ZnO Thin Films Elaboration and Characterization by Sputtering

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Zinc oxide (ZnO) is a binary semiconductor material with wide direct gap (3.3eV) [1,2]. Considering the optoelectronics properties [1,3,4], ZnO thin films have several virtues because of which they find applications [3,4] such as solar cells, sensors with gas, piezoelectric sensors, wave guides, and others. The thin film ZnO can be elaborated by several techniques such as reactive pulverization [5], the method of spray [6], thermal evaporation [7], sol gel [2], and the laser ablation [1].

In this work, we are interested in the influence of the percentage of reactive gas in a gas mixture (argon, oxygen, nitrogen), and structural, optical and electrical properties. For that, various series of deposits were carried out on substrates of glass.

We observed in the spectra of x-ray diffractions obtained in films deposited with argon with pure and different mixed rates so that all of the film are wholly and strongly textured and presenting a preferential orientation according to the direction (002). The film deposited with argon and oxygen is composed of an amorphous phase contrary to films deposited with a mixture of argon and nitrogen.

The optical characterization consists in measuring the optical transmission in the spectral range going from 300 to 3000nm in various working conditions. We also noted the presence of the interference rings in the area of strong transparency in the provided spectra. We could extract the energies values of the optical gap $E_g$, their values obtained vary between 3.1to2.8 eV according to conditions' of elaboration.

Electrical properties measurements show that oxygen and nitrogen influence differently on conductivity.

The results are interpreted in term of the influence of the percentage of reactive gas in the gas mixture.

References