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Thermal Effects of the Substrate on Water Droplet Evaporation
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Since a few decades, the evaporation of a drop deposited onto a substrate has been subject to numerous research activities due to the increase of the range of applications underpinned by this phenomenon. However, this process today is always a challenging problem in soft matter physics due to the complexity of present couplings: fluid dynamic, physical chemistry of the substrate, heat and mass transfer. The originality of the presented experiment is to decouple the effects of wetting properties and thermal properties of the substrate. Thus, whereas we previously presented the role of wetting properties on evaporation by changing the surface energy and the roughness while maintaining the thermal properties constant thanks to nanoscale coatings on the substrate surface (B. Sobac and D. Brutin, Langmuir 27, 14999 (2011)), we investigate here the influence of the thermal properties of the substrate while keeping the wetting properties the same (B. Sobac and D. Brutin, Phys. Rev. E, underpress). We experimentally investigate the behavior of a pinned droplet evaporating into air. The influences of the substrate temperature and substrate thermal properties on the evaporation process are studied in both hydrophilic and hydrophobic conditions. Experimental data are compared to the quasi-steady diffusion-driven evaporation model assuming the isothermia of the drop at the substrate temperature. This comparison permits to highlights several thermal mechanisms linked to evaporation and their respective contributions in regard of pure mass diffusion mechanism. The range of validity of the classical evaporation model is also discussed.

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