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Testing of Gas Sensing Performance of Zeolite-Modified ZnO Nanomaterials

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Zinc oxide is a semiconductive material that is highly sensitive to pollutants and is used in semiconductive gas sensors. These materials have low selectivity and require high operating temperatures which is usually around 350°C. This study aims to make the material selective towards specific air pollutants and reduce the operating temperature of ZnO by incorporation it into zeolite. The resistance of ZnO-incorporated zeolites was measured under the influence of N_2O using a custom-built setup. The material was plated on a glass slide in the middle of two aluminium strips to make a simple resistor using ZnO-incorporated zeolite. A known resistor is taken and a voltage is supplied between the fabricated resistor and the known resistor. The fabricated glass slide is placed inside the material testing chamber and is connected to the circuit as the unknown resistor and the voltage is measured between the known resistor when the material is in an inert environment (V_i) and in the presence of a known N_2O concentration (V_r). Using the equation $(V_r-V_i)/V_i$ the response of the material is taken. At 5, 25, 50, 75, 100 ppm the material gave a highest response of 1.83, 1.73, 1.74, 1.73, 1.91, respectively. The fluctuation of the reading between high and low response readings is an indication that the material enters an equilibrium between adsorption and desorption of N_2O. when N_2O is removed and when nitrogen is introduced the sensor response value significantly drops specially for low N_2O gas concentrations. In conclusion, the material changes resistivity in the presence of N_2O but also desorbs shortly. As future directions, the material will be tested against different types of gases to get a more advanced understanding of the sensing capacity of the material.

Keywords: Gas sensing, zeolite, ZnO nanoparticles