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Bioadhesion at Micro-Patterned Stimuli-Responsive Polymer Brushes

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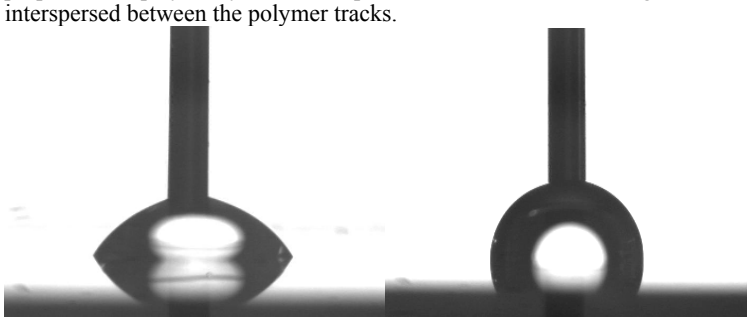
Supplementary Information

Contact angle goniometry

Advancing and receding water contact angles were measured for polymer brush surfaces at temperatures below LCST (typically 12-20 °C and at 40 °C (above LCST). Images of the applied water drops (2 μL) clearly showed the LCST-mediated change in surface properties displayed by PNIPAm patterned brushes even though these surfaces contained a pattern of alkanethiol (HDT) lines interspersed between the polymer tracks.



(a) **(b)**

Figure S1 Images of patterned PNIPAm brushes on gold at variable temperature, at 12 °C (a); and 40 °C (b).

Infra-red spectroscopy

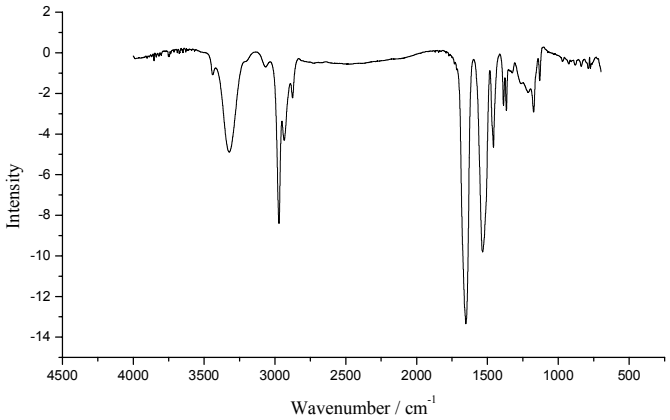


Figure S2: Grazing angle FT-IR of PNIPAm brushes

Atomic Force Microscopy

AFM topography imaging under water of patterned PNIPAm brushes was performed at temperatures above and below the solution LCST of PNIPAm (32 °C) as in Figure S2.

