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SUPERCAPACITOR NANOCOMPOSITE USING rGO, MWNT AND PANI

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ABSTRACT

There has been a lot of research on developing high performance Li-ion batteries and fuel cells but still the slow power capability and high maintenance cost is a barrier in using them for many applications. To solve this problem supercapacitors have been developed, which have long life cycle, high speed charge and discharge, high power density and no issues with short circuit. But they have low energy density. The objective of this paper is to explain how Graphene-based supercapcitors with high power density along with high energy density can be produced at low cost. These supercapacitors store energy as electric charge on porus materials. Graphene is a suitable material for making super capacitors because of its high surface area, chemical stability, lattice structure and most importantly, its appealing electrical properties. Theoretically a monolayer of sp^2 bonded atoms can have a specific capacitance upto ~550 F/g as well as a surface area of 2475 m^2/g. There are many methods to synthesize graphene but the price and quality and viability do not come together. thus being a barrier in industrial applications. The porous graphene material reported in this thesis was synthesised by improved hummers method. It was mixed with a conducting polymer, Polyaniline (PANI) to make the supercapacitor electrode. XRD has a peak at 24.34^0 suggesting that the interlayer distance is 3.64 Å with absence of functional groups containing oxygen such as hydroxyl and carbonyl groups. FTIR peaks also have low intensity of oxygen related peaks, thus supporting the above statement. The resistivity test was conducted using the 4 probe method which showed that the sample containing both MWNT and rGO had the highest resistivity. For comparison electrodes were also prepared using MWNT-PANI and rGO-MWNT-PANI. For the electrochemical performance of the electrodes Cyclic Voltammetry (CV) test was done which showed PANI–RGO–MWNTs have a greater current density and higher specific capacitance of 330 F g^{-1}.

KEYWORDS: Reduced Graphene Oxide, Graphene; Polyaniline, Cyclic Voltammetry, XRD, FTIR