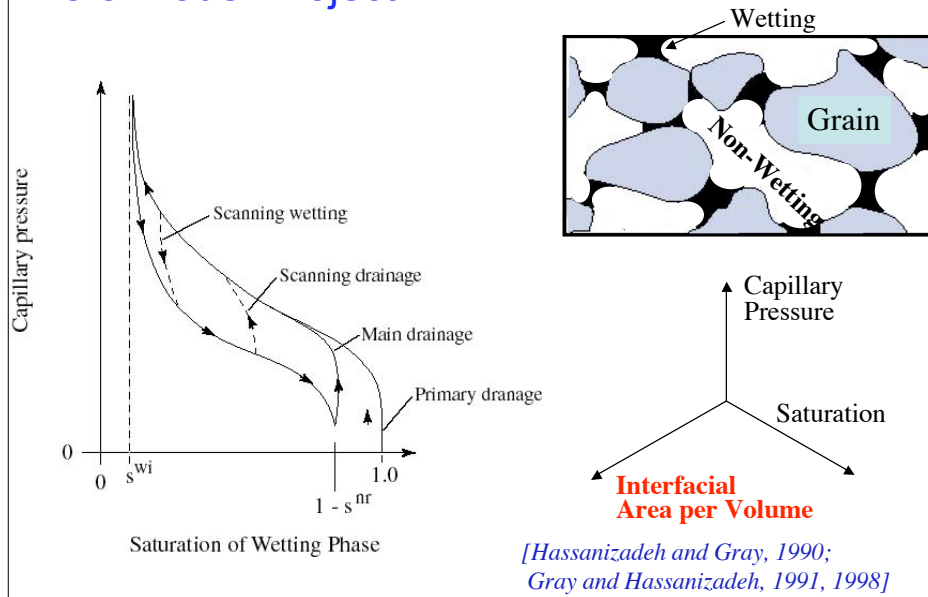


Micro-Model Project



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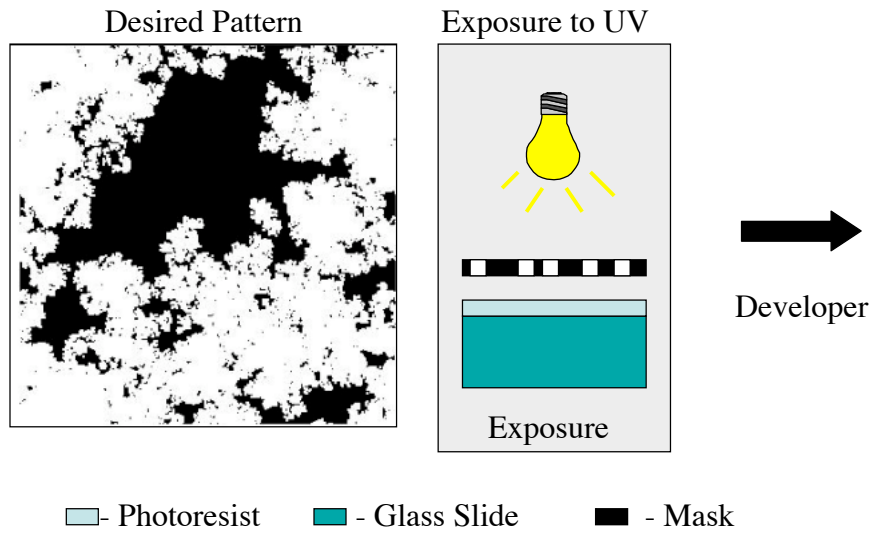
Experimental Approach

- ❖ Photo-projection lithography
- ❖ Displacement measurements
- ❖ Image Analysis

