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Abstract

ZnO/RGO Heterojunction Based near Room Temperature Alcohol SENSOR with Improved Efficiency †

Sanghamitra Ghosal [1,*] and Partha Bhattacharyya [2]

[1] School of VLSI Technology, Indian Institute of Engineering Science and Technology, Shibpur, Howrah 711103, India
[2] Department of Electronics and Telecommunication Engineering, Indian Institute of Engineering Science and Technology, Shibpur, Howrah 711103, India; pb_etc_besu@yahoo.com
* Correspondence: sanghamitra.ju87@gmail.com; Tel.: +91-9433428698
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Abstract: The systematic optimization of surface engineering (dimensionality) indeed plays a crucial role in achieving efficient vapor-sensing performance. Among various semiconducting metal oxides, owing to some of its unique features and advantages, ZnO has attracted researchers on a global scale due to its application in various fields, including chemical sensors. The concomitant optimization of the surface attributes (varying different dimensions) of ZnO have become a sensation for the entire research community. Moreover, the small thickness and extremely large surface of exfoliated 2D nanosheets render the gas sensing material an ideal candidate for achieving strong coupling with different gas molecules. However, temperature is a crucial factor in the field of chemical sensing. Recently, graphene-based gas sensors have attracted attention due to their variety of structures, unique sensing performances and room temperature working conditions. In this work, a highly sensitive and fast responsive low temperature (60 °C)-based ethanol sensor, based on RGO/2D ZnO nanosheets hybrid structure, is reported. After detailed characterizations, the vapor sensing potentiality of this sensor was tested for the detection of ethanol. The ethanol sensor offered the response magnitude of 89% (100 ppm concentration) with response and recovery time of 12 s/29 s, respectively. Due to excessively high number of active sites for VOC interaction, with high yield synthesis process and appreciably high carrier mobility, this has paved the way for developing future generation, miniaturized and flexible (wearable) vapor sensor devices, meeting the multidimensional requirements for traditional and upcoming (health/medical sector) applications. The underlying mechanistic framework for vapor sensing, using this hybrid junction, is explained with the Energy Band Diagram.

Keywords: 2D ZnO nanosheets; hybrid structure of ZnO/RGO; vapor sensing performance; energy band diagram

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