

In this thesis, the synthesis and characterization of a CuO/g-C<sub>3</sub>N<sub>4</sub>/PANI nanocomposite to use in the supercapacitor is reported. In-situ oxidative polymerization was used to prepare the composite and the composite was characterized with XRD, UV Vis, PL, cyclic voltammetry (CV), galvanostatic charge discharge (GCD) and electrochemical impedance spectroscopy (EIS). The presence of a direct band gap of 3.33 eV was established with the help of UV-Vis and PL analysis and effective charge separation was evidenced by the formation of heterojunctions between CuO, g-C<sub>3</sub>N<sub>4</sub>, and PANI. Capacitive behavior was found to be excellent through electrochemical studies. The redox peaks were clearly visible in the CV curves at all scan rates (10-50 mV s<sup>-1</sup>), which indicated reversible and fast charge transfer. GCD curves taken at 1-3 A g<sup>-1</sup> current density were almost triangular and long discharge times with the highest specific capacitance at 1 A g<sup>-1</sup>, indicating the effect of both electric double-layer capacitance and pseudocapacitance. In addition, the Nyquist plot of EIS showed a low charge-transfer resistance, manifested by a low diameter and depressed semicircle, and good ion diffusion through the electrode material. The electrical conductivity, redox activity, and structural stability of the synergistic combination of CuO, g-C<sub>3</sub>N<sub>4</sub>, and PANI, were enhanced, leading to excellent electrochemical performance, even better than that of the separate components. The results provide an idea of CuO/g-C<sub>3</sub>N<sub>4</sub>/PANI as a potential electrode material of the next-generation supercapacitors, which has high capacitance, high rate potential, and stable charge transfer pathway to be used in practice in energy storage applications.