Structural evolution and supercapacitor performance of carbon blacks at thermal oxidation treatment

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Abstract: Carbon black (CB) nanoparticles were oxidized at 450℃ for various hours. The changes of morphologies and structures of CB particles were investigated by X-ray diffraction, transmission electron microscopy, scanning electron microscopy, high resolution transmission electron microseopy, Fourier transform Infrared Spectrometer and Raman spectroscopy. Results show that the oxidized samples exhibit a hollow structure with concentric carbon layers cross the hollow core. When used as the electrode for suoercapacitors, the oxidized CB samples show specific capacitances of 120-170 F g^{-1} at a current density of 0.2 A g^{-1},and retains a high capacitance of 100-120 F g^{-1} at a current density of 20 A g^{-1}. The high specific capacitance and 70% capacitance retention clearly demonstrate that the oxidized hollow CB nanoparticles comprising of micro-, meso- and macropores potentially favor ion kinetics, leading to a high utilization efficiency of electrode materials for supercapacitors.