Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Cavitation stuctures formed during the collision of a sphere with an ultra-viscous wetted surface MOHAMMAD MANSOOR, King Abdullah University of Science and Technology, JEREMY MARSTON, Texas Tech University, JAMAL UDDIN, University of Birmingham, SIGURDUR THORODDSEN, King Abdullah University of Science and Technology — We investigate the inception of cavitation and associated structures when a sphere collides with a solid surface covered with a layer of ultra-viscous non-Newtonian liquid with kinematic viscosities, v, of up to 20 million cSt (at nominal low shear). Using a synchronized dual-view high-speed imaging system, we confirm that there is no shear-induced cavitation even in such highly favorable conditions. We show that liquids with high visco-elastic properties can enable the sphere to rebound without any prior contact with the solid wall. A decrease in sphere impact velocity for such non-contact rebound cases results in a systematic delay in cavity inception by depressurization from the time of achieving the minimum gap distance. We find vastly different bubble entrapment characteristics on the sphere surface during entry into the liquid layer for low and high-viscosity liquids. These were found to play an important role in the formation of cavitation structures in non-contact cases. In contrast, when contact occurs, we observe a cylindrical structure attached to the wall having undulations along the cavity interface which were further investigated using high-speed particle image velocimetry (PIV) techniques.

Mohammad Mansoor
King Abdullah University of Science and Technology

Date submitted: 21 Jul 2014 Electronic form version 1.4