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Pore-scale Analysis of the effects of Contact Angle Hysteresis on Blob Mobilization in a Pore Doublet SHAO-YIU HSU, ROLAND GLANTZ, MARKUS HILPERT, Johns Hopkins University — The mobilization of residual oil blobs in porous media is of major interest to the petroleum industry. We studied the Jamin effect, which hampers the blob mobilization, experimentally in a pore doublet model and explain the Jamin effect through contact angle hysteresis. A liquid blob was trapped in one of the tubes of the pore doublet model and then subjected to different pressure gradients. We measured the contact angles (in 2D and 3D) as well as the mean curvatures of the blob. Due to gravity effects and hysteresis, the contact angles of the blob were initially (zero pressure gradient) non-uniform and exhibited a pronounced altitude dependence. As the pressure gradient was increased, the contact angles became more uniform and the altitude dependence of the contact angle decreased. At the same time, the mean curvature of the drainage interface increased, and the mean curvature of the imbibition interface decreased. The pressure drops across the pore model, which we inferred with our theory from the measured contact angles and mean curvatures, were in line with the directly measured pressure data. We not only show that a trapped blob can sustain a finite pressure gradient but also develop methods to measure the contact angles and mean curvatures in 3D.

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