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A 3D hierarchical microcapsule supercapacitor with ultrahigh current density

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A unique three dimensional (3D) hierarchical microcapsule structure (NiSx@NCV) has been put forward, which is realized by the ensemble of N-doped carbon vesicles encapsulating dual-NiSx (αNiS/NiS2) nanoparticles *via* an *in-situ* nanospace confined pyrolysis strategy. The NiSx@NCV shows a high pseudocapacitance of 1600 F/g at 1 A/g and an impressive rate performance (capacitance retention ratio of 84.5%, from 1 to 25 A/g). Benefiting from the intriguing configuration, a kind of high performance asymmetric supercapacitors (ASCs) has been fabricated, using 3D NiSx@NCV microcapsules and nanoporous carbon (NPC) as positive and negative electrodes, respectively. The fabricated ASCs achieve a capability of 135.06 F/g at 1 A/g and exhibit outstanding rate capability at 32 A/g. More importantly, a high capacitance retention ratio of 87% is still achieved at current density from 32 to 300 A/g, which well displays the ultrahigh rate performance of NiSx@NCV//NPC ASCs. In addition, NiSx@NCV//NPC ASCs deliver an attractive energy density of 48.02 Wh/kg at a power density of 800 W/kg, and still maintain 30 Wh/kg even at an ultrahigh power density of 240 kW/kg. This is attributed to rich the redox reaction and interface effect of dual-NiSx nanoparticles, abundant active sites and high electrical conductivity from N-doped carbon vesicles.

Biography

Lian Gao Lian Gao (born in 1945) is currently Distinguished Professor of Materials Science and Engineering, Shanghai Jiao Tong University. After receiving his PhD degree in inorganic nonmetallic materials in 1986 from Shanghai Institute of Ceramics, Chinese Academy of Sciences, he continued his research in Imperial College, London as a postdoctoral research associate and then in Max-Planck Institute of Metallurgy, Germany as a visiting scholar. After that, he served as a staff scientist in Shanghai Institute of Ceramics, Chinese Academy of Sciences. His research focus has been on high temperature structural ceramics, carbon nanotubes dispersion, high-performance ceramic nanocomposites, and dye sensitized solar cells. His current research investigations involve the development of energy and enviromental materials for applications in energy reservation, photoelectrocatalysis and heterogeneous catalysis. Prof. Gao is an Academician of World Ceramic Academy of Sciences and rated as HiCi scholar by Institute of American Intelligence. He has received numerous awards inlcuding the frist prize of Shanghai Natural Science Award in 2009 and the Award from Ho Leung Ho Lee Foundation for Scientific and Technological Progress in 2010.

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