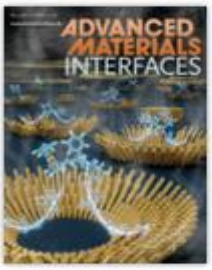

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Schottky Diode Based on a Single Carbon–Nanotube–ZnO Hybrid Tetrapod for Selective Sensing Applications

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Abstract

In this work, a general strategy to change the selectivity of individual ZnO tetrapod (ZnO-T)-Schottky diode-based devices by hybridization with carbon nanotubes (CNT) is presented. A microscale Schottky diode based on Pt-nanocontacts to a single ZnO-T covered/hybridized with CNT, designated as ZnO-T–CNT, is fabricated and the temperature-dependent UV and gas sensing properties are investigated. The gas sensing investigations indicate that due to the presence of CNTs on the surface of the ZnO-T a higher NH_3 response (factor of ≈90) at room temperature is observed, compared to H_2 gas response (≈14). This effect is attributed to the excellent charge transfer between the CNTs and ZnO-T as well as NH_3 molecule adsorption on the surface of the CNTs, which can efficiently reduce the Schottky barrier height. By increasing the operating temperature up to 150 °C (starting from 50 °C) the NH_3 response is considerably reduced, leading to an excellent H_2 gas selectivity. In the case of H_2 gas, an increase in temperature up to 150 °C shows a considerably increase in gas response of about 140 (≈10 times). Thus, this device offers the possibility to be used for selective detection of NH_3 and H_2 by only changing the operating temperature. Furthermore, by using the developed strategy/approach other materials can be used for the fabrication of gas sensors with selectivity to other gases.