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Flexible wearable supercapacitor electrodes

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In this talk, we elaborate our efforts in nanocombinatorial approaches to fabricate flexible electrodes that deliver high performance bendable and flexible supercapacitors. We demonstrate the use of electrochemical redox active oxides and polymeric nanomaterials to achieve high energy density supercapacitor electrodes and microsupercapacitors. Unique synthetic nanomaterials incorporating mixed oxides solid solutions and doping approach are the key innovative strategies that we adopted for achieving high energy density electrodes. Free-standing supercapacitors made with flexible oxide nanofibers hybrid paper in loosely packed corrugated two-dimensional entangled network has shown significant advantages in facilitating the ingress and digress of electrolyte ions. The flexible current collector- free graphene-oxide composite electrodes was also demonstrated.

In addition, we have fabricated all solid state flexible microsupercapacitor on printable photo paper. Three dimensional interconnected coral-like polyaniline-manganese oxide composite is electrochemically deposited onto interdigital finger electrodes. The optimized device shows an ultra-high areal energy density of 6.3 μWh cm^{-2} at a power density of 35 μW cm^{-2} (94.73 mF cm^{-2} at 0.1 mA cm^{-2}), while maintaining 4.8 μWh cm^{-2} at a power density of 3500 μW cm^{-2} (71.43 mF cm^{-2} at 10.0 mA cm^{-2}). The highly flexible micro-supercapacitor is promising for emerging applications in small scale, lightweight and wearable electronic applications.

Keywords: Flexible; Supercapacitor; Microsupercapacitors