Supporting information to accompany

Micropatterned functional interfaces on elastic substrates fabricated by fixing out of plane deformations

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Table 1º. Measured QNM Young Modulus and bulk Young Modulus of the PDMS substrates with different Silicon oligomer /Catalyst (SO/C ratio).

Formulation SO/C	**QNM Young Modulus (MPa)**	**Bulk Young Modulus**
10:1	4.3	7.8 MPa
15:1	3.0	
20:1	2.6	
30:1	2.1	
40:1	1.0	
50:1	0.5	0.6 MPa

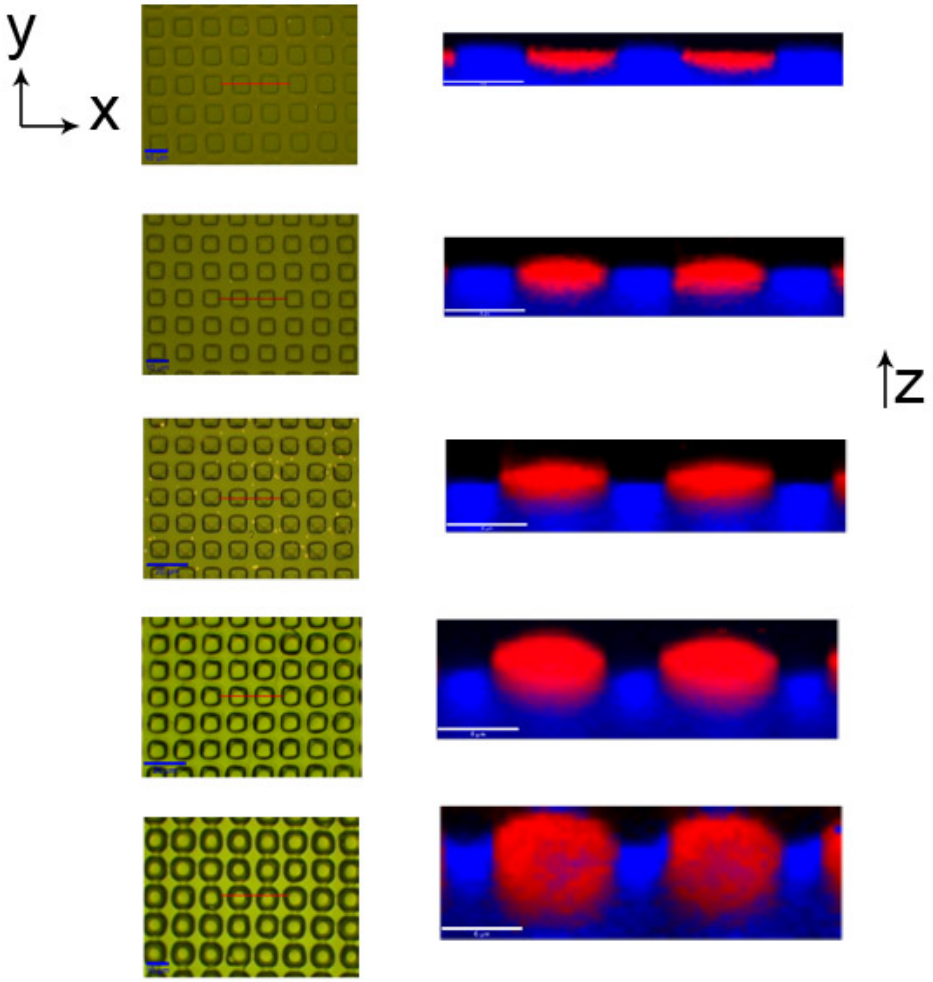

Figure S1: Left: top-view optical images of the patterned PDMS surfaces. Right: cross-sectional Raman images of the different PDMS treated using the $M_{12,7}$ grid and applying 0.81 MPa during the ozonation process. From top to down the silicon were prepared using the following silicon oligomer to catalyst ratio (SO/C): 10:1, 20:1, 30:1, 40:1 and 50:1. White bars in the images correspond to 5 μm

Details of the simulation to obtain Von-Misses stress distribution.

