Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Effects of particle self-assembly and structural disjoining pressure on wetting kinetics of nanofluid droplet[1] GUI LU, Dept. of Thermal Engineering, Tsinghua Universtiy, HAN HU, Dept. of Mechanical Engineering and Mechanics, Drexel University, YUANYUAN DUAN, Dept. of Thermal Engineering, Tsinghua Universtiy, YING SUN, Dept. of Mechanical Engineering and Mechanics, Drexel University — The wettability of nanofluids, fluids containing suspensions of nanometer-sized particles, is of particular interest to microfluidic systems. Previous studies showed that the self-assembly of nanoparticles in the vicinity of the contact line gives rise to a structural disjoining pressure, which greatly affects the wettability of nanofluid droplets of micron size or larger. In this study, dynamic wetting of water nano-droplets containing non-surfactant gold nanoparticles on a gold substrate was studied via molecular dynamics simulations to examine the effects nanoparticle self-assembly. To mimic the effect of structural disjoining pressure, the excess disjoining pressure was calculated for a pure water film on a gold substrate with a smooth surface on one end and ordered nano-pillar structures on the other. The results show that the addition of non-surfactant nanoparticles hinders the nano-second droplet wetting process, attributed to the increases in both surface tension of the nanofluid and friction between nanofluid and substrate. The spreading enhancement of nanofluids due to the presence of structural disjoining pressure as a result of nanoparticle ordering is not the case for this nano-droplet spreading system.

[1]NSFC (No. 21176133) and the US National Science Foundation (Grant No. CAREER-0968927 and No. DMR-1104835).

Gui Lu
Dept. of Thermal Engineering, Tsinghua Universtiy

Date submitted: 02 Aug 2013 Electronic form version 1.4