



INTERNSHIP OFFER

Master 2 or 3rd year of engineering school

Microstructure and doping level of polycrystalline SiC deposited by CVD: establishing a relationship with local growth conditions

Duration	6 months, starting from February 2027
Location	Laboratoire SIMaP, 1130 Rue de la Piscine - BP 75 – 38402 Saint Martin d'Hères – France
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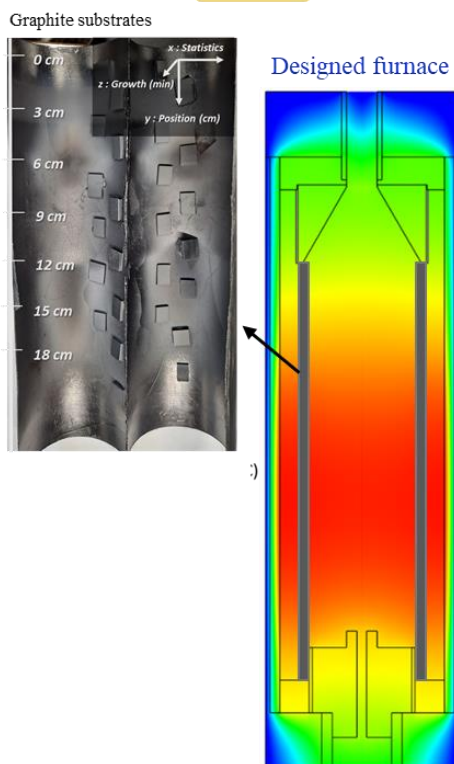
Context & objectives

Today, for ecological and geopolitical considerations, we need to reduce our dependence on fossil fuels. To achieve this, a massive electrification of society is envisaged in which power electronics components will play a key role. **Silicon carbide's** exceptional physical properties make it an ideal material for the manufacture of these components, which however depend on the availability of large single-crystal substrates of excellent crystalline quality, still considered too costly. A high-potential alternative to conventional substrates consists in transferring a thin film of monocrystalline SiC onto a **polycrystalline SiC substrate** which must be thick, highly conductive (thermal and electrical) and flat. **Mersen company** produces highly n-doped poly-SiC substrates by **Chemical Vapor Deposition (CVD)**. Devices like transistors n-IGBT or MESFET however need respectively highly p-doped and highly resistive poly-SiC substrates.

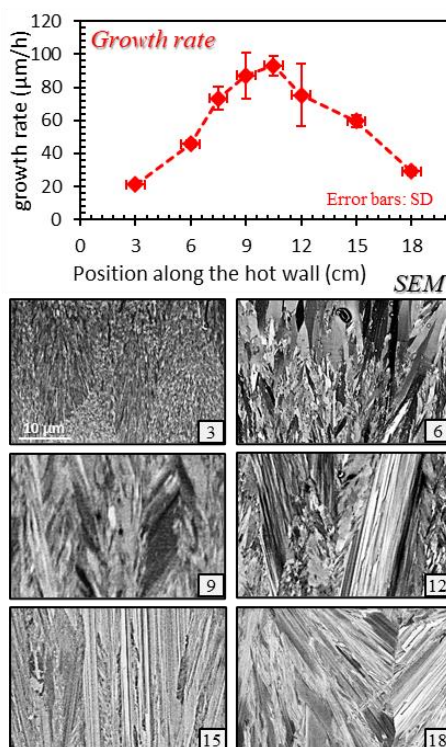
Aluminum is commonly used to obtain **p-type SiC**. Introduced together with nitrogen, it might also be used to grow **highly resistive SiC**. The incorporation of these atoms in the growing film depends on the **local growth conditions** (temperature, concentration of reactive species...) which are also governing the **deposit microstructure** (grain size, crystalline quality, preferential orientation...). The resulting electrical properties of the deposit - which we want to tune - depend both on the incorporated doping agents (aluminum, nitrogen) and the deposit microstructure. Therefore, optimums must be identified.

The general aim of this internship is to deepen our understanding of the relationship between **local growth conditions, incorporated aluminum/nitrogen, deposit microstructure and electrical properties** by exploring various process conditions (pressure, temperature, mass flow rates). To this end, a specialized CVD furnace enabling the exploration of multiple growth conditions in a single run will be employed. This allows for high-throughput screening of the **process-microstructure-composition landscape**. Then, a link will be made with the associated electrical properties.

Process



Characterisations



In practice the intern will be in charge of:

- Reviewing the literature on p-type SiC and co-doping
- Carrying out growth of aluminum/nitrogen doped poly-SiC deposits in a hot-wall CVD reactor
- Preparing the samples for characterization: cutting, polishing...
- Characterizing the microstructure of the samples (optical microscope, SEM, EBSD, XRD)
- Characterizing the electrical properties of the samples (4-probes, Capacitance-Voltage measurements...)
- Reporting her/his results periodically

The internship is part of a PhD thesis, carried out in a Joint Laboratory between MERSEN company (<https://www.mersen.com/fr>) and SIMaP (<https://simap.grenoble-inp.fr/>), a research lab specialized in materials sciences and associated processes. Therefore, you'll have one foot in academia and the other one in industry, allowing you to see how these two can collaborate for tomorrow's new materials and process developments.

Profile & requested skills

We are looking for a highly motivated student (M2 or 3rd year of engineering school) with a background in material science and/or process engineering and who shows interest in research and experimental work. The student must be dynamic, curious and autonomous. The student must speak French and/or English.