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Drainage of a water film squeezed between oil and solid towards stabilization by charges LAURE BLUTEAU, MAURICE BOURREL, NICOLAS PASSADE-BOUPAT, LAURENCE TALINI, EMILIE VERNEUIL, FRANOIS LEQUEUX, Laboratoire de Physique des Interfaces Complexes, ESPCI Paris, Paris, France — When a drop immersed in a liquid bath is put into contact with a solid, it loses its spherical shape and a liquid film is squeezed. The film dimples: it is thicker at the center. This trapped liquid drains out until an equilibrium film of uniform thickness is reached. We experimentally study the drainage dynamics and the equilibrium state of an oil droplet surrounded by brine pressed against a glass substrate. We evidence that this equilibrium state relies on the disjoining pressure and thus, depends strongly onto the salt concentration. Drainage experiments evidence three dynamical regimes. We successfully model those regimes in the lubrication approximation. In particular, we evidence that the first one is capillary dominated, the second is a mixed capillary and disjoining pressure regime, and the third is a disjoining pressure dominated regime. The role of the disjoining pressure is precisely investigated in the limit of thicknesses smaller than the range of electrostatic interactions. The originality of our results relies on the derivation of simple analytical laws quantitatively describing the drainage dynamics and providing tools to uncouple the effect of the film geometry from the effects of disjoining or capillary pressures.

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