Carbon-Metal Oxide Nanocomposite for Electrochemical Supercapacitor

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Abstract

The ever increasing energy demands of modern society force us to search for alternative energy storage and conversion systems due to the depletion of fossil fuel in the earth crust and to control environmental problems. Various types of available energy storage devices, the electrochemical capacitors (ECs) known as supercapacitors have attracted great interest in the recent years due to its unique properties *viz.* ultrafast charge-discharge behavior, high power densities, very long-term stability compared to the lithium-ion batteries. To improve supercapacitors performance, various transition metal oxides such as RuO_2, MnO_2, NiO, Co_3O_4, V_2O_5, Cu_2O, and MoO_3 has been used for the supercapacitor. However, the rate capability and electrochemical reversibility of the electrodes is poor due to the nature of redox reaction. In order to resolve this problem, carbon is an effective source for improving the electrochemical performance of electrodes since it has high electrical conductivity, leads to improve the conductance of composite materials and also increases the stability of the electrodes.

In this presentation, I will give a very short discussion about my previous research work and further will extend my talk for the use of dopamine as a carbon source with metal oxide is highly imperative which enhances the specific capacitance, rate capability with low resistivity due to its excellent properties. Most importantly, it can easily self-polymerization occurs in alkaline medium. Therefore, we have developed the flower-like D-$NiCo_2O_4$ and nanorods-like D-Cu_2O electrodes exhibit a large specific capacitance, good rate capability, and excellent cycling stability, demonstrating its suitability for supercapacitor. Notably, the obtained specific capacitance values are 667 F g^{-1} and 241 F g^{-1} corresponding to D-$NiCo_2O_4$ and D-Cu_2O electrodes, respectively. In addition, the asymmetric supercapacitor device was fabricated through D-$NiCo_2O_4$ as a positive electrode and biomass-derived AC as a negative electrode with the potential range of 0-1.5 V in PVA-KOH gel electrolyte solution.