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Pinelopi Angelopoulou, Fotis Paloukis, Grzegorz Słowik, Grzegorz Wójcik, George Avgouropoulos

PII: S1385-8947(16)31644-8
DOI: http://dx.doi.org/10.1016/j.cej.2016.11.082
Reference: CEJ 16083

To appear in: *Chemical Engineering Journal*

Received Date: 9 August 2016
Revised Date: 10 November 2016
Accepted Date: 11 November 2016

Please cite this article as: P. Angelopoulou, F. Paloukis, G. Słowik, G. Wójcik, G. Avgouropoulos, Combustion-synthesized $Li_xMn_2O_4$-based Spinel nanorods as Cathode Materials for Lithium-ion Batteries, *Chemical Engineering Journal* (2016), doi: http://dx.doi.org/10.1016/j.cej.2016.11.082

Combustion-synthesized $Li_xMn_2O_4$-based spinel nanorods as cathode materials for lithium-ion batteries

Pinelopi Angelopoulou[1,2] , Fotis Paloukis[2], Grzegorz Słowik[3], Grzegorz Wójcik[3] and George Avgouropoulos[1,*]

[1]*Department of Materials Science, University of Patras, GR-26504 Rio Patras, Greece*

[2]*Foundation for Research and Technology-Hellas (FORTH), Institute of Chemical Engineering Sciences (ICE-HT), P.O. Box 1414, GR-26504 Patras, Greece*

[3]*University of Maria Curie-Skłodowska, Faculty of Chemistry, Pl. M. Curie-Skłodowskiej 2, 20-031 Lublin, Poland*

** Corresponding author. E-mail address: geoavg@upatras.gr*

Abstract

In this work we report the physicochemical and electrochemical properties of Li-Mn spinel-based cathode nanostructures in comparison with the corresponding commercial powder. Well dispersed nanorods (diameter of 17-32 nm and average length of 150 nm) are formed in the case of pure $Li_{1.276}Mn_2O_4$, which result in better electrochemical performance compared with the bulk commercial electrode of lithium-ion batteries. Modifications of the structure via substitution with Cu and Al ions at the octahedral sites further improve the insertion/extraction process of lithium cation, especially in the case of $Li_{1.068}Al_{0.099}Mn_{1.901}O_4$. Long term stability test at different charge/discharge rates show that this nanostructure has the highest electrochemical reversibility (~11.5% capacity loss) among the samples studied followed by $Li_{1.281}Cu_{0.086}Mn_{1.914}O_4$ (~22.5 % capacity loss), while the nanostructured $Li_{1.276}Mn_2O_4$ and the commercial $LiMn_2O_4$ spinel have ~28.4 % and ~32.4 % capacity loss, respectively.

Keywords: Li batteries; $LiMn_2O_4$ spinel; doping; nanostructures; combustion method.