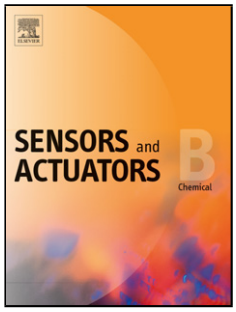

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High Sensitivity in Al-doped ZnO Nanoparticles for Detection of Acetaldehyde

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Abstract

The gas sensing properties of Al-doped ZnO nanoparticles (NPs), which were synthesized via a hydrothermal method, have been described for the detection of volatile organic compounds (VOCs) such as acetaldehyde, toluene, and benzene. The maximum sensing response (R = 2250) of these Al-doped ZnO NPs was observed upon exposure to 10 ppm acetaldehyde at an optimal operating temperature of 500 °C, which was almost 173 and 125 times higher than that observed for toluene and benzene, respectively. The highest dipole moment of acetaldehyde among the three VOCs is responsible for its highest sensitivity. The Al-doped ZnO NPs also show a higher selectivity toward acetaldehyde than that of different interfering gases and their response to acetaldehyde was superior compared with the previously reported responses of other materials. The enhanced sensing performance of Al-doped ZnO NPs to acetaldehyde compared to undoped ones may be explained by an increase in specific surface area, oxygen vacancies, and conductivity after Al doping.

Keywords: metal oxide gas sensor, Al-doped ZnO, nanoparticle, volatile organic compound