



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Fabrication of Polyaniline-Based Nano Materials for the Application in Energy Harvesting and Sensing Devices

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SHORT ABSTRACT

PANI nanomaterials strongly depend on the distribution of nanofillers for property enhancement. Based upon these nanomaterials, a brief introduction of energy storage and sensing devices have been included in Chapter-1. Chapter-2 describes binary and ternary nanocomposites of PANI, G and MoS₂. Among them, PANI-G-MoS₂ ternary nanocomposite exhibits excellent electrochemical activity and enhanced cyclic stability. Chapter-3 describes GO, RGO, and α -MnO₂ based PANI functionalized binary and ternary nanocomposites. Herein, PANI-RGO-MnO₂ has appeared an excellent candidate for high-density energy storage material with superior dielectric strength. Chapter-4 presents a comparative study of binary and ternary nanocomposites of PA6, rGO, and PANI components. We have observed that PA6-rGO-PANI 1:2 shows an excellent electrochemical performance with improved cyclic stability, as compared to other composites. Further, fabricated symmetric supercapacitor devices also have demonstrated outstanding performance. Chapter 5 unveils ZnO (transition metal oxide), and RGO based PANI functionalized nanocomposites. In particular, PANI-RGO-ZnO 2:1 composite reveals a superior performance as an electrode material. Chapter-6 describes preparation of PANI-ES and PANI-EB thin film, deposited on glass and n-type Si wafer substrates using a vacuum evaporation technique. We have observed that deposition of PANI-EB is relatively easier than PANI-ES. Contrary to PANI-EB, PANI-ES thin-film shows better electrical conductivity. Hence, fabricated thin-film capacitors also have shown remarkable current density and energy density with the high percolation threshold. Chapter-7 presents a hierarchical mesostructure of PANI nanorods by incorporating SDS and F127 as structure-directing agents (SDAs). The PANI-SDS-F127 1:1 composition has shown higher glucose sensitivity with a lower detection limit, attributed to the synergistic effect of available organic components. Chapter 8 summarizes the thesis work, with an outlook for future study.