ACS Applied Materials & Interfaces, vol. 5(15), pp 7592-7598

Microwave-Assisted Synthesis of High-Voltage Nanostructured $LiMn_{1.5}Ni0.5O_4$ Spinel: Tuning the Mn_{3+} Content and Electrochemical Performance

Charl J. Jafta,†,‡ Mkhulu K. Mathe,† Ncholu Manyala,‡ Wiets D. Roos,§ and Kenneth I. Ozoemena*,†,⊥

†Energy Materials, Materials Science and Manufacturing, Council for Scientific & Industrial Research (CSIR), Pretoria 0001, South Africa

‡Department of Physics, Institute of Applied Materials, SARChI Chair in Carbon Technology and Materials, University of Pretoria, Pretoria 0002, South Africa

§Department of Physics, University of the Free State, Bloemfontein, Bloemfontein 9300, South Africa

⊥Department of Chemistry, University of Pretoria, Pretoria 0002, South Africa

Abstract

The $LiMn_{1.5}Ni_{0.5}O_4$ spinel is an important lithium ion battery cathode material that has continued to receive major research attention because of its high operating voltage (~4.8 V). This study interrogates the impact of microwave irradiation on the Mn^{3+} concentration and electrochemistry of the $LiMn_{1.5}Ni0.5O_4$ spinel. It is shown that microwave is capable of tuning the Mn^{3+} content of the spinel for enhanced electrochemical performance (high capacity, high capacity retention, excellent rate capability, and fast Li+ insertion/extraction kinetics). This finding promises to revolutionize the application of microwave irradiation for improved performance of the $LiMn_{1.5}Ni0.5O_4$ spinel, especially in high rate applications.