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Scalar mixing and flow field measurements in curved-duct micro mixers DIMITRIOS KYRITSIS, S. PRATAP VANKA, KENNETH CHRISTENSEN, KEVIN JOYCE, University of Illinois at Urbana-Champaign — Measurements of scalar mixing and velocity were performed in a spiral-shaped duct in order to determine the potential of secondary (Dean) flows to enhance mixing and therefore yield an effective micromixer design. Two inlet flow streams were mixed in a curved channel mixer of a 560 x 790 um cross section. One inlet flow was marked with Rhodamine 6G fluorescent dye. The three dimensional flow was imaged using confocal microscopy. Acquisition of frames parallel to the mixer plane at multiple depths in the channel allowed the reconstruction of the three-dimensional flow pattern for a series of stations downstream in the mixer. The effects of secondary flows induced by channel curvature were studied as a function of Re number for Re values between 1 and 12. In general, the secondary flows reduced the mixing time. Higher Reynolds number flows (Re=12) demonstrated more vigorous secondary flows and proportionally shorter mixing times than lower Reynolds number flows (Re=1). These results were complemented by micro - Particle Imaging Velocimetry measurements in order to measure the in-plane velocity field. On the basis of our scalar mixing and velocity data, we define and discuss several measures of mixedness which were used in order to characterize the process.

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