



## ***SiO<sub>2</sub>:ZnO THIN FILMS PREPARED BY SOL- GEL METHOD AND DEPOSITED USING ION-BEAM SPUTTERING: STRUCTURE, MORPHOLOGY, AND OPTICAL AND ELECTRICAL PERFORMANCE***

№ [1719]

Marwan F.S.H. AL-Kamali<sup>1,\*</sup>, A.A. Boiko<sup>1</sup>, Dmitry Kovalenko<sup>2</sup> and Niyazi A.S. Al-Areqi<sup>3</sup>

<sup>1</sup>Sukhoi State Technical University of Gomel, 48 Oktiabria Av., Gomel 246746, Belarus.

<sup>2</sup>Francisk Skorina Gomel State University, Gomel, Belarus.

<sup>3</sup>Department of Chemistry, Faculty of Applied Sciences, Taiz University, Taiz, Yemen.

### **Abstract**

The paper studies Thin Films based on Silica which doped with zinc ions (SiO<sub>2</sub>:ZnO) at A Molar Ratio of (1:0.20; 1:0.30; 1:0.40) Deposited on Quartz and Silicon Substrates. The films were obtained by ion sputtering in a gaseous medium (argon/oxygen) from High-Silica targets obtained by the Sol-Gel method. The morphology and structure of the films were studied using scanning electron microscopy and X-ray phase analysis. X-ray phase analysis of the films revealed that the structure of the films is polycrystalline and has a hexagonal structure. The obtained frequency dependences of the dielectric permittivity of SiO<sub>2</sub>:ZnO films showed a decrease in the dielectric permittivity and dielectric loss tangent in the range of (103 to 106) Hz. It has been found that when the SiO<sub>2</sub>:ZnO film thickness is less than 100 nm, a thin-film capacitor is not always formed. The band gap of E<sub>g</sub>(ZnO) changes with increasing concentration from 3.564 to 2.598 eV, and E<sub>g</sub>(ZnO) changes with increasing concentration from 5.299 to 3.586 eV. A dip corresponding to the plasmon effect is observed in the transmission spectra in the region of 600–650 nm.

**Keywords:** Ion- beam Sputtering, Sol-gel, Zinc ion, Band gap, SiO<sub>2</sub>:ZnO, Morphology, High-silica thin films, XRD, SEM.