

## Accepted Manuscript

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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  $\text{Li}_x\text{Mn}_2\text{O}_4$ -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>

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# Combustion-synthesized $\text{Li}_x\text{Mn}_2\text{O}_4$ -based spinel nanorods as cathode materials for lithium-ion batteries

Pinelopi Angelopoulou<sup>1,2</sup>, Fotis Paloukis<sup>2</sup>, Grzegorz Słowik<sup>3</sup>, Grzegorz Wójcik<sup>3</sup> and George Avgouropoulos<sup>1\*</sup>

<sup>1</sup>Department of Materials Science, University of Patras, GR-26504 Rio Patras, Greece

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

<sup>3</sup>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](mailto: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  $\text{Li}_{1.276}\text{Mn}_2\text{O}_4$ , 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  $\text{Li}_{1.068}\text{Al}_{0.099}\text{Mn}_{1.901}\text{O}_4$ . 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  $\text{Li}_{1.281}\text{Cu}_{0.086}\text{Mn}_{1.914}\text{O}_4$  (~22.5 % capacity loss), while the nanostructured  $\text{Li}_{1.276}\text{Mn}_2\text{O}_4$  and the commercial  $\text{LiMn}_2\text{O}_4$  spinel have ~28.4 % and ~32.4 % capacity loss, respectively.

**Keywords:** Li batteries;  $\text{LiMn}_2\text{O}_4$  spinel; doping; nanostructures; combustion method.

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