The temperature dependence of the transient photoconductivity of ZnO films

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ZnO is attractive for optoelectronic devices operating in the ultraviolet due to their excellent optical properties. It has a wide and direct band gap (3.37eV) and high exciton binding energy (60 meV). Persistent photoconductivity and slow photoconductive decay transients have been observed for ZnO, indicating the strong influence of trap levels. 0.183 g of Zinc chloride were dissolved in 6 ml of isopropanol (*i*-prOH) for the preparation of ZnO films. Then, poly(propylene glycol) bis(2-aminopropyl) ether oligomer was added under vigorous steering in a molar ratio [BAPPG]:[$ZnCl_2$]=1/5. Films on FTO glasses were formed with dip-coating from the above solution and were finally calcined up to 500^0C for 45 minutes total time. The SEM image and XRD spectra are given in Figs. 1 and 2 respectively. The transient photoconductivity (σ_p) of the ZnO sample, in vacuum, is given in Figs. 3 and 4 in the temperature region 50-300 K. The sample follows the known sublinear behavior with no saturation evidence, suggesting the existence of traps within the bandgap. The increase in temperature causes the rise of σ_p as it is expected. The observed significant asymmetry between the two subsequent rises, with σ_p reaching much higher values at the end of the second illumination period, is due to the fact that some traps remained filled even at the end of the first decay period [1].

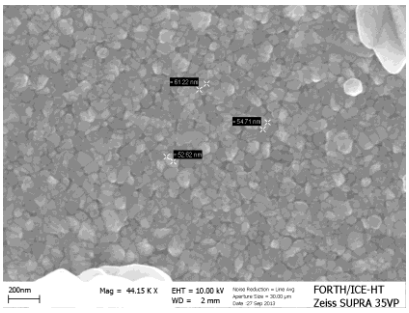

Fig. 1. Sem of ZnO film

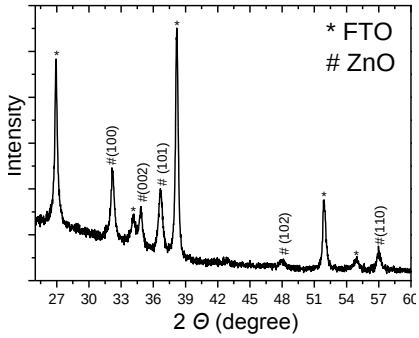

Fig. 2. XRD pattern of the ZnO film

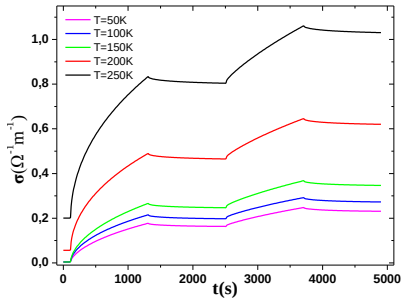

Fig. 3. The photoconductivity responses at 50, 100, 150, 200, 250 K, in vacuum

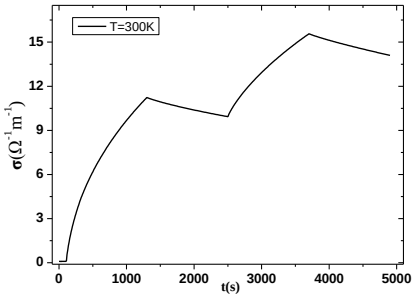

Fig. 2 The photoconductivity response at 300 K, in vacuum

References

[1] K. Pomoni, T. Georgakopoulos , M.V. Sofianou, C. Trapalis, Journal of Alloys and Compounds 558 (2013) 1–5

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