Supporting Information

An Interlocked Flexible Piezoresistive Sensor with 3D Micropyramidal Structures for Electronic Skin Applications

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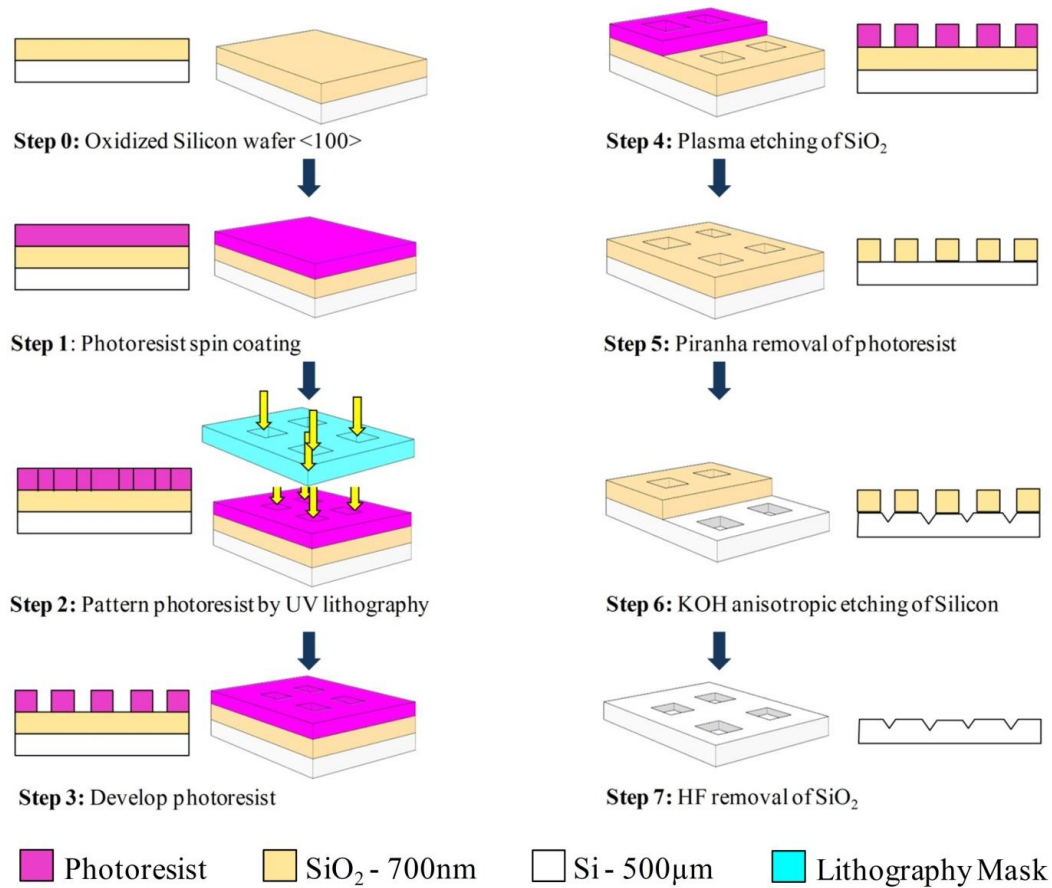[a]Department of Mechanical and Industrial Engineering

