Constant Contact Angle Evaporation on SOCAL

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Abstract: Contact line pinning during evaporation of sessile droplets leads to ring stain deposits. Previous work has shown that using a slippery liquid-infused porous surface (SLIPS) can give an apparently completely mobile contact line with a constant apparent contact angle regime [1]. However, in this system the sessile droplet rests on a lubricant layer and so there is no true droplet-solid contact or contact line. Here we report constant contact angle evaporation on a smooth flat surface using a slippery omni-phobic covalently attached liquid (SOCAL) surface [2]. SOCAL repels water using liquid like PDMS chains that allow liquids to move freely. The constant contact angle evaporation is validated by taking the gradient of the plot of the square of the contact line radius over the evaporation time [Figure 1.]. This gradient is then used to estimate the diffusion coefficient [3]. The diffusion coefficients are in good agreement with the reference book value of $2.46 \times 10^{-5} m^2 s^{-1}$ compared to the experimental value of $2.44 \pm 0.48 \times 10^{-5} m^2 s^{-1}$. Evaporations were carried out at a range of humidities to validate that the constant contact angle regime occurs for different evaporation rates.

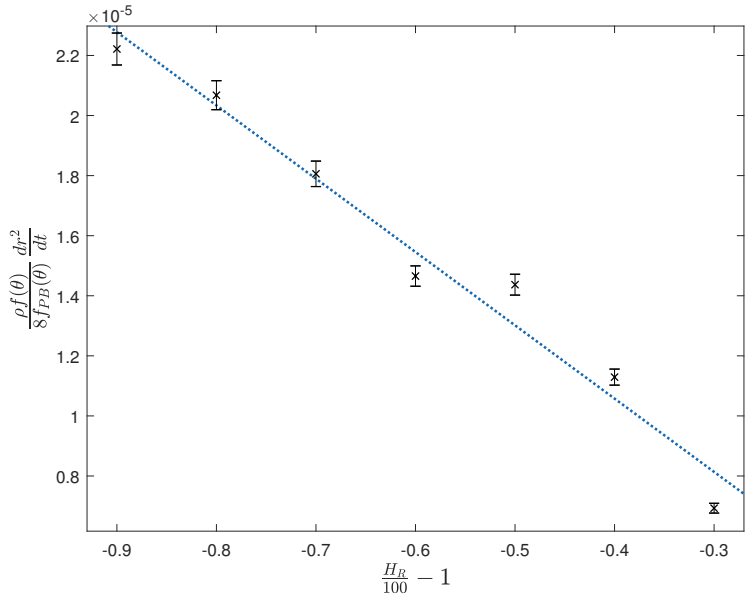

Figure 1: Evaporation rate as a function of humidity, the gradient of the line gives an approximation of the diffusion coefficient as $2.44 \pm 0.48 \times 10^{-5} m^2 s^{-1}$

References

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