Supplementary Information

Movie. The movie of the 3T3 cells on the patterned superhydrophobic surfaces.

Experimental Section

To prepare a superhydrophobic surface, a thin layer of fluoropolymer poly [tetrafluoroethylene-co-2,2-bis(trifluoromethyl)-4,5-difluoro-1,3-dioxole] (Teflon, AF, DuPont) was spin-coated on a cover slip at 3000 rpm for 1 min. The thickness of the fluoropolymer was measured to be about 5 μm. The fluoropolymer coated cover slip was then baked on a hot plate at 110^0 for 30 min. After these processes, the water contact angle measured on the fluoropolymer was about 120^0. A fluoropolymer surface were then roughened by oxygen plasma treatment (Oxford Plasmalab 80 Plus, 80W) with a gas O_2 (2 sccm) at a total pressure of 25 mTorr. The water contact angles on the roughened fluoropolymer surfaces were measured to be 131^0, 138^0, 150^0, 155^0, 160^0,164^0 for 2, 4, 6, 8,10 and 12 minutes of oxygen treatment whereas the surface roughness for these surfaces were 10, 25, 35, 42, 52 nm and 65 nm, respectively. Shown in figure S1 are the AFM images of the flat and the roughened fluoropolymers. The surface roughness was measured by AFM as plotted in figure S2. The water contact angles of the roughened fluoropolymers were measured by a sessile drop method as shown in figure S3. The water droplet was gradually increased and then decreased and a sequence of images was taken. The water contact angle was analyzed by image analysis software. Both advancing and receding contact angles were measured and the results are presented in figure 1(a). To characterize the oxygen plasma treated surfaces, the XPS spectra of various plasma treated fluoropolymers were investigated using a PHI 5000 VersaProbe X-ray photoelectron spectrometer. Shown in figure 1(b) are the XPS spectra of the flat and the patterned (12 minutes plasma treatment) fluoropolymers. The high resolution XPS spectra can be found in figure S4. No significant change in chemical composition was observed.

For the cell adhesion measurement, the patterned superhydrophobic surfaces were prepared on the cover slips. The detail procedure for preparing the patterned superhydrophobic surfaces can be found in a previous publication.[1] In short, the patterned superhydrophobic surfaces were prepared on the cover slips. A layer of 5 μm thick fluoropolymer poly [tetrafluoroethylene-co-2,2- bis(trifluoromethyl)-4,5-difluoro -1,3-dioxole] (Teflon AF, DuPont) was first coated on the cover slips. Then a layer of photoresist (S1813, Shipley) was spun on top of the fluoropolymers and a photolithographic process was used to define the superhydrophobic area on the photoresist. The superhydrophobic microarray can be manufactured using an oxygen plasma treatment (Oxford Plasmalab 80 Plus, 80W) with a gas O_2 (2 sccm) at a total pressure of 25 mTorr. The dimension for each pattern was 200 μm x 200 μm. XPS imaging technique was employed to characterize the roughened patterned fluoropolymer before and after the removal of photoresist. Shown in figure S5 are the XPS images of roughened fluoropolymer with the patterned photoresist. The 200 x 200 μm^2 patterns can be clearly seen through XPS images using different XPS peaks. However, when the photoresist was removed, no patterns can be seen in F 1s, O 1s and C1s region (Figure S6) indicating that there is no difference in chemical composition between the roughened and flat area. To further explore the chemical composition in the first nanometer layer, angle resolved XPS was used where XPS spectra were recorded at 10^0 and 80^0 and the depth profile was analyzed by PHI MultiPak toolbox. The results are shown in figure S7 and S8. Again, no significant change in first nanometer was observed between the untreated flat fluoropolymer and the patterned roughened fluoropolymer. No difference in the ATR-FTIR spectra for both samples was observed as shown in figure S9. To measure the water contact angle on the patterned area, a Dimatix material printer (DMP 2831) was used to deposit a 40 μm drop of water on the patterned

roughened fluoropolymer. The water contact angle measured on the patterned area was larger than 150^0 as shown in figure S10.

Three cell lines, NIH 3T3, CHO and HeLa, were seeded on the patterned superhydrophobic surfaces and placed on a confocal microscope (Fluoview 1000, Olympus) equipped with an incubator (MIU-IBC-IF, Olympus) at 37℃ and 5% CO_2 for 6 hours. The density of the cells was about 10^5 cell/ml. To count the number of cell attached to the patterned area, the suspension cells were removed by PBS solution and the DIC image was taken at each condition.

