WETTING OF SOLIDS BY LIQUIDS

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Our research group has studied the wetting of solids by liquids for over 30 years and did not begin these studies with this objective, but rather we ended up studying this as a fundamental aspect of multiple applications that we were interested in. Figure 1 will be used in the introduction of the presentation. This simple question is the framework for, and in many respects summarizes the research that we have done. Of course we know the answer to this question based on definitions that others have made, but we also know that definitions and premises need to always be questioned.

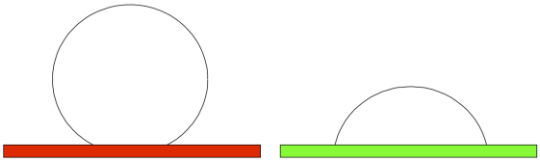

Fig. 1: Which surface is more hydrophobic?

After a review of portions of our previous studies, particularly our 2006-2009 work on wetting and superhydrophobicity, the use of several of the concepts of this work will be described. Several series of experiments involving contact line pinning will be discussed that were designed using the contact line perspective of wetting and require this perspective to explain the observed results. Perspectives based on contact areas, for example, Wenzel's and Cassie's, are not useful in these experimental situations. Descriptions of using thin hydrophilic contact lines to support films of water (puddles and kinetically trapped thin films) on water-repellent surfaces and to control the shape (both 2D and 3D) of these thin films and puddles will be presented. Dip-Coating deposition on both chemically and topographically patterned surfaces will be discussed. Water capillary bridges that span hydrophilic pinning features on parallel and hydrophobic surfaces are distorted by shearing the parallel plates at a low rate. The capillary bridges lengthen and distort to balance Laplace pressure (equilibrate mean curvature) as the features are separated and eventually rupture at a distance that is a function of the liquid volume, the advancing and receding contact angles of the surfaces, the separation between the parallel surfaces, and in particular, the shape and orientation of the hydrophilic pinning features. Sessile capillary bridge failure will be introduced and distinguished from tensile capillary bridge failure.

References

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