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Spreading of hygroscopic ionic solution droplets during vapor absorption ZHENYING WANG, Kyushu University, GEORGE KARAPETSAS, Aristotle University of Thessaloniki, PRASHANT VALLURI, KHELLIL SEFIANE, University of Edinburgh, YASUYUKI TAKATA, Kyushu University — Studies on the evaporation of multi-component droplets have revealed complex and important physical mechanisms. With the addition of hygroscopic salts, the adhesive property of the droplet can be tuned, and the direction of water vapor mass flux inverses. This study focuses on the dynamics of hygroscopic aqueous solution droplets, and analyzes the interacting physical processes, including the capillary effect by spatiotemporally varying droplet geometry, the thermal Marangoni effect by non-uniform absorptive heating, and the solutal Marangoni effect by preferential vapor uptake. Specifically, a lubrication-type model is established, and an expression for the absorptive mass flux is derived combining the balance of chemical potential across the solution-air interface and the Hertz-Knudsen equation. Depending on the droplet state and the ambient condition, evaporation or vapor absorption issues. The evaporative/absorptive mass flux varies both spatially and temporally as the droplet approaches equilibrium with the ambient. It is demonstrated that the dominating mechanisms, *i.e.* capillary, thermal Marangoni and solutal Marangoni, compete with each other, and may lead to diverse droplet dynamics at different stages of evaporation or vapor absorption. The findings shed light on the physical processes within droplets with both positive and negative interfacial phase change, and provides rational explanations to our experimental observations.

Zhenying Wang
Kyushu University

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