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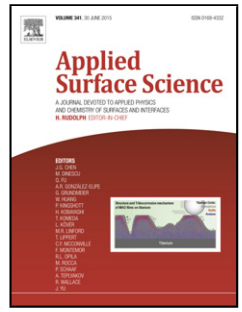

Title: Dynamical Behaviors of Droplet Impingement and Spreading on Chemically Heterogeneous Surfaces

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Dynamical Behaviors of Droplet Impingement and Spreading on Chemically Heterogeneous Surfaces

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Highlights

- The chemically heterogeneous surface was established by alternating stripes with different wetting properties.
- The influence of impact velocity on the dimensionless spread diameter (D*), height (H*) and advancing (θa) and receding (θr) contact angle with fixed Weber number (We) from 40 to 160 was investigated.
- The effect of fraction Φ_{lic} of chemically heterogeneous surface with fixed We was also investigated, which suggested that the final stable value of dimension spread diameter and height were not obviously influenced by fraction Φ_{lic} of the chemically heterogeneous surface in the small We.
- By tracing receding (θr) contact angle, the occurrences of stick-slip motion during the early and later recoiling stage are found to depend on the fraction Φ_{lic} and We, which are the two key parameters inducing stick-slip motion during the period of drop impingement and spreading.

ABSTRACT:

By using many-body dissipative particle dynamics (MDPD), dynamical behaviors of droplet impingement and spreading on chemically heterogeneous surfaces is presented in this paper. The influences of Weber number (*We*) and fraction (Φ_{lic} ratio of hydrophilic area to whole region) on dimensionless spreading diameter (D* ration of spreading diameter to initial droplet diameter), dimensionless height (H* ratio of height of droplets to initial droplet diameter), advancing contact angle (θ_a) and receding contact angle (θ_r) are systematically analyzed. The simulated results show that larger *We* and Φ_{lic} lead to larger spreading diameter, even overspreading. Particularly, the stick-slip motion of droplet during recoiling stage is found to be affected both by Weber number (*We*) and fraction (Φ_{lic}), which cannot be captured on homogenous surface. As a result, the stick-slip motion could be divided into two sub-stages during recoiling stage, which is novel to the situation involving droplet with fixed impact velocity. It provides an insight to understand the mechanism of stick-slip motion for droplet impingement on chemically heterogeneous surfaces.

Keywords: Droplet impact, Stick-slip motion, Many-body dissipative particle dynamics