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Review

NO_x sensing properties of In_2O_3 thin films grown by MOCVD

M. Ali*, Ch.Y. Wang, C.-C. Röhlig, V. Cimalla, Th. Stauden, O. Ambacher

Technical University Ilmenau, Institute of Micro- and Nanotechnologies, Gustav-Kirchhoff-Str. 7, D-98693 Ilmenau, Germany

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Abstract

The NO_x and O_2 sensing properties of highly textured indium oxide In_2O_3 thin films grown by metal organic chemical vapor deposition (MOCVD) technique have been investigated as a function of the operation temperature and partial pressure. The sensor is very sensitive to NO_x and its response is strongly dependent on the gas partial pressure and operating temperature. The responses to NO_x and O_2 have been found to be maximal at 150 °C. The optimum detection temperature for NO_x occurs in the range 150–200 °C considering the response and recovery times. In this range a very low response to O_2 is observed indicating that the sensor is very suitable for selective NO_x detection.
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Keywords: Gas sensor; NO_x detection; Indium oxide; MOCVD; Response time; Recovery time

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1. Introduction

Demands for exact monitoring of nitrogen oxide gases (NO_x), which are air pollutants released from combustion facilities and automobiles, have become more serious all over the world in recent years. For air quality monitoring or exhaust gas control, NO_x is the main gas to be detected.

In order to detect the partial pressure of such hazardous NO_x gas, there have been a lot of efforts in developing a variety of sensors such as electrochemical [1], SAW [2], and polymer based sensors [3]. Recently, much interest has been focused on metal oxide based sensors because of their structural simplicity, high sensitivity, short response time, small size, low cost, and good compatibility with the fabrication process for microelectronic devices. The semiconductor metal oxide (SMO) gas sensors operate on the principle that a chemical reaction between the gas species to be detected and a SMO sensing film produces a change in the film resistance. Although several different metal oxide semiconductors can be used as gas sensing materials, the most popular includes tin oxide (SnO_2) [4–7], tungsten trioxide (WO_3) [4,8–10], titanium oxide (TiO_2) [11,12], zinc oxide (ZnO) [4,13], and indium oxide (In_2O_3)

* Corresponding author. Tel.: +49 3677 69 1172; fax: +49 3677 69 3709.
E-mail address: majdeddin.ali@tu-ilmenau.de (M. Ali).

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