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Heterojunction with ZnO polycrystalline thin films for optoelectronic devices applications

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Abstract

Thin films of ZnO were deposited by thermal decomposition of $Zn(C_5H_7O_2)_2$ on semiconductor substrate, n-type silicon, p-type InP and also on transparent glass substrate. The obtained ZnO/Si and ZnO/InP heterostructures were investigated for optical properties by spectrophotometry and surface morphology by AFM. The measured values of optoelectrical parameters in the visible spectral range and the lateral photovoltage characteristics demonstrate the possibility of using ZnO/n-Si and ZnO/p-InP heterojunctions for photodetection and photovoltaic devices applications.

Keywords: ZnO polycrystalline film; ZnO/Si; ZnO/InP heterojunctions; Photodetection devices

1. Introduction

Polycrystalline films have received a rapidly growing interest due to their increasing area of applications in advanced technologies for microelectronic, photonic, and micromachined devices. The heterostructures for photodetection and photovoltaic device applications were obtained by using one of the following techniques, such as LPE, MOCVD, etc., which are very expensive for such applications. A good alternative low cost technology is based on heterojunctions with transparent conducting oxide (TCO) thin film. In_2O_3 and SnO_2 have been widely used for photovoltaic devices and recently ZnO having a direct bandgap of 3.45 eV and a high transparency ($>80\%$) for visible light, which can be obtained with low resistivity (10^{-3} Ω cm), is playing an important role for optoelectronic applications [1,3]. Recently TCOs have become very attractive layers for metal–semiconductor–metal (MSM) type structures in order to improve the responsivity of conventional MSM photodiodes with metallic electrodes [2]. The spectral range of photodetectors with TCO layers deposited on semiconductor substrates is determined by the semiconductor characteristics. This paper presents the results of surface morphology investigation using AFM and optoelectrical characteristics

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