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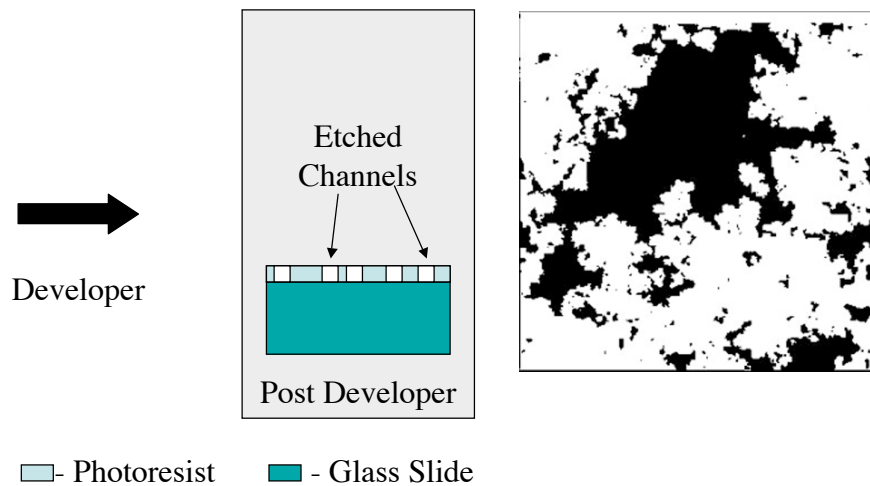
Photo-Projection Lithography



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Photo-Projection Lithography

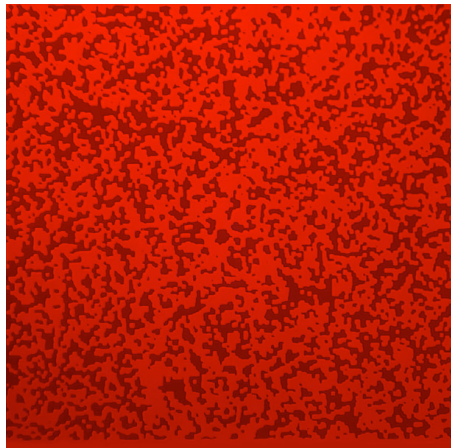


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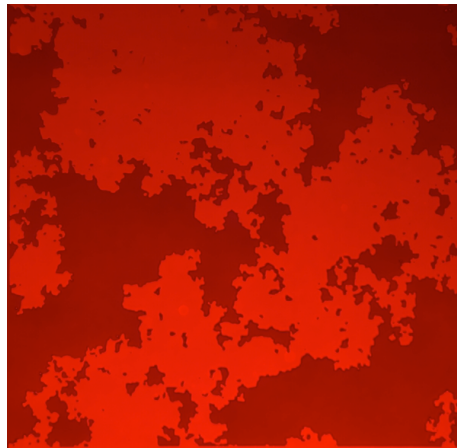
Simulated Pore Structures

Spatially Uncorrelated



600 μm

Spatially Correlated



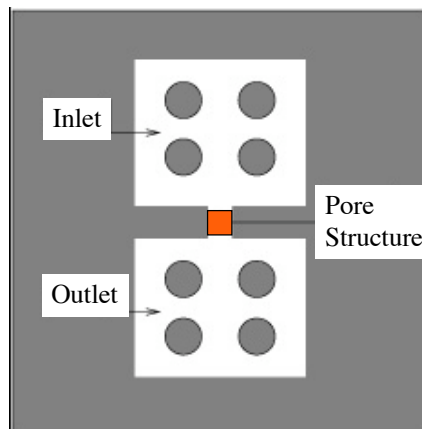
Aperture $\sim 1.08 \mu\text{m}$

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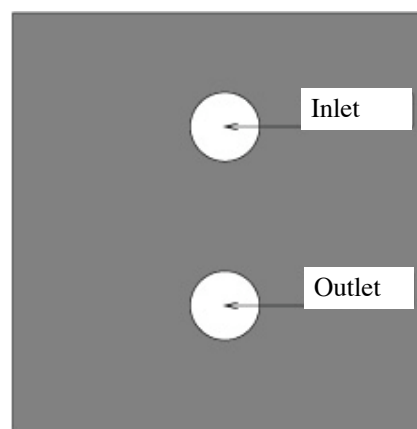
Pyrak-Nolte

