Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Gradient Submillimeter Groove Induced Directional Rebounding of an Impinging Droplet[1] ZHICHENG YUAN, MITSUHIRO MATSUMOTO, RYOICHI KUROSE, Kyoto University, KUROSE LAB TEAM — Manipulating the liquid droplet lateral motion without any external energy input is a challenge but an essential technology for industrial applications ranging from water harvesting to electronic circuit fabrication. Although the droplet migration following the wettability gradient has been reported, the durability of the artificial chemical heterogeneity is still the biggest obstacle towards real life applications. Here we design a new wettability gradient surface that can drive droplet lateral motion, which is achieved by gradually altering the groove width of the structural topography. The droplet impinging behavior on the surface is investigated via a 3-D Direct Numerical Simulation (DNS) employing the Coupled Level-Set and Volume of Fluid (CLSVOF) surface tracking scheme, the Continuum Surface Force (CSF) method, and a mesh dependent Dynamic Contact Angle (DCA) model. The results show that the droplet lateral motion in the groove vertical direction can be following or against the topographic wettability gradient, which is determined by the coexistence of Cassie and Wenzel states and the unbalanced Young's force. The outcomes are helpful in designing robustness and durability surfaces with topographical wettability gradients for droplet transportation.

[1]This research was partially supported by MEXT (Ministry of Education, Culture, Sports, Science, and Technology) as Priority issue on Post-K computer (Accelerated Development of Innovative Clean Energy Systems).

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Date submitted: 28 Jul 2020 Electronic form version 1.4