Master Thesis Project
Nitride/Oxide Heterostructures for Power Electronics

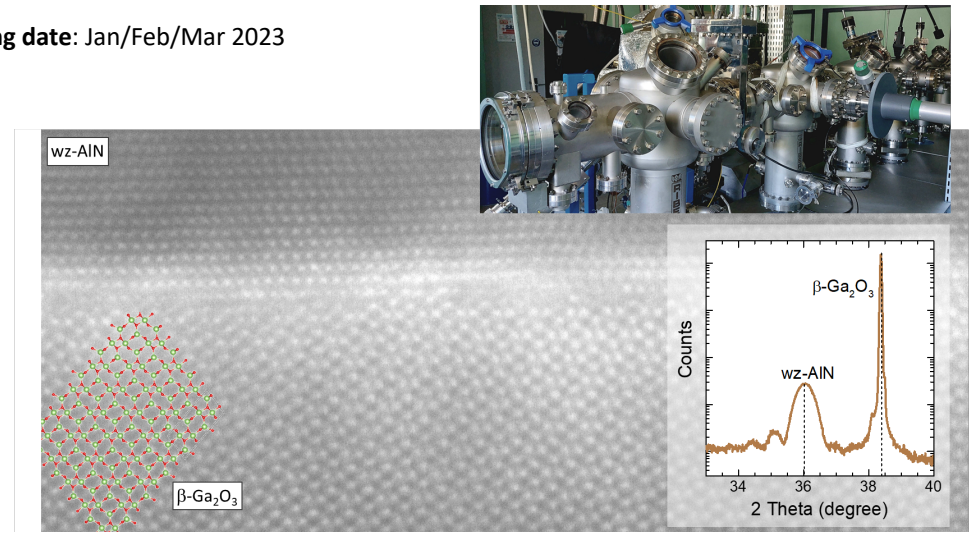
Context: The increasing demand of growth of electricity consumption, linked to the challenges of digital and ecological transition, is boosting the market for power electronics. With their high breakdown electric field, ultra-wide-bandgap semiconductors (UWBG) like gallium oxide (Ga_2O_3) and aluminum nitride (AlN) are promising competitors for the next generation of power electronics, surpassing not only traditional silicon-based materials but also GaN and SiC. UWBG materials can handle higher voltages, temperatures, and power densities. Nitride/oxide heterostructures hold great promise for power electronics by offering a compelling combination of UWBG properties, high breakdown voltage and fast switching capabilities.

Targets and strategy: The fabrication of an AlN/oxide device requires to address a number of material challenges, particularly the nucleation of epitaxial AlN on Ga_2O_3 managing the polarity of the AlN layer and the eventual activation of thermal interdiffusion. These phenomena can determine the electronic properties of the heterojunction. During this internship, we will optimize the AlN/Ga_2O_3 interface in terms of structural quality and electrical performance. Our ultimate goal is the fabrication of a chemically-sharp AlN/Ga_2O_3 heterostructructure hosting a polarization-induced two-dimensional electron gas at the interface.

The student will be trained in epitaxial growth of III-nitride semiconductors on gallium oxide. He/she will perform structural characterization of the samples using atomic force microscopy, scanning electron microscopy and x-ray diffraction. Transmission electron microscopy will also be accessible through in-place collaborations. Additionally, the student will be trained in cleanroom processing to perform basic electrical characterization of the material.

Required skills: Taste for experimental work. Interest in solid-state physics, semiconductors, epitaxy, structural and electrical characterization.

Starting date: Jan/Feb/Mar 2023



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To apply for this position, send your application (including CV) by e-mail to: eva.monroy@cea.fr

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