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Experimental Investigation of Spatially-Periodic Scalar Patterns in an Inline Mixer OZGE BASKAN, MICHEL F. M. SPEETJENS, HERMAN J. H. 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 3D spatially-periodic flow fields. However, in the limit of zero-diffusivity, the evolution of the scalar fields results in more detailed structures that can only be captured by experiments due to limitations in the computational tools. Our study employs the-state-of-the-art experimental methods to analyze the evolution of 3D advective scalar field 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 and equipped with 3D Laser-Induced Fluorescence. The results reveal that the continuous process of stretching and folding of material creates finer structures as the flow progresses, which is an indicator of chaotic advection and the experiments outperform the simulations by revealing far greater level of detail.

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