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Slip induced mixing in a model slug flow S GOWTHAM SANKARANANTH, S PUSHPAVANAM, Indian Inst of Tech-Madras — Mixing of reactants in microfluidic slugs has a significant influence on the performance of processes. We discuss how mixing can be enhanced in slug flows by introducing periodic hydrophobicity on the confining walls. We consider a rectangular slug moving in a straight microchannel constructed by a shift-reflect transform of a unit cell with finite slip on one wall. This leads to alternating regions of slip and no-slip on each wall. The velocity field within the 2D slug is approximated as that in a driven cavity and computed by a Chebyshev spectral collocation. We go beyond a blinking flow model by capturing the velocity field under the discontinuous boundary conditions of inter-cell transit using domain decomposition. Thus,advection is described by a sequence of maps. It is seen that the hydrophobic sections reduce the size of the closer vortex and locally attract the separatrix. This permits "crossing" of streamlines in adjacent unit cells ,opening up the possibility of chaotic mixing. "Good crossing", as quantified by an Eulerian indicator called "transversality", seems to occur in a larger area when slug length is comparable to unit cell length. We quantify mixing and the internal structures that result using different Lagrangian techniques to reach a holistic consensus.

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