Fabrication Procedure

Base Plate



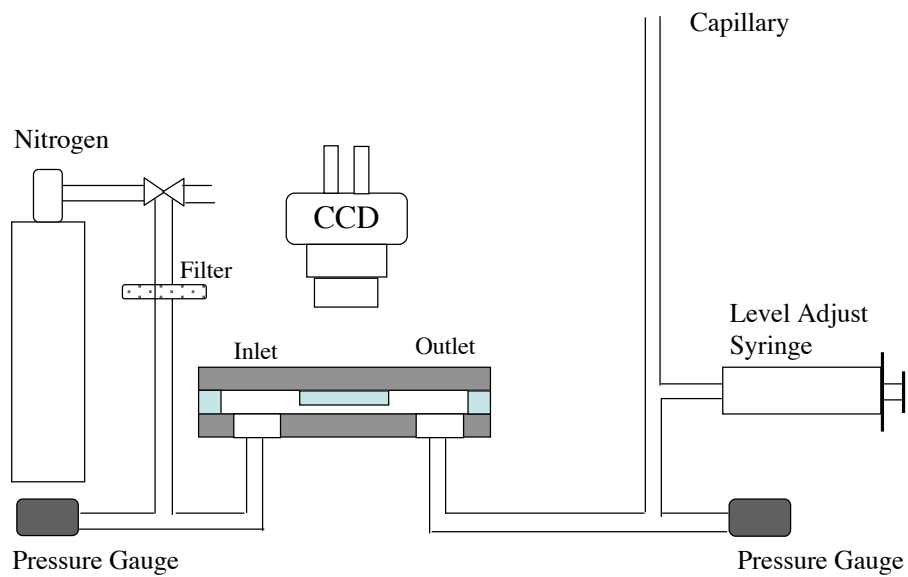
Port Plate



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Experimental Set-up



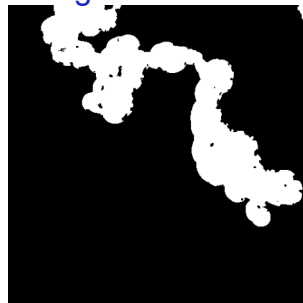
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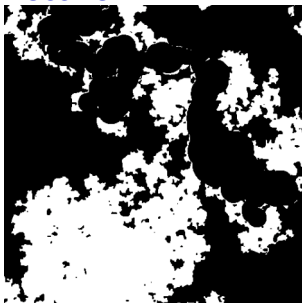
Raw Image



