

Dynamics of A Water Droplet Impacting an Ultrathin Layer of Oil Suspended on A Pool of Water

Amir Dehghanghadikolaei¹, Bilal Abdul Halim¹, Ehsan Khoshbakhhtnejad¹, Hossein Sojoudi^{1,*}

¹ Department of Mechanical, Industrial, and Manufacturing Engineering, The University of Toledo, Toledo, OH 43606

* Corresponding author: hossein.sojoudi@utoledo.edu

Movie S1. Represents different impact stages of a falling water droplet on an ultrathin layer of silicone oil suspended on a pool of water. The pool of water is large and deep enough to consider it semi-infinite pool. A droplet in size of $d \approx 4.1$ mm was released from $Z = 750$ mm on an ultrathin layer of silicone oil ($\nu = 1$ cSt) suspended on a deep pool of water.

Movie S2. Represents different impact characteristics for different experimental conditions. (A) impact occurs on a deep pool of water without any suspended oil layer ($H = 0$). (B) impact occurs on an ultrathin layer of silicone oil ($\nu = 50$ cSt, $H \approx 0$) suspended on a deep pool of water. (C) impact occurs on a thin layer of silicone oil ($\nu = 50$ cSt, $H = 3$ mm) suspended on a deep pool of water. (D) impact occurs on a thick layer of silicone oil ($\nu = 50$ cSt, $H = 5$ mm) suspended on a deep pool of water. (E) impact occurs on a thicker layer of silicone oil ($\nu = 50$ cSt, $H = 8$ mm) suspended on a deep pool of water. The difference between the impact characteristics is evident as the thickness of the oil layer decreases and reaches to an ultrathin layer.

Movie S3. Represents a similar impact from a 45° view angle. The impact conditions are identical as well.

Movie S4. Represents the two different types of jet formations, singular jets, and compound jets and how the jet type affects the pinch-off modes and consequently the number of formed secondary droplets. The singular jet is resulted from an impact with relatively lower impact We_e numbers, but it has a higher number of secondary droplets formed. Evidently, the thicker jet needs more upward velocity/energy to onset necking and pinch-off as it contains a larger volume of liquid, compared to that of the singular jet.