Abstract Submitted
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Micromixers for studies of protein folding kinetics[1] SHUHUAI YAO, OLGICA BAKAJIN, Lawrence Livermore National Laboratory — We are developing microfluidic mixers with mixing dead time of microseconds and sample consumption of femtomoles for use in studies of protein folding kinetics. Our mixer uses hydrodynamic focusing of pressure-driven flow to form a sub-micron wide stream, which reduces diffusion length and results in fast mixing. We discuss the design, optimization, and characterization of these mixers. In the original mixer (Hertzog et al., Anal. Chem. 2004) with cross-shaped microchannels, the mixing time and the mixing uniformity are limited. The limitation to the mixing time arises due to formation of Dean vortices at high flow rates, while the photolithographically defined nozzles limit mixing uniformity. We addressed these two problems in two individual designs with reduced side channel curvatures and shape-optimized nozzles, respectively. The final design that we will present combines both of these features and achieves optimized performance. We quantified the mixing performance of these four designs by numerical simulation of coupled Navier-Stokes and convection-diffusion equations, and experiments using both dye quenching and FRET-labeled DNA.

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Shuhuai Yao
Lawrence Livermore National Laboratory

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