Contribution ID: **90** Type: **Oral**

Structural and optical properties of β-Ga_2O_3 thin films obtained by spray pyrolysis

Tuesday, November 5, 2024 4:05 PM (15 minutes)

Beta gallium oxide (β-Ga_2O_3) thin films have attracted considerable research interest due to their wide bandgap, high thermal and chemical stability, and high breakdown voltage making them suitable for power electronics, UV photodetectors, solar cells, and sensors [1]. In this work, β-Ga_2O_3 thin films were deposited on c-plane sapphire substrates via spray pyrolysis [2]. This approach is cost-effective and can be further used in large-scale production.

For spray pyrolysis, we used $Ga(NO_3)_3$ dissolved in a 1 : 1 water-ethanol mixture or water with 1% polyethyleneimine (PEI), followed by annealing at 800 ℃ or 1000 ℃. The films were characterized by SEM, AFM, XRD, Raman spectroscopy, spectroscopic ellipsometry, UV-vis. spectroscopy, and electrical resistance using the four-point probe. The films obtained are stoichiometric Ga_2O_3 in the β-phase with thicknesses of ˜70–100 nm (spray from precursor water-ethanol solution) and ˜30 nm (water-PEI solution). The films revealed a preferred orientation $(\bar{2}01)$ in agreement with previous results for β-Ga_2O_3 on c-plane sapphire [3]. The samples showed high transparency in the visible range and a sharp absorption edge in the UV range with bandgaps of 4.9 to 5.3 eV. The resistivity of the undoped films was in the GΩ range.

Thus, the current results show that spray pyrolysis allows the fabrication of highly crystalline, transparent, and dielectric β-Ga_2O_3 films suitable for further studies as UV photodetectors.

References

[1] Meng, Y., et al. Annealing induced phase transition and optical properties of Ga2O3 thin films synthesized by sputtering technique. Optik, 2021, 244, 167515.

[2] Schmidt, C. et al. The Influence of Process Parameters on the Microstructural Properties of Spray-Pyrolyzed β-Ga2O3. Nanomaterials, 2023, 13(9), 1455.

[3] Akazawa, Housei. Formation of various phases of gallium oxide films depending on substrate planes and deposition gases. Vacuum, 2016, 123: 8-16.

Type of presence

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Session Classification: Workshop on Sustainable Materials and Technologies

Track Classification: Workshop on Sustainable Materials and Technologies