduces the results of the positive and negative electrode observation at low accelerating voltage using a conventional SEM. Figure 1 shows the back scattered electron image of an NCM positive electrode (Ni:Co:Mn=5:2:3) used for an automotive LIB. In figure 1 (a), particle size of the active material and distribution of the conductive additive could be confirmed. Figure 1 (b) shows magnified image of the red framed area in Figure1 (a). In this image, surface structure of the active material and surface distribution of the conductive additive could be observed.

Sample:	Positive Electrode SEM conditions
Instrument:	FlexSEM1000II
Accelerating voltage:	3 kV
Magnification:	(a) 1 k× (b) 5 k×
Signal :	BSE

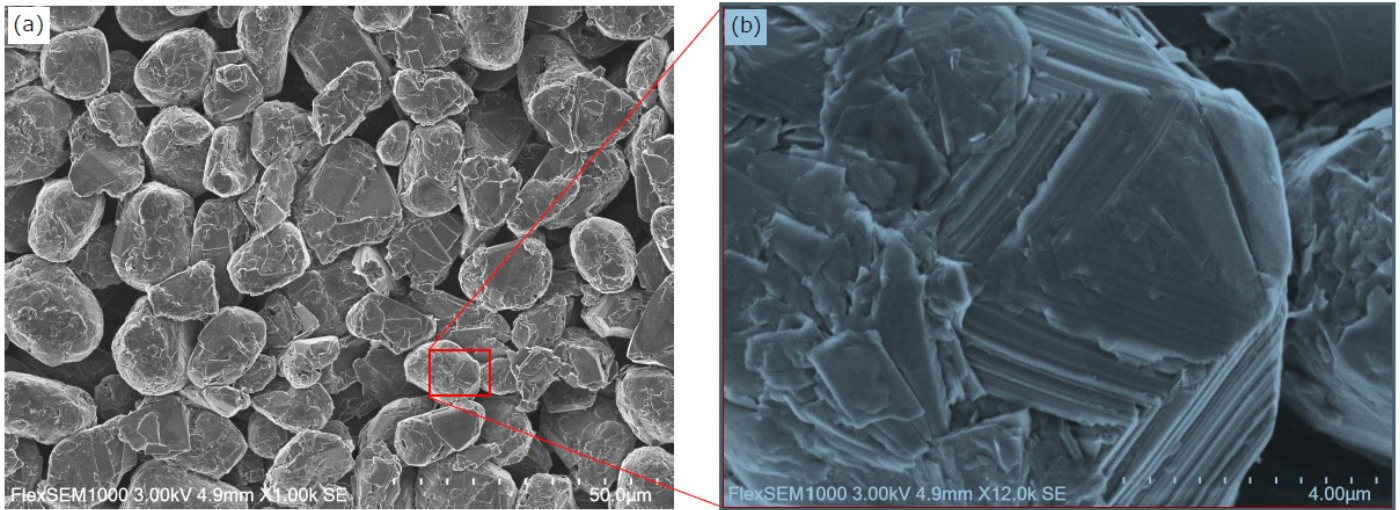


Figure 2. SEM images of a negative electrode

Graphite-based materials such as natural or artificial graphite are mainly used for the negative electrode. Since the morphology and surface structure of the graphite particles affect electrode characteristics, evaluations of them using the SEM hold crucial importance.

Figure 2 shows secondary electron images of a negative electrode made of spherical natural graphite. Morphology of the spherical graphite particles could be confirmed in figure 2 (a). Figure 2 (b) shows magnified image of the red framed area in Figure 2 (a). Scaly graphite structure on the particle surface could be clearly observed.

Thus, SEM observation at low acceleration voltage enables to confirm particle size, surface structure and additive distribution of the LIB electrode materials.

Sample:	Negative Electrode SEM conditions
Instrument:	FlexSEM1000II
Accelerating voltage:	3 kV
Magnification:	(a) 1 k× (b) 12 k×
Signal :	SE

## FlexSEM 1000II



The FlexSEM 1000 II is a compact variable-pressure SEM, without compromising on image resolution. Despite its compact design, it delivers the performance of a conventional SEM. The user interface is easy to use, which allows you to easily obtain data in a large range of applications. Due to its adaptability and flexibility, this fully automated electron microscope is a lab-friendly option for both novice and expert microscopists.



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