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Selective detection of propanol vapour at low operating temperature utilizing ZnO nanostructures

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ABSTRACT

We report on the propanol vapour (C_3H_8O) gas sensing characteristics of ZnO nanostructures prepared via hydrothermal assisted method. The ZnO-4h sensor showed a high response (i.e. resistance ratio), sensitivity and selectivity toward C_3H_8O gas at low operating temperature of 125 °C. A response and recovery times of approximately 190 and 200 s were recorded. The response of ZnO-4h based sensor to 40 ppm C_3H_8O was approximately 2 times higher than that of other sensing materials in dry air, while in the presence of 40% RH the response was 5 times higher. The exceptional C_3H_8O-sensing performance of ZnO-4h is related to more C_3H_8O adsorption sites provided by VO. The ZnO-04h based sensor showed a clear repeatability towards 40 ppm C_3H_8O for four successive cycles in the presence of various RH of 40 and 60% at 125 °C. The sensor response improved in the presence of RH humidity showing that the water vapour was not competing with the C_3H_8O for the pre-adsorbed oxygen ions, thus its interfering effect in the C_3H_8O sensing was considerably minimized. The ZnO-4h based sensor was further tested for long-term stability and the sensor was very stable after 45 days. The fundamental sensing mechanism towards C_3H_8O vapour is also discussed.