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A Novel RGO-MoS_2-CdS Nanocomposite Film for Application in the Ultrasensitive NO_2 Detection

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Abstract:

In this work, we studied the synthesis and sensing performance of RGO-MoS_2-CdS nanocomposite films serving as the sensing layer. By a facile solvothermal treatment, CdS nanocones could be grown on the 2D layered RGO-MoS_2 substrate to form a new heterostructure. Importantly, the gas sensor based on RGO-MoS_2-CdS films, with the higher specific surface area, more adsorption sites and lots of heterojunctions, showed a largely enhanced sensor response of 27.4% toward 0.2 ppm NO_2, about 7 times higher than the value of RGO-MoS_2 based gas sensor. Moreover, the gas sensor presented an outstanding selectivity toward NO_2 gas against the other gases, which was of great significance in both environmental protection and human health.

Keywords: RGO; MoS_2; CdS; Nanocomposites; NO_2 detection; Sensors

1. Introduction

Currently, with the rapidly expanding industry and an increasing number of motor vehicles, NO_2 has become the major source of air pollution, which plays an important role in the formation of ozone and acid rain [1]. Trace amounts of NO_2 are enough to damage the human respiratory system and lung tissues [2]. The U.S. Environmental Protection Agency (EPA) has set the environmental air quality standards for the average NO_2 per year to 53 ppb, and for the single-hour average to 100 ppb [3]. Efficient detection of ppb-level NO_2 is of great significance for environmental protection and human health. So far, a variety of techniques for detecting trace NO_2 have been developed, including electrochemical sensors, optical sensors, and resistive chemical sensors [4]. A great deal of research work has concentrated on developing nanostructured metal oxides, such as In_2O_3, Cu_2O, Fe_2O_3, and ZnO [5]. However, sensors based on metal oxides always encounter problems such as high-temperature operation and poor selectivity, which limits the practical application of gas sensors. Therefore, the RGO based gas

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