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Synergetic Fluid Mixing from Viscous Fingering and Alternating Injection BIRENDRA JHA, LUIS CUETO-FELGUEROSO, RUBEN JUANES, Massachusetts Institute of Technology — We study mixing of two fluids of different viscosity in a microfluidic channel or porous medium. We show that the synergetic action of alternating injection and viscous fingering leads to a dramatic increase in mixing efficiency at high Peclet numbers. Based on observations from high-resolution simulations, we develop a theoretical model of mixing efficiency that combines a hyperbolic mixing model of the channelized region ahead, and a mixing-dissipation model of the pseudo-steady region behind. Our macroscopic model quantitatively reproduces the evolution of the average degree of mixing along the flow direction, and can be used as a design tool to optimize mixing from viscous fingering in a microfluidic channel.

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