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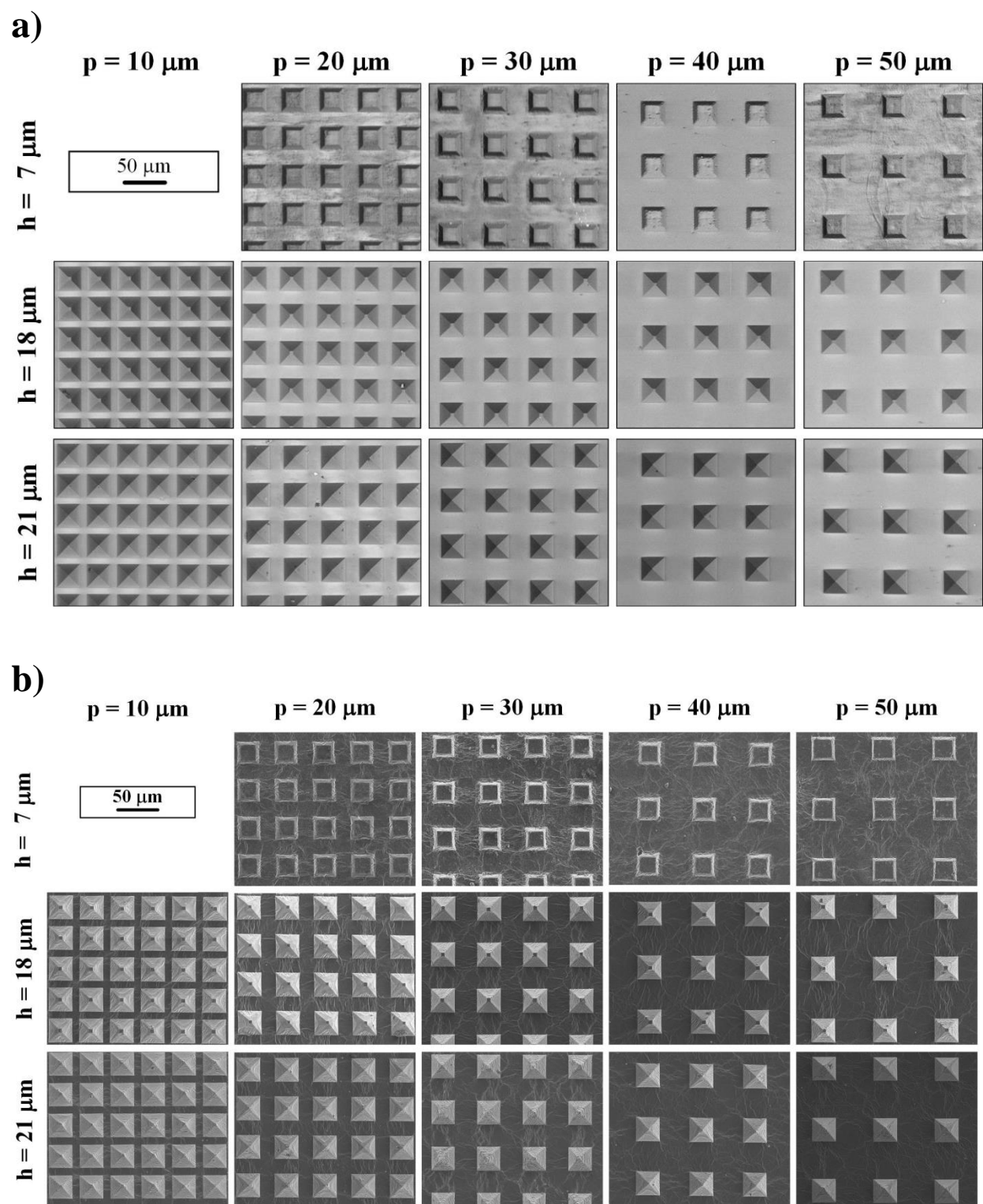[c]Institute of Biomaterials and Biomedical Engineering

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Step 0: Oxidized Silicon wafer <100>

Step 1: Photoresist spin coating

Step 2: Pattern photoresist by UV lithography

Step 3: Develop photoresist

Step 4: Plasma etching of SiO$_2$

Step 5: Piranha removal of photoresist

Step 6: KOH anisotropic etching of Silicon

Step 7: HF removal of SiO$_2$

■ Photoresist   □ SiO$_2$ - 700nm   □ Si - 500μm   ■ Lithography Mask

Figure S1. Schematic fabrication process of the negative silicon mold to shape the pyramidal micrstructures with varying height and pitch sizes. The change in the pitch can be generated using different masks whereas height difference can be achieved by varying the dry etching time of the silicon wafer.


