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Microscopy Applied to Battery Materials

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Abstract

Li-ion battery technology is being acknowledged as a path towards a greener economy. The battery properties depend on the specific chemistry and design. New technologies offer many advantages, however understanding the material properties and interactions is key for a successful product.

Here we present improvements which allows microscopy to be applied to battery materials.

Understanding the composition of the Li-ion battery materials and how the manufacturing processes affect chemistry is important for controlling the properties of the final product. Chemical analysis of Li-ion battery materials has benefitted from improvements to EDS detector hardware, making analysis of beam sensitive materials easier, higher spatial resolution mapping at low kV a routine (see figure 1) and the added ability to detect Lithium x-rays.

EBSD hardware and software technology has improved, providing structural analysis of battery materials. Thereby increased knowledge about strain in the materials, which might be generated during cycling and which potentially can lead to failure (cracking).

Correlation of data from multiple instruments or techniques provides added information, thereby supporting more informed decisions about materials and battery designs. Oxford Instruments Relate software allows correlation of data from a wide range of sources, including AFM, SEM, EDS and EBSD.

Oxford Instruments provides a wide range of hardware and software solutions to effectively add automation to quality control and means to understanding of failure mechanisms. For manufacturing, thorough quality control leads to safer products of superior quality. For research and development, understanding failure mechanisms aims at discovering the insights to take into consideration when designing batteries to make them sturdier and more reliable.

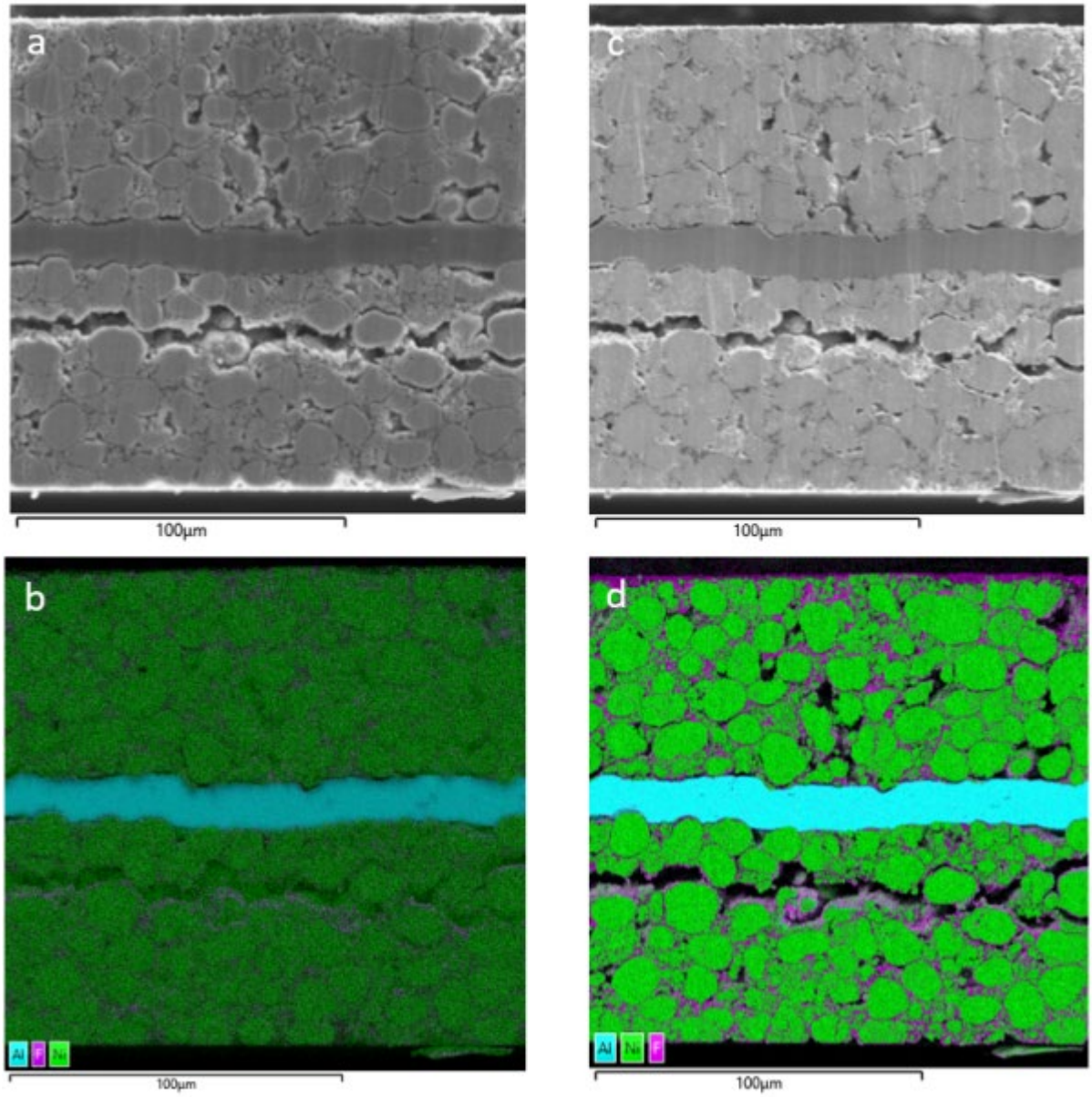

Figure 1 - Electron image and EDS Layer maps of NCM cathode foil. (a&b) UltimMax170 EDS detector at 20kV, 300pA and (c&d) Ultim Extreme at 5kV, 300pA.