

Supporting Information

Tuning Micropillar Tapering for Optimal Friction Performance of Thermoplastic Gecko-inspired Adhesive

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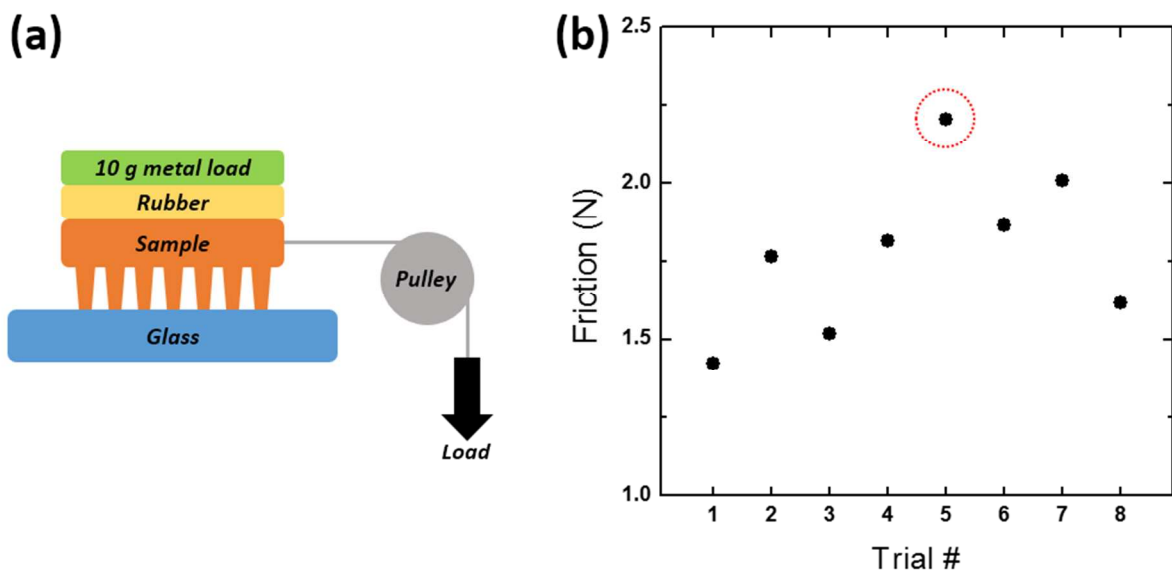


Figure S1 – (a) A schematic of the friction testing setup for the sample size of $1 \times 1 \text{ cm}^2$. The small normal load is used to ensure consistent contact, and the rubber to distribute the load evenly. Weight is progressively added over a pulley until the sample slides and detaches from the glass. (b) A representative friction data set from one sample (5/1 – 10 s) over multiple test trials. Increase in friction is observed over several cycles, followed by a decrease. The maximum value is taken for all samples for consistency.

