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SnO2-loaded Ga2O3-nanorods for selective and sensitive isopropanol sensing at low operating temperature.

N-type low-dimensional semiconducting oxides such as Ga₂O₃ and SnO₂ have received significant interest in the detection of toxic gases due to their excellent opto-electronic response, thermal and chemical stability. However, key challenges such as high operating temperatures and poor selectivity continue to impede their practical usage. In this study, pure Ga₂O₃ nanorods and SnO₂ nanoparticle-loaded Ga₂O₃ nanorods composite have been synthesized by hydrothermal method. A systematic comparison of their gas sensing performance, focusing on sensitivity and selectivity was conducted. The Ga₂O₃/SnO₂ nanocomposite-based sensor exhibited an 8-fold enhancement in response to isopropanol compared to pure Ga₂O₃, with efficient operation at a reduced operating temperature of 80 deg;C. Moreover, the sensor showed superior selectivity towards isopropanol compared to other gases. These improvements can be attributed to the synergistic effects of high surface area, enhanced electron transport in nanorods, formation of depletion layers on Ga₂O₃ and SnO₂ microstructures, creation of heterojunction interfaces between Ga₂O₃ and SnO₂, and abundant surface-adsorbed oxygen species. The proposed sensing mechanism of the Ga₂O₃/SnO<sub>2</s nanocomposite demonstrates the advantage of engineered nanostructures in advancing Ga₂O₃-based gas sensors.

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