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Hydrogen sulfide gas sensing mechanism study of ZnO nanostructure and improvement of sensing property by surface modification

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This study reports the hydrogen sulfide gas sensing properties of ZnO nanorods bundle and the investigation of gas sensing mechanism. Also the improvement of sensing properties was also studied through the application of ZnO heterstructured nanorods. The 1-Dimensional ZnO nano-structure was synthesized by hydrothermal method and ZnO nano-heterostructures were prepared by sonochemical reaction. Scanning electron microscopy (SEM) and X-ray diffraction (XRD) spectra confirmed a well-crystalline ZnO of hexagonal structure. The gas response of ZnO nanorods bundle sensor increased with increasing temperature, which is thought to be due to chemical reaction of nanorods with gas molecules. Through analysis of X-ray photoelectron spectroscopy (XPS), the sensing mechanism of ZnO nanorods bundle sensor was explained by well-known surface reaction between ZnO surface atoms and hydrogen sulfide. However at high sensing temperature, chemical conversion of ZnO nanorods becomes a dominant sensing mechanism in current system. In order to improve the gas sensing properties, simple type of gas sensor was fabricated with ZnO nano-heterostructures, which were prepared by deposition of CuO, Au on the ZnO nanorods bundle. These heteronanostructures show higher gas response and higher current level than ZnO nanorods bundle. The gas sensing mechanism of the heteronanostructure can be explained by the chemical conversion of sensing material through the reaction with target gas.

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