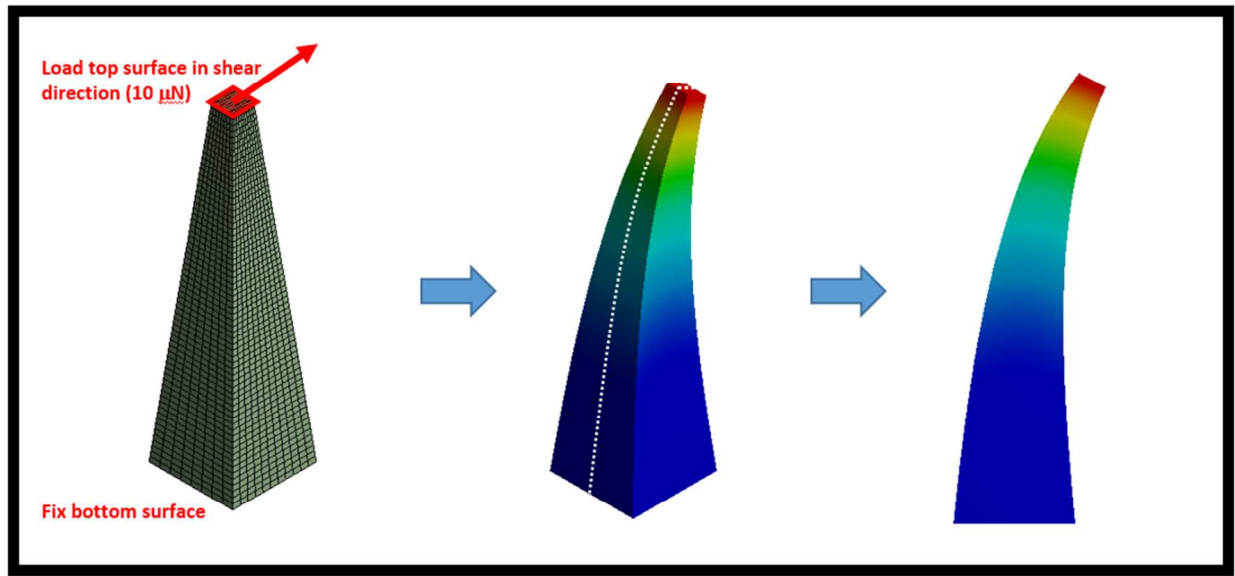


Figure S2 - The finite element modelling was performed using ANSYS, and the representative images showing mesh elements, boundary conditions, resulting deformation, and the cross-section are shown. The applied force is an order of magnitude approximation from 1 N of force (range observed from the friction data) distributed to 250,000 pillars on a $1 \times 1 \text{ cm}^2$ area. This comes out to be 4 μN/pillar , but the actual load on each pillar is likely much higher since not all pillars are in contact. This actual force would be dependent on the shape, but fixing the load at 10 μN allows comparison of stiffness across all shapes. Only elastic deformation is considered, though in reality, the deformation is both elastic and plastic. The Young's modulus and the Poisson's ratio have been estimated as 200 MPa and 0.43 , respectively [13].

