Sensors and Actuators B: Chemical

Fabrication of ultra-high sensitive and selective CH4 room temperature gas sensing of TiO2nanorods: Detailed study on the annealing temperature

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Abstract

Applications of ultra-highly sensitive and selective methane (CH(sub4)) room temperature gas sensors are important for various operations especially in underground mining environment. Therefore, this study is set out to investigate the effect of annealing temperature on the sensitivity and selectivity of TiO(sub2)-based sensors for detection of CH(sub4) gas at room temperature. TiO2 nanoparticles synthesized using hydrothermal methods were annealed at various temperatures. Surface morphology analyses revealed that the nanoparticles transformed to nanorods after annealing at 700 °C. The results showed that the sensing properties are annealing temperature dependent. The 1.0 M TiO(sub2) nanostructures annealed at higher temperatures (700 °C) revealed improved sensing response to CH(sub4) gas at room temperature due to higher surface area of 180.51 m(sup2) g(sup-1) and point defects related to Ti(sup3+) observed from electron paramagnetic resonance (EPR) and photoluminescence (PL) analyses. In addition, the 1.0 M TiO2 sensing material annealed at 700 °C also revealed an excellent sensitivity and selectivity to CH(sub4) gas at room temperature compared to other gases (H(sub2), NH(sub3), and NO(sub2)), indicating that the TiO2 nanoparticles are possible candidates for motoring CH(sub4) at low concentration of ppm level.