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Synthesis and fabrication of ZnO-MoS_2 nanocomposite thin film for hydrogen sensing application

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Abstract

This work reports the synthesis of Zinc Oxide-Molybdenum disulfide (ZnO-MoS_2) nanocomposite for hydrogen gas sensing. Pristine MoS_2 is synthesized using simple and economical sol-gel hydrothermal method. Further it is doped with various concentrations of ZnO nanoparticles using in-situ chemical route. Xray diffraction (XRD) spectroscopy and transmission electron microscopy (TEM) are used to study the morphological and crystallographical characteristics of synthesized MoS_2 and its nanocomposites respectively. Further, Fourier transform infrared (FTIR) spectroscopy and ultraviolet-visible (UV-Vis) absorption spectroscopy have been employed to analyze the presence of bonds and optical properties respectively. Uniform thin films of MoS_2 and ZnO-MoS_2 nanocomposites are fabricated on interdigitated platinum electrode glass substrates using spin coating and dip coating method. The pristine MoS_2 and its nanocomposite thin films on interdigitated glass electrodes are used as transducer for conductometric hydrogen gas sensing application at room temperature. It is observed that ZnO-MoS_2 nanocomposites thin film demonstrate good hydrogen sensitivity as compared to the pristine MoS_2 and their sensitivity is found to be increasing as the concentration of ZnO increases. Also, the nanocomposite thin film exhibits good selectivity for hydrogen (H_2) on comparison with other gases. These results will help in construction of sensitive, selective and stable hydrogen gas sensing platform which can operate at room temperature.

Keywords : ZnO-MoS_2 , conductometric,hydrothermal method, hydrogen sensing, solid-state

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