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Abstract
In past literature on the collision of liquid drops on a heated plate, the plate has been assumed infinite and the effects of the edge on the collision outcome have been ignored. In this experimental study, we concerned ourselves with the collision behaviors of liquid drops near the edge of a heated plate. A stainless plate was heated above the Leidenfrost temperature and 95% ethanol drops were directed to hit the edge region of the plate. The collision process was recorded by a high speed camera.
The results have shown that two dimensionless parameters control the collision outcome. One is the Weber number We, which represents the power of the impact. And the other is the impact parameter X, which defines how close to the edge the impact happens. For a fixed Weber number, the impact resembles one on an infinite plate if the impact parameter is greater than a threshold value. For a Weber number smaller than 30, this threshold value increases with the Weber number. For an impact parameter smaller than this threshold value, the impact outcome differs from one on the infinite plate because of the influence of the edge. We have found five collision outcomes near the edge region different from the two outcomes far from the edge. Simple mathematical models based on geometrical relations and energy balance were constructed to derive two of the regime boundaries. The derived boundaries were found to fit the experimental data adequately.
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