Resolving fluid motion near the air-water interface in model porous media

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Project Description:

Fluid flows through porous media such as soils, river beds, and rocks transport molecules, bacteria, and particles that influence a wide spectrum of environmental and energy related processes, ranging from carbon dioxide sequestration to groundwater remediation. Although flows in porous media are basically understood when they involve a single fluid, like air or water, our ability to predict simultaneous flows of several fluids (like air and water together) remains limited. In this project, students will conduct laboratory experiments to achieve new understanding of fluid dynamics in porous media. Students will quantify the velocities of multiple fluids flowing together through porous media by combining two methodologies we have recently developed: (1) construction of transparent model porous media with stereolithography 3D printing, and (2) resolution of fluid velocities with laser-based imaging of fluorescent particles. Students will collaborate with researchers at Porelab and the Njord Centre to merge these technologies and characterize fluid velocities during multiphase porous media flow. Results will be summarized in a report which we will work together to develop into a publication. Students will be encouraged to present their results at scientific conferences to support their professional development.

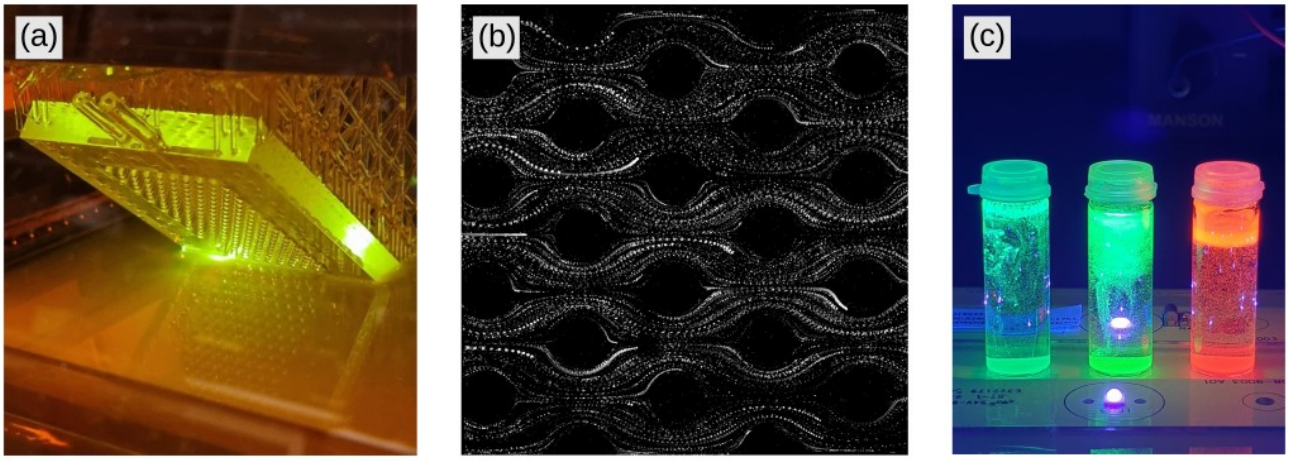

Figure: (a) Model porous medium during printing; (b) time lapse image of fluorescent particles in motion in a single phase flow through the model; (c) vials of particles illuminated by an LED

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Practical Information:

Supervisors:	Kevin Pierce, Gaute Linga, and Marcel Moura
Preferred student backgrounds:	Physics, Geoscience, or Engineering, with interest in fluid dynamics or hydrology. Programming experience with Matlab or Python and experience with image analysis would be an advantage. Diverse backgrounds welcomed
Number of available projects:	Two projects, with flexibility to adapt either to bachelor or master level students
Preferred project period:	Six week duration beginning at any time between April 1st and September 15th, 2023
Expected deliverables:	A report summarizing key results on spatio-temporal velocity characteristics during multiphase flow in model porous media