INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **EXPERIMENTAL STUDIES ON PORE SCALE MULTIPHASE FLOW IN HOMOGENEOUS AND HETEROGENEOUS MICROMODELS USING MICRO-PIV.**

Name of Thesis Supervisor(s)	:	Prof. Ujjwal K. Saha (ME) and Prof. Anugrah Singh (CL)
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SHORT ABSTRACT

Micromodels are useful tool to study the fluid flow behavior in porous media at micron scale that is relevant to the many fields like petroleum recovery. During the last 30 years, micromodels have found to be the most precious tool, which allow the observation of fluid flow and transport at the micron scale in many processes related to chemical, biological, and physical fields of engineering. Micro-fluidic devices have been designed and used to investigate immiscible fluid-fluid displacement processes. Due to their optically transparent nature, such devices allow direct visualization of pore scale events using light microscopy. In this thesis, we focus on imaging multiphase flow phenomena at the pore scale within specifically designed micro-models using optical microscopy.

In this work, the fundamentals of steady flow through porous media: it discusses single-fluid flow, multi fluid immiscible flow, including the effects of heterogeneity, non-uniformity, and anisotropy of media in the form of fracture and multi porosity. First, this research tries to adopt an alternative procedure of fabrication of micromodel, which is simple and cost effective method compared to the traditional techniques like optical lithography, soft lithography and etching method. This modified procedure offers increased flexibility in size and network pattern as well as a significant reduction in the material, time and operation costs. Next, the fabricated prototype is applied in both single phase and two-phase flow visualization studies to verify the applicability and reliability of the features under the specified experimental conditions.

Following the fabrication of a suitable PDMS micromodel, this thesis will present the processing/analysis of the visual data in micromodel experiments. In this section, an image processing MATLAB tool (PIV lab, version 1.41) is used that quantifies the flow field. The availability of advanced image processing functions and the simplicity of working with PIV lab, provide the unique opportunity to implement it that quantifies the visual observations during PDMS micromodel test and single-phase and two-phase flow studies.