Special Program in Applied Mathematics and Applied Mechanics

Experimental Pore-scale Study on the Dynamic Response of Blobs in Porous Media to Pressure Gradients

2013 - 11 - 27 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

The dynamic response of blobs, which are trapped in porous media due to capillary forces, to applied pressure gradients is of interest to petroleum reservoir detection, enhanced oil recovery, and groundwater remediation. By performing planar laser- induced fluorescence experiments, we visualized the dynamics of blobs subject to steady and oscillatory pressure gradients in porous media. By analyzing blob images, we measured the 2D/3D contact angles and mean curvatures of the liquid-liquid interfaces and furthermore quantified the effects of contact angle hysteresis on blob mobilization. Once a blob was mobilized, the subsequent movement and interface behavior, such as contact line pinning, contact line slipping, and snap off, depended very much on the magnitude of the applied pressure gradient. We also revealed the flow patterns inside moving blobs by performing particle image velocimetry experiments. For an oscillatory pressure gradient, we showed that a trapped blob can exhibit resonance which can be exploited to enhance blob mobilization by seismic waves.