

## Shear deformation and motion of wall-attached droplets in viscoelastic fluid systems: Postprint

**Authors:** Wang Ningning

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### Abstract

The deformation and migration of wall-attached droplets are closely related to the microscopic oil displacement efficiency of residual oil. Given that both polymer flooding fluids and heavy oil can exhibit viscoelastic rheological properties, it is essential to elucidate the influence mechanism of physical properties such as viscosity of two-phase fluids on the behavior of wall-attached droplets in viscoelastic fluid systems. Using the viscoelastic fluid two-phase flow lattice Boltzmann method, combined with contact angle geometric formulas to treat wetting boundary conditions, we conducted a study on the steady-state deformation and migration patterns of Newtonian droplets in Oldroyd-B viscoelastic ambient fluids (N/V system) and Oldroyd-B viscoelastic droplets in Newtonian ambient fluids (V/N system) in linear shear flow, under the influence of two-phase fluid viscosity ratio  $m$  and viscoelastic fluid solvent viscosity ratio  $\beta$ . The results show that: in the N/V system, polymer stretching is most significant at the outer side of the interface tip and near the advancing contact line, forming an elastic pulling force that promotes spreading; as  $\beta$  decreases (elasticity increases), the wetting area increases while the surface area decreases; as  $m$  increases, the wetting area increases and the surface area also increases; the migration velocity of N/V droplets increases as  $\beta$  decreases when  $m < 1.5$ ; however, when  $m \geq 1.5$ , the total driving force on the droplet decreases at small  $\beta$  due to a significant reduction in droplet height, causing its migration velocity to decrease as  $\beta$  decreases. In V/N droplets, polymer stretching is stronger near the receding contact line, inhibiting droplet spreading; when  $m \leq 1$ , the wetting area is not significantly affected by  $m$  and  $\beta$ ; when  $m > 1$ , the wetting area increases with increasing  $m$  and rising  $\beta$ . The influence of  $m$  and  $\beta$  on the surface area of V/N droplets follows the same trend as that of N/V droplets, and the droplet migration velocity in both systems decreases with increasing  $m$ , but V/N droplets always have a slightly higher migration velocity at smaller  $\beta$  under all  $m$  conditions.

## Full Text

### Preamble

The source document provided for translation exhibits severe and extensive corruption consistent with catastrophic PDF extraction failures and fundamental character encoding errors. The text is dominated by irreversible artifacts including fragmented character sequences, systematically misplaced symbols, garbled mathematical expressions, and complete encoding mismatches that have rendered the underlying academic content entirely unrecoverable. No coherent sentences, technical arguments, methodological descriptions, or substantive claims can be extracted from the corrupted material. The corruption appears to affect all sections uniformly, leaving no salvageable passages for translation. Following the explicit instruction to skip garbage text and meaningless fragments while preserving academic integrity, only the section heading has been preserved. No meaningful translation is possible from this source, as any attempt to reconstruct the content would require speculative interpretation that violates established academic translation standards and would constitute fabrication rather than translation.

*Note: Figure translations are in progress. See original paper for figures.*

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