Graphene Hydrogel/Manganese Oxide/Carbonate Composite as a Novel Electrode for a Supercapacitor

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Supercapacitors provide high power and low energy densities compared with conventional batteries. Current supercapacitors have energy densities well below the values required to offer power assists in various applications including hybrid electric vehicles or other high energy uses. In order to develop a supercapacitor with both high energy and power densities, this paper reports a composite containing graphene hydrogel (GNS) and manganese oxide/carbonate (MOCC). GNS possess large surface area that allows the adsorption of ions functioning as electric double layer capacitor and MOCC can provide intrinsic reversibility of surface redox contributing to large capacitance. GNS/MOCC composite was synthesized under mild hydrothermal conditions. The exfoliated graphite oxide is reduced to graphene, and then MOCC nanoparticles are formed in situ and homogeneously anchor onto the surface of graphenes, which can therefore separate neighbouring graphene sheets. The graphene sheets overlap to afford a three-dimensional conducting network, which facilitates fast electron transfer between the active materials and the charge collector and thus improves the contact between the electrode materials and the electrolytes. The as-obtained GNS/MOCC composite exhibited high specific capacitance (187 F/g at10 mV/s) and excellent long cycle life (200). Furthermore, the effect of the microstructure on the electrochemical performance of supercapacitor was investigated.

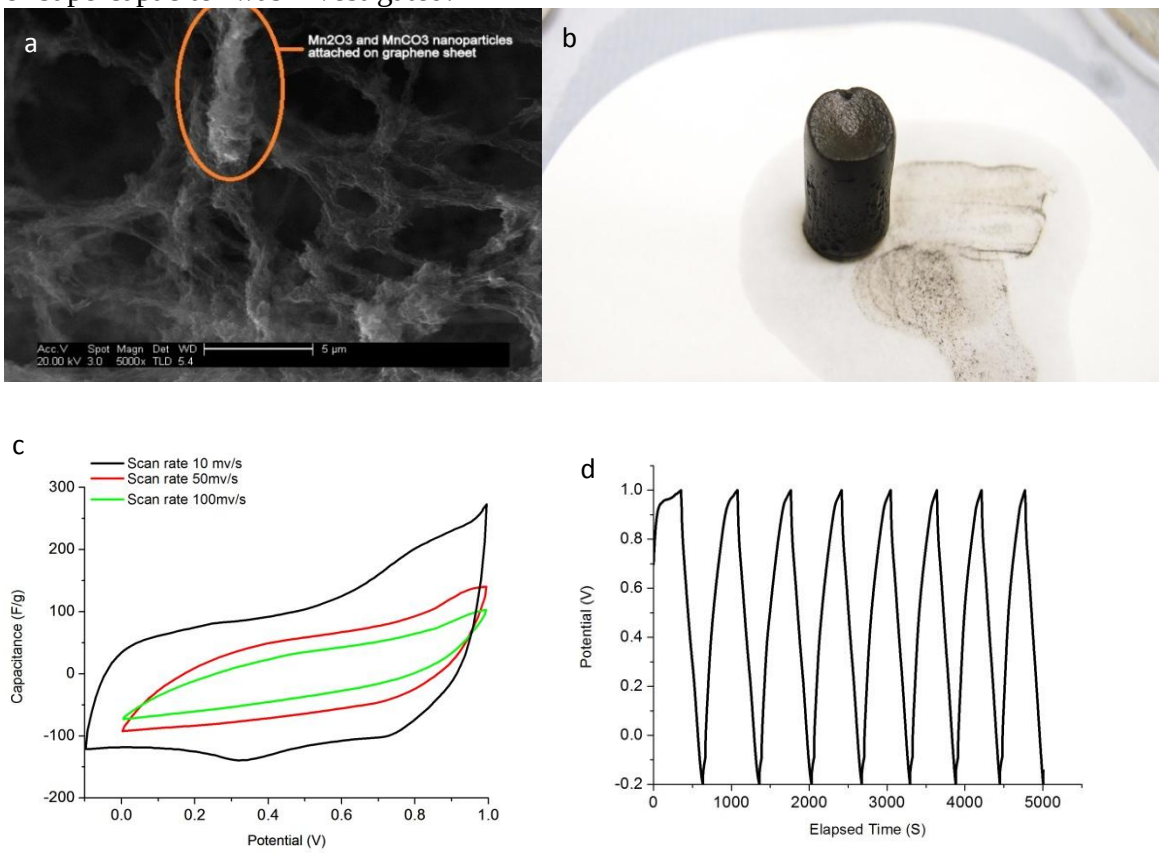

Fig 1. a:SEM images of GNS/MOCC at different magnifications; b: GNS/MOCC specimens; c: Cyclic voltammetry of GNS/MOCC at different scan rates; d: Galvanostatic charge/discharge (CC) curves of an GNS/MOCC measured at 1 mA/g.