For the transfection experiment, PolyFect (Qiagen) was used as a transfection reagent and the Kaede fluorescence protein expression vector (PKaede-MC1, MBL International), which can express a fluorescence protein Kaede, was used. To conduct transfection, the CHO cells were cultured on the patterned superhydrophobic surfaces at 37℃ for 6 hours. After washing the suspension cells with PBS solution, the PolyFect mixed with plasmid DNA was introduced at room temperature for 10 minutes. The fluorescence images were monitored during the expression process on a confocal microscope (Fluoview 1000, Olympus).

To measure the amount of the fibronectin adsorbed on the superhydrophobic surfaces, roughened fluoropolymers with an advancing water contact angle of 164^0 was used in this experiment. Clean glasses, PEG glasses (Microsurfaces, Inc), and flat fluoropolymers were used as the control. These substrates were dipped into solution containing 50μg/ml fibronectin conjugated with Oregon Green (Invitrogen) for a given amount of time and washed by PBS buffer solution before the fluorescence measurement. The fluorescence of intensity was measured by a fluoresce microscopy (IX 71, Olympus). All fluorescence intensities were normalized to the fluorescence intensity measured on a flat glass after 6 hours of incubation in the fibronectin solution. The result is shown in figure S11.

Figure

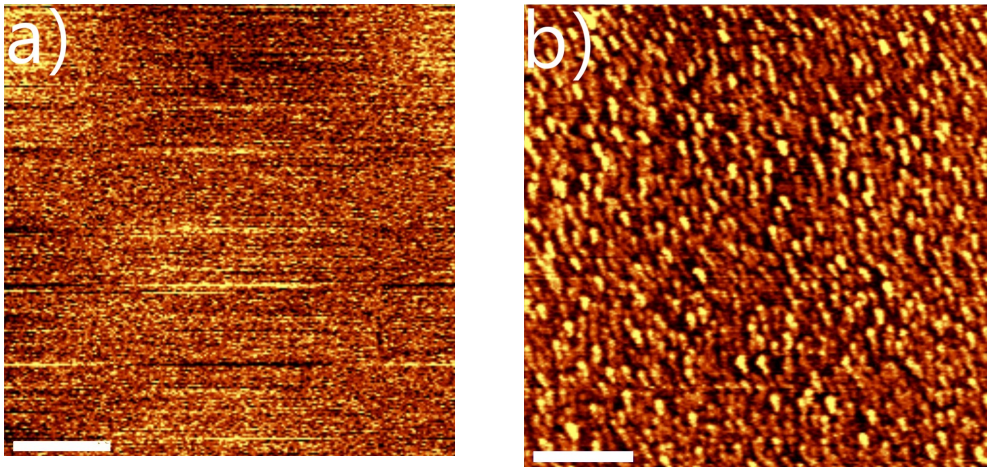


Figure S1 The AFM images of (a) flat and (b) roughened Teflon AF. Bar: 1μm. (Measured by VEECO Innova SPM)

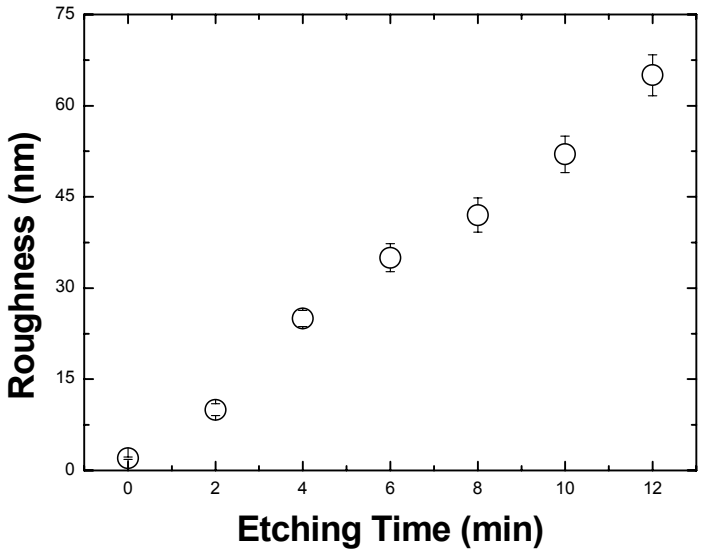
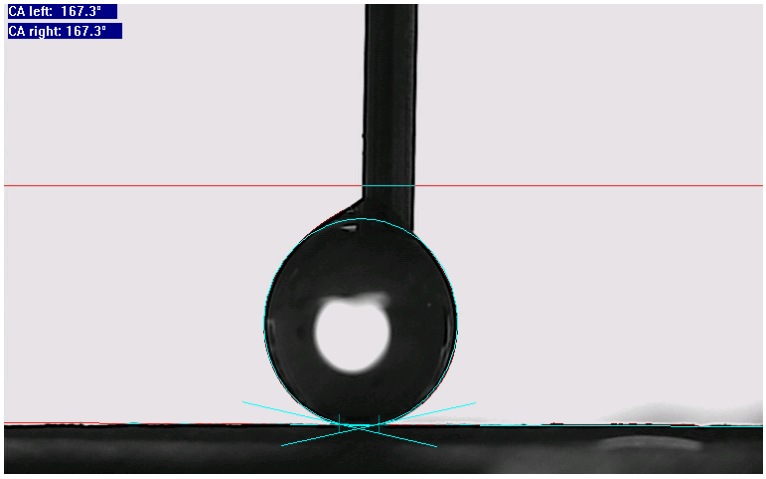


