Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Contact angle dynamics in droplet impact on flat surfaces: Effect of surface wettability ILKER BAYER, CONSTANTINE MEGARIDIS, University of Illinois at Chicago — Contact angle dynamics is examined experimentally during spreading/recoiling of mm-sized water droplets impacting orthogonally on various flat surfaces with $We = O(0.1) - O(10)$, $Ca = O(0.001) - O(0.01)$, $Oh = O(0.001)$ and $Bo = O(0.1)$. In this impact regime, inertial, viscous, and capillary phenomena act in unison to influence contact angle dynamics. The wetting properties of the target surfaces range from wettable to non-wettable. The objective of the work is to provide insight into the dynamic behavior of the apparent (macroscopic) contact angle θ and its dependence on contact line velocity V_{CL} at various degrees of surface wetting for droplets impacting with low to moderate Weber numbers. The hydrodynamic wetting theory of Cox (1998) is implemented to relate the microscopic wetting parameters to the observed θ vs. V_{CL} data. It is concluded that Cox's model works well in the fast spreading regime, but proves inadequate for slow spreading where solid/liquid interactions are dominant. In addition, the molecular-kinetic theory of wetting by Blake and Haynes (1969) is tested with good results. This study offers guidance for numerical or analytical studies, which require special attention to the boundary conditions at the contact line, and more specifically the functional dependence of contact angle on contact line speed.

Ilker Bayer

Date submitted: 12 Aug 2005 Electronic form version 1.4