

The Synthesis of Nb₂O₅@Carbon Core-Shell Nanoparticles and Reduced Graphene Oxide Nanocomposite for Anode of Sodium-Ion Hybrid Supercapacitor

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Sodium ion hybrid supercapacitors (Na-HSCs, combined with sodium ion battery and supercapacitor) are fascinating system as next generation energy storage. In spite of its advantages such as low cost of sodium, long cycle life, high energy density and power density, there are some problem to solve. One of the problems is kinetic imbalance between the rapid non-faradaic capacitive reaction on cathodic parts and the slow faradaic reaction on anodic parts. Therefore, nanocomposites of Nb₂O₅@Carbon core-shell nanoparticles (Nb₂O₅@C NPs) and reduced graphene oxide(rGO) are applied to Na-HSCs to solve the imbalance problem. Nb₂O₅@C NPs could be synthesized through facile one pot method (water-in-oil microemulsion synthesis). By mixing PH-controlled GO solution and as-synthesized NbOx NPs, intended nanocomposite could be produced with heat-treatment. The half-cell which is applied Nb₂O₅@C NPs/rGO nanocomposite shows highly reversible capacity (285 mA h g⁻¹ at 0.025 A g⁻¹). Na-HSCs full cell delivers high energy density (76 W h kg⁻¹) and high power density (20,800 W kg⁻¹) and it is higher than those of similar Li-HSCs.