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## Ternary nanostructures of Cr<sub>2</sub>O<sub>3</sub>/graphene oxide/conducting polymers for supercapacitor application

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**Abstract.** In this work, nanostructured composites of Cr<sub>2</sub>O<sub>3</sub>-graphene oxide (Cr<sub>2</sub>O<sub>3</sub>/GO) with conducting polymers; polyaniline (PANI) and polypyrrole (PPy) with the shape of cauliflower were synthesized via a simple and low cost one-step chronoamperometry method. The structures and morphologies of the resulting ternary nanocomposites were characterized by using Fourier transform infrared spectroscopy, X-ray diffraction, field emission scanning electron microscopy, and energy-dispersive X-ray spectroscopy. The electrochemical capacitive properties of the prepared nanocomposites were evaluated by using cycle voltammetry, galvanostatic charge-discharge, and electrochemical impedance spectroscopy. The as-synthesized Cr<sub>2</sub>O<sub>3</sub>/GO/PANI and Cr<sub>2</sub>O<sub>3</sub>/GO/PPy composites exhibit a highest specific capacitance of 525 and 495 F g<sup>-1</sup> at 5 A g<sup>-1</sup> in the three-electrode tests, respectively. Interestingly, Cr<sub>2</sub>O<sub>3</sub>/GO/PANI and Cr<sub>2</sub>O<sub>3</sub>/GO/PPy composites retain 84 and 80 % of their initial capacitance values after 4000 charge-discharge cycles, suggesting good electrochemical stability of the nanocomposite electrodes. The assembled symmetric devices based on Cr<sub>2</sub>O<sub>3</sub>/GO/PANI and Cr<sub>2</sub>O<sub>3</sub>/GO/PPy composites show a high specific capacitance of 263 and 100 F g<sup>-1</sup> at the current density of 5 A g<sup>-1</sup>, respectively.

**Keywords:** Supercapacitor; Polypyrrole; Polyaniline, Graphene oxide, Ternary composite, Chromium oxide

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