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THERMOELECTRIC PROPERTIES OF DODECYLBENZENE SULFONIC ACID SODIUM SALT (DBSA) DOPED POLYANILINE & REDUCED GRAPHENE OXIDE(RGO)-DBSA DOPED POLYANILINE COMPOSITES

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Polyaniline (PANI) is a highly adaptable conducting polymer. An effort has been made to enhance the thermoelectric properties of PANI by doping it with dodecylbenzene sulfonic acid sodium salt (DBSA). DBSA is a protonic organic acid, and it has a sulphonic group and a long alkyl side chain which interacts with amine/imine hydrogens. It helps to enhance the electrical properties of the polymer and ionization of charges. The sheet like structure of reduced graphene oxide (rGO) supports uniform distribution of polymer matrix and it improves the interfacial interactions between the rGO and the polymer matrix. In this work, rGO incorporated DBSA-PANI was introduced and it was compared with the DBSA doped PANI. The chemical oxidative polymerization method was used to synthesise three different DBSA doped PANI (DBSA-PANI) samples (1.0, 1.5 and 2.0 g) with 2 mL of aniline. rGO was synthesised using the modified Hummer's method. rGO-DBSA-PANI composites were prepared using the chemical oxidative method. Three different weight percentages of rGO (24%, 35% and 50%) relative to aniline (2ml) were used, with a constant DBSA mass of 1.5 g in all three synthesis processes. The resulting powders were pressed into pellets, and room temperature electrical conductivity and temperature-dependent Seebeck coefficients were measured. The successful synthesis of DBSA-PANI was observed by Fourier Transform Infrared Spectroscopy (FTIR). Characteristic peaks observed at 2914, 2829, 792 and 673 cm^{-1} confirmed the presence of DBSA anion. Peaks at 3441, 3201, 1553 and 1293 cm^{-1} confirmed the successful synthesis of PANI. Synthesised rGO was characterized using X-ray diffraction (XRD) and Raman Spectroscopy. Characteristic XRD peak at 25° and D and G vibrational bands observed in the range of 1700 and 1353 cm^{-1} confirmed the successful synthesis of rGO. Our previous study shows an electrical conductivity of 3.5 S/m for undoped PANI. The highest electrical conductivity values of 80.7 S/m and 54.4 S/m were observed for 2.0 g DBSA-PANI and 35% rGO-1.5 g DBSA-PANI at 300 K, respectively, indicating 23 times and 16 times increments compared to that of the undoped material. The highest Seebeck coefficient values of 1.40×10^{-4} V/K and 1.85×10^{-4} V/K were observed for 2.0 g DBSA-PANI at 300 K and 24% rGO-1.5 g DBSA-PANI at 300 K, respectively. The highest power factor values of 1.58×10^{-6} $Wm^{-1}K^{-2}$ and 1.32×10^{-6} $Wm^{-1}K^{-2}$ were obtained for 2.0 g DBSA-PANI and 24% rGO-1.5g DBSA-PANI at 300 K, respectively.

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