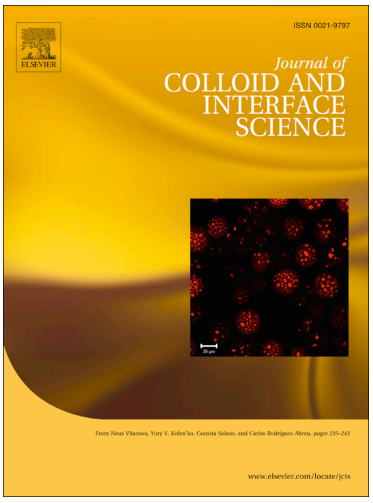

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Hierarchically porous cobalt-carbon nanosphere-in-microsphere composites with tunable properties for catalytic pollutant degradation and electrochemical energy storage

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Abstract

Unreliable energy supply and environmental pollution are two major concerns of the human society in this century. Herein, we report a rational approach on preparation of hierarchically-structured cobalt-carbon composites with tunable properties for a number of applications. A facile hydrothermal treatment of cobalt nitrate and sucrose results in the formation of a metallic cobalt-amorphous carbon composite with cobalt nanospheres anchored homogenously on an amorphous carbon substrate. Tuning the calcination conditions in air will generate either a metallic cobalt-cobalt oxide core-shell structure with magnetism or a fully oxidized Co_3O_4 composite. The different materials are demonstrated as anodes for lithium-ion batteries (LIBs) and catalysts for advanced oxidation-based wastewater remediation. A fully oxidized composite (FC@CS, fully oxidized Co loaded on carbon spheres) as a LIB anode exhibits superior electrochemical performance, possessing a high reversible capacity, high initial columbic efficiency, outstanding cycling performance and excellent rate capability. The anode performance is superior to most reported Co_3O_4-based