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**Water imbibition by mica pores: what happens when capillary flow is suppressed?** CHAO FANG, RUI QIAO, Department of Mechanical Engineering, Virginia Tech — The imbibition of liquids into porous media plays a critical role in numerous applications. Most prior studies focused on imbibition driven by capillary flows. In this work, we study the imbibition of water into slit-shaped mica pores filled with pressurized methane using molecular simulations. Despite that capillary flow is suppressed by the high gas pressure, water is imbibed into the pore as monolayer liquid films. Since the classical hydrodynamic flow is not readily applicable for the monolayer water film propagating on the mica wall and the imbibition is driven by the strong affinity of water molecules to the mica walls, the observed imbibition is best taken as surface hydration. We show that the dynamics of water's imbibition front follows a simple diffusive scaling law. The effective diffusion coefficient of the imbibition front, however, is more than ten times larger than the diffusion coefficient of the water molecules in the water film adsorbed on the mica walls. Using a molecular theory originally developed for the spreading of monolayer films on solid substrates, we clarify the mechanism underlying the rapid water imbibition observed here.

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