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Time evolution of distributive entropy in rectangular microchannel mixers MIRON KAUFMAN, PETRU FODOR, Cleveland State University — Patterning ridges on the surface of microchannels has been found to be a viable strategy to induce mixing in straight channels, despite the characteristically small Reynolds numbers. In this work we evaluate the time evolution of the Rényi entropy associated with the spatial distribution of tracers advected by an incompressible fluid moving in several straight rectangular channels: staggered herring bone [1], fractal surface patterning [2]. The steady state flow fields are obtained by solving the Navier – Stokes and continuity equations using a finite element analysis package. The Rényi entropy is then evaluated at different times using the spatial distribution of the tracers. The entropy increases with time as lnt with a slope approximately equal to unity. The slope quantifies the rate of distributive mixing. The rate of increase in the entropy is found to be independent of the Renyi beta parameter. This is qualitatively different than the distributive mixing in channels with moving walls [3] where the rate of distributive mixing changes with the beta parameter. We also study the dependence of the distributive entropy on the Reynolds number. [1] A.D. Stroock et al., Science 295, 647 (2002); [2] M. Camesasca, M. Kaufman, I. Manas-Zloczower, J. Micromech. Microeng. 16, 2298 (2006); [3] W. Wang, I. Manas-Zloczower, M. Kaufman, Chemical Engineering Communications, 192(4), 405-423 (2005).

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