Figure S2 The surface roughness on the roughened Teflon AF surfaces as a function of etching time. (Measured by VEECO Innova SPM)



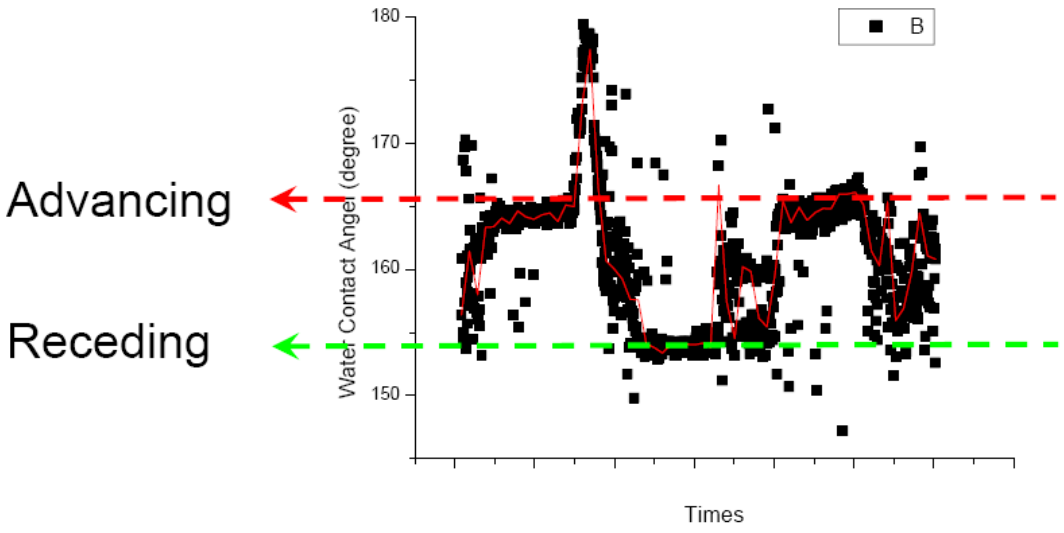


Figure S3 Water contact angle measurement and data fitting.

