Nanostructured surfaces

Structural optical and electrical properties of Zinc oxide layers obtained by pulsed laser deposition method

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Zinc oxide (ZnO) is one of the most important group II–VI semiconductor materials. It is a wide-band gap oxide semiconductor with a direct energy gap of about 3.37 eV [1]. ZnO has high chemical and mechanical stability. Recently, transparent conducting oxides (TCOs) have been widely studied. ZnO is one of the most promising materials for the fabrication of the next generation of optoelectronic devices in the UV region and optical or display devices [2].

The ZnO films were deposited on silicon substrates by PLD using the YAG: Nd^{3+} laser with the 532 nm wavelength (II harmonics), 6 ns pulse time, 10 Hz repetition rate and fluence F in the range 10 J/cm^2. The laser beam was focused on the target using a quartz lens with focal distance of 600 mm. The growth temperature T_S was kept at 20 ºC – 400 ºC and the deposition of the layers was carried out at 10^{-7} mbar vacuum. The morphological and structural properties of the ZnO thin films were investigated by scanning electon microscope.

The electrical characterization was carried out in a four probe conductivity cell. A constant voltage was applied to the sample and the variation of current was measured using Keitheley electrometer, with sample temperature from 20 ºC to 200 ºC. The variation of current depending to temperature was recorded during the cooling as well. In the following cycle parameters were measured for the samples subjected to annealing at 250 °C under an oxygen atmosphere.

Optical characterization of ZnO films gives information about other physical properties, band gap energy and band structure. The effect of thickness and anneals on the optical transmittance and the band gap (E_g) values of the ZnO films have been studied.

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