Highly Selective Xylene Sensor Based on NiO/NiMoO4 Nanocomposite Hierarchical Spheres for Indoor Air Monitoring

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Abstract

Xylene is a hazardous volatile organic compound, which should be measured precisely for monitoring of indoor air quality. The selective detection of ppm-level xylene using oxide semiconductor chemiresistors, however, remains a challenging issue. In this study, NiO/NiMoO4 nanocomposite hierarchical spheres assembled from nanosheets were prepared by hydrothermal reaction, and the potential of sensors composed of these nanocomposites to selectively detect xylene gas was investigated. The sensors based on the NiO/NiMoO4 nanocomposite hierarchical spheres exhibited high responses (maximum resistance ratio =101.5) to 5 ppm p-xylene with low cross-responses (resistance ratios <30) to 5 ppm toluene, benzene, C2H5OH, CH3COCH3, HCHO, CO, trimethylamine, and NH3. In contrast, a sensor based on pure NiO hierarchical spheres exhibited negligibly low responses to all 9 analyte gases. The gas-sensing mechanism underlying the high selectivity and response to xylene in the NiO/NiMoO4 nanocomposite hierarchical spheres is discussed in relation to the catalytic promotion of the xylene-sensing reaction by synergistic combination between NiO and NiMoO4, gas-accessible hierarchical morphology, and electronic sensitization by Mo addition. Highly selective detection of xylene can pave the road toward a new solution for precise monitoring of indoor air pollution.

Keywords

Author Keywords: NiO; NiMoO4; hierarchical structures; selective gas sensor; xylene

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