Mask   Exposed Photoresist   Plasma etched SiO$_2$ Photoresist removed   Etched silicon
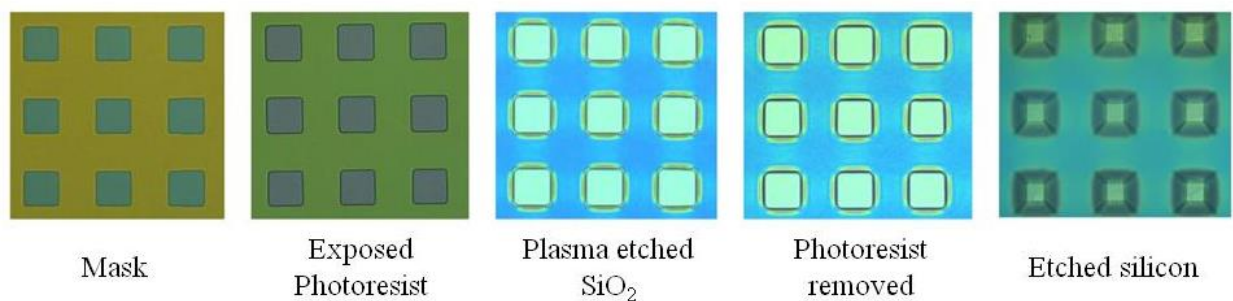
Figure S2. Optical images of the mold fabrication process

a)

b)

