

## EFFECTS OF DRY OXIDATION TREATMENTS ON THE CHARACTERISTICS OF GALLIUM OXIDE THIN FILMS PREPARED USING SOL-GEL SPIN COATING METHOD

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**ABSTRACT-** In this paper, gallium oxide ( $\text{Ga}_2\text{O}_3$ ) thin films were grown on silicon (Si) substrate using a relatively simple and low-cost sol-gel spin coating method followed dry oxidation process. Two series of dry oxidation experiments were conducted, i.e., (i) annealing at different oxygen flow rates (i.e., from 2 L/min – 5 L/min) under 1100°C, and (ii) annealing at oxygen flow rate of 5 L/min under different temperatures (i.e., from 800°C to 1100°C). The effects of the oxygen gas flow rates under different temperatures on the structural, surface morphology, and optical properties of the deposited films were investigated. All results revealed that crystalline  $\text{Ga}_2\text{O}_3$  layers were formed. From the X-ray diffraction results, all deposited films exhibit two prominent diffraction peaks corresponding to the  $\text{Ga}_2\text{O}_3$  (1 $\bar{1}$ 0) and (002). The annealing at different temperatures experiments showed that the surface roughness and the grains size increased as the temperature increases from 800°C to 1100°C. The optical band gap energy of the deposited films was extracted from the Ultraviolet-violet transmission spectra. This obtained energy bandgap is within the ranges of 4.69 – 4.83 eV, i.e., in reasonable agreement with the reported values. In summary, all the results showed that polycrystalline  $\text{Ga}_2\text{O}_3$  thin films were able to be grown on p-Si (100) substrate through the proposed methodology. While the best conditions for the dry oxidation process are at the oxygen flowrate of 5 L/min at temperature of 1100°C.

**Keywords:** Gallium oxide, Sol-gel, Spin coating, Dry oxidation, Annealing, X-ray diffraction, Kubelka-Munk function.