

# (Chaire CRSNG-IBM) Additive microfabrication: development of high-density interconnects on organic substrates for high-performance electronics

Record number : OPR-471

## Overview

### RESEARCH DIRECTOR

Dominique Drouin, Professeur -  
Department of Electrical and Computer  
Engineering

### Information

[dominique.drouin@usherbrooke.ca](mailto:dominique.drouin@usherbrooke.ca)

### ADMINISTRATIVE UNIT(S)

Faculty of Engineering  
Department of Electrical and Computer  
Engineering  
Interdisciplinary Institute for Technological  
Innovation

### LEVEL(S)

Ph.D.

### LOCATION(S)

3IT - Institut interdisciplinaire d'innovation  
technologique  
C2MI - Centre de Collaboration MiQro  
Innovation

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## Project Description

Context: In the field of high-performance computing (HPC), the heterogeneous integration of electronic chips on the same organic substrate makes it possible to increase the computing power of the modules while diversifying their functionalities. This implies that the density of metal lines on the substrate interconnecting the different chips (i.e. processors and memories) must increase steadily to provide the bandwidth required by future HPC applications. However, the processes currently used for the manufacture of organic substrates face technical limitations slowing down the shrinkage of the interconnects' dimensions. In this context, high-precision additive manufacturing technologies (eg 3D printing) using polymers and metals represent a promising approach to significantly increase the density of the last levels of interconnection of organic substrates. We thus propose a thesis subject dedicated to the fabrication and the study of micrometric metal interconnects using state-of-the-art additive manufacturing equipment.

Research project: This PhD project focuses on the development of additive manufacturing processes for the realization of high-density interconnects on organic substrates, presenting the main challenges of the reproducibility and reliability of the structures obtained. Based on the processes and expertise of Prof. Dominique Drouin's research group at 3IT and C2MI in the fields of micro-manufacturing and advanced encapsulation, the student will be in charge of (i) design a prototype incorporating on an organic substrate electrical test structures, high-density interconnects and solder joints; (ii) developing the complete micro-manufacturing process, including steps of dielectric layers lamination, laser etching and additive manufacturing of metal structures using dedicated state-of-the-art equipment; (iii) perform complete morphological and electrical characterizations of the samples to determine the manufacturing quality and performance of the interconnects. Functional validation after assembly of a chip on the high-density substrate will also be explored; (iv) study the environmental reliability and resistance to electromigration of the fabricated interconnects.

Supervision & work environment: This PhD thesis will be realized under the co-direction of Prof. Dominique Drouin and Prof. Sylvain Cloutier (ETS Montréal), as part of the IBM/CRSNG Industrial Research Chair on High Performance Heterogeneous Microelectronic Integration. 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.

Researched profile:

- Master's degree
- Specialization in micro-nanotechnology, materials science or microfluidics
- Strong adaptability, autonomy and teamwork
- Strong taste for design, experimental cleanroom work, research and development
- Strengths: experience in additive micromanufacturing and advanced packaging

Documents to provide: CV, cover and recommendation letters and transcripts for the past two years.

Discipline(s) by sector	Funding offered	Partner(s)
<b>Natural Sciences and Engineering</b>	Yes 21 000\$	IBM Canada Ltée.
Electrical Engineering and Electronic Engineering		

The last update was on 24 November 2020. The University reserves the right to modify its projects without notice.