Facile synthesis of three-dimensional graphene/nickel oxide nanoparticles composites for high performance supercapacitor electrodes

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This study presents a simple and facile method for preparing three-dimensional (3D) porous reduced graphene oxide (rGO) and NiO nanoparticles composites (3D-RGNi) as high performance supercapacitor electrodes. The 3D porous graphene framework is first produced by the self-assembly of poly(methyl methacrylate) (PMMA) particles and graphene oxide (GO), followed the adsorption of Ni precursor on GO. High-temperature treatment is simultaneously carried out to fabricate the 3D porous structured rGO decorated with NiO nanoparticles. The as-synthesized 3D-RGNi electrode exhibits a high specific capacitance of 1328 F·g−1 at a current density of 1 A·g−1 and an excellent cycling stability with 87% retention of the capacitance after 2,000 cycles of galvanostatic charge-discharge. These high capacitance performances are attributed to the synergistic effects from the incorporation of the rGO network and NiO nanoparticles, and the highly porous structure of 3D-RGNi. Hence, it is expected that 3D-RGNi might serve as a promising materials for electrochemical energy storage applications.