

MS06-057

Size Effects of Materials Surface Roughness for Wetting and Transportation: From Nature to Experiments and Models

Quanshui Zheng¹, Cunjing Lv¹

1. Department of Engineering Mechanics, CNMM, and LAM, Tsinghua University, Beijing 100084, China

E-mail: zhengqs@tsinghua.edu.cn

How to make small liquid droplets move spontaneously and directionally on solid surfaces is a challenge in lab-on-chip technologies, drug screening, and DNA analysis. The best-known mechanism, a wettability gradient, does not move droplets rapidly enough for most purposes and cannot move droplets smaller than a critical size defined by the contact angle hysteresis. Here we report on a mechanism using curvature gradients, which we show is particularly effective at accelerating small droplets, and works for both hydrophilic and hydrophobic surfaces. Using this mechanism, we observed speeds of two and four orders of magnitude higher than obtained by wettability gradient in sub-millimeter and nano scales, respectively. We also show that scaling surface roughness down to a specific submicron scale defined by the interface energies and three-phase contact line tension is a dominant factor for achieving a stable superhydrophobicity. A review on related references is presented.

Keywords: Soft Materials; Superhydrophobicity; Spontaneous Motion; Size effects;

Preferred Presentation Type: lecture