

Astor Visiting Lecture - TT 2010

*Week 6, Thursday June 3rd 2010, 5:00PM-6:00PM
Lecture Room 1, Thom Building, Engineering Science*

Designing Robust Omniphobic Surfaces

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Abstract

Superhydrophobic surfaces that display water contact angles greater than 150° with low contact angle hysteresis are becoming commonplace in the materials community. Microscopic pockets of air trapped beneath the high surface tension ($\gamma_{lv} = 72\text{mN/m}$) water droplets lead to a composite solid-liquid-air interface in thermodynamic equilibrium. Previous experimental and theoretical work suggests that it should not be possible to form similar fully-equilibrated composite interfaces with drops of low surface tension liquids such as alcohols or alkanes (e.g. pentane: $\gamma_{lv} = 16\text{ mN/m}$). In his lecture Bob Cohen will discuss novel surfaces that possess the required combination of re-entrant topographical texture and surface chemistry to support strongly metastable composite solid-liquid-air interfaces for any liquid. Quantitative design parameters will be introduced to guide the development of these novel omniphobic surfaces. For a given feature size R , two independent design parameters [surface chemistry as revealed in the equilibrium contact angle θ , and texture spacing, embodied in the dimensionless spacing ratio $D^* = (R+D)/R$] can be used to develop surfaces with desirably large values of apparent contact angle (θ^*) and robustness of the metastable composite interface. Most revealing is the scaling of the composite interface robustness which indicates clearly why, in the consideration of self-similar arrangements of topographical surface features, 'smaller is better' for producing surfaces that resist wetting by low energy liquids. Examples that have been realized to date include lithographically fabricated features in silicon, randomly deposited electro spun fiber mats, dip-coated textiles and wire meshes.

