

Title: Advanced Lithium Ion Battery Materials – Coupling Thermodynamics and Electrochemistry

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Abstract

Thermodynamic modeling and experiments support the understanding and development of advanced lithium ion battery materials. Computer calculations of multicomponent systems couple thermodynamic and electrochemical properties of advanced lithium battery materials. Reversible open circuit voltages of electrochemical cells assembled from new active battery materials and their maximum theoretical specific energies can be derived. Additionally, calorimetric experiments for adiabatic, isothermal and isoperibolic conditions, respectively, are used to investigate the thermal behavior of the cells during electrochemical cycling. From calorimetric data the quantitative information on heat generation, heat dissipation and cell efficiency can be derived. Of major interest are also lifecycle studies and the related materials property fading. Therefore, the active materials are investigated before and after experiments by analytical methods of Materials Science and Engineering. Experimentally determined phase diagrams and thermochemical data are key input data for the development of analytical descriptions for the Gibbs energies of all active materials system phases. Examples for modeling and experiments will be presented for intercalation- and conversion-type materials, respectively.

Biography

Hans J. Seifert is head of the Institute for Applied Materials (IAM-AWP) at the Karlsruhe Institute of Technology (KIT) and Professor in Materials Science and Engineering. He received his PhD in Materials Science from University of Stuttgart, Germany, in 1993. He then served as a research group leader for Materials Thermodynamics at the Max Planck Institute for Metals Research, Stuttgart. From 2001 to 2003 he worked as a Senior Coating Expert and Quality Manager for Alstom (Birr, Switzerland) and from 2003 to 2006 as an Associate Professor at the Department of Materials Science and Engineering, University of Florida (Gainesville, USA). In July 2006 he was appointed Professor by the Technical University of Freiberg, Germany. Since January 2011 he is working for Karlsruhe Institute of Technology. He is speaker of the Priority Programme 1473 of the German Research Foundation: "Materials with New Design for Improved Lithium Ion Batteries" and coordinator of EERA Joint Programme "Energy Storage" (European Energy Research Alliance). The main research areas of Hans Seifert are concerned with engineering materials for advanced energy technologies including lithium ion batteries, stationary gas turbines and power plant technologies.