IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Visualizing Multiphase Flow Processes Using Porous Media Microfluidic Devices

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Departments of Chemical and Biomolecular Engineering (CHBE) and Material Science and Nanoengineering (MSNE)

Rice University

Faculty host: Jaime Juarez

Seminar on September 10, 2019 at 11:00 am in 2004 Black

Abstract

The use of foam in enhanced oil recovery (EOR) applications is being considered for gas mobility control to ensure pore-trapped oil can be effectively displaced. In fractured reservoirs, gas tends to channel only through the highly permeability regions, bypassing the less permeable porous matrix, where most of the residual oil remains. Because of the unique transport problems presented by the large permeability contrast between fractures and adjacent porous media, we aim to understand the mechanism by which foam transitions from the fracture to the matrix and how initially trapped oil can be displaced and ultimately recovered. My lab has generated micromodels, which are combined with high-speed imaging to visualize foam transport in models with permeability contrasts, fractures, and multiple phases. The wettability of these surfaces can be altered to mimic the heterogeneous wettability found in reservoir systems. We have shown how foam quality can be modulated by adjusting the ratio of gas flow ratio to aqueous flow rate in a flow focusing system and this foam quality influences sweep efficiency in heterogeneous porous media systems. I will discuss how this understanding has allowed us to design better foam EOR processes.

Asphaltene deposition is a common cause of significant flow assurance problems in wellbores and production equipment as well as near-wellbore regions in oil reservoirs. I will describe how we utilize microfluidic devices with imaging to visualize asphaltene deposition and transport in porous media. I will discuss how this understanding has allowed us to design better strategies to address asphaltenes deposition in porous media.

Dr. Sibani Lisa Biswal is Professor and Associate Chair in the Department of Chemical and Biomolecular Engineering at Rice University in Houston, TX and leads the Soft Matter Engineering Laboratory. She has a B.S in chemical engineering from Caltech (1999) and a Ph.D. in chemical engineering from Stanford University (2004). She is the recipient of an ONR Young Investigator Award (2008), a National Science Foundation CAREER award (2009), Rice U. Graduate Student Association Faculty Teaching and Mentoring Award (2012), the George R. Brown Award for Superior Teaching (2015), the Rice University Chemical Engineering Alumni Professional Progress Award (2017), and the Southwest Texas Section AICHE Best Applied Paper Award (2018)

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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