

An Indian-Australian research partnership

Project Title: **Role of textured surfaces in determining flow and heat transfer characteristics of microchannels**

Project Number **IMURA0426**

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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. **Advanced computational engineering, simulation and manufacture**
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Define the problem

Microchannels are an integral part of microdevices. However, the pressure drop in microchannels is relatively large due to their small size, which results from relatively large surface area to volume ratio. Texturing microchannels is one possible way to reduce the pressure drop penalty. Texturing has another benefit: it can potentially increase the heat transfer coefficient. Although there are a number of studies on static drop resting

on a textured surface, the dynamics characterization over a textured surface is relatively less well studied. The goal of this work is fabricate textured microchannels possibly through MEMS approach, and to experimentally and numerically determine the pressure drop and heat transfer characteristics in textured microchannel. The overall goal of the project is to achieve reduction in the size of a heat exchanger.

Project aims

Define the aims of the project

The specific aims of the project are

- (i) To fabricate textured microchannels
- (ii) To experimentally determine pressure drop and heat transfer characteristics of textured microchannels
- (iii) To develop CFD based model(s) of flow characteristics and validate the models through detailed experimentation
- (iv) To understand the role of textures in the physics of flow process
- (v) To evolve empirical correlations for the determination of the pressure drop and heat transfer coefficient in textured microchannel.

Expected outcomes

Highlight the expected outcomes of the project

The project would lead to detailed physical insights into the flow and heat transfer characteristics of textured surfaces, which could potentially be correlated to reduction in the size of heat exchangers. It would also lead to empirical correlations for various geometries of textures, which can be used for making engineering design calculations.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

The problem of textured surface is of current interest, involving various aspects: including manufacture, experiments and advanced computational techniques. The project therefore is very much in line with Theme 1 of the Academy.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Master's or Bachelor's in Mechanical, Aerospace, Chemical, Civil or Electrical Engineering (with MEMS/Nanotechnology background). Exposure to CFD and MEMS fabrication preferred.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Dr. Mark Thompson

Please provide a few key words relating to this project to make it easier for the students to apply.

Microfluidics; Heat Transfer; CFD (Computational Fluid Dynamics); Lithography; MEMS; Heat exchanger