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Fabrication of CuO/ZnO Nano-heterostructure by Photochemical Method and Their H2S Gas Sensing Properties

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Postech

This study reports the H2S gas sensing properties of CuO / ZnO nano-hetero structure bundle and the investigation of gas sensing mechanism. The 1-Dimensional ZnO nano-structure was synthesized by hydrothermal method and CuO / ZnO nano-heterostructures were prepared by photo chemical reaction. Scanning electron microscopy (SEM) and X-ray diffraction (XRD) spectra confirmed a well-crystalline ZnO of hexagonal structure. In order to improve the H2S gas sensing properties, simple type of gas sensor was fabricated with ZnO nano-heterostructures, which were prepared by photo-chemical deposition of CuO on the ZnO nanorods bundle. The furnace type gas sensing system was used to characterize sensing properties with diluted H2S gas (50 ppm) balanced air at various operating temperature up to 500^{o}C. The H2S 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. Photo-chemically fabricated CuO/ZnO 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 H2S gas.

Keywords: ZnO, Photochemical method, H2S sensing