UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

Mittwoch, 20.04.2022
13:00 Uhr
MC 122 und Zoom

https://uni-due.zoom.us/j/61481460592?pwd=NTBkdk1xNWtFdnk1TTdtZkI0UllzUT09 (gilt für alle Vorträge)

Order and disorder in Li-ion batteries: insights from non-invasive thermodynamic measurements

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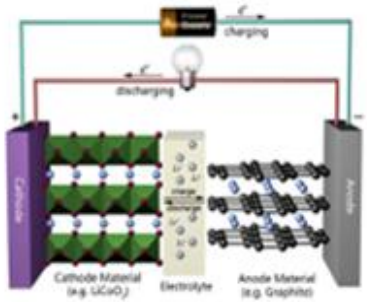

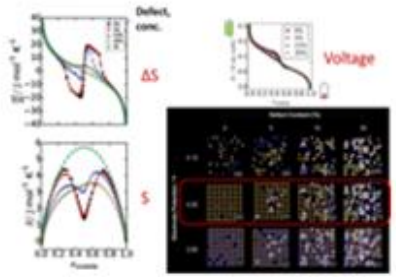

Like adsorbate layers known in Surface Science, Li-ions in rechargeable batteries assume ordered and disordered distribution phases in their host electrodes. Thermodynamically, they are in a grand-canonical equilibrium with Li-ions in the electrolyte and with Li hosted in the counter electrode. The electrochemical potential of an electrode steers its Li contents and phases in the same way as the vapour pressure steers adsorbate layers in Surface Science.

Unique markers in voltage profiles are created by Li-distribution phases during battery charge/discharge. Their meaning goes beyond scientific curiosity: such markers are used in battery management systems; changes in marker patterns over time provide non-destructive insights into battery degradation mechanisms.

Partial molar enthalpy and entropy are experimentally disentangled by recording voltage responses on temperature modulations. This provides a thermodynamic understanding of marker patterns in voltage profiles and a basis for atomistic models and their validation.

Lattice gas modelling tools transferred from Surface-Science to the world of batteries created a framework to interpret, model, and understand the phase behaviour of lithiated electrodes.