PROPERTIES OF ZnO AND ZnMnO THIN FILMS OBTAINED BY THE PULSED LASER ABLATION

I.S. Virt[1], I.V.Gadzaman[1], I.S. Bilyk[1], I.O. Rudyi[2], I.V. Kurilo[2], M.S. Frugynskyi[2]

[1] Drogobych State Pedagogical University, Drogobych, Ukraine,
[2] Lviv Polytechnic National University, Lviv, Ukraine
E-mail: isvirt@mail.ru

Zinc oxide is an inorganic compound often called as II-VI semiconductor. It is a perspective material for formation of transparent electrodes in display systems and different sort of sensors. Usually attention is given to investigation of thin-film material and structures on their basis, especially doped with magnetic impurities.

In this work results of experimental study of structural and electrophysical properties of ZnMnO thin films are presented. The films were deposited by the pulsed laser ablation method from the $Zn_{1-x}Mn_xO$ ($x \approx 0.04$) targets. The targets were obtained by pressing and consecutive sintering of ZnO powder with addition of Mn. For the ablation process a YAG:Nd laser was used (λ = 1064 nm, f = 0.5 Hz, pulse duration 10 ns) [1]. The films were deposited on glass and Al_2O_3 substrates at various temperatures (mainly 200°C) and various operating modes of the laser. The semiconductor substrates CdTe and Si were also used for formation of heterostructures. A fine-grained structure of targets provides stabilization of parameters of the deposition process and allows receiving film of better structural quality.

The films possess a good enough morphology of surface. Rather high specific conductivity of films with thickness less than 100 nm and their slow increase for the films of greater thickness were observed. This testifies that the process of condensation of metal atoms, most likely Zn atoms, prevails at initial stages of films growth. Impact on conductivity of as-grown films has also radiation defects caused by laser plasma. Process of annealing of these radiation defects occurs within several hours at room temperature.

Measurements of electrical characteristics, in particular temperature dependences of specific electroconductivity, allow estimating a concentration of carriers and their Hall mobility. A correlation between thickness of films and their electrophysical parameters was ascertained.

References

[1] Wisz G., Virt I., Kuzma M. Thin Solid Films (1998), v. **336,** p. 188–190.