The simulation was performed the solid mechanics modulus of COMSOL 5.6 software. For that, a solid plate with varying dimensions and mechanical properties were simulated. Releasing the pressure applied during the formation of the patched surface produces a vertical force on the formed rigid plates that arises from the compliant substrate. In the simulations, the magnitude of this force per area has been approximated to have the value of the applied external pressure. The fact that the plate is attached also laterally to the compliant substrate is simulated forcing the lateral planes of the plate to be fixed. These has been schematically explained in Figure S2.

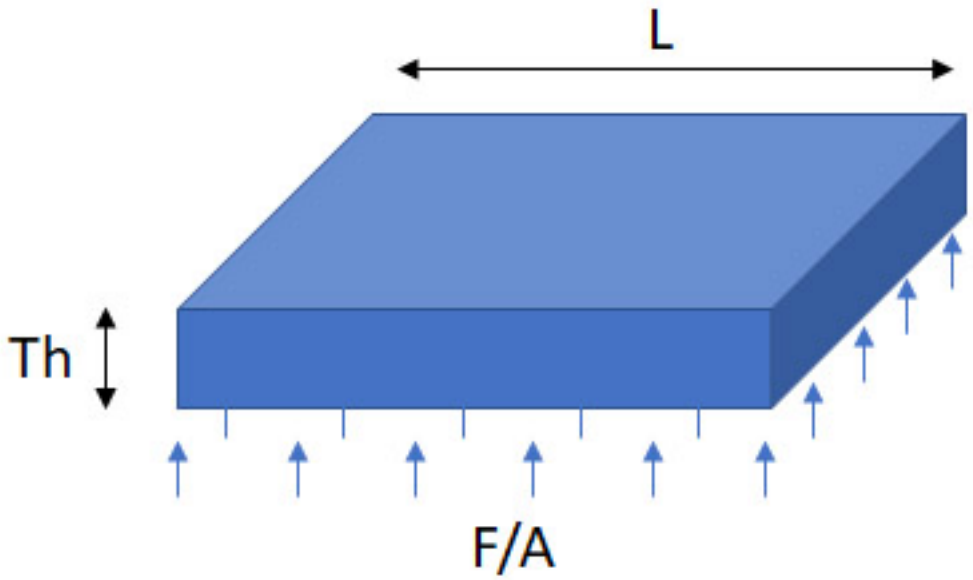

Figure S.2. Scheme of the main parameters considered in the simulations. The lateral sides of the plate are fixed.

The rigid plate was modelized as being a linear elastic material whose Young modulus was obtained from the QNM measurements. The calculations were performed by using an extrafine free tetrahedral mesh from the model builder node of COMSOL, and in a stationary mode for the minimization of energy. Different sets of calculations were performed. In the first set, the aim is to understand the role of the magnitude of the applied external pressure on the deformation of the rigid plate. For that, we chose a rigid plate with a Young modulus of E_s^{ox}=7.88 MPa, a size of the square side L of 38 μm, and a thickness Th of 1.19 μm (obtained from the Raman measurements). Figure S.3 shows the distribution of stresses obtained for different magnitudes of the applied pressure.

