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Evaporation of a sessile droplet on a slope AMIR JARRAHI DARBAN, University of Nevada, Reno, SAEED JAFARI KANG, HASSAN MASOUD, Michigan Tech — We theoretically examine the drying of a droplet sitting stationary on an incline, assuming that the effect of gravity relative to the surface tension is weak, i.e., Bond number (Bo) is small. We express the shape of the drop and the vapor concentration field as perturbation expansions in terms of Bo. We suppose that the evaporation results from a purely diffusive transport of the vapor phase and that the contact line is a pinned circle. At the zeroth-order (Bo = 0), the droplet takes the form of a spherical (or cylindrical in 2D) cap, for which the vapor concentration field is already known. Here, the Young-Laplace and Laplace equations are solved analytically to calculate the first-order corrections to the shape and concentration field, respectively. Perhaps surprisingly, we find that, to the leading order in Bo, the asymmetry caused by the component of gravity parallel to the slop does not contribute to the total evaporation rate. This result can also be obtained using the reciprocal theorem without even solving for the first-order correction to the concentration field. Finally, comparison with direct numerical simulations indicates that considering only the leading order corrections provides estimates that are valid well beyond the limit of very small Bo.

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