All-Carbon Supercapacitor Optimization in Electric Vehicles: Fabrication and Empirical Analysis of Graphene Dispersion/Activated Carbon on Conductive Networks in Porous Felt Supercapacitor for Acceleration and Regenerative Braking Assistance

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Supercapacitors are a promising candidate for the electric vehicle system due to their inherent fast charging and high-current/temperature tolerance capabilities. However, commercial supercapacitors suffer from high weight to capacitance ratio, which averts the use of supercapacitors in electric vehicles. This research proposes a lightweight supercapacitor electrode fabrication, which consists of networking conductive layers of graphene dispersion and activated carbon in porous graphite felt using conductive ink. The composite electrode showed a specific capacitance up to 170 F/g, or 13 F/g from the complete device in type III deep eutectic solvent electrolyte, which gave the starting voltage of 2.3 V. In comparison with other supercapacitors, the samples were three times lighter than leading devices with matching capacitance. The fabrication was designed to minimize the transition from research to manufacturing capability as current industrial machinery can adapt to the production process. For a demonstration of the supercapacitor application in the electric vehicle, devices were connected with batteries to assist during vehicle acceleration.

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