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Gamma Radiation Sensitization of ZnO/Al2O3 Sensors Based on Nanoheterostructures

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Abstract

Reliable detection of dangerous gases by using devices based on semiconductor materials in environments, with different influencing factors, such as gamma radiation, is a challenge for a medical facility or space program. A study of the influence of gamma radiation on the electrical and sensing properties of ZnO/Al2O3 core@shell heterostructure has been carried out in this work. Using as radiation source Cs-137, a low level of ionizing radiation was applied. It was observed that gamma irradiation did not affect the electrical resistance in real time measurements, but changes have been observed once comparing I-V characteristics before and after measurements. Initial gas tests showed that ZnO/Al2O3 heterostructure does not detect volatile organic compounds (VOC) gases in the operating temperature range between 150–200 °C and gas concentration up to 100 ppm. Further gas sensing tests, after irradiation, showed that the experimental results are of interest for the gas sensors development based on the ZnO/Al2O3 heterostructure, showing an increase in response value by more than 100% and 200% for 100 ppm 2-propanol and n-butanol VOC gases at operating temperature of 200 and 250 °C, respectively. These findings can be used for further development of gas sensors in environments with gamma radiation field and for biomedical applications too.

Keywords: zinc oxide, aluminium oxide, heterostructures, gas sensors gamma irradiation

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