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Abstract
A water drop impacting on a deep immiscible liquid pool was experimentally conducted in this study. Three liquids were served as target liquids, namely, diesel oil, salad oil and light lubricating oil. The surface tensions of these oils are almost the same, but the viscosities are very different. By using high speed video-camera, the deformation of the incoming water drop, the evolution of the cavity, and the disintegration of the water drop under the pool surface were investigated.
Based on the experimental results, we found that the evolution of the cavity depended on the impacting Weber number and the viscosity. For a target liquid with lower viscosity, namely, diesel oil and light lubricating oil, a necking on the cavity was observed while the impacting Weber number of the water drop was low. In contract, the necking disappeared for higher impacting Weber number. On the other hand, for a target liquid with higher viscosity, namely, salad oil, the necking was not observed. For all three target liquids, a compound jet composed of the incoming liquid and target liquid ejected from the pool surface and broke into compound drops when the impact energy of the incoming drop was high enough.
Under the pool surface, we counted the numbers of the tiny drop which came from the disintegration of the impacting water drop. For the diesel oil served as target liquid, the numbers of the tiny drop increased as the impacting Weber increased until a specific regime where the numbers of the tiny drop was maximal reached. Also, the size of the tiny drop was minimal in this specific regime. For the salad oil and light lubricating oil served as target liquid, the numbers of the tiny drop increased as the impacting Weber increased under the experimental condition in this study. In addition, the disintegration of the incoming water drop under the pool surface was more obvious when the water impacted on the salad oil than on the diesel oil or on the light lubricating oil.
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