

Hunting down materials for the batteries of the future

E3. Batteries: From Materials to Cell

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Introduction/Purpose

This plenary lecture will describe the current status of material science for rechargeable batteries, such as lithium and sodium-based. The field is boiling of activities to find or modify materials that can lead to batteries with higher energy density, higher power, better life-time, better safety: all produced in a sustainable way and to a low prize. Many of these targets are complementary. It is difficult to both make batteries with high energy and high power. The batteries of the future must also take the available global amounts of raw materials into account. Therefore, the research field has diversified since different applications have different needs for batteries. Metal-air battery systems, solid state batteries, and multivalent ions as electrode materials are some routes tested for the future. The synthesis of any electrode or electrolyte material is crucial for the success as one component in a battery. A subtle difference in temperature or in preparation conditions can mean the success or failure when discharging or charging in a battery. This will be exemplified. How one component influences - cross talks to the others will be discussed.

Methods

A welth of methods will be described to highlight the progress in the field. Characterisation of battery materials and battery cells in as realistic conditions as possible is another important area where advances in synchrotron and neutron scattering techniques give new insight on materials properties for batteries. Operando studies of synthesis of materials or of the reaction mechanisms in battery cells will be highlighted.

Results

The result of this presentation is to try to answer the question: how far can we reach with the current ideas to make materials which lead to stable batteries with more than the double capacity of today?

Conclusions

Materials battery research will continue to be an existing and broad field for many years to come.