NANOSCALE INTERFACE CONTROL OF HIGH-QUALITY ELECTRODE MATERIALS FOR Li-ION BATTERY AND FUEL CELL

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The market for Li-ion batteries and fuel cells is undergoing rapid expansion, as portable electronic devices demand a higher energy efficiency and a better long-term stability. After a brief review of research activities on Li-ion battery and fuel cell, I will focus on the nanoscale interface control of electrode materials.

Electrochemical cycling with a high cutoff voltage causes rapid capacity fading of $LiCoO_2$. The possibilities of producing more-efficient electrodes are offered by nanoscale/nanoparticle coating on $LiCoO_2$. Nanoparticle coating is also applied to thin-film batteries, exploring the mechanisms involved with the coating layer. Nanoscale control, such as nanoparticles, mesopores, and nanoscale coating, is also developed for novel anode materials.

Despite significant progresses in proton-exchange-membrane fuel cells (PEMFCs) and direct methanol fuel cells (DMFCs), prohibitive issues remain, such as the low electrode efficiency, the loss of Pt activity by long-term operation, and CO poisoning, in addition to the economic barrier. The long-term stability of Pt nanoparticles is enhanced by Pt/phosphate nanocomposites, by preventing both the dissolution and aggregation of Pt nanoparticles, without any initial degradation. The involved mechanisms for the enhanced stability, by the nanoscale interface control of the electrode materials, will be discussed in this talk.

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