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Layer by layer assembly of graphene and ultrathin vanadium pentoxidecoated MWCNTs on textile fabrics for high flexible supercapacitor electrodes

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Among transition metal oxides, vanadium oxides have received relatively modest attention for supercapacitor applications. Yet, this material is abundant, relatively inexpensive and offers several oxidation states which can provide a broad range of redox reactions suitable for supercapacitor operation. Electrochemical supercapacitors based on nanostructured vanadium oxide (V_2O_5) suffer from relatively low energy densities as they have low surface area and poor electrical conductivities. To overcome these problems, we developed a layer by layer assembly (LBL) technique in which a graphene layer was alternatively inserted between MWCNT films coated with ultrathin (3 nm) V_2O_5 . The insertion of a conductive spacer of graphene between the MWCNT films coated with V_2O_5 not only prevents agglomeration between the MWCNT films but also substantially enhances the specific capacitance by 67 %, to as high as ~2,590 Fg^{-1}. Furthermore, the LBL assembled multilayer supercapacitor electrodes exhibited excellent cycling performance > 97 % capacitance retention over 5,000 cycles and a high energy density of 96 $Whkg^{-1}$ at a power density of 800 Wkg-1. Our approach clearly offers an exciting opportunity for enhancing the device performance of metal oxide-based electrochemical supercapacitors suitable for next-generation flexible energy storage devices by employing a facile LBL assembly.

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, he 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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