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Topic of Research: Effect of decoration of nano particles on sensing properties of carbon nanotubes.

Abstract

In this study, both pristine and decorated sensors have been examined with optimized geometrical shapes, surface modifications and associated adsorbing parameters to gain a better knowledge of these adsorbing reactions and the adsorbing capability of doped complex to the gas molecules. I have studied the adsorption behaviour and gas response of modified CNTs using the doped CNT model, which I have developed from the previous representative research based on sensing mechanism. Doping improves the sensing and adsorption mechanism in the model. With the improvement of industry, living standards and the emphasis on the environment, the detection of toxic and hazardous gases is facing higher challenges. So, to detect the toxic gas concentration from the mixture of gases I have developed the carbon nanotube-based ammonia gas sensor. The special characteristics of carbon nanotubes (CNTs) and the catalytic actions of nanoparticles make CNT-based ammonia (NH_3) gas sensors improved by nanoparticle decorating very sensitive, selective, and responsive. For gas sensing applications, carbon nanotubes (CNTs) are perfect because of their large surface area, superior electrical conductivity, and potent adsorption properties. Enhancing charge transfer mechanisms and boosting adsorption sites for NH_3 molecules are two ways that decorating CNT surfaces with metal or metal oxide nanoparticles, such as Indium (In), Manganese (Mn), or Tantalum Oxide (Ta_2O_5), greatly increases sensor performance. When exposed to NH_3, the nanoparticles active areas facilitate electron exchange with CNTs and vary their electrical resistance. Improved selectivity against interfering gases, quicker response and recovery times, and lower detection limits are the outcomes of this synergistic strategy. The use of polymer-CNT-nanoparticle composites in sensor technology opens the door to extremely effective, compact, and low-power gas sensing instruments for industrial safety, healthcare, and environmental monitoring applications.

Gas sensing capability is greatly improved by the decorating of carbon nanotubes with metal nanoparticles, as this improves sensitivity, selectivity, and reaction time. Through the utilization of CNTs and MNPs' synergistic effects, scientists can create sophisticated gas

sensors that satisfy the increasing needs of industrial safety, environmental monitoring, and healthcare diagnostics. This promising subject will grow further with continued research into synthesis technique optimization, stability improvement, and safety concerns. One of the main pollutants with significant effects on human health is ammonia (NH_3). It is found in sectors like manufacturing, coal, agriculture, and the chemical industry, and its concentration calls for careful observation. Ammonia has recently been found to be a biomarker in exhaled gas. A high concentration of NH_3 in exhaled gas is believed to be a sign of kidney disease. Because of their high specific surface area, carbon nanotubes (CNTs) can be used as gas sensors to identify different gaseous substances. The author has made significant modifications to the intended chemical functional groups, metals, and nanoparticle decorations to improve the CNT-based sensors' selectivity, sensitivity, and response to a single type of gas (NH_3) in the presence of mixed gases. This increases its accessibility for industrial applications connected to gas detection.