Concave bending of contact line due to polarization and surface trapping

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The formation and configuration of 3 part (solid/ liquid/vapor) contact line is of central importance in understanding wetting dynamics and electrowetting. The contact zone is divided into four regions: the gross region, the mesoscopic region, the proximal region, and also the molecular region. However, the contact angle and also the contact line profile inside the molecular region still stay obscure. during this study, we tend to used molecular dynamics simulation to look at the contact line profile within the molecular region. it's found that the contact line experiences planoconcave bending at the molecular region, that is iatrogenic by the polarization of water molecules in that and also the friction among the bedded structure of treed water molecules. The polarization close to the solid surface manifest within the variety of orientation bias of water molecules. The surface housing of water molecules within the proximity of solid surface happens within the variety of oscillatory peak densities within the density profile. each effects, that area unit restricted to some one nm off from the solid surface, contribute to extra energy dissipation within the method of contact line formation and work together as an additional term within the changed Young-Laplace equation.

Vertically aligned TiO2 fullerene and Al2O3 nanopore arrays are obtained by pattern target-hunting anodization with uniform concave depths. There square measure some studies regarding the result of surface curvature on the expansion of Al2O3 nanopores. However, the surface curvature influence on the event of TiO2 nanotubes is rarely studied. Moreover, there's no analysis regarding the result of heterogeneous concave depths of the guiding patterns on the anodized TiO2 fullerene and Al2O3 nanopore characteristics, like diameter, growth direction, and termination/bifurcation. during this study, targeted inoic beam lithography is employed to form concave patterns with heterogeneous depths on flat surfaces and with uniform depths on arciform surfaces. For the previous, bending and bifurcation of nanotubes/nanopores square measure ascertained when the anodization. For the latter, bifurcation of an outsized tube into 2 smaller tubes happens on concave surfaces, whereas termination of existing tubes happens on lenticular surfaces. the expansion direction of all TiO2 nanotubes is perpendicular to the native surface and so is totally {different|completely different} on different aspects of identical Ti foil. At the sting of the Ti foil wherever 2 aspects meet, the fullerene growth direction is bent, leading to an outsized stress unharness that causes the formation of cracks. Besides the Wenzel state, liquid droplets on micro/nano-structured surfaces will keep within the acacia state and consequently exhibit intriguing characteristics like massive contact angle, little contact angle physical phenomenon and exceptional quality. Here we tend to report molecular dynamics (MD) simulations of wetting dynamics of Cassie-state water droplets on nano-structured ultrahydrophobic surfaces with a stress on the genesis of the contact line friction (CLF). From associate degree at first perspective, CLF may be ascribed to the collective result of solid-liquid retarding and viscous damping. Solid-liquid retarding is said to the work of adhesion, whereas viscous damping arises from the viscous force exerted on the liquid molecules at intervals the three-phase (liquid/vapor/solid) contact zone. during this work, a universal scaling law springs to generalize the CLF on nano-structured ultrahydrophobic surfaces. With the decreasing fraction of solid-liquid contact (i.e., solid fraction), CLF for a Cassie-state drop gets increased because of the actual fact that viscous damping is counter-intuitively intense whereas solid-liquid retarding remains unchanged. however, the friction between a Cassie-state drop and therefore the structured surface is so reduced since the air cushion fashioned within the interstices of surface roughness beneath the Cassie-state drop applies negligible resistance to the contact line. Our results have disclosed the genesis of CLF from associate degree at first perspective, incontestible the results of surface structures on moving contact line and even the essential role of CLF within the analysis of wetting-related things.

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