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Design optimization of passive micromixers with fractal surface patterning PETRU FODOR, MATTHEW ITOMLENSKIS, MIRON KAUFMAN, Cleveland State University — Relief patterning of the surface of microchannels has been actively pursued as a method of promoting mixing in systems with a low Reynold's number (<<100). For example, structures such as the staggered herring bone (SHB), which consists of periodic groves and ridges distributed along the channel length, improve mixing by inducing counter – rotating helical flows in pressure driven systems. In this work, we explore computationally using the COMSOL Multiphysics Package and its Chemical Engineering Module, the possibility of enhancing the mixing quality of two fluids within a microchannel by employing a Weierstrass fractal function with different fractal dimensions to produce a non-periodic pattern of groves and ridges on the channel bottom. The designs are optimized with respect to two geometrical parameters: i.e the distances between the ridges and the position range of their tip along the width of the channels. The quality of the mixing between two fluids is analyzed numerically using an entropic measure for the binary fluid system, and is compared with the performance of SHB designs with similar geometrical parameters. The results show that the mixing efficiency associated with Weierstrass function based designs is consistently better than for the SHB counterparts.

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