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The effects of morphology re-arrangements on the pseudocapacitive properties of mesoporous molybdenum disulfide (MoS2) nanoflakes

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ABSTRACT:

Mesoporous molybdenum disulfide (MoS(sub2)) with different morphologies have been prepared via hydrothermal method using different solvents, water or water/acetone mixture. The MoS(sub2) obtained with water alone gave a graphene-like nanoflakes (g-MoS(sub2)) while the other with water/acetone (1:1 ratio) gave a hollow-like morphology (h-MoS(sub2)). Both materials are modified with carbon nanospheres as conductive material and investigated as symmetric pseudocapacitors in aqueous electrolyte (1 M Na(sub2)SO(sub4) solution). The physico-chemical properties of the MoS(sub2) layered materials have been interrogated using the surface area analysis (BET), scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD), Raman, fourier-transform infrared (FTIR) spectroscopy, and advanced electrochemistry including cyclic voltammetry (CV), galvanostatic cycling with potential limitation (GCPL), repetitive electrochemical cycling tests, and electrochemical impedance spectroscopy (EIS). Interestingly, a simple change of synthesis solvents confers on the MoS(sub2) materials different morphologies, surface areas, and structural parameters, correlated by electrochemical capacitive properties. The g-MoS(sub2) exhibits higher surface area, higher capacitance parameters (specific capacitance of 183 F g(sup-1), maximum energy density of 9.2 Wh kg(sup-1) and power density of 2.9 kW kg(sup-1)) but less stable electrochemical cycling compared to the h-MoS(sub2). The findings show promises for the ability to tune the morphology of MoS(sub2) materials for enhanced energy storage.