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Flexible Self-Charging Supercapacitor Based on Graphene-Ag-3D Graphene Foam Electrodes

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Abstract

A flexible three-dimensional porous graphene foam-based supercapacitor (GFSC) is presented here for energy storage applications. With a novel layered structure of highly conductive electrodes (graphene-Ag conductive epoxy-graphene foam), forming an electrochemical double layer, the GFSC exhibits excellent electrochemical and supercapacitive performance. At a current density of 0.67 mA cm^{-2} , the GFSCs show excellent performance with areal capacitance (38 mF cm^{-2}) about three times higher than the values reported for flexible carbon-based SCs. The observed energy and power densities ($3.4 \text{ } \mu\text{W h cm}^{-2}$ and 0.27 mW cm^{-2} respectively) are better than the values reported for carbon-based SCs. Analyzed under static and dynamic bending conditions, the GFSCs are stable with up to 68% capacitance retention after 25000 charge-discharge cycles. The light-weight, cost-effective fabrication and no self-heating make the GFSCs a promising alternative to conventional source of energy in the broad power density ranging from few nW cm^{-2} to mW cm^{-2} . In this regard, GFSC was integrated with a flexible photovoltaic cell resulting in a

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