

## Accepted Manuscript

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PII: S0030-4026(16)30955-X  
DOI: <http://dx.doi.org/doi:10.1016/j.ijleo.2016.08.079>  
Reference: IJLEO 58096

To appear in:

Received date: 24-6-2016  
Accepted date: 27-8-2016

Please cite this article as: {<http://dx.doi.org/>

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<AT>Evaluation of microstructural and electrical properties of  $\text{WO}_{3-x}$  thin films for p-Si/n- $\text{WO}_{3-x}$ /Ag junction diodes

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### <ABS-HEAD>Abstract

<ABS-P>The  $\ln(J)$ - $V$ - $T$  characteristics of the p-Si/n- $\text{WO}_{3-x}$ /Ag junction diode have been analyzed by thermionic emission (TE) mechanism with Gaussian distribution (GD) of the barrier heights. The ultra-fine homologous phases of tungsten oxide ( $\text{WO}_{3-x}$ ) thin films on the glass substrate can be prepared simply via sol-gel spin coating method. The oxygen reduction of the tungsten trioxide ( $\text{WO}_3$ ) thin films was experimentally controlled by various organic acid additives. The organic acid-treated films have hexagonal and monoclinic crystallographic Magneli phases of  $\text{W}_n\text{O}_{3n-2}$  series ( $\text{WO}_{2.92}$ ,  $\text{WO}_{2.9}$  and  $\text{WO}_{2.89}$ ). The morphological changes in the plate-like structure under the strong influence of the organic acids were observed from SEM analysis. In the temperature dependent dc electrical conductivity, the charge transport mechanism of the  $\text{WO}_{3-x}$  thin films was analyzed by Arrhenius, Mott's variable hopping, small polaron mechanisms. From the  $J$ - $V$ - $T$  characteristics of the p-Si/n- $\text{WO}_{3-x}$ /Ag diode, the increasing of barrier height ( $\Phi_B$ ) and decreasing of ideality factor ( $n$ ) reveal that barrier inhomogeneities at the interface, which is assumed by Gaussian distribution. The mean barrier height ( $\bar{\Phi}_B$ ), the standard deviation ( $\sigma_0^2$ ) and Richardson constant ( $A^*$ ) values were investigated in the temperature range 303 - 423K. The better diode performance was acquired to the Si/ $\text{WO}_{2.89}$ /Ag device with the experimentally intended  $A^*$  value of  $34.81 \text{ A/cm}^2/\text{K}^2$  which is near to the well-known value of  $32 \text{ A/cm}^2/\text{K}^2$  for p-type Si.

<KWD>Keywords: tungsten oxide; oxygen reduction; organic acids; dc electrical conductivity; Gaussian distribution.

<H1>1. Introduction

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