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Cavitation structures 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 its structures when a sphere collides with a solid surface covered with a layer of non-Newtonian liquid having kinematic viscosities of up to $\nu_0 = 20{,}000{,}000$ cSt. Liquids with high visco-elastic properties are shown to enable sphere rebound without any prior contact with the solid wall. Cavitation by depressurization (i.e. during rebound) in such non-contact cases is observed to onset after a noticeable delay from when the minimum gap distance is reached and originate from *remnant* bubbles (remains of the obliterated primary bubble entrapped initially by the lubrication pressure of air during film entry). Contact-cases produced 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. We show the existence of shear-stress-induced cavitation during sphere approach towards the base wall (i.e. the pressurization stage) in ultra-viscous films. A theoretical model based on the lubrication assumption is solved for the squeeze flow in the regime identified for shear-induced cavity events to investigate the criterion for cavity inception in further detail.

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