Figure S3. SEM micrographs of a) uncoated and b) coated micropyramidal PDMS substrates with varying height and pitch size.
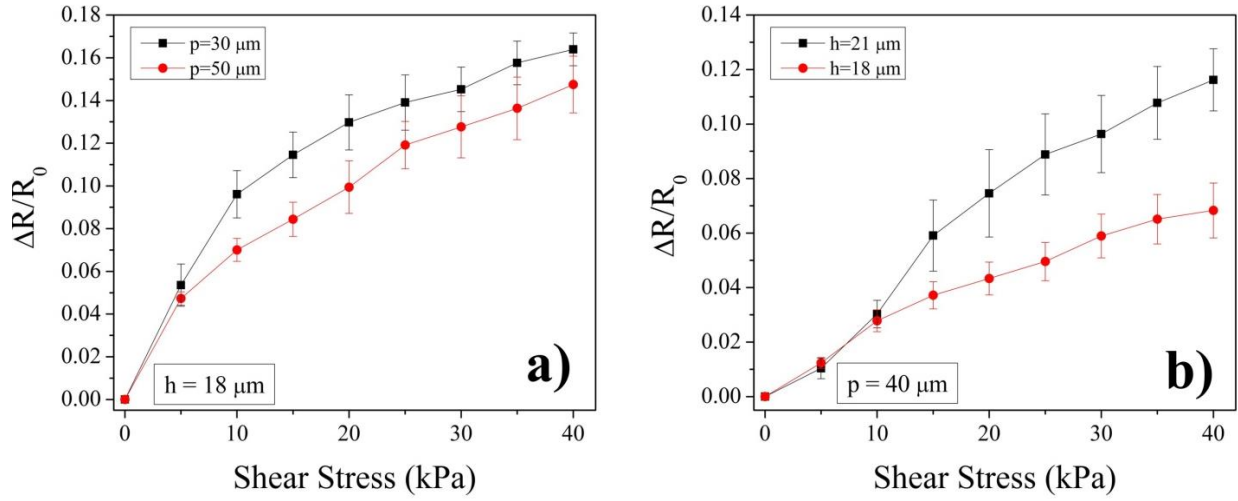
Figure S4. The piezoresistive response of the interlocked sensors to a shear stress loading ranging from 0 to 40 kPa for a) h = 18 μm and p = 30, 50 μm and b) p = 40 μm and h = 18, 21 μm.
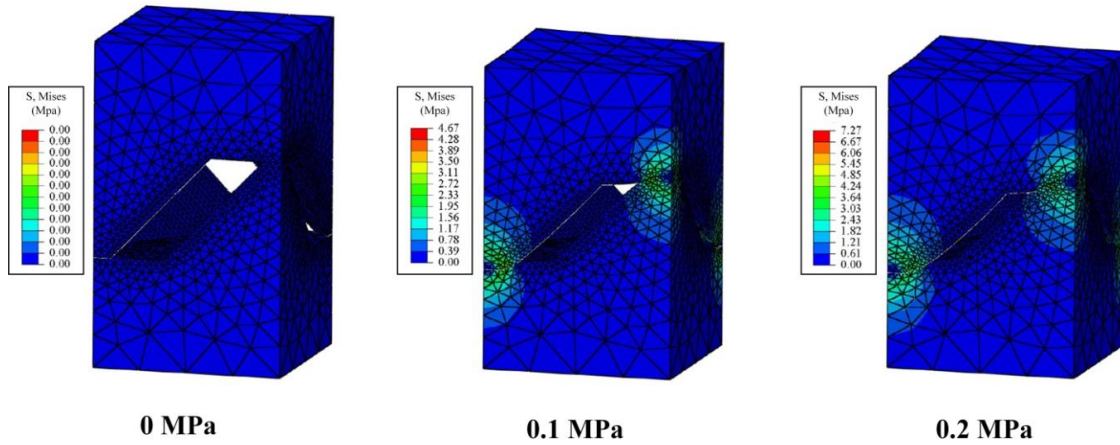
Figure S5. The deformed unit cell used in the performed finite element analysis. The stress concentration regions can be observed under different applied loads.
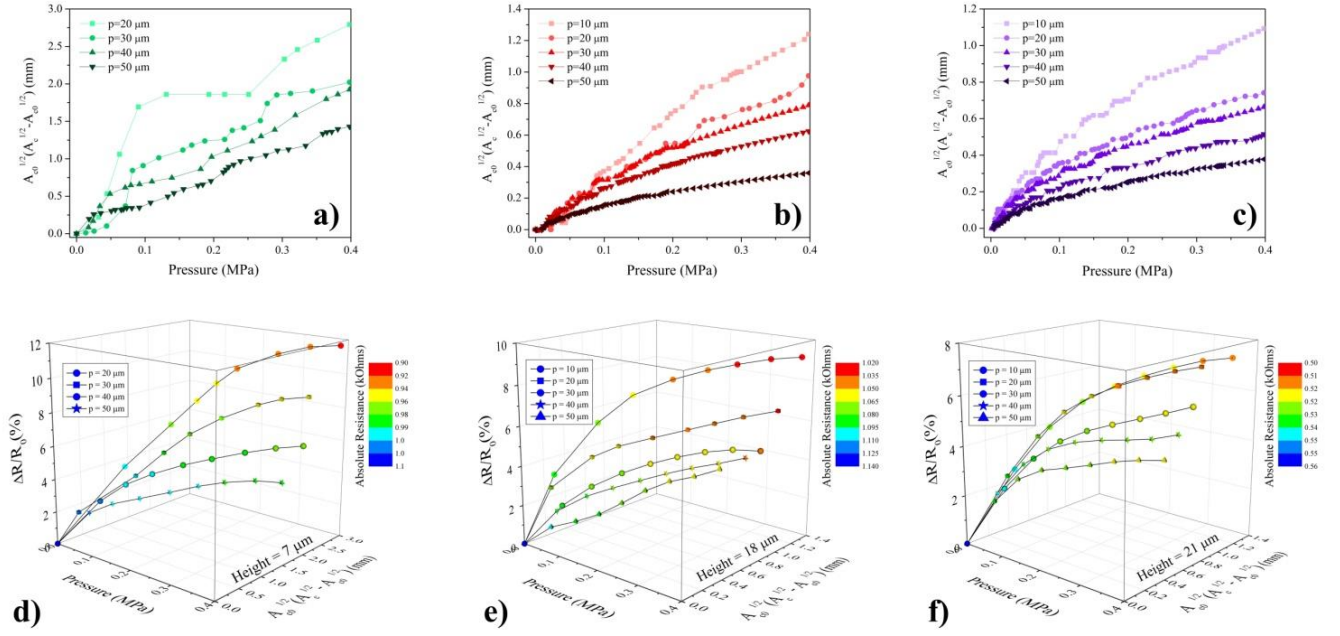
Figure S6. Change of $\sqrt{A_{c_0}}(\sqrt{A_c} - \sqrt{A_{c_0}})$ in response to compressive stress ranging from 0 to 0.4 MPa for different height and pitch sizes: a) h = 7 μm, b) h = 18 μm, and c) h = 21 μm. The relative and absolute resistance change vs. the relative contact area change for d) h = 7 μm, e) h = 18 μm, and f) h = 21 μm.