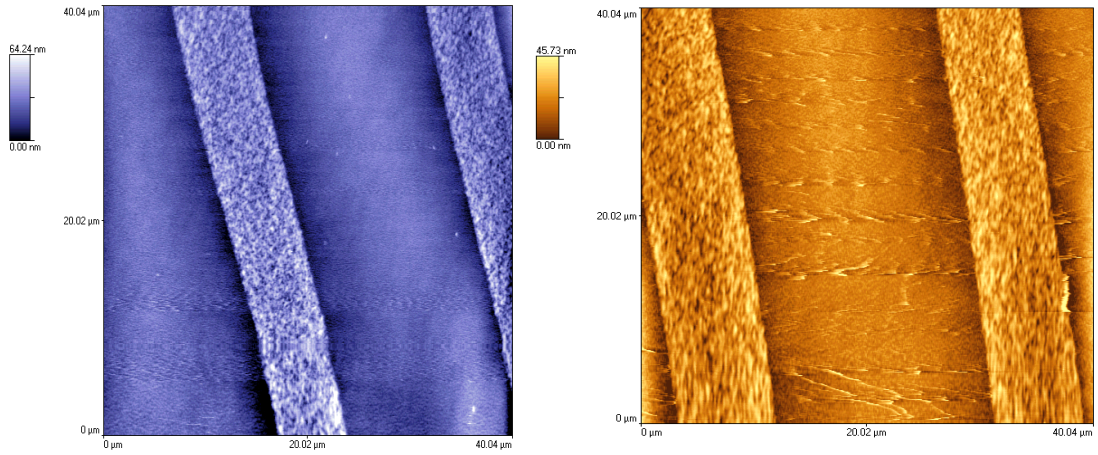
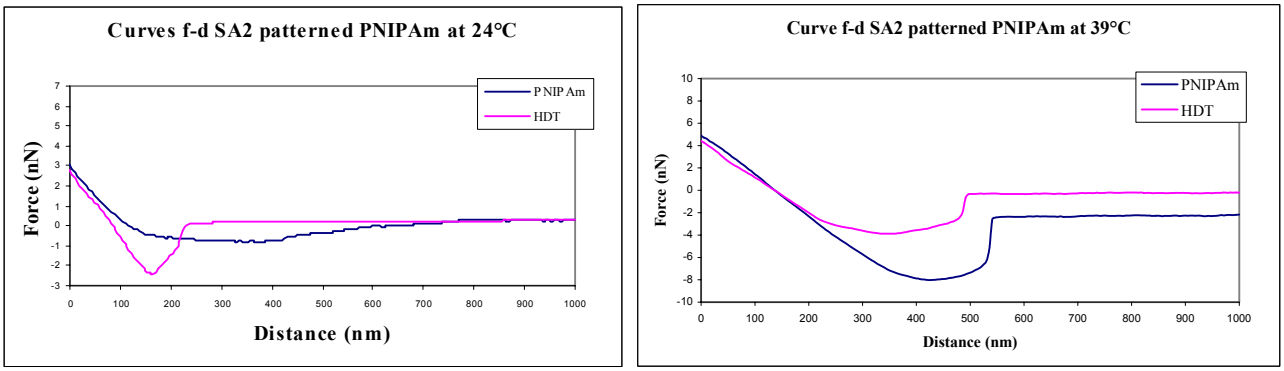


Figure S3. *AFM topography image of PNIPAm / hexadecanethiol (HDT) patterned surface, obtained in water at 24 °C (a); and at 39 °C (b). Average polymer brush height in water: 50 ± 5 nm, 27 ± 2 nm, respectively.*

The average heights of PNIPAm patterns obtained in these images indicated a compaction of the brushes from 50 ± 5 nm at 24 °C to 27 ± 2 nm at 39 °C.

Adhesion Force Mapping

Adhesion force mapping was carried out above and below LCSTwith force distance curves obtained from pull off forces of the AFM tip in water over the PNIPAm brushes and HDT domains as shown below:



a) b)

Figure S4. Force vs. distance curves obtained for PNIPAm / HDT patterned surface retracted from a Si_3N_4 AFM tip in water at 24 °C (a) and at 39 °C (b).

Bioadhesion studies onto patterned brush surfaces

Protein attachment

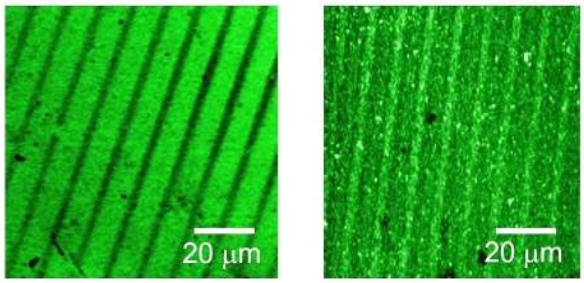
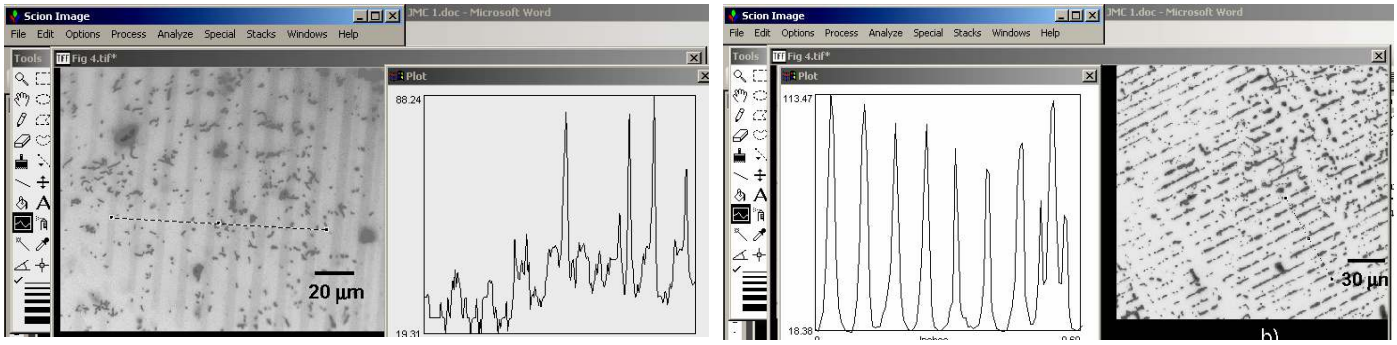


