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Effect of viscosity contrast on mixing and dispersion in a capillary tube AMIR A. PAHLAVAN, Mechanical Engineering, MIT, BIRENDRA JHA, LUIS CUETO-FELGUEROSO, RUBEN JUANES, Civil and Environmental Engineering, MIT, GARETH H. MCKINLEY, Mechanical Engineering, MIT — Microfluidic mixing has received a renewed attention during the past decade due to its ubiquitous presence in nature and novel industrial devices. Most microfluidic devices however operate in the Stokes flow regime, meaning that turbulence and inertia do not play any role in the mixing process. While many fundamental aspects of microfluidic mixing are now understood, and a variety of methods have been proposed to enhance mixing at low Reynolds number flows, the influence of viscosity contrast on the non-equilibrium physics of mixing remains to be explored. In this work we address this problem through numerical simulations and reduced-order modeling. We investigate the role of viscosity contrast on hydrodynamic instabilities that control the dispersion and mixing of miscible fluid flows in a capillary tube, and exploit this new understanding to propose strategies for enhancing mixing at the microscale.

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