STUDY OF THE EFFECT OF HEAT TREATMENT ON OPTICAL AND ELECTRICAL PARAMETERS OF CuO FILMS

Suman[1] V., Lungu[2] I., Potlog[2] T., Ghimpu[1] L.
1. Technical University of Moldova, Institute of Electronic Engineering and Nanotechnologies, Academiei str., 3/3, Chisinau, Moldova,
2. State University of Moldova, str. Alexei Mateevich 64, Chisinau

The effect of vacuum heat treatment of CuO films obtained using RF magnetron sputtering at a pressure of 10^{-5} Pa for further use in CuO/ZnO and CuO/TiO2 heterojunctions was studied. A 99.95% pure Cu wafer with a diameter of 50 mm and a thickness of 2 mm was used as a target. The sapphire supports used had a dimension of 20 × 20 mm. The pressure in the chamber was 5.4 x 10^{-5} Pa, and the target–support distance was 80 mm. The temperature of the holder was kept constant at 500°C, and the O_2/Ar ratio in the gas flow was 3 : 5, respectively. Film deposition took place under the following conditions: a pressure of 7.4 × 10^{-3} Pa, a magnetron power of 80 W, and a condensation rate of 5 nm/min. The thickness of the resulting films was 500 nm. The obtained CuO films were subjected to heat treatment in a temperature range of 500–800°C. The upper limit of 800°C was selected because, at higher temperatures, CuO metal oxide undergoes decomposition into Cu_2O and O_2, as estimated in [1]. Scanning election microscopy studies revealed a significant increase in the crystallite size with increasing heat treatment temperature. The chemical composition of the CuO films analyzed by EDX spectroscopy showed a composition of 47/53 for Cu/O, respectively, which indicates that the CuO compound is of high purity. An increase in the curing temperature of CuO metal oxide films up to 600°C leads to a significant decrease in the surface resistance of the films on the order of a few kΩ, which can be attributed to lattice defects simultaneously with the increase in crystallite size. It was observed that an increase in the treatment temperature of the films from 600 to 800°C results in an increase in the resistance of CuO films from approximately 20 to 200 kΩ, in

contrast to L. Fara et al., who argue that, for Cu_2O films, their resistance decreases with an increase in temperature up to 900^{o}C [2]. Unlike the conditions described by L. Fara et al., in this case, the films were treated in a chamber at a pressure of about 10^{-5} Pa and the heat treatment time was about 20 min.

References:

1. Чистые химические реакивы. Ю.В. Каракин., И.И. Ангелов, Москва, Госхимиздат, 1995, стр. 349.

2. On numerical Modelling and an Experimental Approach to Heterojunction Tandem Solar Cells Bazed on Si and Cu_2O/ZnO-rezults and perspectives. L. Fara, I. Chilibon, I.C. Vasiliu, D. Crociumescu, A. Diaconu, S. Fara. Coatings 2024, 14(3) 244. https: doi.org.10.3390/coatings 14090244.

Corresponding author: Victor Suman
UTM, Institute of Electronic Engineering and Nanotechnologies “D. GHITU”
Academiei 3/3, Chisinau MD2028 Moldova, e-mail: victor.suman @ieen.utm.md
ORCID: 0000-0003-3309-9476