Sintering Time Effect on Ethanol Sensor Based on ZnO:Au Nanostructures

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ABSTRACT

In this study, ZnO with 5 % Au by weight nanostructures were prepared by thermal oxidizing technique and employed as an ethanol sensor. The mixture powder of ZnO and Au of 5% by weight was screened as a thick film onto alumina substrate. The thick films were sintered at 700°C under oxygen atmosphere for various times from 6, 12 and 24 hours. The wire-like and belt-like nanostructures were observed outward from microparticles. It was found that the diameter of ZnO nanostructures depended on the sintering time. Moreover, the ethanol sensing properties of ZnO:Au sensors as a function of sintering time at ethanol concentration of 1000 ppm and at various operating temperatures were studied. It was found that the sensor sensitivity of ZnO:Au depended on sintering time.

Key words: Zinc oxide, Nanostructure, Ethanol sensor, Gas sensor

INTRODUCTION

The gas sensing materials have been widely investigated in order to achieve highly sensitive and selective long-term-operating sensors. Zinc oxide (ZnO) is one of the gas sensing material that has caught much attention. ZnO has a wurtzite hexagonal structure and possesses various interesting properties including wide band gap semiconducting property of 3.3 eV and having a large exciton binding energy of 60 meV. Moreover, ZnO nanostructures have gained attention due to their huge surface-to-volume ratios which are expected to exhibit better sensing properties than gas sensors based on bulk or thin films. Previous researches have established that the ZnO nanostructures could be synthesized by many techniques, such as hydrothermal hot-press method, evaporation of pure Zn in the gas flow, sol-gel, spray pyrolysis, vapour phase oxidation and wet oxidation (Xu et al., 2006, Xiangfeng et al., 2005, Kim et al., 2003, Zhu et al., 2005 and Li et al., 2007). The oxidation technique is a simple, low-cost and thus, it is commonly used for the preparation of ZnO nanostructures. In addition, the metal doping such as Au, Pt or Pd etc. in semiconductor is a typical method used to enhance sensing properties. The metal dopant acts as a catalyst to modify surface reactions of metal oxide