INTERNSHIP OFFER

Master 2 or 3rd year of engineering school

Determination of graphite insulation felts properties from a simulation-experiment dialogue

Duration	6 months, starting from february/march 2025
Location	Laboratoire SIMaP, 1340 Rue de la Piscine - BP 75 – 38402 Saint Martin d'Hères – France
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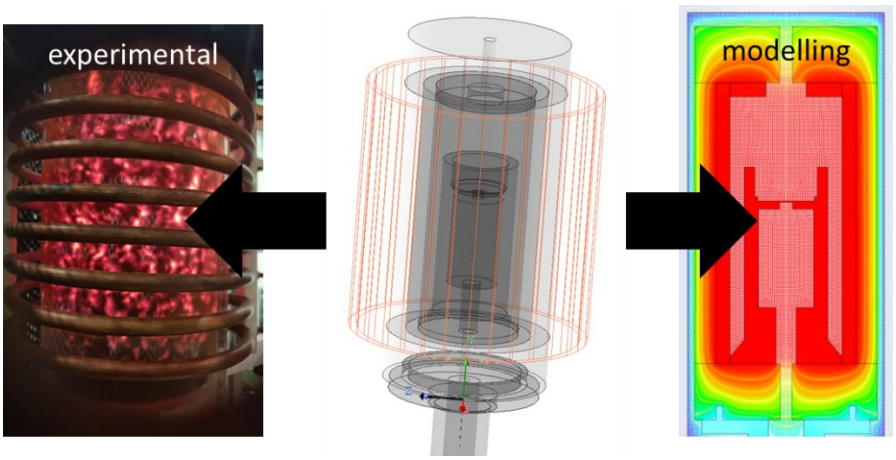
Context & objectives

Today, for ecological and geopolitical considerations, we need to reduce our dependence on fossil fuels. To achieve this, a massive electrification of society is envisioned in which power electronics components will play a key role. **Silicon carbide**'s exceptional properties make it an ideal material for the manufacture of these components, which however depend on the availability of large monocrystalline substrates of excellent quality. These substrates are fabricated from SiC boules grown by a **very high temperature (~2500°C)** process named PVT, for physical vapor transport. This process involves the inductive heating of a graphite crucible surrounded by a **graphite thermal insulation felt**. These **graphite felts** obviously need to have a **low thermal conductivity**, to limit heat losses to the ambient, but they also require a **low electrical conductivity** to limit the interaction (coupling) with alternating magnetic field used for induction heating which would result in a degradation of the process performance. To characterize the **overall performance of the felts**, it is therefore important to characterize both their **electrical and thermal conductivities on a broad range of temperature (20-2500°C)**. However, conventional methods cannot be easily used to characterize these properties for insulations felts, firstly due to their fibrous nature, and secondly due to the very high temperature required. Therefore, the main objective of the present internship is to develop **inverse methods based on a dialogue between simulation and experiment, that would give a good estimation of the thermal/electrical conductivity of the felts as a function of temperature**. Different options are envisioned and will be explored during the internship (simple regression, machine learning-based methods…). Both stationary (stabilized temperature in the furnace) and transient cases (heating up, cooling down) will be investigated.



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In practice the intern will be in charge of:

- Learning a simulation tool (commercial code) to solve induction and heat transfers phenomena involved in the high temperature furnace
- Developing and evaluating inverse methods to retrieve an expression for thermal (eventually electrical) conductivity of the insulation felt on a broad range of temperature (20-2500°C)
- Apply the methodology on various type of insulation felts to build a database
- Analyzing the data and reporting the results periodically

The internship will take place in the framework of a very dynamic and long-term collaboration 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.

Profile & requested skills

We are looking for a highly motivated student (M2 or 3rd year of engineering school) with a background in thermal engineering and who is keen on learning and using simulation tools. Programming skills (e.g. Python, Matlab…), at least basic level, are also required for data processing. The student must be dynamic, curious and autonomous. The student must speak French and/or English.