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Diffusion Into Dead-End Pores of Non-Uniform Cross-Section[1]
FRANCESCA BERNARDI, Worcester Polytechnic Institute, JESSICA P. REMEIS, EMMA ABELE, GARAM LEE, ABIGAIL W. TAYLOR, DANIEL M. HARRIS, Brown University — Understanding micron-scale fluid flows is critical to perfecting the manufacturing and use of microfluidic technologies for medical and engineering applications. In particular, microchannels with dead-end pores are ubiquitous in natural and industrial settings, and ongoing research focuses on fluid and chemical transport in and out of these pores. In the present work, we detail a repeatable and accessible experimental protocol developed to study the passive diffusion process of a dissolved solute into dead-end pores of rectangular and trapezoidal geometries. Custom microchannels with pores of specified geometries are rapidly produced using inexpensive materials and a commercial craft cutter. The experimental data is compared directly to both detailed 3D numerical simulations as well as to analytical solutions of an effective 1D diffusion equation: the Fick-Jacobs equation. The role of the pore geometry on the passive diffusion process will be highlighted. Ongoing and future directions will be discussed.

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