Dewetting of liquid two-layer films

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We study the dewetting of thin nanometric thin polystyrene (PS) films from liquid polymethyl-methacrylate (PMMA) substrates. In order to induce dewetting the PS/PMMA samples are heated above the glass transition temperature of both polymers, where both liquids can be considered as Newtonian with comparable viscosities. After a few minutes circular holes appear in the PS film and their radii grow with time and finally coalescence leading to a set of droplets on the substrate [1-3].

The considered mechanism leading to the symmetry breaking of the initially flat film is called spinodal dewetting, which is initiated due to the growth of thermally activated surface waves. Spinodal dewetting can only take place if the second derivative of the effective interfacial potential with respect to film thickness is negative, $\varphi^{"}(h_0) < 0$, i.e. if the long-range forces do not favor wetting, which is fulfilled in the considered system. The spinodal rupture of the liquid film results in a dewetting pattern of 'hills and gullies' with a certain preferred wavelength λ in both liquid/air and liquid/liquid interfaces leading eventually to the formation of holes after a certain time *t*. Interestingly, the deformation of the liquid/liquid interface is larger than that of the liquid/air interface due to the lower surface tension. According to theoretical predictions, can the deflection of both interfaces be in phase or antiphase which determines the dewetting pathway. The preferred wavelength, holes distance and deflection of interfaces contain experimentally accessible information about the underlying long range forces and evolution of the interfaces and therefore are of special interest [1,3].

In this study we experimentally measured the preferred wavelength λ and holes distance and we monitor deformation of interfaces by atomic Force Microscopy as function of PS film thickness. Using a lift off technique, we also gather information about the deformation of the liquid-liquid interface. Ultimately, the result of experimental observations will be compared with theoretical modelling.

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