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Development of Asymmetric Supercapacitors with Titanium Carbide-Reduced Graphene Oxide Couples as Electrodes

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Abstract

Two-dimensional (2D) nanomaterials have attracted significant interest for supercapacitor applications due to their high surface to volume ratio. Layered 2D materials have the ability to intercalate ions and thus can provide intercalation pseudocapacitance. Properties such as achieving fast ion diffusion kinetics and maximizing the exposure of the electrolyte to the surface of the active material are critical for optimizing the performance of active materials for electrochemical capacitors (*i.e.* Supercapacitors). In this study, two 2D materials, titanium carbide ($Ti_3C_2T_x$) and reduced graphene oxide (rGO), were used as electrode materials for asymmetric supercapacitors, with the resulting devices achieving high capacitance values and excellent capacitance retention in both aqueous and organic electrolytes. This work demonstrates that $Ti_3C_2T_x$ is a promising electrode material for flexible and high-performance energy storage devices.

Keywords: Supercapacitors; MXene; graphene; volumetric capacitance; 2D materials.