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Film Relaxation and Pressure-Saturation Hysteresis in a Wedge-shaped Microfluidic Channel[1] YIHONG LIU, Purdue University, LAURA PYRAK-NOLTE, DAVID NOLTE — Wetting-phase films play important roles in the fluid distribution and pressure-saturation behavior of porous media, but are often difficult to quantify because of their complex geometry. We used fluorescent confocal microscopy to image three-dimensional water-films in 40 μm deep wedge-shaped microfluidic channel. The microfluidic channels were fabricated from photoresist on a cover glass using two methods to achieve different wall roughness: a) two-photon laser machining, and b) UV-illumination. From the confocal images, we experimentally acquired the movement and transformation of the films and the time-dependent volume, thickness, and length of the films at controlled pressures. We also observe hysteresis in the capillary pressure vs. saturation behavior in this simple geometry when performing imbibition and drainage scanning. The wetting film, as an extension of the wetting phase, strongly increases the interaction area of the wetting phase (water) with the non-wetting phase (air) and the solid phase (channel), which contributes irreversible effects to hysteresis mechanisms.

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