MAR10-2009-000828

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Nanocrystal Formation and Cation Ordering in Li-Intercalation Metal Phosphate.

SUNG-YOON CHUNG, Inha University / Nalphates LLC

The control of the nucleation and growth behavior of crystals from solutions or melts in inorganic compounds is scientifically and technologically of great importance for fabricating crystalline particles of optimum size and shape as well as with a narrow size distribution. Here, we show the formation of metal phosphate nanocrystals at a high temperature using high-resolution transmission electron microscopy (HRTEM), of which new developments allow one to determine the structural variation in real time in a variety of nanoscale materials. Lithium iron phosphate (LiFePO4) was selected as a multi-component model system for this atomic-level in situ observation. Since the report of the impressive lithium intercalation reaction in LiFePO4 (S.-Y. Chung et al., Nature Mater., 1, 123 (2002)), a great deal of attention has been paid to the phosphate as an alternative cathode material in lithium-ion batteries due to its outstanding thermochemical stability and environmental benignity. Our present study will be able to suggest practical approaches to the effective synthesis of metal phosphate nanocrystals, as well as to elucidate the fundamental mechanism for nucleation and growth during crystallization of complex inorganic materials. And also in this presentation the observations of a variety of lattice defects in ordered olivine LiFePO4 crystals after rapid phase transformation during crystallization will be presented, showing notable distribution behaviors of the defects. For this direct observation, in siu and ex situ high-resolution transmission electron microscopy is utilized. This analysis suggests that the lattice defects in LiFePO4 can be adjusted for improved Li ion transport.