Abstract Submitted
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Numerical study of mixing viscous fluids in T-shaped micro-channels with compressibility effects[1] JUNFENG YANG, OMAR MATAR, Imperial College London, CHRISTOPHER HARRISON, MATTHEW SULLIVAN, Schlumberger-Doll Research, Cambridge, MA — We study numerically the mixing processes of two miscible fluids in T-shaped micro-channels in the presence of compressibility effects. Three mixing modes are considered: passive mixing, which relies on the molecular diffusion and chaotic advection; active mixing relies on external disturbances, e.g. due to periodic compression; and a combination of these modes. In all cases considered, one of the fluids, fluid A, is initially present in the dead-end region of the micro-channel. In the 'passive mixing case, the other fluid, fluid B, flows through the open part of the channel at a constant flow rate. In the active case, this fluid is initially at rest but is then set in motion through pressure cycling. The combined case, involves the flow of fluid B in the presence of compression-decompression cycles. Numerical simulations are carried out for three different fluids, accounting for their compressibility, and their pressure-dependent e.g. density, viscosity, and diffusivity; a simple mixing rule is used to model the properties of the mixed fluids. Our results indicate that the vortices in the dead-end zone, engendered by the relative motion of the fluids leads to their mixing; the combination of mixing modes is shown to promote mixing efficiency significantly.

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