Supporting information for:

A Systematic Study of Plasma Activation of Silicon Surfaces for Self Assembly

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AFM Force Spectroscopy:

In AFM force spectroscopy (see Fig.S1), the tip is lowered with a constant rate toward the surface (point **a** in approach mode) to which it makes a contact at point **b**, until a pre-determined upward deflection of the cantilever is obtained at **c**. Conversely, during the withdrawal of the tip (retraction mode), the cantilever first flattens off (**d**) and then deflects in the negative direction as a result of stiction forces acting between the tip and the surface (**e**). Upon further retraction the cantilever snaps off the surface to its rest position when the pull force overcomes the stiction at point **f**. Fig.S1 graphically illustrates this sequence of events along with real data recorded on an O_2 plasma activated surface. This is a powerful technique as it not only allows a direct record of the surface tip interactions, but also provide a quantitative platform to measure the *stiction energy* by integrating the triangle area defined by the retraction curve before the snap-off event. Before doing so, however, raw spectroscopy curves (the photodetector deflection signal in units of Volts) must be post-processed. After a deflection offset correction, the slope of the linear portion of the lift-off curve (**d** in Fig.S1) and the spring constant (k) of the cantilever must be used to convert detector signal (in Volts) to actual Force (nN) data. Actual energy calculation can be done analytically (triangle approximation) or numerically, and is much easier than the contact angle measurements along with the knowledge of free surface energies in standard formulae (ref.9 in the manuscript). The most significant feature of Fig.S1 is the fact that the colloidal tip has a strong affinity with the plasma activated surface with a quite sizable triangular area proportional to the stiction energy. This feature has been exploited for the optimization of the plasma activation process in the manuscript.

In order to take advantage of this technique in a study of the surface hydrophilic behavior, and to avoid possible experimental errors and process variations, multiple curves must be collected so as to build a statistical average picture. An example set used in the process optimization section is provided in Fig.S2 for Si control sample, where sixteen data sets are shown along with the average (bold curve). Due to thermal drift, piezo creep and hysteresis

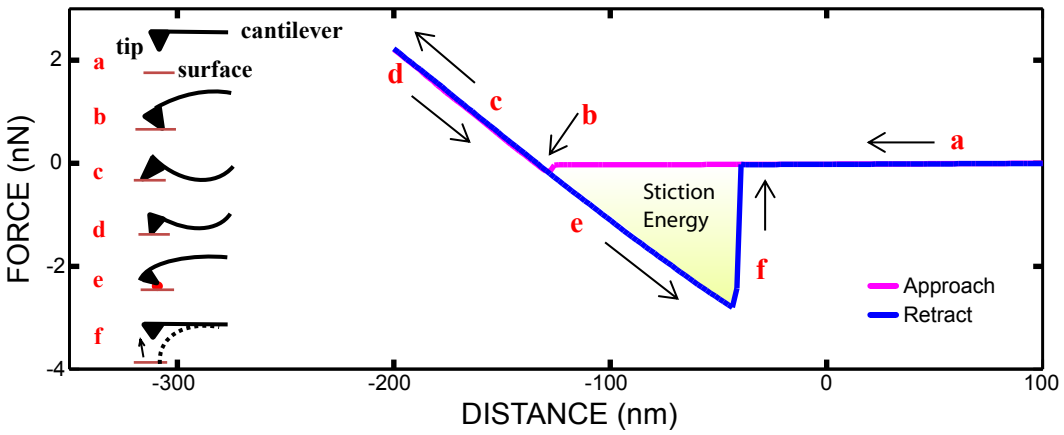

Figure S1: Contact mode AFM force spectroscopy process on a surface

of z-servo of the AFM scanner, these data points are not originally aligned well horizontally. Therefore, the curves must be shifted along x-axis to line up contact points before the aforementioned post processing for unit conversion on y-axis.

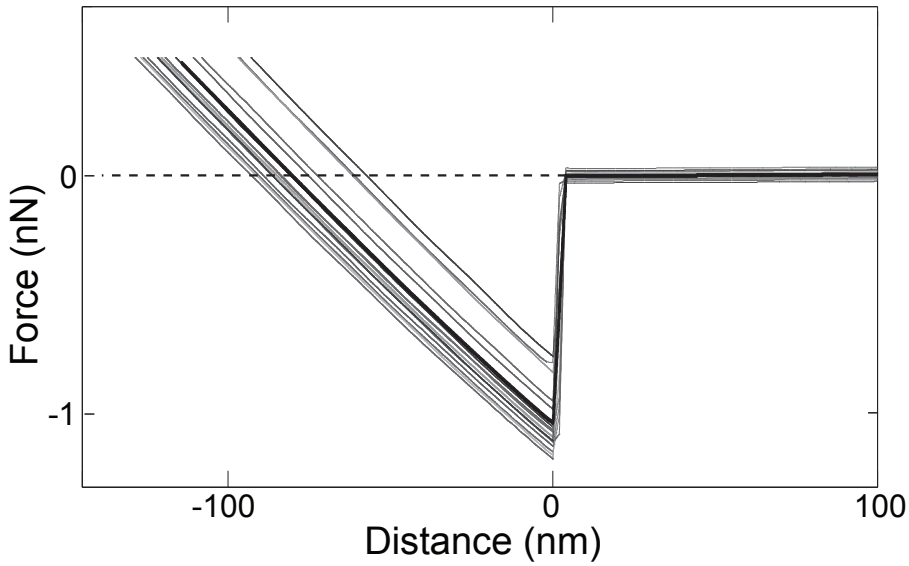

Figure S2: An example set of 16 F-d curves collected for a single sample to build a more accurate, statistical average of activation response. The bold line corresponds to the statistical average for the set.