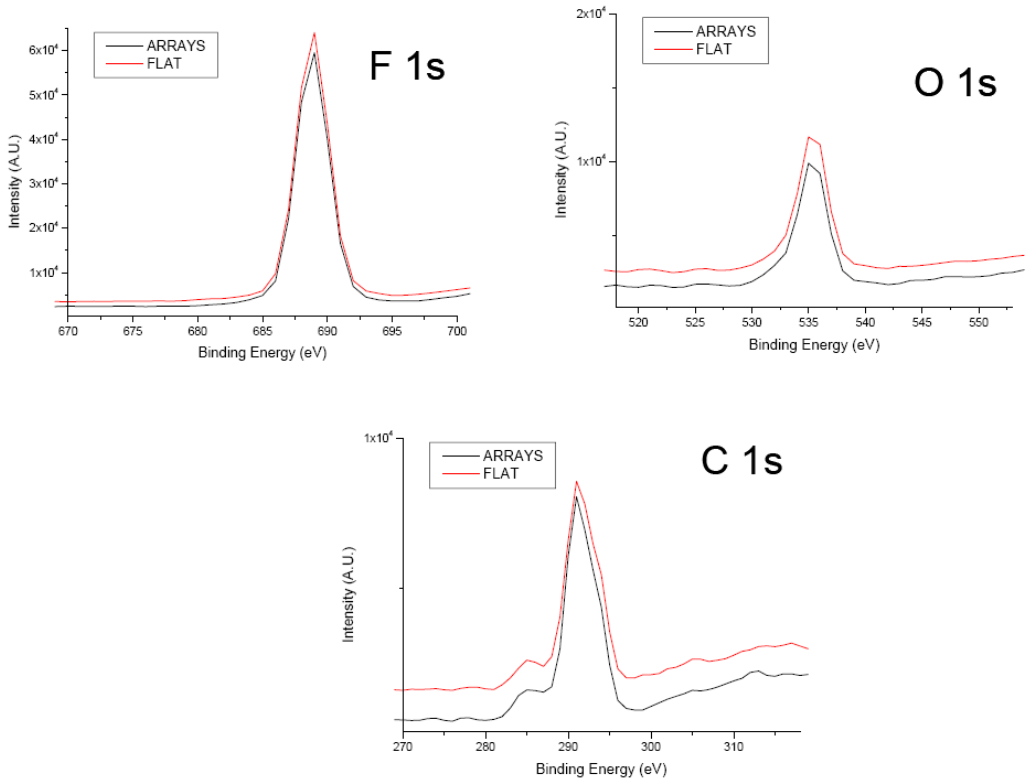


Figure S4. XPS spectra of the flat and the patterned fluoropolymers.

