Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Experimental Analysis and Predictive Modeling of Droplet Impingement and Spreading onto a Solid, Smooth Surface BRETT BATHEL, Department of Mechanical and Industrial Engineering, University of Iowa, MICHAEL HUISENGA, School of Engineering Sciences, KTH Royal Institute of Technology, Stockholm, Sweden, LUKAS JOHNSON, NEENA STEPHEN, ALBERT RATNER, Department of Mechanical and Industrial Engineering, University of Iowa — An experimental study of the impact and spreading process of water droplets on a smooth glass surface is presented. Impact droplet velocity, diameter, Reynolds number, and Weber number varied from 1.3 to 3.1 m/s, 2.5 to 4.2 mm, Re 3610 to 12100, and We 60 to 515, respectively. The impact surface was smoothed to $1/4$ λ to minimize solid-surface induced flow instabilities during expansion. A high speed digital camera was used to capture the droplet motion at 2200 Hz with an image plane spatial resolution of $\sim$16 μm. The size of the data set allowed for calculation of uncertainty related to characteristic spread time, τ_{max}, and maximum spread ratio, β_{max}. Applying previous literature values for β_{max} and a newly formulated model for τ_{max} as boundary functions, a new function predicting radial expansion from impact to β_{max} was defined. A statistical comparison with existing literature models for the entire expansion process was made based upon the experimental results obtained.

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Date submitted: 10 Aug 2005 Electronic form version 1.4