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Functionalized carbon nanotubes by direct liquid injection chemical vapor deposition method as CO_2 sensor

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In the present work we have reported the synthesis and characterization of Multiwall Carbon Nanotube (MWCNT) based thin film and its application as a CO2 gas sensor. The MWCNT was prepared by Direct Liquid Injection Chemical Vapor Deposition method (DLICVD) using ethanol as a precursor in the presence of argon gas atmosphere and furnace temperature at 750 oC. The experimental set-up is shown in Figure-1. The apparatus consists of a (5×100 cm) cylindrical quartz tube provided one end with a connection for a vacuum system and for the injection of carrier gas (Ar/N_2) gasses and ethanol vapor at another end. In this process, the catalyst particle was prepared by chemical reduction of cobalt chloride particle by the sol-gel process. The synthesized cobalt nanoparticle used as a catalyst particle for the growth of CNTs and a thin film such nanoparticles on quartz glass were made by using spin coating technique with revolution rate 1500 rpm for 30 s and then prepared film was placed in a hot air oven for 15 minutes at 100 . The thin film of MWCNT was prepared by using spin coating technique and characterized using scanning electron microscope (SEM), UV-visible spectrometer, particle size analyzer and X-ray Diffractometer (XRD). The vibrational and rotational spectra were observed through Fourier Transform Infra-Red Spectroscopy (FTIR) and Raman spectroscopy. The SEM image of the thin film revealed the nanotubelar structure grown throughout the surface. From XRD the minimum crystalline size was found to be 14 nm. The optical energy band gap of the nanotube-based thin film was found as 3.6 eV. The synthesized CNT-based thin film was employed for the CO_2 sensing. The sensor response of the sensor at room temperature was found as 2.1 and the results were found 98% reproducible. The response and recovery times were found to be 30.2 and 49.6 s, respectively.

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