

## Poster session

### Tunable Electrical Conductivity and Optical Parameters in Sn-Doped Ga<sub>2</sub>O<sub>3</sub> Thin Films for Optoelectronic Applications

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**Abstract:** Gallium oxide (Ga<sub>2</sub>O<sub>3</sub>) is an ultra-wide bandgap semiconductor that has attracted significant attention for next-generation power electronics [1], optoelectronic devices [2], and transparent electronic applications [3] due to its exceptional electrical and optical properties. In this study, the electrical and optical properties of Sn-doped Ga<sub>2</sub>O<sub>3</sub> thin films (1-3 % in the precursor solution) were systematically investigated. The films were deposited using the spray pyrolysis technique and subsequently thermally annealed in air at 800 °C for 30 minutes in order to improve crystallinity and structural quality. Electrical characterization was carried out using current–voltage (I–V) measurements, while optical properties, including optical transmittance and bandgap energy, were analyzed using UV–Vis spectroscopy. The results indicate that incorporation of Sn into the Ga<sub>2</sub>O<sub>3</sub> lattice induces n-type semiconductor behavior through the substitution of Ga<sup>3+</sup> ions by Sn<sup>4+</sup> ions, resulting in the generation of additional free electrons. The I–V measurements at 4 V revealed a substantial decrease in resistance with increasing Sn concentration: pure Ga<sub>2</sub>O<sub>3</sub> – 17.6 MΩ, 1 % Sn – 2.3 MΩ, 2 % Sn – 700 kΩ, and 3 % Sn – 290 kΩ. Increasing Sn content reduced resistivity and enhanced electrical conductivity while maintaining high optical transparency of approximately 80 % in the visible region. A slight decrease in the optical bandgap with increasing Sn concentration was also observed, indicating modification of the electronic band structure from 4.79 eV to 4.67 eV. These results demonstrate that Sn-doped Ga<sub>2</sub>O<sub>3</sub> thin films possess an excellent combination of high electrical conductivity, enhanced carrier mobility, and high optical transparency, highlighting their potential for advanced sensing applications.

**Keywords:** Ga<sub>2</sub>O<sub>3</sub>, Sn doped, Band gap, Transmittance, I-V characteristics.

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