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Advanced 3D $Ni(OH)_2$/CNT Gel Composite Electrodes for Supercapacitors[1] HANLIN CHENG, HAI MINH DUONG, National University of Singapore — In order to enhance the performance of supercapacitors, advanced 3D Porous CNT/$Ni(OH)_2$ gel composite electrodes are developed in this work. Compared with previously reported graphene gel supercapacitors, our electrodes using 1D CNTs have smaller diffusion resistance due to a shorter ion transport path. The developed 3D xerogel composite electrodes demonstrate the success of a careful engineered guest/host materials interface. Initially, the CNT gels are coated on the nickel foam to form a 3D scaffold, which serves as a microscopic electrical conductive network. Then $Ni(OH)_2$ are incorporated using a traditional electrodeposition method. In this work, two types of the 3D CNT-coated nickel foams are investigated. The gels can be used directly as hydrogels or dried in air to form xerogels. Both hydrogels and xerogels present 3D tangled CNT networks. It shows that the hydrogel composite electrodes with unbundled CNTs, though presenting high capacitances of 1400 F/g at low discharge rate, possess lower capacitances at higher discharge rate and a poor cycling performance of less than 23% retention. In contrast, the xerogel composite electrodes can overcome these limitations in terms of a satisfied discharge performance of 1200 F/g and a good cycling retention more than 85% due to a stronger $Ni(OH)_2$/CNT interface. The CNT bundles in the xerogel electrodes formed during the drying process can give a flat surface with small curvature, which facilitate the $Ni(OH)_2$ nucleation and growth.

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