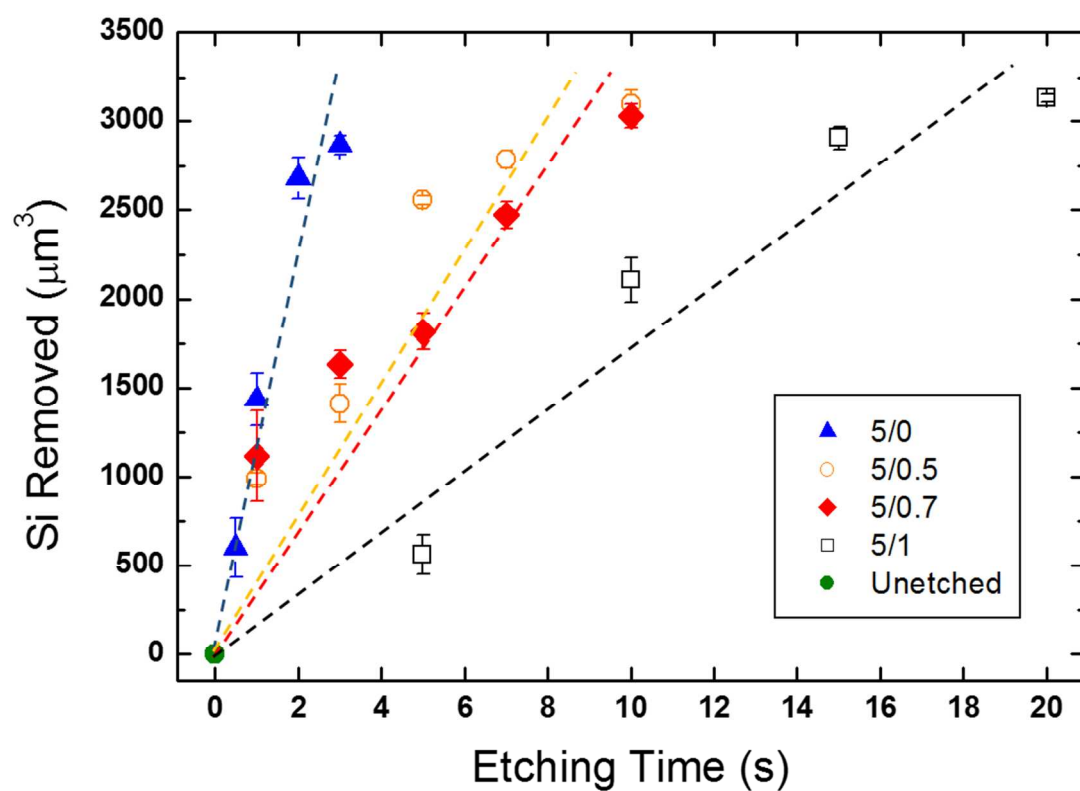


Figure S3 – The amount of silicon removed in volume as a function of etching time for various dilution. The lines are linear fits to the data, although the volume removed is not quite a linear function of etching time.

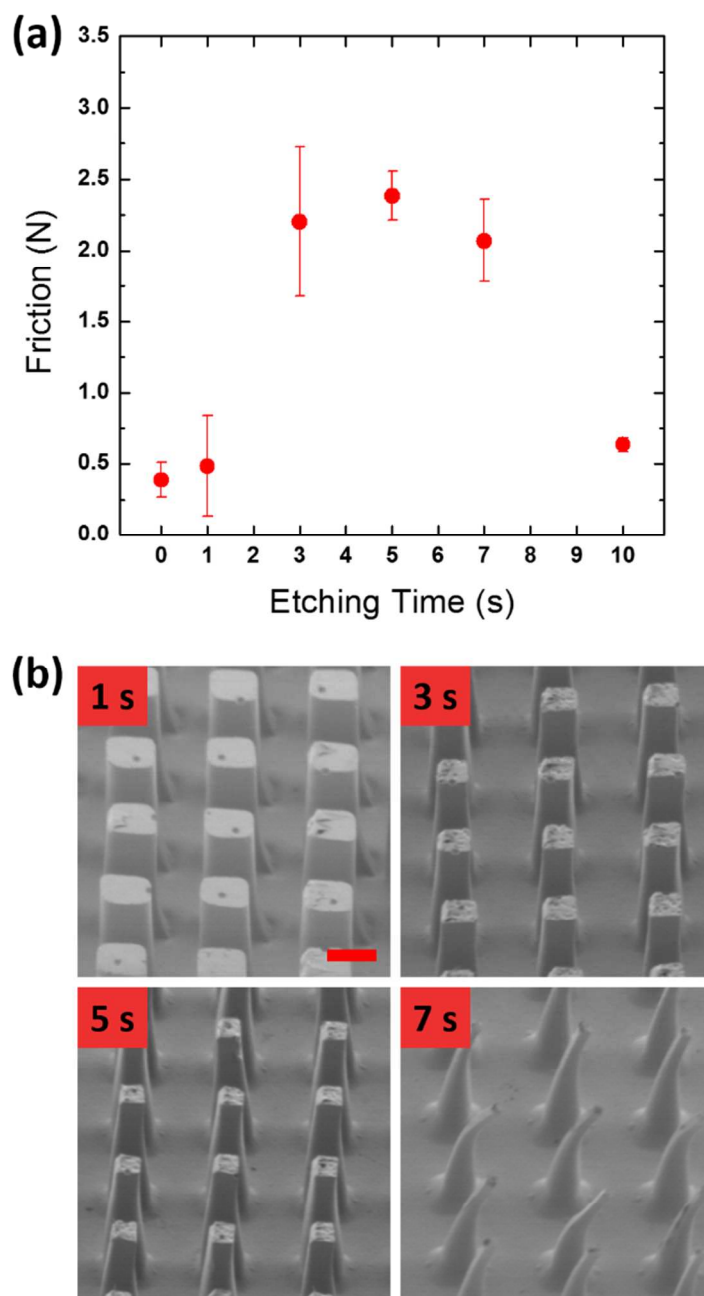


Figure S4 – (a) Friction performance of $1 \times 1 \text{ cm}^2$ patch of LDPE pillar array on smooth glass as template etching progresses in diluted HNA solution (HNA/H₂O = 5/0.7 mL for each $1 \times 1 \text{ cm}^2$ template). (b) Representative SEM images of LDPE pillars after friction testing for samples molded from 1, 3, 5, and 7 s etched templates in 5/0.7 solution.