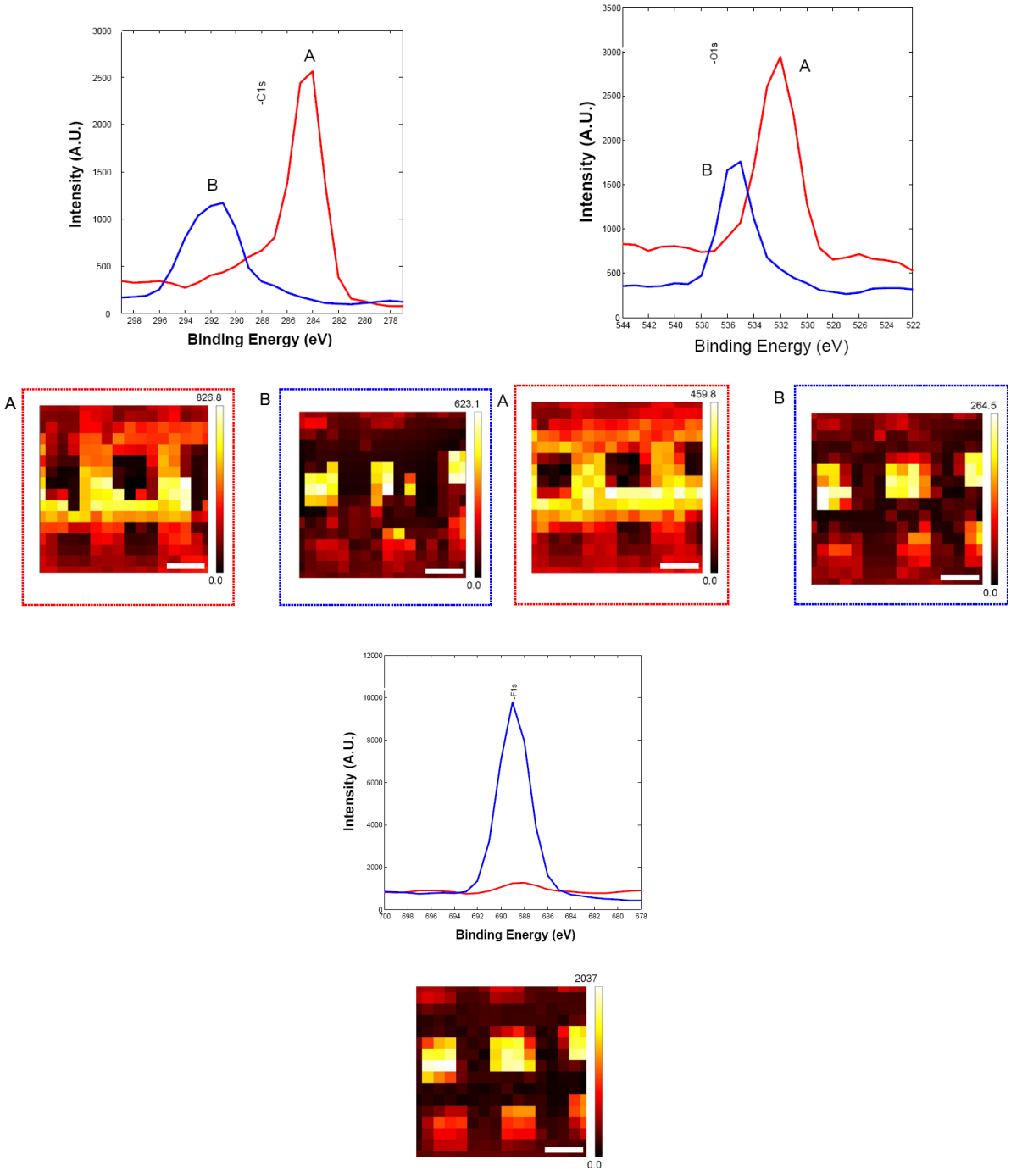


Figure S5. XPS images using two different peaks (A and B) in C 1s and O 1s regions and one peak in F 1s region for the roughened patterned fluoropolymer without removing the photoresist. Bar: 200 µm

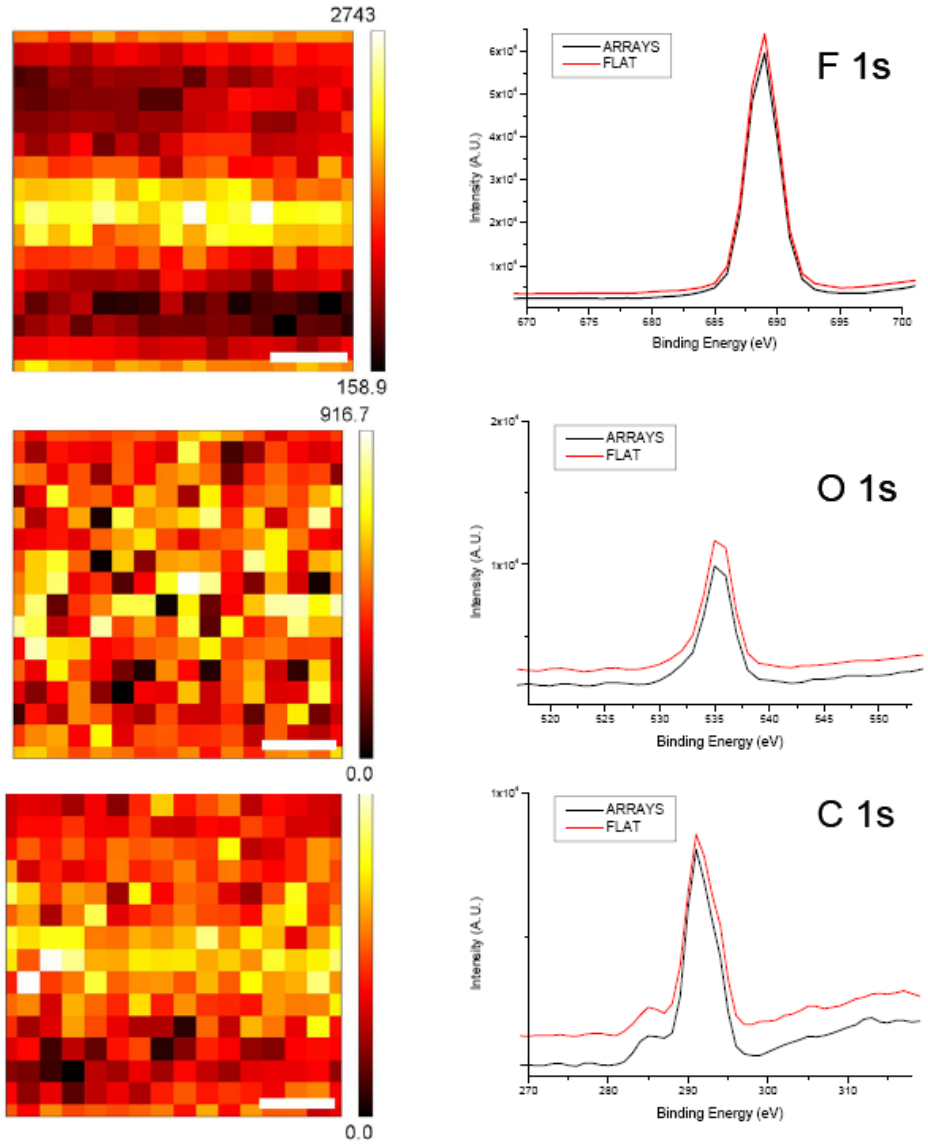


Figure S6. XPS images of the roughened patterned fluoropolymer without photoresist. No patterns can be observed. Bar: 200 µm

