Physical Properties of thin Zno Layers

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Abstract – **It has been investigations the photoluminescence spectra, form of the surface and x-ray diffraction analyzing of ZnO epitaxial layers grown by VPE and MOCVD technology.**

Keywords – **zinc oxide, photoluminescence, x-ray diffraction analyzing, morphology of surface**

I. Introduction

The wide-gap semiconductor ZnO is suitable material for various optoelectronic devices operating in the visible part of the spectrum. Formation of extremely pure films of A_2B_6 compounds with sharp boundaries makes it possible to synthesize superlattice, which are finding applications in laser technology and others devises [1].

II. Experimental and Results

First group of samples of ZnO layers have been grown by VPE technology on GaAs(100) substrate. The VPE technology characterized by low growth temperatures (T = 150 – 350 °C), big temperature gradient (200 – 250 °C/cm) is a competitive method for the synthesis of epitaxial structures [2].

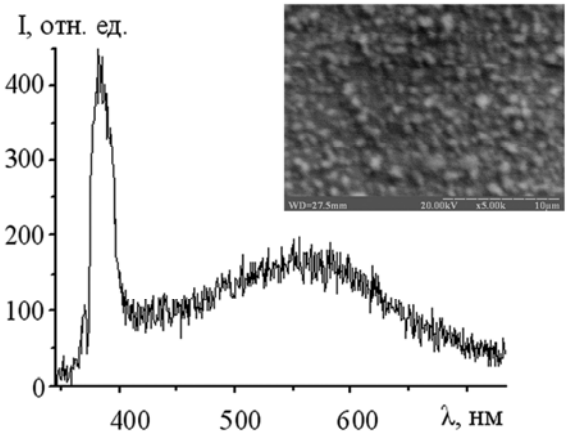

Fig. 1. Photoluminescence spectra at T=300K and the form of the surface of polycrystalline ZnO epitaxial film on GaAs(100) substrate grown by VPE technology.

Using of VPE technology ZnO layers of tree tipes: polycrystalline, sharply textured and single-crystalline have been grown on GaAs(100) substrate. Photoluminescence spectra and the form of the surface of polycrystalline ZnO epitaxial film on GaAs(100) are shown in fig.1**.** X-ray diffraction pictures and others physical properties of this samples have been studied.

Second group of samples of ZnO layers have been grown by MOCVD. The ZnO films were obtained by reactor of slit-flow gas phase, as a carrier gas were used Ar, O_2 and their mixtures. Acetylacetonates of zinc, which were synthesized from reagent grade materials, were used for obtaining ZnO films. The mixture of Ar + O_2 with the O_2 concentration within the 8 ÷ 10% was used for ZnO films. The substrate temperature for obtaining ZnO films was 290 ÷ 310 °C. The gas's flow velocity was determined visually through the quartz sight glass and was chosen in the laminar regime to ensure the uniform of film deposition. The standard substrate 20 × 15 mm of ceramics condenser and glass LC-7 were used as the substrates.

According to the X-ray diffraction analyzing, films which was deposited are characterized by fine-grained polycrystalline structure with grain sizes from 90 to 110 nm, have a hexagonal structure with unit cell parameters a = 3,2811 Å, c = 5,2066 Å and with a low degree of microstrain M = 1,09 · 10^{-3} %.Photoluminescence spectra and the form of the surface of polycrystalline ZnO epitaxial film on glass LC-7 are shown in fig. 2 respectively.

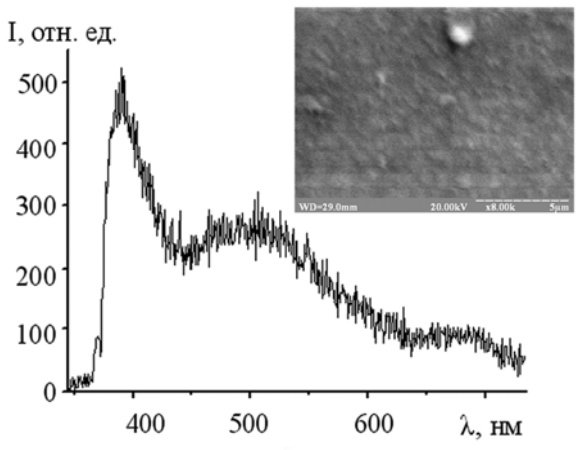

Fig. 2. Photoluminescence spectra at T=300K and the form of the surface of polycrystalline ZnO epitaxial film on glass LC-7 grown by MOCVD technology.

III. Conclusion

VPE and MOCVD technique has good perspective for synthesis high-pure ZnO epitaxial layers.

References

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