

Topic for Master 2 internship – Academic year 2022-2023

Development of epitaxial Ga₂O₃ thin films for next generation power electronics

General Scope:

The demand for power electronic devices keeps increasing due to the rapid development of industries related to electricity, automotive and consumer electronics. In order to meet this demand, the use of ultra wide bandgap semiconductors such as diamond, aluminum nitride or gallium oxide (Ga₂O₃) has emerged as a potential avenue for development. Among these materials, β-phase Ga₂O₃ has many advantages, such as a large bandgap energy (4.6-4.9 eV), a particularly high breakdown voltage (8 MV/cm) as well as a high electron mobility ($\approx 250 \text{ cm}^2/\text{Vs}$). In addition, the availability of large and reasonable-cost Ga₂O₃ substrates makes it possible to consider this semiconductor as building block for next-generation power devices.

Research topic and facilities available:

The target of this internship is to develop the epitaxial growth of Ga₂O₃ thin films by pulsed liquid injection metalorganic chemical vapor deposition using a semi-industrial reactor, in which different chemicals as precursors will be explored. A wide range of morphological and structural characterization techniques will be used, including scanning and transmission electron microscopy, X-ray diffraction, and Raman spectroscopy, to finely assess and optimize the thin film growth mechanisms involved as well as the interface properties with the substrate. The optical and electrical properties of Ga₂O₃ thin films will be further characterized by optical absorption, Fourier Transform infrared spectroscopy, I-V, and photoconductivity measurements.

Possible collaboration and networking:

The candidate will work in the Materials and Physical Engineering Laboratory (LMGP), in the Nanomaterials and Advanced Heterostructures team (NanoMAT), as well as in Institut Néel, in the Wide Band Gap Semiconductor team (SC2G). The research project is part of the PowerAlps Cross-disciplinary research project funded by UGA, aiming at developing materials, functions and systems for next generation power electronics taking into account sustainability and industrialization issues.

Possible extension as a PhD: Yes. Funding already available.

Required skills:

The applicant should be an Engineering School or Master 2 student in the fields of materials science and engineering and/or semiconductor physics. Specific skills for teamwork and oral and written English expression will be appreciated. We are looking for dynamic, highly motivated candidates, who are interested to pursue a PhD thesis.

Starting date: February to April 2023, for 5 to 6 Months long

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