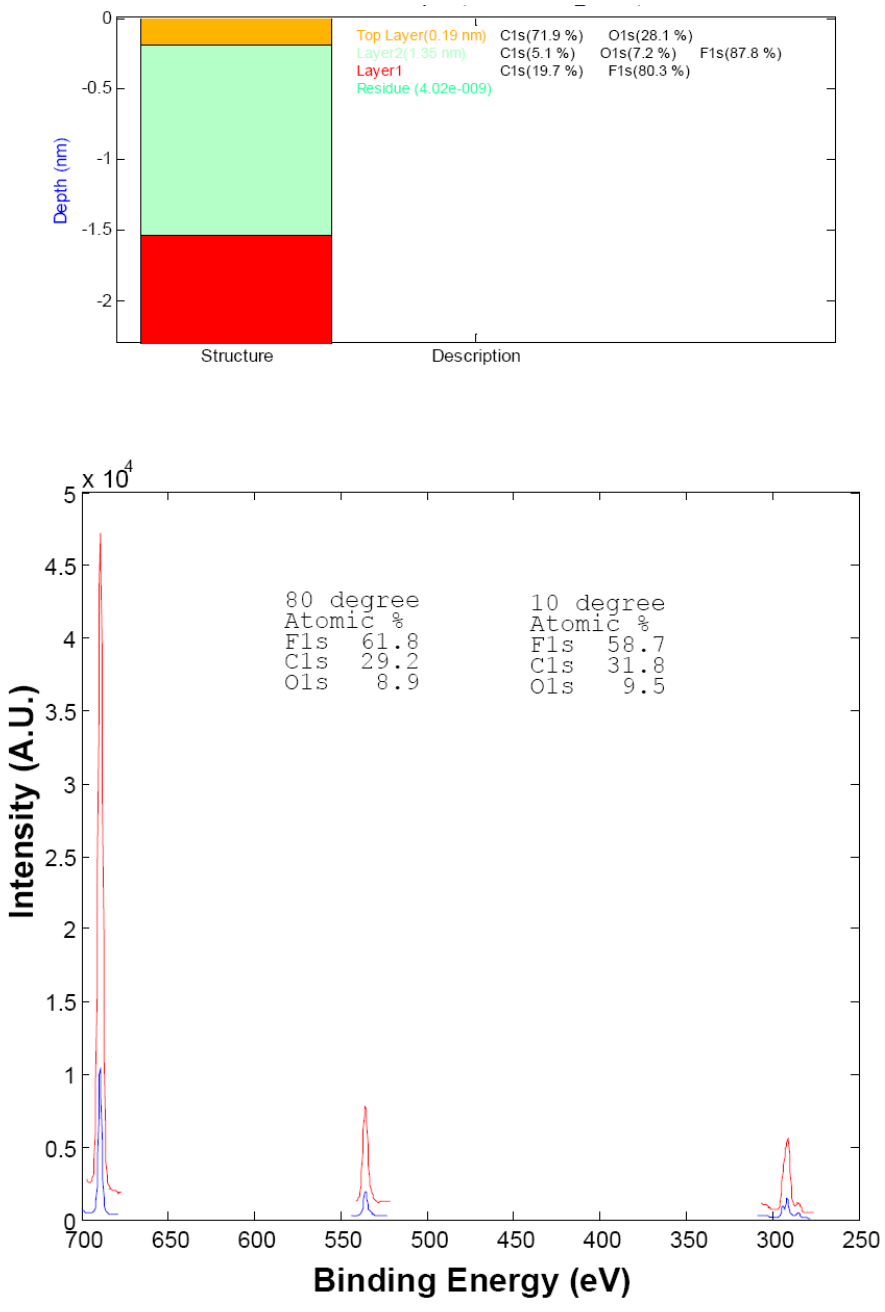


Figure S7. Depth profile for the untreated flat fluoropolymer using XPS spectra measured at 10^0 and 80^0.

