Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Identification and decomposition of advective transfer on micro-textured surfaces YANXING WANG, New Mexico State University, TIE WEI, New Mexico Institute of Mining and Technology, WANG'S CFD LAB COLLABORATION, WEI'S CFD LAB COLLABORATION — Through well-designed physical models and high-fidelity numerical simulations, the physics of advective heat and mass transfer on a solid surface embedded with structured micro pillars is revealed. Two types of advection mechanism are identified, local advection and long-range advection, corresponding to the eddy recirculation in the gaps between streamwise neighboring pillars and the fluid circulation between the regimes above and below pillar tips. The flow topologies suggest that the flow of local advection recirculates primarily in xz plane, and the flow of long-range advection recirculates in yz plane. This fact allows for the decomposition of the two mechanisms by averaging the flow quantities in the streamwise and spanwise coordinates. The enhancement of heat and mass transfer by local and long-range advection is examined for typical geometries, and the transition of the primary transfer method between the two mechanisms due to geometrical change is analyzed in detail. The dependence of local and long-range advection on streamwise and spanwise distances between micro pillars is identified, and this offers promising potential for the accurate control of heat and mass flux in micro fluidics.

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Date submitted: 28 Jul 2019 Electronic form version 1.4