Postdoc or Engineer Position – Power electronics

FIRE Project: Innovative Foundry for Coolers in Power Electronics

Start:	Autumn 2026
Laboratory:	L2EP - https://l2ep.univ-lille.fr/ LMFL - https://lmfl.univ-lille.fr/
Team:	Power Electronics / Laboratoire de Mécanique des Fluides de Lille
Location:	Campus Cité Scientifique, Université de Lille / ENSAM, Lille
Application:	CV, recommendation letters if any
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Context

In 2025, the automotive industry accounts for approximately 7% of the EU's GDP and employs nearly 14 million people. The EU's decision to ban the sale of new internal combustion engine vehicles from 2035, as part of its climate change reduction efforts, is driving a major shift in the sector. This transition requires automakers and their suppliers to move toward electric vehicle production, fundamentally transforming vehicle design and industrial models to ensure long-term sustainability. A key technical challenge in this transition is the integration of power electronics in vehicles, which manage energy flow between lithium-ion batteries and electric motors using semiconductor-based power switches. While highly efficient, these systems generate substantial thermal losses—up to 1 kW/cm² at the switch level—requiring innovative cooling solutions to keep junction temperatures (T_j) below critical thresholds.

Current cooling systems, often based on simple structures like fins or pin surfaces, are not optimized for automotive constraints. Their design relies on thermofluid simulations in steady-state conditions, leading to oversizing to ensure T_j remains below its maximum limit ($T_{j,max}$). However, transient thermal peaks during acceleration could be better addressed with advanced models validated by experimental instrumentation. Additionally, the emergence of next-generation semiconductors like silicon carbide (SiC) and gallium nitride (GaN) is revolutionizing power electronics. Though more efficient than silicon, their immaturity complicates traditional thermal characterization methods. New measurement approaches dedicated to wide-bandgap materials are needed. To address these new challenges, the LMFL laboratory and the L2EP laboratory aim to develop a thermal characterization bench and methods to obtain refined thermal model.

Objectives

The postdoc or engineer will contribute to a research project aimed at developing advanced thermal characterization methods for power electronics components, particularly in silicon carbide (SiC). Initially, they will focus on sample preparation, designing and purchasing ceramic substrates, and mastering the equipment for assembly.
Next, they will contribute to the development of the experimental bench by instrumenting the chips and integrating them into a measurement system using the Thermal Sensitive Electrical Parameter method. A robust experimental protocol will be established to ensure the reliability of measurement campaigns while addressing instability issues related to gate voltages (V_{gs}).
Finally, they will work on advanced modeling and multi-fidelity coupling by implementing and validating a multi-fidelity ensemble Kalman filter (MFEnKF) for data assimilation of experimental results. The goal will be to optimize the prediction of heat transfer and flow behavior in cooling systems by integrating high-fidelity multiphysics models and reduced-order machine learning-based models. The acquired knowledge will be transferred through technical workshops, simulation script sharing, and a methodological report.

Position requirements

As an ideal candidate:

- You have a Master or a PhD degree with a relevant background in power electronics. Knowledge of thermal engineering will be appreciated also.
- You must have a strong interest in experimental work and simulation.
- You should have obtained excellent study results.
- You should have an interest to work in a team with experts studying different aspects of power electronics.
- This work is included in the framework of a regional project with a industrial partner, you must be able to make effective reporting to the members of the consortium.
- You should have a strong motivation for scientific writing and for publishing in journals.

Localization and supervision

L2EP is the Laboratory of Electrical Engineering and Power electronic located in Lille – France (https://l2ep.univ-lille.fr/). The Power Electronics group is mostly working on the development of efficient power conversion structures, focusing on wide-bandgap components (SiC, GaN).
LMFL is the Laboratory of Fluidic Mechanical of Lille – France (https://lmfl.univ-lille.fr/). The LMFL is working on modelling fluid and thermal flows, by reduced-order physics-based models and by data-driven models.
The position will take place in the ESPRIT building of the University of Lille and in the ENSAM building in Lille city center.