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Measuring Convective and Diffusive Mixing in Inertial Droplet-Pair Collisions BRIAN CARROLL, CARLOS HIDROVO, The University of Texas at Austin — Complete mixing, dilution, and sample homogenization are essential processes in modern Lab on a Chip and Micro Total Analysis Systems and these seemingly simple tasks remain a major obstacle. A new mixing technique has been proposed that accelerates mixing rates in droplets through controlled, high speed droplet-pair collisions. The collisions take place inside a confined microchannel and the droplet generation and entrainment processes are provided by an inertial gaseous flow. The fast time scales, small length scales, and highly Lagrangian nature of discrete droplet collisions makes optical diagnostics the obvious choice for understanding, characterizing, and quantifying mixing processes. Presented here is a simple and robust visualization and measurement technique that captures convective and diffusive mixing inside droplets using differential fluorescence. High speed digital imagery, custom image processing, and fluorescent intensity statistical analysis are employed to examine the contribution of convective rearrangement and tracer diffusion to droplet mixing following inertial droplet-pair collisions.

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