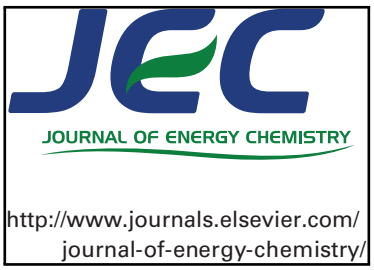

Porous core–shell $CoMn_2O_4$ microspheres as anode of lithium ion battery with excellent performances and their conversion reaction mechanism investigated by XAFS

Hang Su , Yue-Feng Xu , Shou-Yu Shen , Jian-Qiang Wang , Jun-Tao Li , Ling Huang , Shi-Gang Sun

PII: S2095-4956(17)31169-5
DOI: 10.1016/j.jechem.2018.04.009
Reference: JECHEM 590

To appear in: *Journal of Energy Chemistry*

Received date: 23 December 2017
Revised date: 15 April 2018
Accepted date: 16 April 2018

Please cite this article as: Hang Su , Yue-Feng Xu , Shou-Yu Shen , Jian-Qiang Wang , Jun-Tao Li , Ling Huang , Shi-Gang Sun , Porous core–shell $CoMn_2O_4$ microspheres as anode of lithium ion battery with excellent performances and their conversion reaction mechanism investigated by XAFS, *Journal of Energy Chemistry* (2018), doi: 10.1016/j.jechem.2018.04.009

Porous core–shell $CoMn_2O_4$ microspheres as anode of lithium ion battery with excellent performances and their conversion reaction mechanism investigated by XAFS

Hang Su[a], Yue-Feng Xu[b], Shou-Yu Shen[b], Jian-Qiang Wang[c], Jun-Tao Li[a], Ling Huang[b], Shi-Gang Sun[a,b,*]

[a]College of Energy & School of Energy Research, Xiamen University, Xiamen 361005, Fujian, China

[b]College of Chemistry and Chemical Engineering, Xiamen University, Xiamen 361005, Fujian, China

[c]Shanghai Synchrotron Radiation Facility, Chinese Academy of Sciences, Shanghai 201204, China

[*]Corresponding author. sgsun@xmu.edu.cn

Abstract

Porous core–shell $CoMn_2O_4$ microspheres of ca. 3–5 μm in diameter were synthesized and served as anode of lithium ion battery. Results demonstrate that the as-synthesized $CoMn_2O_4$ materials exhibit excellent electrochemical properties. The $CoMn_2O_4$ anode can deliver a large capacity of 1070 mAh g^{-1} in the first discharge, a reversible capacity of 500 mAh g^{-1} after 100 cycles with a coulombic efficiency of 98.5% at a charge–discharge current density of 200 mA g^{-1}, and a specific capacity of 385 mAh g^{-1} at a much higher charge-discharge current density of 1600 mA g^{-1}. Synchrotron X–ray absorption fine structure (XAFS) techniques were applied to investigate the conversion reaction mechanism of the $CoMn_2O_4$ anode. The X–ray absorption near edge structure (XANES) spectra revealed that, in the first discharge–charge cycle, Co and Mn in $CoMn_2O_4$ were reduced to metallic Co and Mn when the electrode was discharged to 0.01 V, while they were oxidized respectively to CoO and MnO when the electrode was charged to 3.0 V. Experiments of both XANES and extended X–ray absorption fine structure (EXAFS) revealed that neither valence evolution nor phase transition of the porous core–shell $CoMn_2O_4$ microspheres could happen in the discharge plateau from 0.8 to 0.6 V, which demonstrates the formation of solid electrolyte interface (SEI) on the anode.

Keywords