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Segregation Dynamics of Suspensions in Micro-Vortices DIANA HOU, HSUEH-CHIA CHANG, University of Notre Dame - Center for Microfluidics and Medical Diagnostics — Cylindrical vortices generated by AC electro-osmotic (AC-EO) flows on microelectrodes have been seen to attract and concentrate micro-particles. The particles are attracted to the vortex by dielectrophoretic (DEP) forces of the underlying micro-electrodes. However, shear-induced particle migration mechanisms can counter the DEP transport resulting in a filled vortex or an annulus. A dimensionless parameter χ relates the two opposing forces and defines the extent of particle invasion. The cylindrical vortices suffer a symmetry-breaking instability, break up into band structures along the axis and coalesce into more concentrated slugs. The instabilities are analyzed theoretically and attributed to longitudinal shear-induced migration due to dependence of the vortex shear rate on the local particle concentration. The concentrated funnel-shaped slugs exhibit fore-aft asymmetry along their axis and propagate in a specific direction at a constant speed. They are shown to be a solitary traveling wave solution of the Kuramoto-Sivashinsky equation.

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