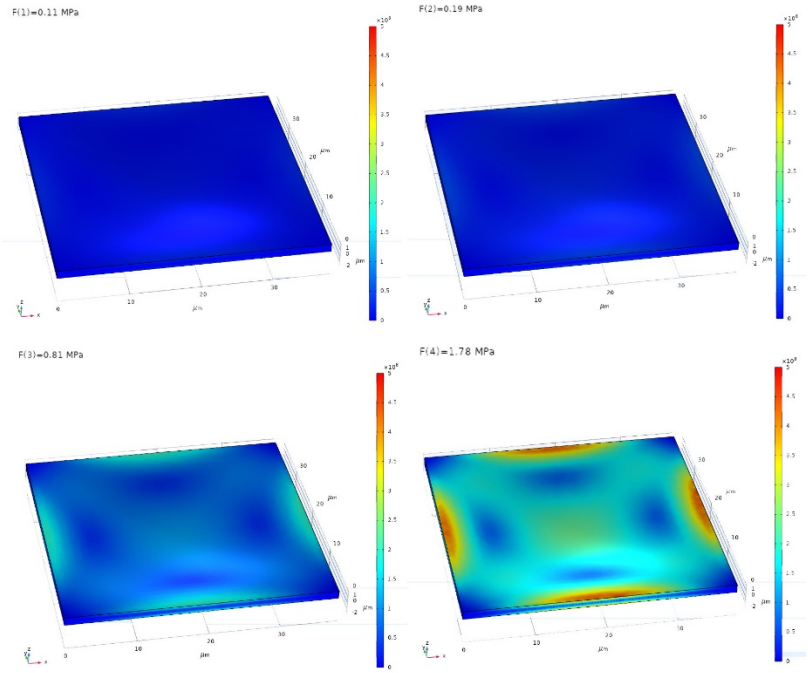

Figure S.3. Distribution of Von Misses stresses in a plate of Young Modulus of 7.88 MPa, a square side of 38 μm and a thickness of 1.19 μm.

As mentioned in the main text, the thickness and the Young Modulus (E_s^{ox}) of the created rigid plate by oxidation is related to the Young modulus of the original PDMS (E_s^0). To observe the distribution of stresses in the plates created from different original PDMS, a set of simulations were performed on a plate of size of 12 mm, with different thicknesses and mechanical properties, corresponding to those of the experimental values. The results are presented in Figure S.4.

