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Viscous wave breaking in microchannels¹ XIAOYI HU, THOMAS CUBAUD, Stony Brook University — Destabilization processes of viscous-stratified flows are experimentally investigated for two-layer configurations with both miscible and immiscible fluid pairs using straight square microchannels. We systematically characterize the appearance and dynamics of waves propagating at the interface of highly viscous fluid layers and delineate flow regimes based on flow parameters and fluid properties. We examine in particular the mechanism of wave breaking, which is characterized with the development of viscous filamentous structures entrained from wave crests, in the presence and absence of interfacial tension between fluids. The wave breaking phenomenon offers new means for mixing miscible fluids or emulsifying immiscible fluids having large viscosity contrasts in confined microsystems.

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