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Improved sensitivity and selectivity of pristine zinc oxide nanostructures to H2S gas: Detailed study on the synthesis reaction time

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ABSTRACT:

The gas sensing properties of ZnO nanostructures synthesized at various reaction times are reported in this study. The response of ZnO nanostructures to H(sub2), NH(sub3), H(sub2)S and NO(sub2) gases was investigated at different operating temperatures and gas concentrations. Surface morphology analyses showed that the geometry of the nanostructures transforms with the synthesis reaction time. Topography analyses demonstrated a surface roughness of approximately 68.25, 70.31, 74.75 nm for the samples synthesized for 24, 48 and 72 h, respectively. The dependence of the morphology on the H(sub2), NH(sub3), NO(sub2) and H(sub2)S gas sensing performance was observed. The alteration of the nanostructures diameter/geometry demonstrated a change in both the magnitude and temperature of the maximum sensor response. The 72 h ZnO sensing material revealed improved response and higher sensitivity and selectivity to H(sub2)S gas, while the 24 h sensing material revealed enhanced response and selectivity to NO(sub2) gas at 300 °C. Moreover, the 72 h sensing material exhibited a higher sensitivity of 144.22 ppm(sup-1) at 300 °C. These findings disclosed that by varying the synthesis reaction time, the sensing properties, such as the response, sensitivity and selectivity of the ZnO nanostructures could be tuned.