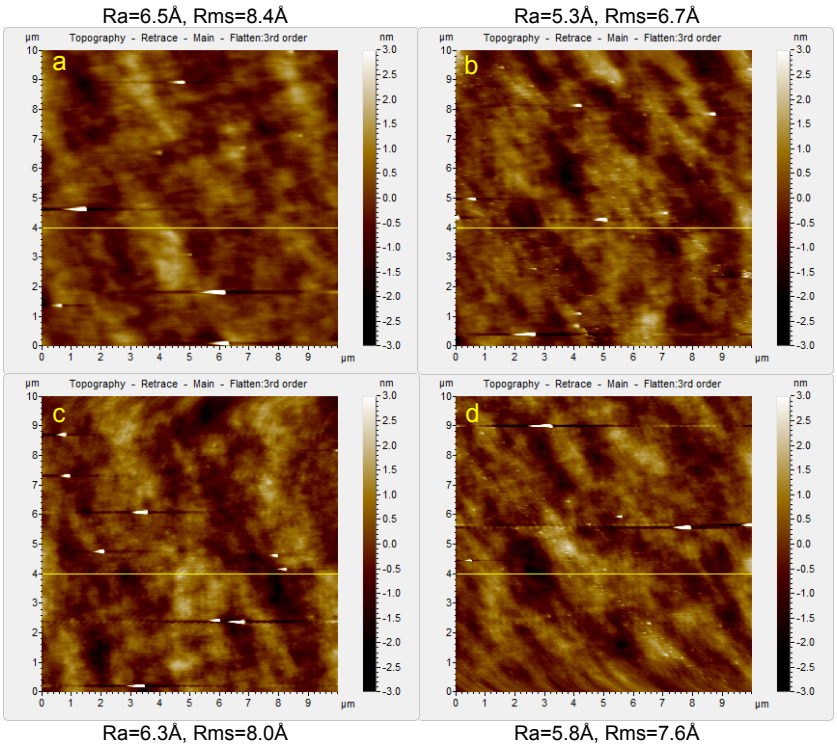

Figure S3: AFM scans of (a) Si control and plasma processed (b) 45 W, (c) 100 W and (d) 250 W samples reveal that average (Ra) and RMS (Rrms) roughness remain the same and are not correlated with hydrophilic behavior. Yellow lines show the location of 1-D data presented in Fig.S4

AFM Images and Profiles

In an effort to provide additional insights to the unchanging roughness on activated Si surfaces after exposure to O_2 plasma, We provide in Fig.S3 and S4 larger ($10\times10\,\mu$m) AFM scans that are scanned using identical conditions and tip as the earlier smaller scans. as well representative 1-D profiles obtained on the same samples. This data does corroborate and support all conclusions derived from the earlier set and has larger noise due to contamination on the surface. Except with the slight increase in the RMS or average roughness resulting from the spikes assoaciated with the contaminations, the roughness show no methodical increase with activation power levels.

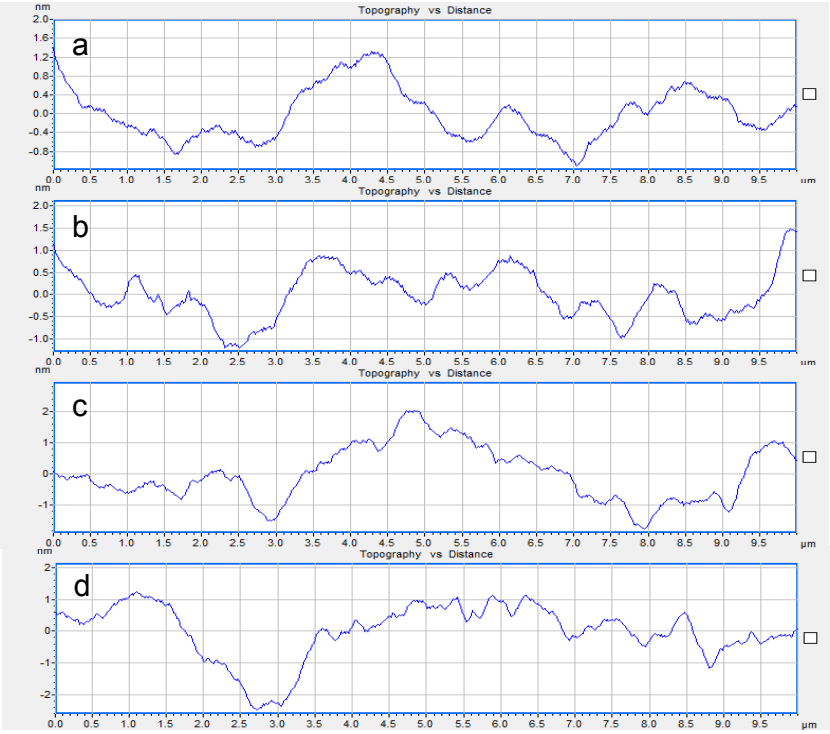

Figure S4: 1-D surface profile extracted from 2-D 10×10 μm topography data of Fig.S3. Data for (a) Si control and plasma processed (b) 45 W, (c) 100 W and (d) 250 W samples are shown.