

T10-P2: Selective hydrogen sensor with fast response/recovery time based on single ZnO/ZnAl₂O₄ nanowire

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Hydrogen represents a promising candidate for the replacement of fossil fuels, which have a massive impact on the environment [1]. However, the reliable detection of hydrogen leaks remains challenging due to its intrinsic properties, underscoring the need for solid-state, portable, selective sensors with fast response/recovery time and high response value, working at low operating temperatures. Core ZnO nanowires were synthesized using flame transport synthesis method and covered with Al₂O₃ layers using atomic layer deposition method [1]. Afterwards, the obtained

nanostructures were annealed at 975 °C. The morphological, chemical and structural study revealed the formation of ZnO/ZnAl₂O₄ nanowires after thermal annealing. Using FIB/SEM, individual core/shell nanowires were integrated into gas sensing devices (Fig. 1a). Multiple devices based on single ZnO/ZnAl₂O₄ nanowire were tested to a series of gases (hydrogen, methane, ethanol, acetone, n-propanol, 2-butanol and ammonia) with concentration of 100 ppm at different operating temperatures from room temperature up to 150 °C [1]. In Fig. 1b are presented results for a sensor based on ZnO/ZnAl₂O₄ nanowire, which demonstrated hydrogen selectivity, achieving a maximum response of ~913 at 100 °C and decreased with the increase of operating temperature to ~33 at 150 °C. The response and recovery time to 100 ppm hydrogen at 100 °C were ~6 s and ~1 s, respectively.

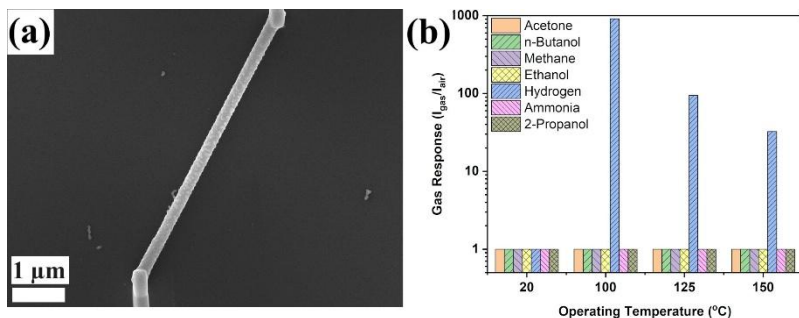


Fig. 1. (a) SEM image of device based on single ZnO/ZnAl₂O₄ nanowire; (b) Gas response to a series of test gases at different operating temperatures for sensor device based on ZnO/ZnAl₂O₄.

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