MICROWAVE SYSNTHESIS OF NANOSTRUCTURED ELECTRODES FOR LI-ION BATTERIES

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Nowadays, Li-ion batteries play a key role in the growing demand of portable electronics and hybrid electric vehicles (HEVs).[1] Fast and low temperature syntheses are highly desirable for the preparation of high quality functional inorganic nanoparticles. Microwave or ultrasonic treatment of metal alkoxides presents a rapid and low cost route to both anode and cathode nanomaterials for Li-ion battery applications.[2] Here, we demonstrate the significant reduction in processing times and energy consumption during the preparation of nanostructured battery materials when using single source metal alkoxides in comparison to commercial starting materials. In particular, we show the formation of olivine $\mathrm{Li}M\mathrm{PO}_4$ (M=Fe, Mn) and Mn_3O_4 hausmannite nanostructures *via* a simple and energy efficient route employing metal alkoxides, which affords electrode materials exhibiting excellent electrochemical performances.[3] Co-location of two transition metals in these metalorganic precursors is believed to bypass the need of diffusional mixing and allow the reactions to proceed faster and at lower temperatures generating highly crystalline materials. We also present neutron pair distribution function (PDF) analyses of some of our phases in an effort to examine the local structure and show that microwave processes produce highly crystalline materials. Finally, we also include cycling studies in order to probe the relationship between the synthetic route, composition and electrochemical performance.

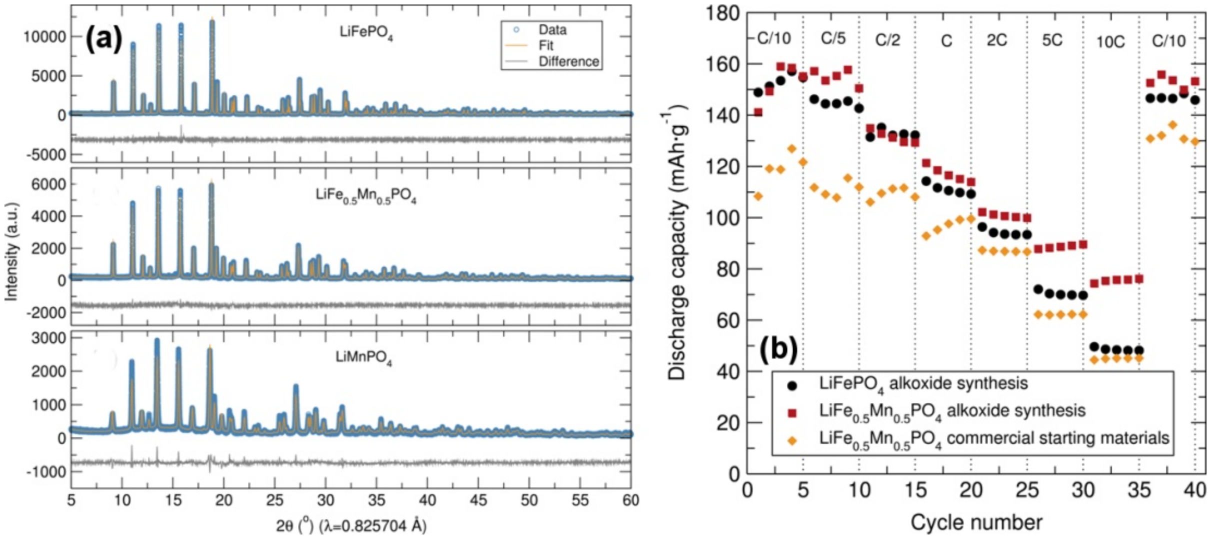

Figure 1. (a) High resolution powder x-ray diffraction of $LiFe_{1-x}Mn_xPO_4$ prepared from alkoxide precursors and **(b)** rate performance of $LiFePO_4$ and $LiFe_{0.5}Mn_{0.5}PO_4$ nanostructures.

[1] J.-M. Tarascon and M. Armand, Nat. 414 (2001) 359-367

[2] T. E. Ashton. J. Vidal Laveda, D. A. MacLaren, P. J. Baker, A. Porch, M. O. Jones and S. A. Corr, J. Mater. Chem. A, 2 (2014) 623

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