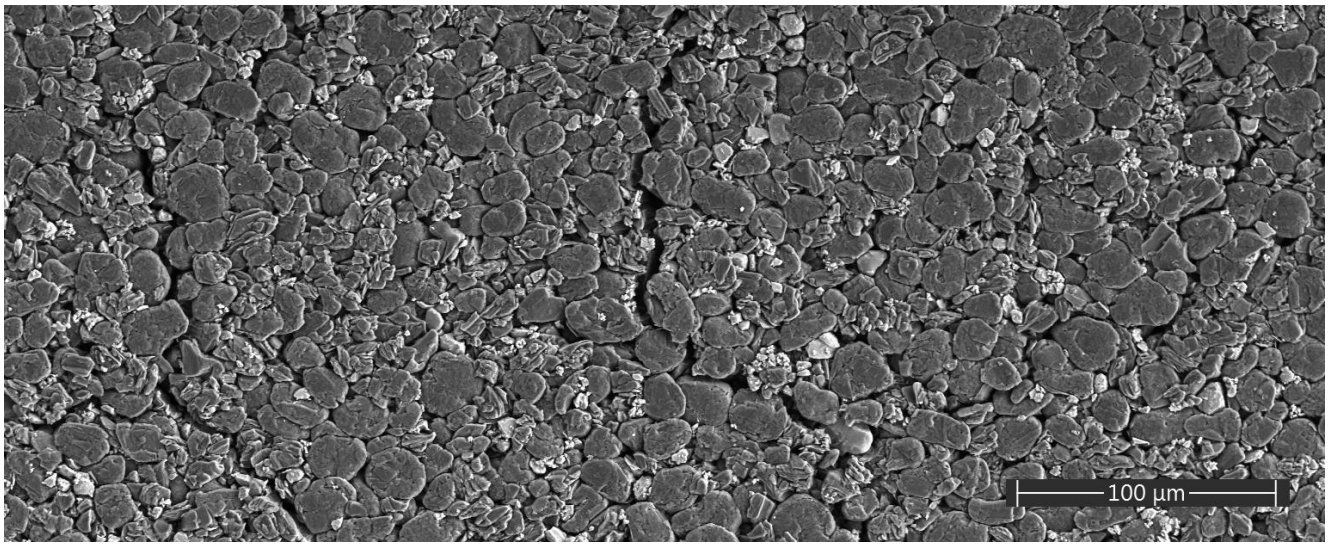
TURUN YLIOPISTO



The future is electric

Smartphones, laptops, electric vehicles, and the rapid change towards renewable energy production - all these, and more, affect that batteries have a pivotal role now and in the future.

Manufacturing of batteries is a complex process with hundreds of steps. Proper design and high manufacturing quality are needed for the safe and reliable use of batteries in every application, whether it is small or large. On this study battery materials were imaged by Scanning Electron Microscopy (SEM) and their elemental composition was mapped by Energy Dispersive X-ray Spectroscopy (EDS) at the University of Turku.

A battery pack consists of one or several cells, safety components, and cell monitoring electronics.

A lithium-ion cell consists of an anode, cathode, separator, electrolyte, and current collectors. Lithium ions are stored in the active anode and cathode materials. Cell voltage is the difference between cathode and anode potentials and depends on the selected active materials.

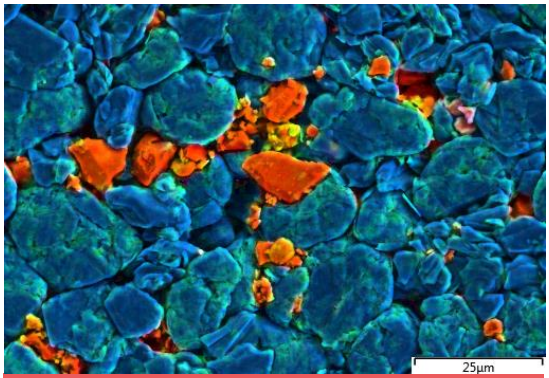
An anode and a cathode consist of active materials, conductive additives, and a binder material to glue all the components together on the current collector foil. The current collector is usually copper for anode and alumininum for cathode. Commonly used active material for anode is graphite and sometimes a small amount of silicon compounds is added. Commonly used cathode active materials are blends of certain oxides e.g. lithium nickel manganese cobalt oxide (NMC). In the mixed oxides the ratios of the different metals often vary, which affects the capacity, voltage, and structural stability.

We studied cathode and anode surfaces of two different cells by SEM imaging and elemental mapping. The results reveal that both anode surfaces contain mainly graphite, that is a commonly used active material for an anode. It was also clearly visible in the images that there are silicon oxide particles situated between graphite particles. Studies of cathodes showed interesting differences between two cells. The elemental composition of active materials in one of the studied cathodes was not at all as expected!

Research methods of this study:

Scanning Electron Microscopy, SEM

Energy Dispersive X-ray Spectroscopy, EDS



This showcase and the measurements are produced in co-operation with Akkurate Oy.

Contact for more information: www.utu.fi/casualbee