Université de Sherbrooke

Development of molding processes for heterogeneous integration of large electronic chips

Record number : OPR-1177

Overview

RESEARCH DIRECTION

Dominique Drouin, Professeur - Department of Electrical and Computer Engineering

INFORMATION

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RESEARCH CO-DIRECTION

Serge Ecoffey, Professeur sous octroi de recherche - Department of Electrical and Computer Engineering

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ADMINISTRATIVE UNIT(S)

Faculté de génie
Département de génie chimique et de génie biotechnologique
Département de génie électrique et de génie informatique
Département de génie mécanique
Institut interdisciplinaire d'innovation technologique (3IT)

LEVEL(S)

3e cycle

LOCATION(S)

3IT - Institut interdisciplinaire d'innovation technologique

Project Description

Context:

Advanced packaging technologies are crucial for the evolution of microelectronics, enhancing performance through heterogeneous integration. Traditional methods struggle to meet the demands of high-performance computing, AI, aerospace, and defense. Fan-Out Wafer-Level Packaging (FOWLP) was developed several years ago for the integration of advanced microelectronic systems. This technology allows the assembly of a multitude of components into a monolithic wafer conducive to the microfabrication and integration processes of the microelectronics industry. Despite its strong potential and high level of maturity, FOWLP is still very rarely used for the integration of heterogeneous systems with large chips. Thus, we propose this thesis project to develop a novel approach for process (FOWLP) to integrate heterogeneous active chips (HBM, ASIC) and passive interconnect/thermal chips using a molding approach that is compatible with large chips (> 400 mm2).

Topic:

This thesis aims to develop molding processes for heterogeneous integration of large chips. The successful candidate will be in charge of (i) conducting a literature review of molding methods and epoxy materials used in molding to understand their properties and associated challenges, (ii) selecting 2-3 candidates based on vendor data, focusing on curing temperature, Tg, Young’s modulus and adhesion, as well as the ability to fill the narrow chip gap, (iii) developing molding processes for molding chips in epoxy material compound (EMC) using industrial grade equipment, (iv) studying the influence of die placement process parameters and materials (EMC, molding plate and release tape) on critical specifications such as warpage and chip displacement after molding,(v) performing complete morphological characterizations of the molding compounds to determine the quality and the integrity of FOWLP. At the end of this thesis, the student will have established a new robust molding process for the integration of advanced microelectronic systems.

Work Supervision:

This PhD thesis will be realized under the co-direction of Pr. Dominique Drouin and Pr. Serge Ecoffey, as part of the IBM/NSERC Alliance Project on Multi-Chip Heterogeneous Integration for High Performance Computing. The work will be done mainly at the Interdisciplinary Institute for Technological Innovation (3IT) at the Université de Sherbrooke and at the MiQro Innovation Collaborative Center (C2MI) in Bromont. 3IT is a unique institute in Canada, specializing in the research and development of innovative technologies for energy, electronics, robotics and health. C2MI is an international center for collaboration and innovation in the MEMS and encapsulation field. It is the essential link between applied research and the marketing of microelectronics products. The student will thus benefit from an exceptional research environment that combines students, professionals, professors and industrialists working hand-in-hand to develop the technologies of the future.

Desired Profile:

• Master’s degree in engineering or science in the field of chemistry, physics, or materials.
• Experience in characterizing organic materials (epoxy, polymers)
• Ability to communicate in English or French both orally and in writing
• Strong ability to adapt, be autonomous and work in a team
• Pronounced taste for design, experimental work in a clean room, research and development
• Assets: Knowledge of microfabrication and integration processes, advanced microelectronic packaging

Contact: inpaqt@usherbrooke.ca
Starting date: September 2025
Documents to provide: Cover letter, curriculum vitae, transcripts for the past two years & contact details of 2 references

Discipline(s) by sector

Sciences naturelles et génie

Génie chimique, Génie électrique et génie électronique, Génie mécanique

Funding offered

Yes

$ 25 000 CAD per year

Partner(s)

IBM Canada Ltée., Institut Interdisciplinaire d’Innovation Technologique (3IT), Centre de Collaboration MiQro Innovation (C2MI)

The last update was on 11 March 2025. The University reserves the right to modify its projects without notice.