Nitrogen



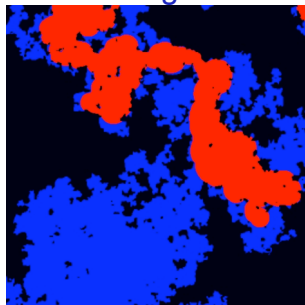
Decane



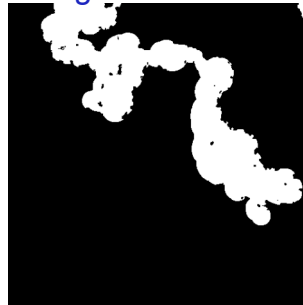
Photoresist



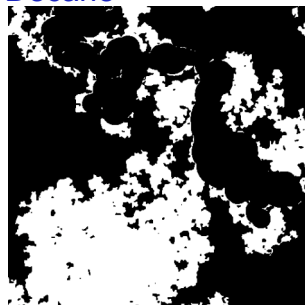
Phase Image



Nitrogen



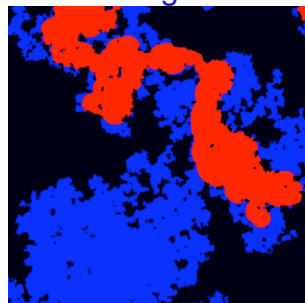
Decane



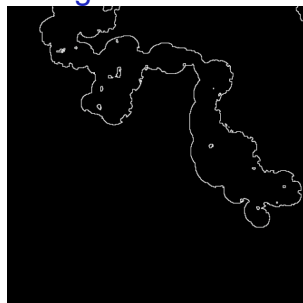
Photoresist



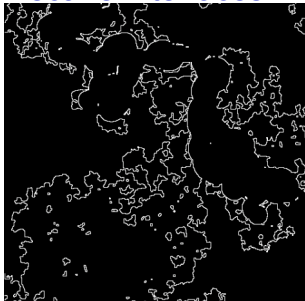
Phase Image



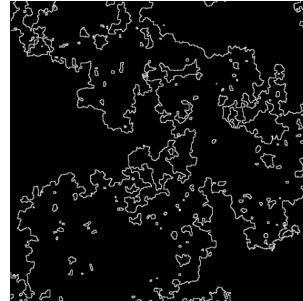
Nitrogen Interfaces



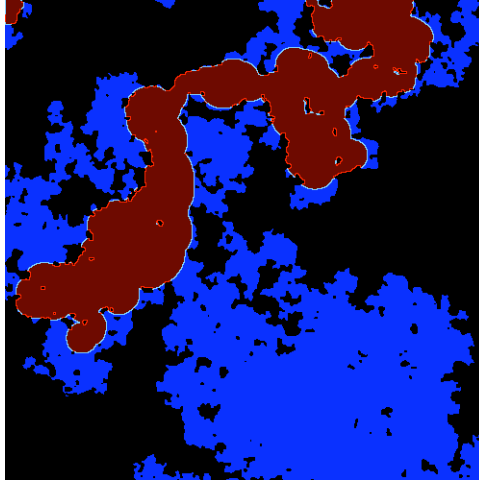
Decane Interfaces



Photoresist Interfaces



Interface Between Nitrogen - Decane



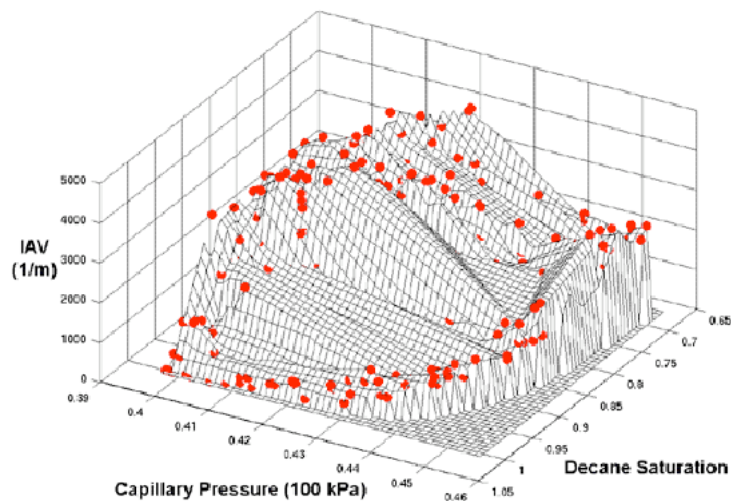
Black - Photoresist Maroon - Nitrogen Blue - Decane
White - Capillary Dominated Bright Red - Non-Capillary Interfaces

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Conclusions

- * If only interfaces dominated by capillary forces are considered, IAV_{nw} is a single valued function of capillary pressure and saturation to within 4% and is now invertible.



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Project Micro-Models

Project Description: Comparison of experimental data and percolation analysis on the relationship among capillary pressure, saturation and interfacial area per volume.

Objectives:

- * Extraction of relevant physical parameters (e.g., pore geometry, phase saturation, interfacial areas, etc.) from image analysis of laboratory data using such techniques as level sets
- * Analysis of the observed relationship from experimental data to determine uniqueness of the surface, fit the surface, compare drainage and imbibition surfaces, etc.
- * Development of a percolation code that incorporates the difference in interfacial behavior during drainage and imbibition.
- * “Monte Carlo” like simulations using percolation code to determine upscaling behavior (if any) of the system.

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Mini-Lectures

- * **The Role of Interfacial Area per Volume in Multiphase Flow & Upscaling Relationships**, by Casey Miller
- * **Introduction to Percolation Theory**, by Nick Giordano
- * **Introduction to Level Sets for Image Analysis**, James McClure

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