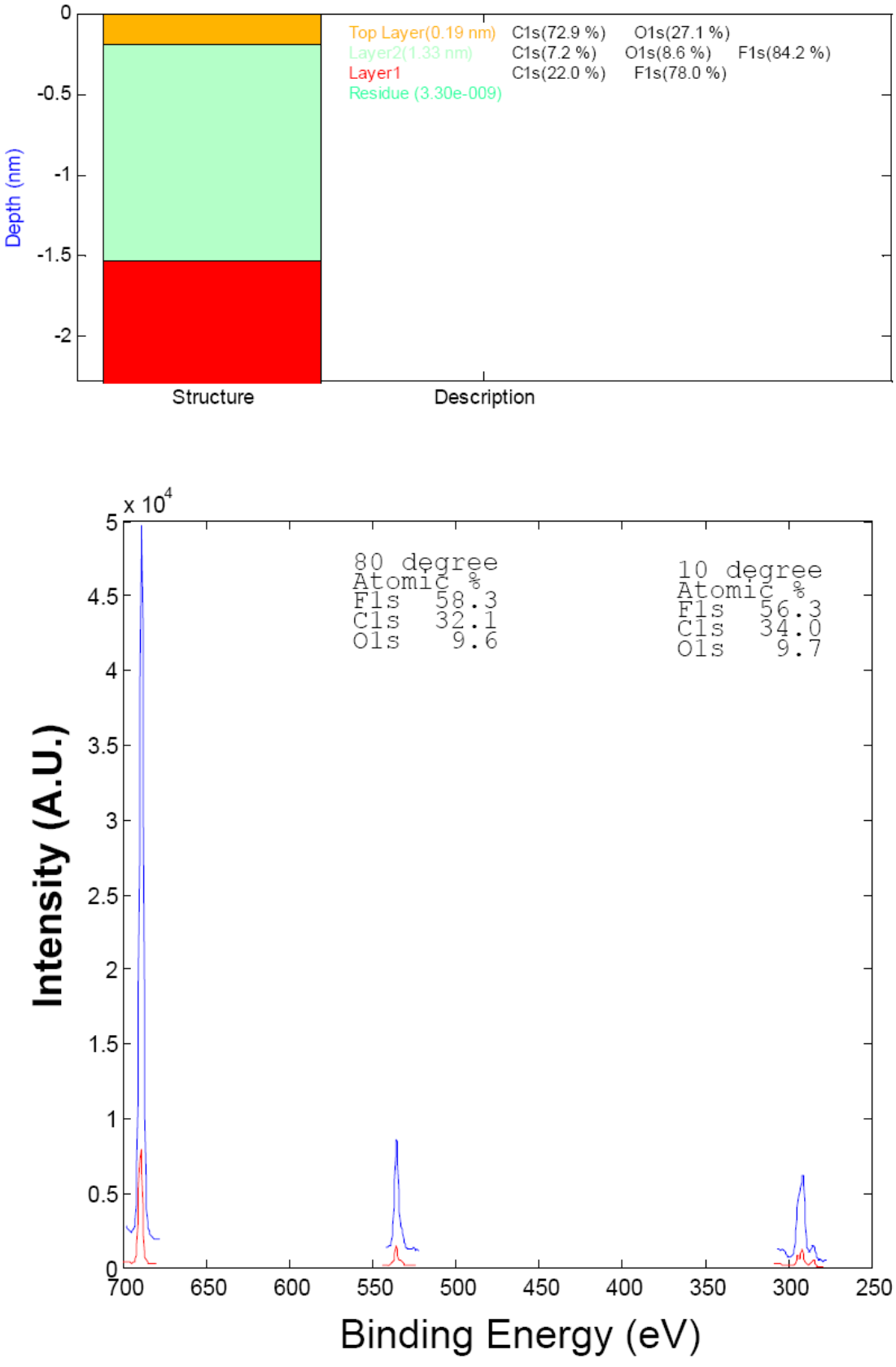


Figure S8. Depth profile for the patterned fluoropolymer using XPS spectra measured at 10^0 and 80^0.

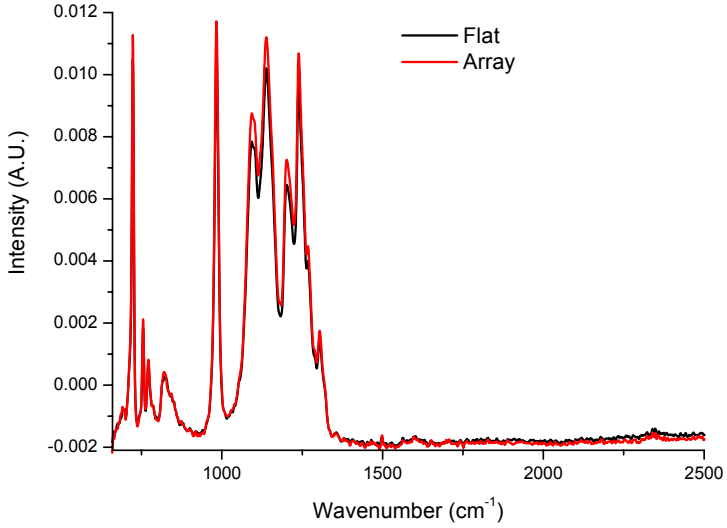


Figure S9. ATR-FTIR spectra of the flat (black) and the patterned (red) fluoropolymers.

