NANO MICRO small

Supporting Information

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Fracture-Based Fabrication of Normally Closed, Adjustable, and Fully Reversible Microscale Fluidic Channels

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Supplementary Material

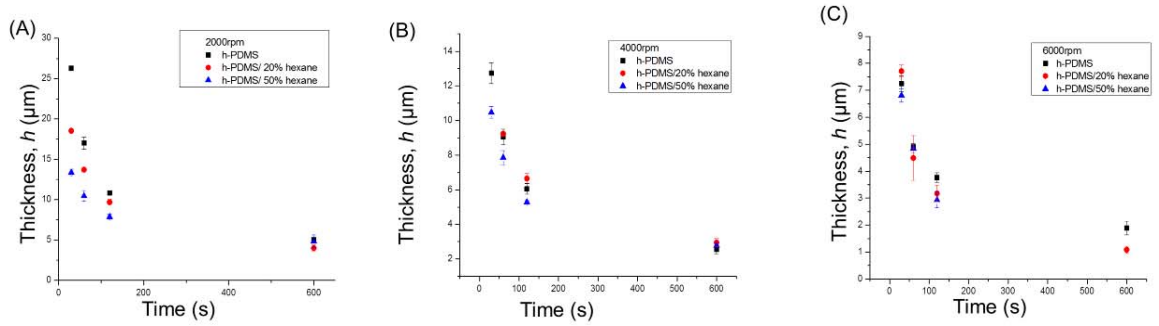

Figure S1. The thickness of spin-coated hPDMS films can be manipulated by diluting the h-PDMS in hexane. The decreased viscosity of the prepolymer enables thinner films. These thinner films are not significantly different over long spin times owing to increased solvent evaporation during the spin-coating process.

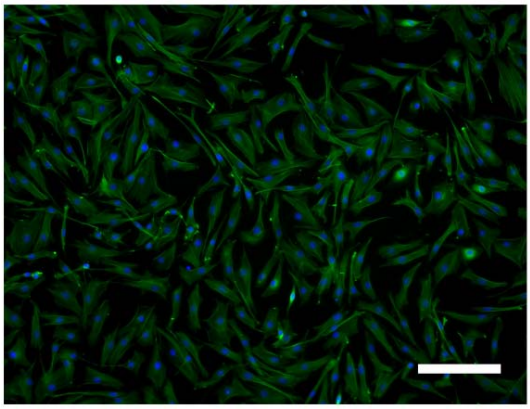

Figure S2. To demonstrate biocompatibility of the surface, NIH 3T3 cells were plated onto the h-PDMS surface in fully supplemented Dulbecco's Modified Eagle Medium (DMEM, supplemented with 10% fetal bovine serum, 1% antibiotics-antimycotics). Fibronectin (FN) extracellular matrix protein was used as an adhesive layer by incubating with 10 µg/mL FN (Sigma) for 30 minutes, prior to cell seeding. After one day in culture, the cells were fixed, and fluorescently stained for actin cytoskeletal structure (phalloidin-488; FITC) and cell nuclei (Hoechst 33258; DAPI). NIH 3T3 cells adopt a standard morphology when cultured on fibronectin-coated h-PDMS surfaces (green = actin fibers; blue = cell nuclei). Scale bar: 200 µm.

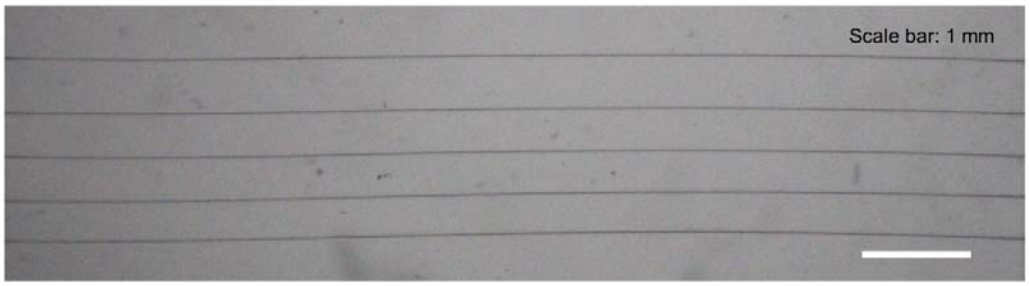

Figure S3. Fracture-fabricated microstructures extend into the centimeter-length scale regime. The maximum length of a crack is limited only by the ability to maintain a constant loading profile over a large area (scale bar = 1mm).

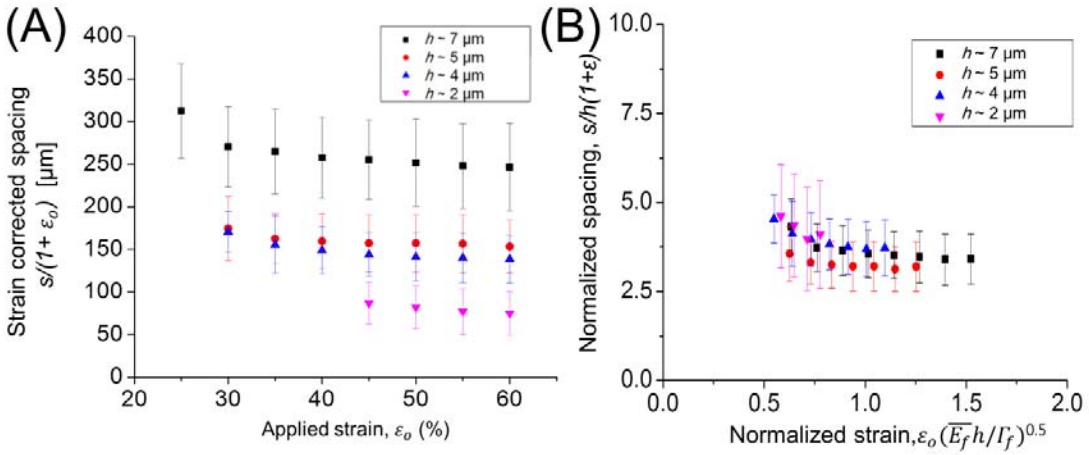

Figure S4. Characterization of spacing between cracks generated in the h-PDMS/PDMS material system. (A) As expected based on theoretical fracture mechanics, the critical strain required to generate cracks is inversely proportional to the thickness of the h-PDMS layer; and the spacing between cracks is proportional to the thickness of the h-PDMS layer and exhibits large variations in spacing within each condition. (B) Non-dimensionalizing the crack spacing data collapses the results to a single curve, indicating that the cracks are strongly localized to the h-PDMS layer.

Supplemental Movie 1. Optical video microscopy of crack propagation and specimen failure in a representative h-PDMS tensile dog-bone sample.

Supplemental Movie 2. V-notch structures localize stresses in the h-PDMS film and dictate the location of fracture-fabricated channels when tension is applied to the system.