Supercapacitor Performance with Activated Carbon and Graphene Aerogel Composite Electrodes

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Abstract

Thus far, activated carbon (AC) has been the material of choice as practical supercapacitor electrode material. However, graphene can be a better alternative material. This work presents a comprehensive ratio study of AC and Graphene Aerogel (GA) as the sole and composite electrodes.

The material and facile-fabricated electrodes were characterized, and the electrochemical performances of the prototypes were correlated and discussed in terms of specific capacitance, internal resistances, cyclic performance, and self-discharge. It was found that 20% GA addition on the AC electrode (GA20 specimen) recorded the highest charge-discharge specific capacitance at 78.9 F/g, which was 4% higher than AC at 75.8 F/g, even though the estimated surface area for the electrode was 20% lower than the pure AC electrode. Further addition of GA wt% decreased the capacitance due to the lack of electrode surface area. The equivalent series resistance (ESR) increased with an increase in GA wt% due to the higher electronic resistance of GA material. AC electrode had the lowest self-discharge among all specimens, which was caused by the deeper ion storage inside the electrode's pores.

Author keywords

activated carbon; composite electrode; Graphene aerogel; self-discharge; supercapacitor

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