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Characteristics of the Dewetting Dynamics and Equilibrium Droplets from Elastic to Visco-Elastic Substrates

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Dewetting dynamics and the emergence of equilibrium droplet morphologies of polystyrene on top of visco-elastic substrates is considered experimentally. Our initially prepared sample consists typically of glassy polystyrene layer with a molecular weight of 18 kg/mol and a thickness of about 100 nm prepared on top of PDMS viscoelastic substrates. Dewetting is activated by heating the sample above the glass transition temperature of the polystyrene and the dewetting scenario is monitored by atomic force or optical microscopy.
The early stage of the dewetting is characterised by the appearance of holes that increase in diameter with a certain dewetting velocity. Our observations suggest that this dewetting velocity, as well as the morphology of the dewetting rims directly depend in a non-trivial manner on the elastic modulus of the PDMS layer that we vary from 2 MPa to 3 kPa.
When we reach the equilibrium state at the end of the dewetting process, we observe the formation of polystyrene droplets of few microns that could be analysed from both sides (i.e. air/PS and PS/PDMS interfaces) using the lift off technique in combination with atomic force microscopy. Similar to the dewetting dynamics depend the equilibrium droplets shapes on the elastic module of the the (visco-)elastic substrates.
In this poster we highlight the major trends and differences that could be observed in our experimental studies, for the dewetting dynamics and equilibrium droplet morphologies with sizes below the elasto-capillary length (i.e. in the limit of a purely viscous substrate), with the idea of extending this study to droplet sizes exceeding the elasto-capillary length (i.e. in the limit of purely elastic substrates)).

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