Figure S5: Micrograph to show changes in protein adsorption over time – the left hand image is the brush surface after the initial cold water wash while the right hand image shows the surfaces after 72 hr, and several temperature cycles showing patterning still evident but evidence for partial protein aggregation.

Cell attachment: Quantification and Image analysis

Image analysis was conducted for 3 fields chosen at random on each surface using Scion Image software (available free of charge at **http://www.scioncorp.com/frames/fr_scion_products.htm**). Line profiles were drawn of nominal 100 µm using the Profiling Tool and greyscale intensities recorded along PNIPAm brushes, along HDT domains, and across brush and SAM areas. Screen capture output is shown below:



Profiling across brushes - assay start 37 ºC

Profiling across brushes - assay start 4 ºC

Figure S6 – Line profiling and image intensity analysis (Scion Image)

Comparison of line intensities at the different brush arrays under the two temperature regimes are shown in Figure S7

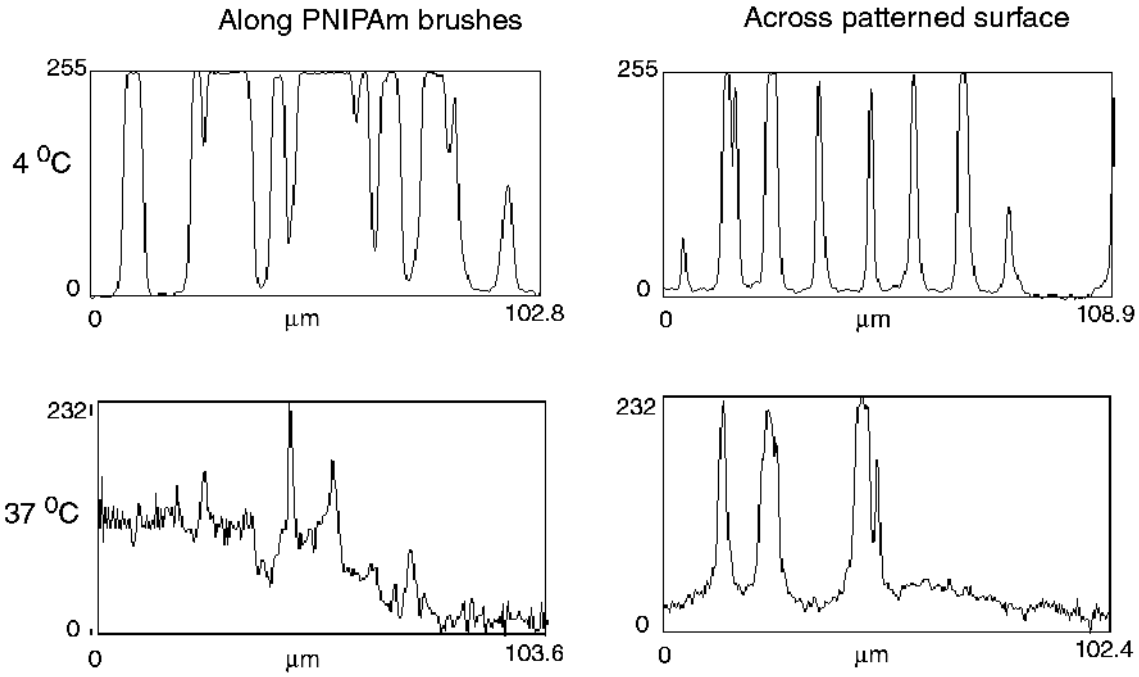


Figure S7 – Image intensity data

Image intensities were converted to bacterial counts using the Analyse Particles Tool – based on image intensities of individual cells at selected points on each micrograph.