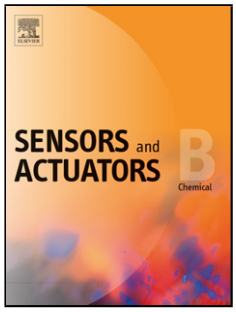

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PII: S0925-4005(17)31518-6
DOI: http://dx.doi.org/10.1016/j.snb.2017.08.094
Reference: SNB 22961

To appear in: *Sensors and Actuators B*

Received date: 30-3-2017
Revised date: 6-7-2017
Accepted date: 10-8-2017

Please cite this article as: Jurgi Gonzalez-Chavarri, Laura Parellada-Monreal, Irene Castro-Hurtado, Enrique Castaño, Gemma G.Mandayo, ZnO nanoneedles grown on chip for selective NO2 detection indoors, Sensors and Actuators B: Chemicalhttp://dx.doi.org/10.1016/j.snb.2017.08.094

ZnO nanoneedles grown on chip for selective NO_2 detection indoors

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Highlights

- A ZnO nanoneedle growth method has been developed from sputtered films of Zn and a growth mechanism is proposed.
- The method has been also employed for ZnO nanoneedles in-situ growth on 500 chips simultaneously.
- A high selectivity to NO_2 is shown with a limit of detection down to 0.08 ppm.

Abstract

A conductometric sensor based on ZnO nanoneedles for the detection of NO_2 is described. The material is grown on chip over Pt interdigitated electrodes patterned on alumina substrates without the need of a catalyst layer. The nanostructure growth relies on two different mechanisms (Vapor-Solid and Liquid-Solid) so nanoneedles with few µm of length and wurtzite structure are obtained. The procedure is optimized on chip, which supposes a significant advantage in the fabrication of nanostructures on sensing devices. The sensor response has been measured under a target gas (NO_2) and two interfering pollutants (benzene and formaldehyde). Lower working temperatures than other pure ZnO nanostructures found in the literature have been achieved and limit of detection (LOD) in the order of ppb has been reached. The significant higher response to NO_2 with respect to benzene and formaldehyde makes this sensing device suitable for selective NO_2 detection indoors.

Keywords: zinc oxide, gas sensor, nanoneedle, growth mechanism, NO_2

1. Introduction

Semiconductor oxides for conductometric sensors have been broadly researched during the last years. The utilization of ZnO for gas sensors has a long history because of its chemical stability and sensitivity to different adsorbed gases, easiness to include additives, non-toxicity and low cost. ZnO has been studied as chemoresistive material to detect gases like H_2, NH_3, CH_4, ethanol or CO, among others. The response of conductometric sensors with ZnO sensing elements under