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Highly packed graphene–CNT films as electrodes for aqueous supercapacitors with high volumetric performance†

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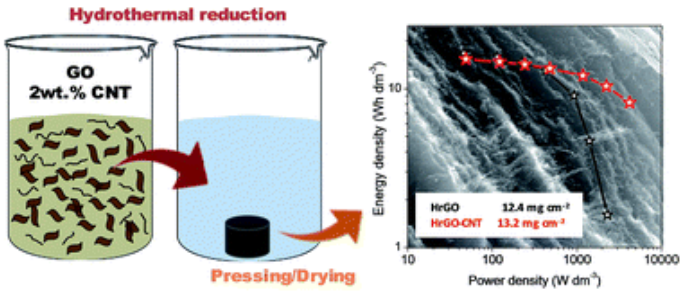
The increasing complexity of portable electronics demands the development of energy storage devices with higher volumetric energy and power densities. In this work we report a simple strategy for the preparation of partially reduced graphene oxide/carbon nanotube composites (prGO–CNT) as highly packed self-standing binder-free films suitable as electrodes for supercapacitors. These carbon-based films are easily obtained by the hydrothermal treatment of an aqueous suspension of graphene oxide and CNTs at 210 °C and then compacted under pressure. The prGO–CNT films, which had an apparent density as high as 1.5 g cm^{-3}, were investigated as binder-free electrodes for aqueous supercapacitors using 6 M KOH solution as the electrolyte. The results show that the presence of merely 2 wt% of CNTs produces a significant enhancement of the capacitance retention at high current densities compared to the CNT-free samples, and this improvement is especially relevant in systems formed using electrodes with high mass loadings. Volumetric capacitance values of 250 F cm^{-3} at 1 A g^{-1} with outstanding capacitance retention (200 F cm^{-3} at 10 A g^{-1}) were achieved using the prGO–CNT electrodes with an areal mass loading above 12 mg cm^{-2}.



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