Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

An Experimental Investigation on the Impingement of Water Droplets onto Superhydrophobic Surfaces Pertinent to Aircraft Icing Phenomena[1] HAIXING LI, RYE WALDMAN, HUI HU, Iowa State University
— Superhydrophobic surfaces have self-cleaning properties that make them promising candidates as anti-icing solutions for various engineering applications, including aircraft anti-/de-icing. However, under sufficient external pressure, the liquid water on the surface can transition to a wetted state, defeating the self-cleaning properties of superhydrpphobic surfaces. In the present study, an experimental investigation was conducted to quantify the transient behavior of water droplets impinging onto test surfaces with different hydrophobicity properties under different environmental icing conditions. The experiments were performed in the Icing Research Tunnel of Iowa State University (IRT-ISU) with a NACA0012 airfoil. In addition to using a high-speed imaging system to reveal transient behavior of water droplets impinging onto test surfaces with different hydrophobicity properties, an IR thermometry was also used to quantify the unsteady heat transfer and dynamic phase changing process within the water droplets after impingement onto the test plates with different frozen cold temperatures. The high-speed imaging results were correlated with the quantitatively temperature measurements to elucidate underlying physics in order to gain further insight into the underlying physics pertinent to aircraft icing phenomena.

[1]The research work is partially supported by NASA with grant number NNX12AC21A and National Science Foundation under award numbers of CBET-1064196 and CBET- 1435590

Hui Hu
Iowa State University

Date submitted: 26 Jul 2015 Electronic form version 1.4