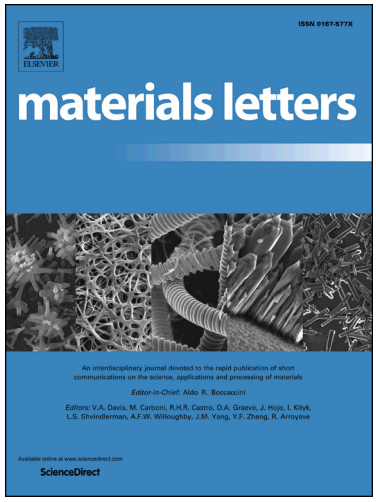
Accepted Manuscript



Enhancing the Performance of Room Temperature ZnO Microwire Gas Sensor through a Combined Technology of Surface Etching and UV Illumination

Leixin Meng, Qi Xu, Zhe Sun, Gaoda Li, Suo Bai, Zenghua Wang, Yong Qin

PII: S0167-577X(17)31578-1
DOI: https://doi.org/10.1016/j.matlet.2017.10.102
Reference: MLBLUE 23337

To appear in: *Materials Letters*

Received Date: 31 July 2017
Revised Date: 23 September 2017
Accepted Date: 22 October 2017

Please cite this article as: L. Meng, Q. Xu, Z. Sun, G. Li, S. Bai, Z. Wang, Y. Qin, Enhancing the Performance of Room Temperature ZnO Microwire Gas Sensor through a Combined Technology of Surface Etching and UV Illumination, *Materials Letters* (2017), doi: https://doi.org/10.1016/j.matlet.2017.10.102

Enhancing the Performance of Room Temperature ZnO Microwire Gas Sensor through a Combined Technology of Surface Etching and UV Illumination

Leixin Meng[1], Qi Xu[1], Zhe Sun[1], Gaoda Li[1], Suo Bai[1], Zenghua Wang[1], Yong Qin[1, 2, *]

[1]Institute of Nanoscience and Nanotechnology, Lanzhou University, Lanzhou 730000, China

[2]School of Advanced Materials and Nanotechnology, Xidian University, 710071, China

*Corresponding author. E-mail address: qinyong@lzu.edu.cn

ABSTRACT

Enhancing the performance of individual micro/nanowires based room temperature gas sensors is a big challenge for real-time detection of toxic gases. In this work, we developed a surface etching method to increase the sensitivity of individual ZnO microwire (MW) based gas sensor. The etching of the MW increases the adsorption sites for gas molecules on it by increasing the specific surface area and the surface density of single ionized oxygen vacancies. This leads to a ~20-fold increase of the gas sensor's sensitivity. When working under 148.8 μWcm^{-2} of UV light, the sensitivity is further increased to 411%. Meanwhile, the response and the recovery time decreases to ~20% and ~2% of the values in dark condition, respectively. As a result, the individual ZnO microwire based gas sensor's performance was greatly enhanced, and it has great potential to be used as a room temperature gas sensor towards NO_2.

Keywords: Sensor; Sensitivity enhancement; Surfaces; Etching; individual microwire.

1. Introduction

Detecting toxic environmental pollutants such as NO_2 in real-time at room temperature is very important to avoid their damage to the health of plants, human beings, and animals [1]. Consequently, gas sensors incorporated into portable systems such as wearable devices and hand hold terminals are attracting considerable interest [2]. These systems require both small device size and low power consumption. Recently, gas sensors fabricated with individual micro/nanowires, which meet the