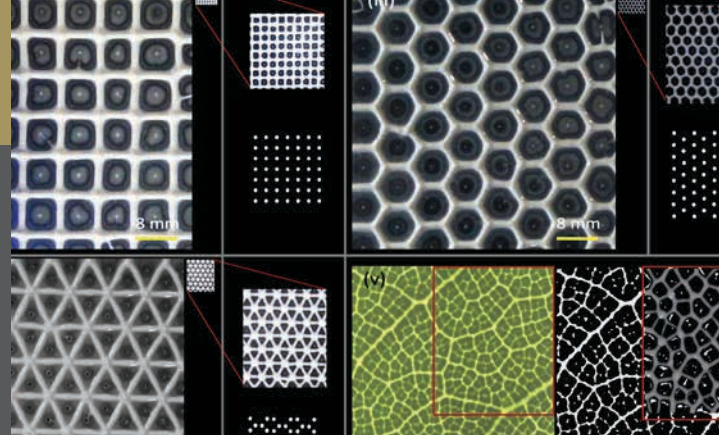
Multiport Controlled Hele-Shaw Cells for Multi-Scale Manufacturing



Problem Statement: The existing method for developing patterns using Hele-Shaw cell of micron/nanometer-sized particles of various materials such as minerals/oxides/sulphides/metals/ceramics may disclose the use of a steadily expanding liquid-liquid interface. The interface may be populated using a suitable surfactant molecule that may spontaneously organise into superstructures. These superstructures may vary over large length scales. However, such a method may enable pattern formation without control over neither initiation nor evolution of various features being formed by the displacing or displaced fluid. Further, the existing techniques like lithography can only fabricate the 2D structures. Thus, researchers at IIT Bombay are working on addressing this need through lithography-less fabrication. Lithographyless fabrication of a class of structures (fractal geometry, regular array, large triple point boundary islands) at multiple scales (submicron to 300 cm).

Uniqueness of the Solution: The proposed solution is a complete out-of-the-box solution for this multiscale fabrication. Starting with viscous fluid sandwiched between two plates (Hele-Shaw Cell), it is based on novel control over the Saffman Taylor instability that occurs when plates are separated. Control is exercised by providing seed locations on the cell plates creating preferential pathways for the fluid structures to grow in the desired patterns.

Current Status of Technology: Several systems and prototypes for multiple scales have been developed based on this technology and tested in the laboratory successfully.

Societal Impact: The proposed technology has applications in the energy and healthcare sector. Large triple point boundary island structures are being explored in the energy sector for efficient hydrogen production. Future growth of clean, efficient hydrogen production is crucial for the energy sector. In healthcare application development of whole blood plasma separator with high yield from heel prick volume 30 microliter blood is in advance stage of research.

Patent(s): Filed and Granted

Relevant Industries: Healthcare, Medical Devices, Clean Energy

Faculty: Prof. Prasanna Gandhi, Mechanical Engineering.