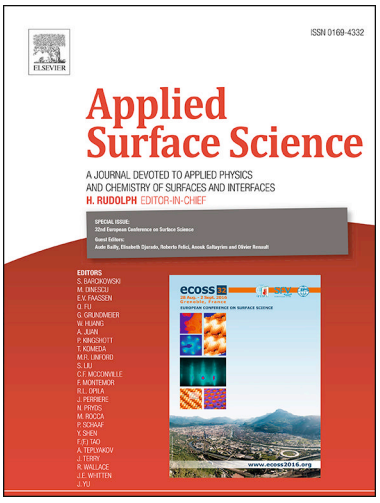
Accepted Manuscript



Full Length Article

Facile synthesis of 2D graphene oxide sheet enveloping ultrafine 1D $LiMn_2O_4$ as interconnected framework to enhance cathodic property for Li-ion battery

Niraj Kumar, Jassiel R. Rodriguez, Vilas G. Pol, Arijit Sen

PII: S0169-4332(18)32354-7
DOI: https://doi.org/10.1016/j.apsusc.2018.08.210
Reference: APSUSC 40247

To appear in: *Applied Surface Science*

Received Date: 7 June 2018
Revised Date: 5 August 2018
Accepted Date: 23 August 2018

Please cite this article as: N. Kumar, J.R. Rodriguez, V.G. Pol, A. Sen, Facile synthesis of 2D graphene oxide sheet enveloping ultrafine 1D $LiMn_2O_4$ as interconnected framework to enhance cathodic property for Li-ion battery, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.08.210

Facile synthesis of 2D graphene oxide sheet enveloping ultrafine 1D $LiMn_2O_4$ as interconnected framework to enhance cathodic property for Li-ion battery

Niraj Kumar[a], Jassiel R. Rodriguez[b], Vilas G. Pol[b*], Arijit Sen[a*]

[a]*SRM Research Institute and Department of Physics & Nanotechnology, SRM Institute of Science & Technology, Kattankulathur 603203, India.*

[b]*Davidson School of Chemical Engineering, Purdue University, West Lafayette, Indiana 47907, United States.*

**corresponding author: vpol@purdue.edu; arijit.s@res.srmuniv.ac.in*

Abstract

Cubic spinel lithium manganese oxide ($LiMn_2O_4$) has been able to attract a great deal of attention over the years as a promising cathode material for large-scale lithium-ion batteries. Here a facile hydrothermal route followed by solid state reaction is developed using as grown ultrafine α-MnO_2 nanorods to prepare 1D $LiMn_2O_4$ with 10-50 nm diameters. To enhance the cathodic property of these nanorods, a unique synthesis technique of heat treatment is developed to grow 2D graphene oxide sheet enveloping 1D $LiMn_2O_4$ as interconnected framework. This nanocomposite 3D porous cathode exhibits a high specific charge capacity of 130 mAh g^{-1} at 0.05 C rate and Coulombic efficiency of ~98% after 100 cycles in the potential window of 3.5 to 4.3 V vs Li/Li^+ with promising initial charge capacity retention of ~87%, and outstanding structural stability even after 100 cycles. Enhancement in the lithiation and de-lithiation processes leading to improved performance is likely to have its origin in the 2D conducting graphene oxide sheets. It allows for decreasing the Mn dissolution, improve the electron conductivity and reduce the Li-ion path diffusion inside the favourable morphology and crystallinity of the ultrafine 1D $LiMn_2O_4$ nanorods, giving rise to a promising cathode nanocomposite.

Keywords: Nanorods, ultrafine, graphene oxide, hydrothermal, cathode, Li-ion battery

1. Introduction

Li-ion batteries (LIBs) in recent time are used extensively as the main source of power in almost every portable electronic device like personal computers, phones, digital cameras and electric vehicles, which is due to their compact size and high portability [1].