ATTRACTION OF SESSILE DROPS OF THE SAME PURE VOLATILE LIQUID

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Controlling the motion of sessile drops has many well rewarding applications in industry. For instance, creating a surface tension gradient on the surface of a heat exchanger improves the total heat transfer by up to three times due to the motion and coalescence of sessile drops (Daniel et al. 2001). In this research we show experimentally that two sessile drops of pure volatile perfectly wetting liquid placed in a close proximity of one another feel each other and attract (See Figure 1) at a velocity significant enough for the drops to coalesce well before they eventually vaporize. Our experiments reveal that the drops attract each other even if, unlike the binary-liquid drops recently studied (Cira et al. 2015), they are made of the same pure liquid. Several perfectly wetting liquids of different volatilities are tested in order to unveil and quantify the mechanisms enabling droplets to communicate. While all recent works on the topic consider vapor-mediated interactions only, we here show that evaporation-induced temperature gradients in the substrate heavily influence this dynamics. For instance, we will describe a hereto unknown "cold-trap resistance" as an effective drag force opposing any motion, like the viscous drag does. The interaction mechanisms described here could hopefully open new directions of research about thermal effects as a mean of self-organizing evaporating/condensing liquid entities on substrates of various shapes and thermal properties.

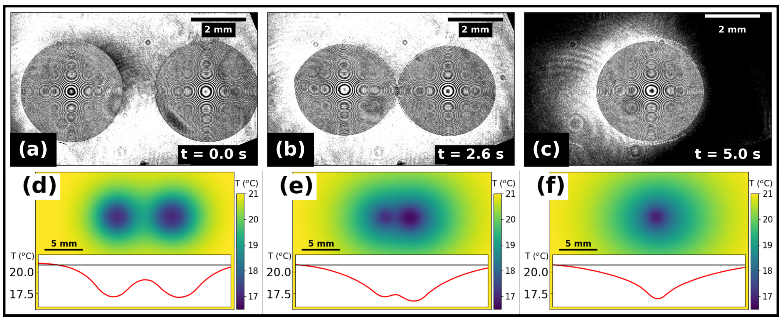

Figure 1- a) Attraction between two sessile hexane drops (initial radii ~ 1.9 mm, inter-apex distance = 5.25 mm on a sapphire substrate, (b) first touching after 2.6 s, (d) forming a single drop at 5 s, (d-f) temperature of substrate measured using an Infrared camera for attracting HFE7100 sessile drops

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