

Nanotechnology and nanomaterials

Characterization Copper Oxide thin films

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Copper oxide is a low cost and a non-toxic p-type semiconductor, which due to its properties is a promising material for fabrication many electronic devices, such as gas sensors, field emitters, optical switches, solar cells, etc. [1].

For obtaining of the CuO thin films have used spray pyrolysis method. Glass plates were cleaned in ultrasonic bath and washed with ethanol, used as a substrates. We used an aqueous solution of copper chloride ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$) with a concentration of 0.05 M as a precursor. The substrate temperature range from 570 to 720 K, with step $T=50$ K. For atomization of precursor the air flow with a pressure of 0.25 MPa was used.

Optical polarizing microscope Nikon LV100 was used to investigate surface of the obtained layers. Analysis showed that the films have homogeneous and uniform structure of the sample surface and have a small number of three-dimensional defects.

The thickness of the samples was determined using by a probe Profilers Dektak XT. Measurements were carried out relative to the area of the substrate without a copper oxide layer. Established that the average thickness of the samples ranged from 0,8 μm at $T_s = 720$ K to 2,2 μm at $T_s = 570$ K.

The Raman spectra measurements of the films were carried out using Ar^+ laser with a wavelength = 514,5 nm. Laser beam power was 20 mW. The Raman spectra contained the peaks at frequency 274 cm^{-1} and 327 cm^{-1} that meet the A_g and B_g CuO modes respectively. We also identified a number of peaks in the range of 100 cm^{-1} to 200 cm^{-1} , which correspond to bending vibrations clusters of CuO_2 / CuO_4 . These results are in good agreement with published data [2].

1. *Gopalakrishna D., Vijayalakshmi K., Ravidhas C.* Effect of annealing on the properties of nanostructured CuO thin films for enhanced ethanol sensitivity // *Ceramics International.* – 2013. – **39**. – N.7. – P. 7685-7691.
2. *Baruah T., Zope R. R., Pederson M.R.* Molecular structures and vibrations of neutral and anionic CuO_x ($x = 1-3,6$) clusters // *Physical Review A.* – 2004. – **69**. – N.2. – P. 023201.

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