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VABILO NA INŠTITUTSKO PREDAVANJE / INVITATION TO THE INSTITUTE LECTURE

Prof. Dr. Christian Masquelier

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Četrtek/ Thursday, 18. 2. 2010, ob / at 13:00

Velika predavalnica Kemijskega inštituta / Lecture Hall at the
National Institute of Chemistry; Hajdrihova 19, Ljubljana

The impact of downsizing $LiFePO_4$ particles to nanoscale: a key step for new generations of Li-ion batteries

$LiFePO_4$ is now recognized (and used) as a new electrode material for Li-ion batteries as it represents a low cost and safe material that exhibits high specific capacity and exceptional structural stability upon cycling. Li ions can be reversibly removed from the structure, leading to the formation of $FePO_4$ in a two-phase process with a theoretical specific capacity of 170 mAhg-1. Its main drawback is its low electrical conductivity and effective approaches such as the use of $LiFePO_4$/carbon composites or the minimization of particle sizes have been proposed.

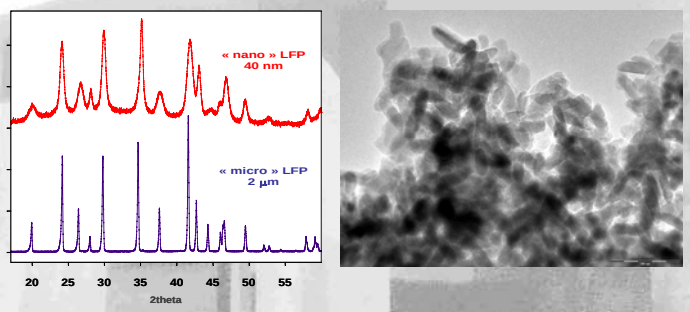

Figure 1: X-ray diffraction patterns and TEM photograph of $Li_xFe_yPO_4$ nano-particles

Downsizing $LiFePO_4$ particles to the nanometric scale (fig. 1) indeed translates in an improved electrochemical activity against lithium as the electrode/electrolyte contact area is increased, which yields higher cycling rates, and the mean path lengths for both electrons and lithium cations are minimized, allowing the use of low electronic and/or ionic conducting materials. This was demonstrated a few years ago in particular for electrochemically active $LiMnPO_4$ powders.
The crystal chemistry and electrochemical behavior of various nanometric "$LiMPO_4$" (M = Fe, Mn) powders prepared by direct precipitation in water will be presented. We report on the discovery, probed by insitu X-Ray diffraction, of a full solid solution process during Li^+ extraction / insertion at room temperature for triphylite nanopowders that contain significant amounts of defects on the Li and Fe octahedral crystallographic sites, as deduced from Rietveld analysis of powder neutron diffraction data. The possibility of having single phase extraction/insertion mechanisms (e.g., a sloping voltage curve) presents some intrinsic advantages with respect to applications such as an easier and cheaper monitoring state of charge of the battery as compared to a flat constant voltage curve.

Vljudno vabljeni! / Kindly invited!

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