Hydrogen gas sensing of TiO2/MWCNT thick film via screen-printing technique

ABSTRACT

Titanium dioxide is a well-known sensing material for sensing gas, especially hydrogen, while the carbon nanotube is able to operate the gas sensor at room temperature. This study combined both characteristics and investigated varying operating temperatures and different hydrogen concentrations on the sensor response. To prepare the gas sensor sensing film, an organic binder was mixed with TiO2/MWCNT. Then, using a screen-printing method, the mixture was deposited on the alumina substrate. Annealing was done using air at 500°C and then using nitrogen at 600°C, for 30 min each. FESEM, EDX, and XRD were used to characterise the structural and morphological analysis of the sensing film. The operating temperature was varied at 100°C, 200°C, and 300°C and the hydrogen concentration varied from 100 - 1000 ppm. When exposed to hydrogen, the gas sensor showed decreased current, and vice versa when exposed to nitrogen. Therefore, the gas sensor can be categorised as a p-type gas sensor. The sensor was able to sense 500-1000 ppm of hydrogen at operating temperatures of 100°C and 200°C. The gas sensor was able to sense lower concentrations of hydrogen at 300°C i.e. 100-1000 ppm hydrogen; thus the optimal operating temperature for the gas sensor in this study is 300°C.

Keyword: Gas sensor; TiO2/MWCNT; Hydrogen; P-type; Screen-printing