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An empirical approach to NO2 gas sensing properties of carbon films fabricated by arc discharge methane decomposition technique

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Today, the use of carbon based materials such as graphene, carbon nanotubes, etc., in various applications is being extensively studied by researchers in the field. One of such applications is using them in gas sensors. While analytical investigations on the physical and chemical properties of carbon nanomaterials are the focal points in the studies, the need for experimental measurements on various physical characteristics of these materials is deeply felt. In this work, a set of experiments have been conducted using arc discharge methane decomposition attempting to obtain carbonaceous materials (C-strands) formed between graphite electrodes. The current-voltage (I-V) characteristics of the fabricated C-strands have been investigated in the presence and absence of 3 different gases, Methane, NO_2 and CO_2. The results reveal that the current passing through the carbon films increases when the concentrations of gases are increased from 200 to 800 ppm. This phenomenon is a result of conductance changes and can be employed in sensing applications such as gas sensors.

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Polymer blends modified nanomaterials to form nanocomposites using bifunctional linker as a compatibilizer: Stabilization, characterization and water purification

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The blend of two polymer components, chitosan (CH) and renewable resource polylactide (PLA) incorporated nanomaterials were cross-linked with a bifunctional linker. The two biodegradable, biocompatible polymers were hydrophilic and hydrophobic, respectively. The purpose of incorporating nanoparticles and blending the two polymers was to modify, compatiblize and stabilize the polyurethane nanocomposite formed. The solution casting method was used instead of melt techniques considering the decomposition temperature of chitosan.These two polymers at different ratio compositions of 1:4-4:1 (P1C4HMDI-P4C1HMDI) were prepared to obtain homogeneity. Effects of modifications and interactions between the two components of the polyurethane polymer blend and the nanoparticles were investigated and established using FT-IR, XRD, TGA, DSC, SEM, TEM and EDXS. FTIR results showed that there were intermolecular hydrogen bond interactions between the functional groups (-OH, C=O) of these two components of the polyurethane polymer blend. The results obtained concur with what have been reported which means that the two components of the polyurethane polymer blend were miscible. To further confirm the FTIR evidence of miscibility, DSC technique was used. The DSC thermographs proved that only one Tg (53^{o}C) for one component of the polyurethane polymer blend was present. This result also agrees with another report provided on DSC thermograph of a blend. In this study, we intend to make miscible, two immiscible polymers and incorporate nanoparticles to produce polyurethane nanocomposite blend, test the efficiency and effectiveness of the composite blend in the removal of model organic pollutants in drinking water. Batch wise and solid phase extraction (SPE) techniques were used for the removals with batch wise showing a high percentage removal efficiencies of 89% and 92% for rhodamine B and 4-nitrophenol, respectively, while the SPE technique showed 68% for 4-nitrophenol. The huge variance in removal efficiencies between the two techniques could presumably be as a result of intervals in contact exposure times.

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