n-type Ni-Co-MOF anchored on precursor-free p-type 1D CuO for energy storage devices

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Herein, we propose an effective strategy to enhance the electrochemical activity of metal organic framework-based (MOF) electrode material for electrochemical capacitors. The fabrication involves the synthesis of CuO nanowires on Cu substrate by facile solution-free dry oxidation route followed by the deposition of oriented Ni-Co-zeolitic imidazolate framework (Ni-Co-ZIF) on 1D CuO. This synthesis strategy benefitted from the highly exposed redox active sites of aligned Ni-Co-ZIF, an "ion and electrolyte repository", to assist the diffusion of electrolyte ions, and a p-n heterojunction between CuO and Ni-Co-ZIF. ZIFs represent an emerging and unique class of MOFs. The oriented pseudocapacitive Ni-Co-ZIF@CuO composite electrode yielded excellent electrochemical merits including a high gravimetric capacitance which is 3.3- and 2.1-fold higher than the self-supported CuO and bulk MOF, respectively. Furthermore, we employed first principles density functional theory calculations to study the enhanced electronic conductivity and reduced work function of Ni-Co-ZIF@CuO systems upon CuO doping, which reinforced the experimental findings. Moreover, asymmetric supercapacitor (ASC) device was assembled to evaluate the application of the as-fabricated electrode material for electrochemical capacitors. The gadget obtained a maximum energy density of 43 W h kg-1, with improved cyclic stability after 10,000 cycles. The oriented Ni-Co-ZIF@CuO with remarkable electrochemical activity and mechanical flexibility inspires for next-generation MOF-based electrode materials with superior electrochemical attributes.

Biography

Iftikhar Hussain has completed his Master degree from Yeungnam University South Korea and now studies PhD from City University of Hong Kong. He has published more than 25 papers in reputed journals on energy storage devices.