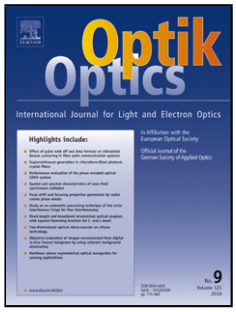

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<AT>Evaluation of microstructural and electrical properties of WO_{3-X} thin films for p-Si/n-WO_{3-X}/Ag junction diodes

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<ABS-HEAD>Abstract

<ABS-P>The ln(J)-V-T characteristics of the p-Si/n-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 (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 (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 W_nO_{3n-2} series ($WO_{2.92}$, $WO_{2.9}$ and $WO_{2.89}$). 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 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-WO_{3-X}/Ag diode, the increasing of barrier height (Φ_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 (σ_0^2) and Richardson constant (A*) values were investigated in the temperature range 303 - 423K. The better diode performance was acquired to the Si/$WO_{2.89}$/Ag device with the experimentally intended A* value of 34.81 A/cm^2/K^2 which is near to the well-known value of 32 A/cm^2/K^2 for p-type Si.

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

<H1>1. Introduction