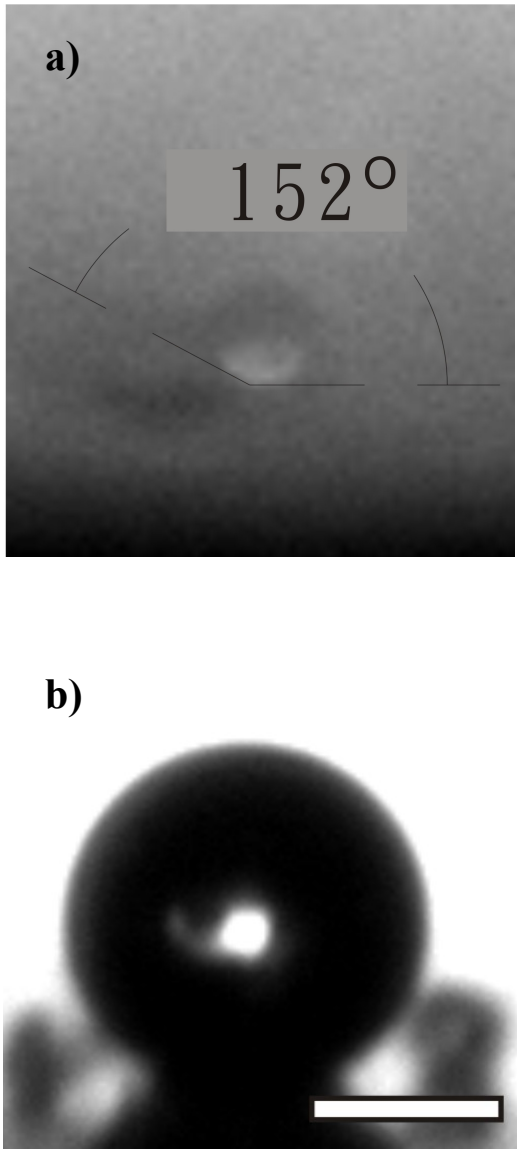


Figure S10: Water contact angle measured on the patterned area using a 40 µm drop printed by Dimatix printer (DMP 2831). b) Measured with Navitar 12X zoom lens. Bar 20 µm.

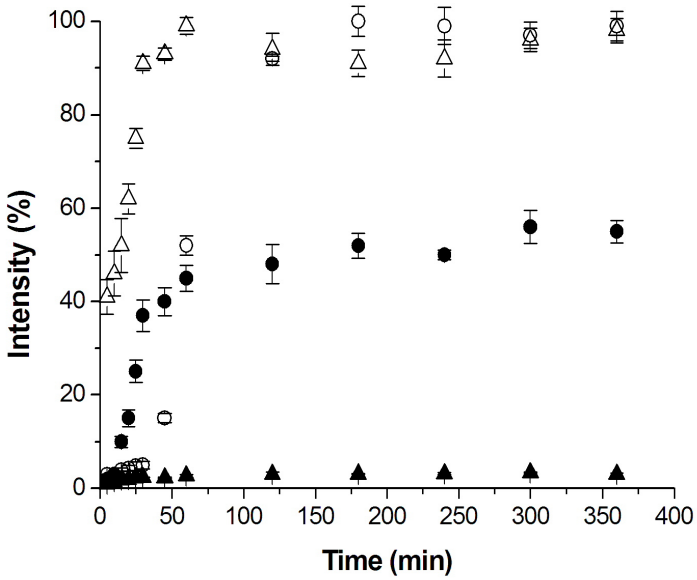


Figure S11**.** The fluorescence intensity of the dye conjugated fibronetins on various surfaces as a function of solution contact time. Open triangles: glass surfaces. Close triangles: PEG presenting surfaces. Open circles: roughened fluoropolymers with an advancing contact angle of 164^0. Close circles: flat fluoropolymers.

Reference

1. Shiu, J. Y. ; Chen, P. *Adv. Funct. Mater.* **2007**, *17*, 2680.