Controlled Synthesis of Manganese Oxyhydroxide Nanotubes for High-efficiency Supercapacitor

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Controlled synthesis of tubular manganese oxyhydroxide (MnOOH) with nano-dimension on high electronic conductivity graphite felt (GF) as flexible supercapacitor electrode was successfully synthesized via a facile hydrothermal method. As a fundamental study, the time-dependent kinetics was investigated to interpret its formation mechanism, which can be depicted as the curling of 2-dimensional precursor into 1-dimensional structure with hollow interior. The subtle interplay between the morphology and dimension was found to be responsible for the remarkable properties of MnOOH as supercapacitor. With the nanotubes structure, the active surface area of the MnOOH can be completely accessible to electrolyte ions besides of having shorter charge transport length and greater ability to withstand the structural deformation. The unique structural properties of MnOOH nanotubes endowed them with excellent electrochemical performances which can be reflected from their high specific capacitance (1156 Fg^{-1} at 1 A g^{-1}), energy (1125 W h kg^{-1}) and power densities (5.05 kW kg^{-1}). On the other hand, hybridizing the GF with MnOOH species using the binder-free concept in this scalable approach enabled them to be used as the high-efficiency flexible supercapacitor electrodes, making it feasible for industrial use.

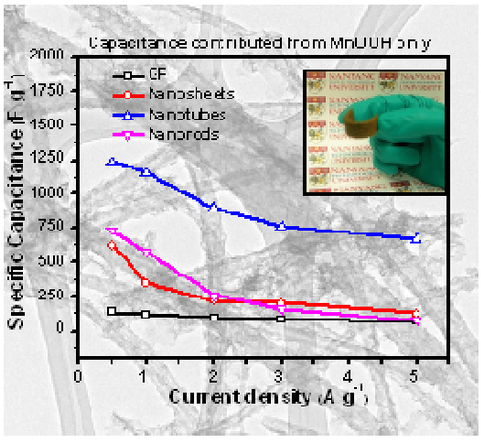

Figure 1 Specific capacitance of the as-prepared samples as a function of current densities

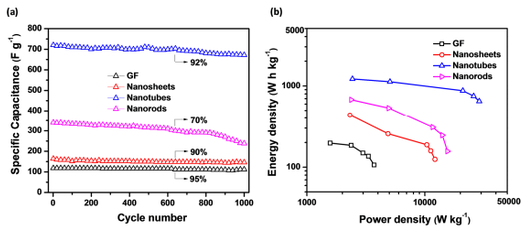

Figure 2. (a) Cycling performance of the as-prepared MnOOH/GF composites; (b) Ragone plot.