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Graphene-Based Hybrid Electrodes for High Performance Supercapacitors

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The high power density, long life cycle and very short charging time make supercapaictor a desirable energy stirage system.1 One of the limitations, however, is their low energy density as compared to the batteries.2 The best approach so far to overcome this problem is to design hybrid electrodes by comibining the capacitor type and battery type materials.3 Such hybrid electrodes use carbon materials as a conductive backbone and the transition metal oxides as an electroactive components.4 As a result, a synergistically high performance is obtained which originates from the high conductivity and long life cycle of carbon materials and the high specific capacitance of TMOs.5 Herein, we report two hybrid ternary electrode systems by using graphene-CNTs and graphene-CNCs as conductive matrix and combining them with bimorph Akaganeite (β-FeOOH) and Manganese dioxide (α-MnO2) nanoparticles respectively via a simple hydothermal self assembly method. When used as electrode in symmetirc and asymmetric spercapacitors (2V) in an aqeous electrolyte system, the hybrid electrodes gave an excellent energy-power profile, high specific capaictance and remarkable cylic stability of upto 99.8% after 10,000 galvanostatic charge-discharge cycles. This high performance is attibuted to a dominant capacitive charge storage mechanism and the well-structuring of the hybrid electrodes. This system approcah can be useful in desiging high performance electrodes for long life supercapacitor systems with high energy and power desnsities.