

Internship Offer M/F (6 months)

Development of an analysis tool to measure the degradation of power electronic device interconnections using infra-red maps information and thermal-electrical modelling
(ref PPCMOH012021)

Background

MITSUBISHI ELECTRIC R&D CENTRE EUROPE (MERCE) is the European R&D centre from the Corporate R&D organisation of MITSUBISHI ELECTRIC. The aim of our centre is to provide advanced R&D support to the Japanese R&D centres and to the business units of MITSUBISHI ELECTRIC CORPORATION.

Situated at the heart of Europe's leading R&D community, MERCE includes two entities: MERCE-France and MERCE-UK, and conducts R&D into next generation communication systems and technologies related to Energy and Environment. Design of power converter is a major activity in the Power Electronic System division.

Internship Description

The need for electrification of a large variety of systems (railways, automotive, aircrafts, etc...) continuously requires more robust, reliable and smart power electronic converters for easy and safe usage. Power modules are considered as the key components that are widely used inside conversion systems. Classically, they integrate several semiconductor switches typically made of silicon (Si) or silicon carbide (SiC). During operation, the power module generates heating losses that induce thermomechanical stresses at different interfaces, where the aluminum wire- chip interconnection (wirebond) is pointed out as a critical and a major cause of failure. Therefore, it is desirable to track the damage of wirebonds to monitor the power module health-state and/or to build reliability models. **This internship project will focus on the measurement of wirebonds degradation based on infrared thermal imaging and electro-thermal simulations. The final objective is to deliver a software tool that can be used routinely on measurement platforms to evaluate wirebonds degradation levels.**

Organisation

The internship will take place in MERCE, located in Rennes, and will include the following tasks:

- ✓ Experimental data analysis: Extraction of wirebond temperature profiles from temperature maps, including corrections for radiation view factors and 3D profile of the chip.
- ✓ Model calibration: A thermal-electrical model will be built to reproduce the measured temperature distribution: from the simple analytical models to more complex and accurate solution using the finite element method.
- ✓ Model application: Using the developed model(s) to extract information on the interconnections degradation on a commercial device
- ✓ Toolbox development: Delivery of a tool that allows extracting the information on the interconnections degradation under different test conditions
- ✓ Writing the internship's report

Prerequisites

- ✓ Engineer/Master level student in power electronics, electrical engineering, physics, material science or related field with interest in research
- ✓ Interest in and understanding of heat transfer principles (radiation, diffusion)
- ✓ Strong interest in image analysis, coding skills (Matlab)
- ✓ Experience in Finite Element Modelling preferred (Ansys, Comsol or similar platform)
- ✓ Autonomous, but team player
- ✓ English: written

Duration: 6 months**Project start:** 2021**Contact :** Magali BRANCHEREAU (jobs@fr.mercede.mee.com)

Please send a CV and Motivation letter in pdf format indicating the Reference of this offer (*PPCMOH012021*). An internship contract must be signed with your school / university so you must still have the student status to apply to this offer.