Hindawi Publishing Corporation
International Journal of Electrochemistry
Volume 2012, Article ID 878416, 2 pages
doi:10.1155/2012/878416

Editorial

Lithium-Ion Batteries: Recent Advances and New Horizons

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Received 2 February 2012; Accepted 2 February 2012

The lithium-ion battery has evolved as the major power source ever since its discovery in 1991 by Sony and represents one of the major successes of materials electrochemistry. Lithium-ion batteries are becoming more and more popular in view of the multifarious applications arising from their high voltage and high power leading to light weight and smaller size cells/batteries. In view of the growing day-to-day demand for lithium-ion batteries, intensive research is being pursued globally to develop new high performing cost effective electrode and electrolyte materials and importantly without compromising on environmental issues.

This special issue contains five papers, where five papers related to cathode, anode, electrolytes, lithium-ion cell, and two-phase transition electrode materials for lithium ion batteries, respectively.

In the paper entitled "*Preparation and characterization of $LiFePO_4$/CNT material for lithium ion batteries,*" R. Mohamed et al. present the synthesis technique involving growth of carbon nanotubes onto the $LiFePO_4$ using a novel spray pyrolysis modified CVD technique. The composite cathode exhibited excellent electrochemical performances with 163 mAh/g discharge capacity with 94% cycle efficiency at a 0.1 C discharge rate in the first cycle, with a capacity fade of approximately 10% after 30 cycles.

In the paper "*Influence of the C/Sn ratio on the synthesis and lithium electrochemical insertion of tin-supported graphite materials used as anodes for Li-ion batteries,*" C. Mercier et al. present a novel composites consisting of tin particles associated to graphite prepared by chemical reduction of tin(+2) chloride by t-BuONa-activated sodium hydride in the presence of graphite. The largest tin particles associated to graphite layers were observed for the material with a C/Sn ratio of 16. Electrodes prepared from the C/Sn = 42 material exhibit a high reversible capacity of over 470 $mAhg^{-1}$ up to twenty cycles with stable cyclic performances.

In the paper, "*A new class of PVdF-HFP-CeO_2-$LiClO_4$ based composite microporous membrane electrolytes for Li-Ion Batteries,*" G. Vijayakumar et al. present a composite microporous membranes based on Poly (vinylidene fluoride-co-hexafluoro propylene) (PVdF-co-HFP)-CeO_2 were prepared by phase inversion and preferential polymer dissolution process. As a result, a cell fabricated with PDCME in between mesocarbon microbead (MCMB) anode and $LiCoO_2$ cathode had better cycling performance than a cell fabricated with PICME.

In the paper "*Quantifying cell-to-cell variations in Lithium ion batteries*," S. Santhanagopalan et al. identifies a quantitative procedure utilizing impedance spectroscopy, a commonly used tool, to determine the effects of material variability on the cell performance, to compare the relative importance of uncertainties in the component properties and to suggest a rational procedure to set quality control specifications for the various components of a cell, that will reduce cell-to-cell variability, while preventing undue requirements on uniformity that often result in excessive cost of manufacturing but have a limited impact on the cells' performance.

In the paper "*OCV hysteresis in Li-ion batteries including two-phase transition materials*" M. A. Roscher et al. present a relation between batteries' state-of-charge (SOC) and open-circuit-voltage (OCV) is a specific feature of electrochemical energy storage devices. As a pronounced difference remains

between the OCV after charge and discharge adjustment, obviously the hysteresis vanishes as the target SOC is adjusted with very high current rate.

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