

Tunable rGO/GO Nanochannels for High-Rate Supercapacitors

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Abstract

Precise control of ion confinement within graphene nanochannels is essential for achieving high energy density without compromising rate capability [1]. Here, we report a reduced graphene oxide/graphene oxide (rGO/GO) composite with tunable interlayer spacing enabled by controlled assembly of conductive rGO sheets and oxygen-functionalized GO spacers. By adjusting the rGO/GO ratio, the nanochannel distance is optimized for ion-pore size matching. Organic electrolytes containing cations of different sizes were systematically evaluated, revealing that capacitance is maximized when the spacing closely matches the effective cation dimension.

The electrodes are fabricated through a fully water-processable, binder-free method, offering a simple and scalable alternative to complex templating or activation strategies. In a symmetric two-electrode configuration, the optimized composite delivers a specific capacitance of 70 F g^{-1} that remains stable up to 25 A g^{-1} , demonstrating outstanding rate capability under practical device conditions. These results highlight ion-pore size matching in tunable graphene laminates as an effective strategy for scalable, high-power organic-electrolyte supercapacitors.

References

[1] Li, Z., Gadipelli, S., Li, H. *et al.* *Nat Energy* **5**, 160–168 (2020)

Figures

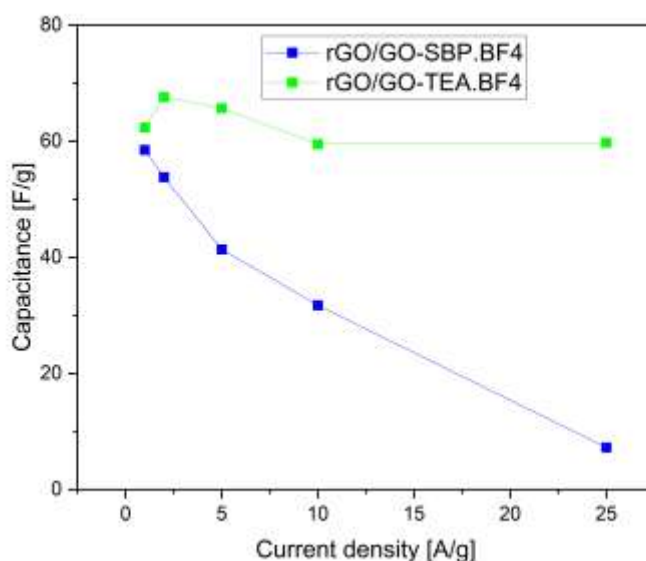


Figure 1: Capacitance variation with current density for different ion size.