Abstract Submitted
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Convection-dominated dissolution for single and multiple immersed sessile droplets[1] KAI LEONG CHONG, YANSHEN LI, CHONG SHEN NG, Univ of Twente, ROBERTO VERZICCO, Univ of Rome 'Tor Vergata', DETLEF LOHSE, Univ of Twente — We numerically investigate both single and multiple droplet dissolution with droplets consisting of less dense liquid dissolving in a denser host liquid. In this situation, buoyancy can lead to convection and thus plays an important role in the dissolution process. Here, we vary the Rayleigh number Ra which characterizes the strength of buoyancy as compared to the viscous damping force. For single droplet dissolution, we observe the diffusively and convectively dominated regimes with distinct flow morphologies: when $Ra \geq 10$, a buoyant plume is clearly visible, which contrasts sharply with the pure diffusion case at low Ra. For multiple droplet dissolution, the well-known shielding effect comes into play at low Ra, so that the dissolution rate is slower as compared to the single droplet case. However, at high Ra, convection becomes more and more dominant so that a collective plume enhances the mass flux, and remarkably the multiple droplets dissolve faster than a single droplet. Our findings demonstrate a new mechanism in collective droplet dissolution, which is the merging of the plumes, which leads to non-trivial phenomena, contrasting the shielding effect.

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