

Fabrication of CuO/MO@rGO nanocomposite coated Ni foam binder free electrode by facile hydrothermal for high efficiency supercapacitor applications

The increasing demand for energy has triggered tremendous research efforts for the development of light-weight and durable energy storage devices. In recent years, there have been tremendous research efforts with the strong objective to increase the energy density, power density and cyclic performance of supercapacitors so that it can reach up to the level of batteries at lower fabrication cost. A fast-growing market for portable electronic devices such as smartphones, notebooks, cameras, etc. are becoming more multifunctional requiring novel, lightweight, inexpensive, flexible and wearable electronic devices. To accomplish the above-mentioned conditions, exploring simple, economical methods of preparation of the active materials and to design lightweight, flexible, free standing supercapacitor electrodes in an inexpensive binder-free process.

Previous literature shows that high specific capacitance can be obtained if metal oxides are uniformly dispersed on carbon materials with high surface areas. Combining carbon nanomaterials with metal oxides to prepare composites could enhance the specific surface areas, induce high porosity, facilitate electron and proton conduction, expand active sites, extend the potential window, protect active materials from mechanical degradation, improve cycling stability and improve the capacitive performance. Among the transition metal oxides, CuO is noteworthy to explore as a promising supercapacitor material due to its low cost, abundant resources, non-toxicity, chemical stability, easy preparation and high theoretical capacitance (1800 Fg^{-1}). However, the poor electronic conductivity of CuO leads to the poor stability of repetitive cycling. By adding conductive carbon nanomaterials (rGO, CNT, g-C₃N₄), the electronic conductivity of the CuO electrodes can be increased.

Research work plan:

- Hydrothermal synthesis of rGO doped CuO/NiO hierarchical nanostructures for high performance supercapacitor applications.
- Synthesis of rGO doped CuMnO₂ nanostructure for hybrid asymmetric supercapacitor applications.

- Decoration of high $\text{CuMn}_2\text{O}_4/\text{CuCo}_2\text{O}_4$ on functionalized CNT for high energy/power density supercapacitor applications

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