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Spinodal turbulence enhances heat transfer in micro devices STEFANO FARISÉ, PIETRO POESIO, GIAN PAOLO BERETTA, Università degli Studi di Brescia — We experimentally prove the possibility of using spinodal mixtures to increase heat transfer in micro devices as a consequence of an evenly distributed micro agitation, which increases the effective diffusivity. Despite the Re-number is as low as 5, turbulence-like mixing can be achieved by mass transfer effects. A mixture of acetone-hexadecane is quenched in a micro heat exchanger to induce spinodal decomposition. The heat transfer rate is enhanced by self-induced convective motion (spinodal turbulence) because the drops of one phase move against each others under the influence of non-equilibrium capillary forces, Korteweg stresses,which are sustained by the free energy liberated during phase separation. The heat transfer is increased up to the 200% and the effect become larger as the bulk Re decreses, while no dramatic increase in the pressure drop is observed. We built two different experimental set-ups: in the first we measure the heat transfer with a feedback method and in the second we measure the pressure drop and we visualize the induced convection. High-speed camera visualization,pressure drop and temperature measurements allow a complete characterization of the phenomenon, with a special attention to the quantification of the heat transfer coefficent enhancement.

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