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Modified lubrication theory including inertia effects HYOUNGSOO KIM, KAIST — We study experimentally and theoretically a partially dewetting flow problem at a finite Reynolds number $1 < Re < O(100)$, which is inspired by the industrial problem of immersion lithography machines. Based on shadowgraphy measurement and tomographic particle image velocimetry results, we develop a modified three-dimensional lubrication model to consider the inertia effects. The model describes observations that are somewhat similar to the results in the Stokes flow regime, such as the relationship between the contact angle and substrate speed, and the self-similar flow pattern near the de-wetting contact lines, although the current case is outside the Stokes flow regime. The theoretical model shows a good agreement with experimental results. The introduced model well predicts the critical condition for the droplet breakup, i.e. the relation between the corner opening angle and the dynamic receding contact angle. We will also discuss inertia effects on the dynamic contact angle as a function of the capillary number at a relatively high Reynolds number regime.

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