

Dynamic Process of Single Water Droplet Impacting on a Hot Heptane Surface

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Abstract : Understanding the interaction mechanism between the water droplet and pool fire has an important significance in engineering application of water sprinkle/spray/mist fire suppression. The micro impact process is unclear when the droplet impacts on the burning liquid surface at present. To deepen the understanding of the mechanisms of pool fire suppression with water spray/mist, dynamic processes of single water droplet impinging onto a hot heptane surface are visualized with the aid of a high-speed digital camera at 2000 fps. Each test is repeated 20 times. The water droplet diameter is around 1.98 mm, and the impact Weber number ranges from 30 to 695. The heptane is heated by a hot plate to mimic the burning condition, and the temperature varies from 30 to 90°C. The results show that three typical phenomena, including penetration, crater-jet and surface bubble, are observed, and the pool temperature has a significant influence on the critical condition for the appearance of each phenomenon. A global picture of different phenomena is built according to impact Weber number and pool temperature. In addition, the pool temperature and Weber number have important influences on the characteristic parameters including maximum crater depth, crown height and liquid column height. For a fixed Weber number, the liquid column height increases with pool temperature.

Keywords : droplet impact, fire suppression, hot surface, water spray

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