Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Viscous drops bounce faster: prompt tumbling-rebound from a sublimating slope CARLO ANTONINI, EMPA, ETH-Zurich, STEFAN JUNG, ETH- Zurich, ANDREAS WETZEL, EMMANUEL HEER, PHILIPPE SCHOCH, ALI MAZLOOMI M., SHYAM S. CHIKATAMARLA, ILYA KARLIN, ETH-Zurich, MARCO MARENGO, University of Brighton, DIMOS POULIKAKOS , ETH-Zurich, LTNT - ETH ZURICH TEAM, LAV - ETH ZURICH TEAM — We discovered a new drop rebound regime, characteristic of highly viscous liquids impacting onto tilted sublimating surfaces. By focusing on non-axisymmetric impact conditions at increasing viscosity, we demonstrate that low viscous drops show a "slide, spread, recoil and rebound" behavior, whereas viscous drops exhibit a "prompt tumbling-rebound" behavior. As such, viscous glycerol drops surprisingly rebound faster than three orders of magnitude less viscous water drops. This is made possible by a small conversion of translational to rotational kinetic energy, at non-axisymmetric impact conditions, as also confirmed by additional Lattice Boltzmann simulations: a rapid transition of the internal angular velocity prior to rebound to a constant value, as in a tumbling solid body, promotes a rapid rebound of more viscous drops, which are capable to rebound without recoiling. By studying drop impact dynamics, we explore the drop behavior in contactless and frictionless conditions, and identify the Ohnesorge number as the primary parameter to predict the transition between different impact regimes on tilted sublimating slopes, with tumbling observed for Ohnesorge numbers higher than unity.

Carlo Antonini
Swiss Federal Laboratories for Material Science and Technology

Date submitted: 15 Oct 2015 Electronic form version 1.4