J Nanomed Nanotechnol 2014, 5:5
http://dx.doi.org/10.4172/2157-7439.S1.019

OMICS Group Conferences
Accelerating Scientific Discovery

4th International Conference on
Nanotek & Expo

December 01-03, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

Hydrothermal synthesis of hierarchical MoO_3- MWCNTs nanocomposites for electrochemical energy storage devices

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Hierarchical nanocomposites of molybdenum trioxide and multiwall carbon nanotubes (MoO_3-MWCNTs) were synthesized through simple and scalable *in situ* hydrothermal method for high performance electrochemical energy storage devices. MoO_3-MWCNTs nanocomposites are hierarchically porous with high surface area, excellent ionic and electric conductivity, improves performance of the devices because of the ease with which ions can access and transport in the active material. The specific capacitance measurementsof the synthesized MoO_3-MWCNTs nanocomposites revealed cycle dependent behavior, which was examined by cyclic voltammetry, galvanostatic charge discharge and impedance spectroscopy. The capacitive charge-storage properties of hierarchical porous MoO_3-MWCNTs were found to be superior to those of either pristine MoO_3 nanowires or randomly entangled mesoporous MWCNTs. This study showed that double-layer, faradaic and intercalation mechanisms are in operation in the charge storage process. This rather complicated mechanism causes irreversible structural modifications to the oxide lattice, which were verified systematically by various characterization techniques. The hierarchical porous nanocomposites showed increased charge-storage capacity 210 F/g, and the energy density is improved greatly to 71.6 Wh/kg with a power density of 600 W/kg without compromising the charge/discharge kinetics in MWCNTs or MoO_3 nanowires. The hierarchical porous nanocomposites electrodes exhibited excellent charge/discharge rate and long-termcyclic stability in capacitance with more than 95% efficiency after 2000 cycles. The synthesized hierarchical porous nanocomposites exhibited excellent cycling stability by retaining95% of their maximum capacitance after 3000 cycles of continuous charge–discharge cycles. The use of such hierarchical porous nanocomposites is quite promising for electrochemical energy storage devices in portable electronic devices.

Biography

Imran Shakir is currently employed in the capacity of Assistant Professor at Sustainable Energy Technologies (SET) center, KSU. He is completed his PhD and postdoc from South Korea. He has worked with Samsung, Electronics, Korea for more than three years for the development of functional nanomaterials for efficient energy storage and devices. In this regard he has several scientific and technological breakthroughs in this field and published more than 60 international publications. While doing PhD and afterwards, Imran has published his work in the area of energy storage and conversion devices in a number of high impact Journals (Nanoscale, ChemComm, J Mat Chem, J Power Sources, RSC Advances, Elctrochimica Acta etc. His current research is mainly focus on the development of high capacitance, high-energy density energy storage devices and also to provide a fundamental understanding of the microscopic underlying mechanisms in the ionic transport properties and the change in the electronic structure of state-of-the-art nanostructures.

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