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Multiphase Microfluidics Near the Speed of Sound AXEL GUENTHER, MIT, KLAVS F. JENSEN, MIT, Chemical Engineering, MICROCHEMICAL SYSTEMS TECHNOLOGY CENTER TEAM — Concepts borrowed from classical low Reynolds number fluid mechanics have been translated into a variety of multiphase microfluidic applications: segmented flows, e.g. allow to the rapid mixing of species, to carry out highly exothermic gas-liquid reactions, or to grow narrowly distributed nanoparticles. In all cases, interfacial forces dominate by several orders of magnitude over gravity, viscous and inertia forces. We focus on conditions where this is *not* the case. The velocities are sufficiently high so that viscous and inertia forces are on the same order or larger than interfacial ones. At gas superficial velocities on the order of one hundred meters per second, we observed Kelvin-Helmholtz type instabilities as a result of this interplay. The obtained flow patterns are characterized by large velocities/interfacial areas, small film thicknesses and can potentially be combined with very rapid/non-equilibrium transport processes.

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