

# Influence of contact angle and temperature on evaporation of droplets

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It was shown experimentally earlier, that the rate of change of the volume of an evaporating droplet depends linearly on the radius of the droplet base [1, 2]:

$$\frac{dV(t)}{dt} = -\alpha L(t), \quad (1)$$

where  $t$  is time,  $V(t)$  is the droplet volume,  $\alpha$  is a proportionality constant,  $L(t)$  is the radius of the droplet base. The latter means proportionality of total flux of vapour from the surface of a droplet,  $J$ , to the radius of the droplet base,  $L$ .

Computer simulations were carried out to verify the above experimental dependency (1), as well as to investigate the dependency of proportionality coefficient  $\alpha$  on contact angle,  $\theta$ , and average temperature,  $T_{av}$ , of the droplet surface.

The following phenomena were taken into account in our simulations: a heat conduction in the substrate, liquid droplet and surrounding air; the latent heat of vaporisation; vapour diffusion in the surrounding air; viscous flow in a droplet caused by thermocapillary tangential stress.

Convection in the air was neglected because experiments [3] have shown that there is no influence of a forced convection in the surrounding air on the evaporation rate. The Soret effect also was neglected due to small range of temperatures (less than 3 degrees) in the system under investigation.

The simulation has revealed that the proportionality coefficient  $\alpha$  substantially depends on the contact angle,  $\theta$ , as well as directly proportional to the difference of saturated and ambient vapour concentrations,  $C_{sat}(T_{av}) - C_{\infty}(T_{\infty})$ , at the droplet surface and in ambient air respectively. The results of simulations are in an agreement with the analytical solution obtained by R.G. Picknett and R. Bexon [4]. The only influence of the average temperature,  $T_{av}$ , of the droplet surface on  $\alpha$  is the change of saturated vapour concentration  $C_{sat}(T_{av})$ .

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