Stroke Asymmetry of Tilted Superhydrophobic Ion Track Textures

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The stroke asymmetry of contact angles of water drops on tilted hydrophobic textures is demonstrated, obtained by ion track etching followed by a hydrophobic treatment. Preliminary trends concerning the advancing and receding contact angles are established, each with and against stroke direction. In rough agreement with Cassie-Baxter theory, the cosines of these four contact angles depend linearly on the wetted area fraction. The etched tracks are randomly distributed on the surface of polycarbonate disks and inclined by 30° with respect to the surface, whereby the aspect ratio of individual etched cones is larger than 10. The morphology of the resulting surface is characterized by randomly shaped flat tops overhanging on one side and gradually falling off on the other side. The area fraction of the supporting tops can be calculated from the number of impinging ions per unit area and the cross section of the etched ion tracks. The top layer of the texture consists of flat, horizontal, irregularly shaped tops supporting water drops in the Cassie-Baxter state. With increasing etching time, the texture becomes increasingly clefted. To fabricate the textures, we irradiated polycarbonate with 5 x 10^7 $^{80}Br^{7+}$ ions/cm^2 of 30 MeV total energy (having a range of about 20 μm in polycarbonate) at a tilt angle of 30° with respect to the sample surface and etched the latent ion tracks selectively. The textured surface is made hydrophobic by carbondifluoride radicals (CF_2) resulting from the decay of octafluorocyclobutane, C_4F_8, in a plasma reactor. The goal of the report is to show that the tilt orientation of a superhydrophobic surface leads to advancing and receding contact angles depending on the orientation with and against the stroke direction. In addition, a rotating movement is demonstrated qualitatively by floating a rotationally asymmetric disk on an ultrasonic bath, similarly treated after an irradiation with (1.2 ± 0.4) x 10^7 $^{129}Xe^{27+}$ ions/cm^2 of 8.3 MeV/ nucleon at an angle of 45°, whereby the superhydrophobic side of the disk points downward to the water of the ultrasonic bath.