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Experimental Investigation of Spatially-periodic Scalar Patterns in an Inline Mixer[1] OZGE BASKAN, MICHEL SPEETJENS, HERMAN CLERCX, Eindhoven University of Technology — Spatially persisting patterns with exponentially decaying intensities form during the downstream evolution of passive scalars in three-dimensional (3D) spatially periodic flows due to the coupled effect of the chaotic nature of the flow and the diffusivity of the material. This has been investigated in many computational and theoretical studies on 2D time-periodic and 3D spatially-periodic flow fields, however, experimental studies, to date, have mainly focused on flow visualization with streaks of dye rather than fully 3D scalar field measurements. Our study employs the-state-of-the-art experimental methods to analyze the evolution of 3D scalar fields and the correlation between the coherent flow/scalar field structures in a representative inline mixer, called Quatro static mixer. The experimental setup consists of an optically accessible test section with transparent internal elements, accommodating a pressure-driven pipe flow. The 3D scalar fields are measured by 3D Laser-Induced Fluorescence. The preliminary results are consistent with the literature and we discuss the comparative analysis between our experimental observations and the numerical simulations from the previous studies.

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