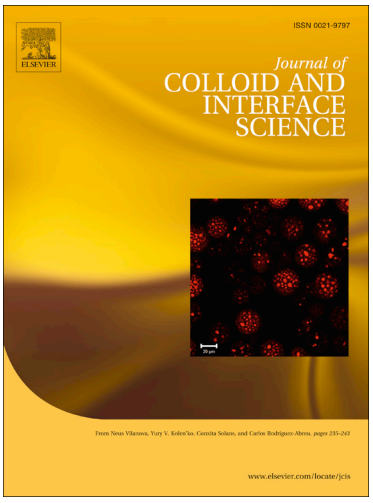

Regular Article

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Impact of viscous droplets on different wettable surfaces: impact phenomena, the maximum spreading factor, spreading time and post-impact oscillation

Shiji Lin[a], Binyu Zhao[a], Song Zou[a], Jianwei Guo[a], Zheng Wei[b], Longquan Chen[a]*

[a]*State Key Laboratory of Traction Power, Applied Mechanics and Structure Safety Southwest Jiaotong University, Chengdu 610031, China*

[b]*College of Mechanical and Electrical Engineering, Beijing University of Chemical Technology, Beijing 100029, China*

Abstract

In this paper, we experimentally investigated the impact dynamics of different viscous droplets on solid surfaces with diverse wettabilities. We show that the outcome of an impinging droplet is dependent on the physical property of the droplet and the wettability of the surface. Whereas only deposition was observed on lyophilic surfaces, more impact phenomena were identified on lyophobic and superlyophobic surfaces. It was found that none of the existing theoretical models can well describe the maximum spreading factor, revealing the complexity of the droplet impact dynamics and suggesting that more factors need to be considered in the theory. By using the modified capillary-inertial time, which considers the effects of liquid viscosity and surface wettability on droplet spreading, a universal scaling law describing the spreading time was obtained. Finally, we analyzed the post-impact droplet oscillation with the theory for damped harmonic oscillators and interpreted the effects of liquid viscosity and surface wettability on the oscillation by simple scaling analyses.

Key words: Droplet impact; viscous liquids; surface wettability; maximum spreading; spreading time; post-impact oscillation