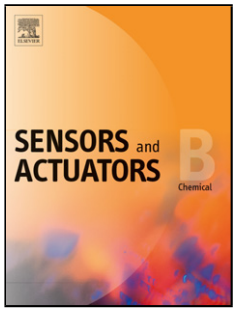

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An innovative gas sensor incorporating ZnO-CuO nanoflakes in planar MEMS technology

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Abstract

In this work, a simple and cost effective MEMS based gas sensor incorporating ZnO-CuO nanoflakes is presented. For ZnO-CuO nanoflakes synthesis, brass film was deposited on oxidized Si substrate by radio frequency (RF) diode sputtering and subsequently subjected to thermal oxidation process. The oxidized samples were characterized using SEM, XRD, XPS and Raman spectroscopy. For the fabrication of the complete sensor, planar MEMS technology with integrated microheater was adopted. This technology uses sputter deposited and recessed SiO_2 platform in Si substrate for providing thermal isolation to reduce the power consumption of Ni microheater and prevents heat spreading from heater area. The microheater performance was simulated and experimentally verified. The sensor was tested for different toxic gases and volatile organic compounds (VOCs) over range of operating temperatures and concentrations for optimal sensing performances. The sensing results revealed that the sensor had highest response for acetone vapours over other gases. Also, it showed reproducible and stable performance.

Key words: ZnO-CuO nanoflakes, MEMS, gas sensor

Introduction

Gas sensors are extremely useful in a variety of applications such as environment monitoring, industrial manufacturing units, agriculture, defense, human health and safety. The desired gas sensor should ideally be a low cost device, small in size having high sensitivity and low power consumption. Use of metal oxide nanostructures such as nanowires, nanotubes, nanorods,