

The Synthesis of Nb₂O₅@Carbon Core-Shell Nanoparticles and their High-Rate performance
for Anode of Li-ion Hybrid Supercapacitor

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Lithium ion hybrid supercapacitors (Li-HSCs, combined with battery and supercapacitor system) are attractive as next generation energy storage devices because of their fascinating properties such as high energy and power density with stable cyclability. However, one of the problems in HSCs is kinetic imbalance between the rapid non-faradaic reaction on cathodic parts and the slow faradaic reaction on anodic parts. In this work, we applied nanosized niobium pentoxide (Nb₂O₅)@carbon core-shell to anode of Li-HSC. It could be synthesized through facile one pot method (water-in-oil microemulsion synthesis). It can be controlled the crystal structures (orthorhombic (T) phase and pseudo-hexagonal (TT) phase) using different pH. The orthorhombic Nb₂O₅@carbon core-shell electrode shows superior rate capability (~98 mA h g⁻¹ at 5 A g⁻¹) within voltage range from 1.1 to 3.0 V (vs. Li/Li⁺) and high specific capacity (~180 mA h g⁻¹ at 0.05 A g⁻¹) due to the orthorhombic crystal structure Nb₂O₅ and nanosized Nb₂O₅@carbon core-shell structure.