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Decoration of lithium spinel oxides using graphene oxides

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Lithium manganese and lithium titanium oxides of spinel structure are very interesting and promising materials for lithium-ion batteries. Nevertheless, the low electronic and ionic conductivity which lead to poor rate capability still limit its practical usage. In this work we are focus on decoration of lithium manganese oxide ($LiMn_2O_4$) - cathode material and lithium titanium oxide ($Li_4Ti_5O_{12}$) - anode material using grapheme oxide. The pristine nanocrystalline $LiMn_2O_4$ powder was synthesized by modified sol-gel method. The pristine $Li_4Ti_5O_{12}$ was synthesized by three-step solid state synthesis. Graphene oxide was prepared by a modified Hummers method. The wet low temperature chemical method was used to modify the LMO and LTO grains using graphene oxide. All the synthesized materials have been characterized by several methods: X-ray powder diffraction (XRD), Raman spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM). The electrochemical properties were investigated using a three-electrode (SWAGELOK® type) electrochemical cells with Li metal foil as a reference and counter electrode and working electrode made of LMO or LTO. Lithium hexafluorophosphate LiPF6 or lithium bis(trifluoromethanesulfonyl)imide LiTFSI salts dissolved in mixture of EC:DMC=1:1 were used as an electrolytes. The porous polymer Celgard® 2400 was applied as the separator. Every cell was cycled using constant current mode in potential range between 3.5 V and 4.5 V for LMO, and 1 V and 3 V for LTO. Charge-discharge current rates for LMO tests varied from 1 C to 30 C (where 1 C corresponds to current density of 148 mA/g) and for LTO tests varied from 1 C to 10 C (where 1 C corresponds to current density of 175 mA/g).

Biography

Monika Michalska is a Vice President of NANONET Foundation. She is also Editor-in-Chief on NANONET Newsletter. She is a research assistant at the Institute of Electronic Materials Technology. She specializes in the field of materials science/chemistry/nanotechnology, including in particular the preparation of electrode (for cathode and anode) nanomaterials for lithium ion batteries and supercapacitors using various chemical methods. She also synthesizes composites with ceramic oxide or metallic materials and with carbon coatings: with graphene flakes, graphene oxide and reduced graphene oxide (which are produced in our laboratory).

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Low-dimensional silver oxide nanoparticles prepared by solution method for nebivolol drug detection

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Here, it was prepared large-scale and low-dimensional silver oxide nanoparticles by a solution method using reducing agents in alkaline medium. The morphological, structural, elemental, and optical properties of nanoparticles were investigated by UV/vis. and FT-IR spectroscopy, powder X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), and field-emission scanning electron microscopy (FESEM) etc. A simple and reliable I-V technique was used for detection of nebivolol drug based on as-grown low-dimensional silver oxide nanoparticles. They were fabricated on a glassy carbon electrode (GCE) to give a fast response towards nebivolol drug. The nebivolol drug sensor also displays good sensitivity and long-term stability, and enhanced electrochemical I-V response. The calibration plot is linear over the broad concentration range (5.46 nM~99.3 μM). The sensitivity and detection limit are calculated from the calibration plots, which are close to 3.481 μAcm-2mM-1 and 0.91 nM (signal-to-noise-ratio, SNR of 3) respectively. This method could also be employed for the determination of drugs in quality control of formulation without interference of the recipients.

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