Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Dynamics of Defrosting on Hydrophobic and Superhydrophobic Surfaces KEVIN MURPHY, Virginia Tech , WILLIAM MCCLINTIC, KEVIN LESTER, PATRICK COLLIER, Center for Nanophase Materials Science, JONATHAN BOREYKO, Virginia Tech — It has recently been demonstrated that frost can grow in a suspended Cassie state on nanostructured superhydrophobic surfaces, which has implications for enhanced defrosting rates. However, to date there have been no direct comparisons of the defrosting kinetics of Cassie frost versus frost on conventional surfaces. Here, we fabricate a hybrid aluminum plate where half of the top face exhibits a superhydrophobic nanostructure while the other half is smooth and hydrophobic. By growing frost to varying thicknesses and melting at several tilt angles, we reveal the advantages and disadvantages of each surface with regards to the extent and speed of the shedding of melt water. For sufficiently thick frost layers, the Cassie state of frost on the superhydrophobic surface uniquely enabled the rapid and effective shedding of melt water even at low tilt angles. On the other hand, the hydrophobic surface was more effective at removing very thin frost sheets, as the reduced contact angle of water on the surface facilitated the coalescence of droplets to grow the melt water beyond the capillary length for gravitational removal. Therefore, the utilization of superhydrophobic versus hydrophobic surfaces for defrosting applications depends upon the context of the system conditions.

Kevin Murphy
Virginia Tech

Date submitted: 25 Jul 2016 Electronic form version 1.4