Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Experimental Investigation of Gravity- and Wind-Forced Drop Stability[1] JASON SCHMUCKER, EDWARD WHITE, Texas A&M University — The stability of drops on surfaces subject to forcing by wind and gravity is relevant to heat exchangers, fuel cells, and aircraft icing. To investigate this phenomenon, drops were placed on the rough aluminum floor of a tiltable wind tunnel and brought to critical conditions over a range of drop size, inclination angle, and flow speed. A technique capable of measuring full 3D drop profiles was used to investigate the drops' evolution toward runback. The measurement uses a comparison of the surface speckle pattern captured in an overhead drop image with a corresponding image of the dry surface to measure drop shape. Drops forced by airflow alone are found to shed at a Weber number of 8.0 ± 0.5 for this system with advancing and receding contact angles of $\theta_a = 63.5° \pm 3.7°$ and $\theta_r = 8.2° \pm 1.5°$. Drops at larger surface inclinations shed at lower Weber number. From reconstructed drop profile sequences, the evolution of contact lines, drop profiles, and contact angle distributions are detailed. Contact line adhesion forces are integrated and related to the forcing air velocity. Drops whose stability limits are dominated by gravity are found to exhibit significantly different evolution toward runback than those dominated by airflow.

[1]Supported by NSF Grant CBET-0828469.

Jason Schmucker
Texas A&M University

Date submitted: 07 Aug 2012 Electronic form version 1.4