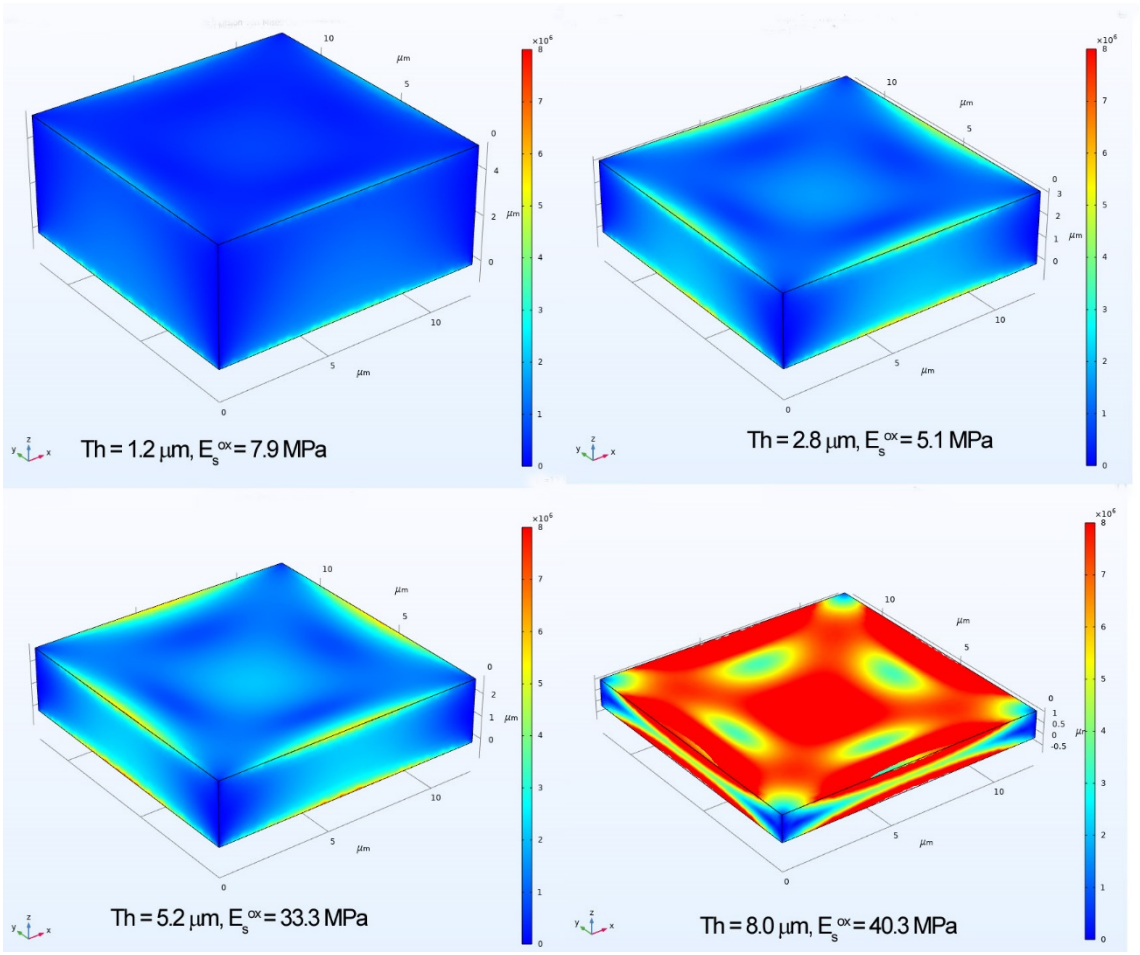

Figure S.4. Distribution of Von Misses strain in a square plate of 12 μm side size with varying thickness and Young modulus as indicated in the labels.

The final set of simulations were performed to probe the role of plate size for fixed mechanical properties and thickness. Results are presented in Figure S.5

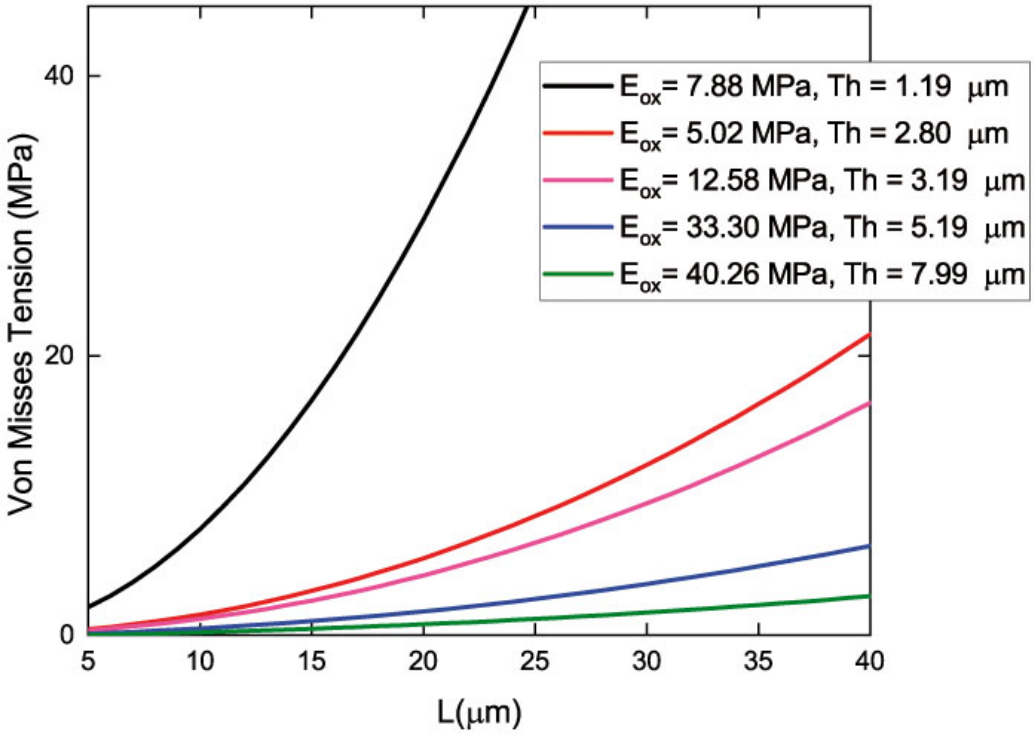

Figure S5. Dependence of the Von Misses tension at the center of the top face of the plate as a function of the length of the plate for different thicknesses and mechanical properties, similar to the ones measured by QNM-AFM, as indicated in the label.

Details of the simulation of the stress distribution using COMSOL Multiphysics 5.6. The Solid Mechanics interface was utilized to define the features and boundary conditions for the mechanical analysis. Finite element calculations were performed by extra fine meshing the rigid plates with standard procedures defined by the Solid Mechanics interface and the dimension of the simulated object. An example of mesh is shown in Figure S3. The mechanical properties of the material were imposed to match those obtained by QNM experiments.

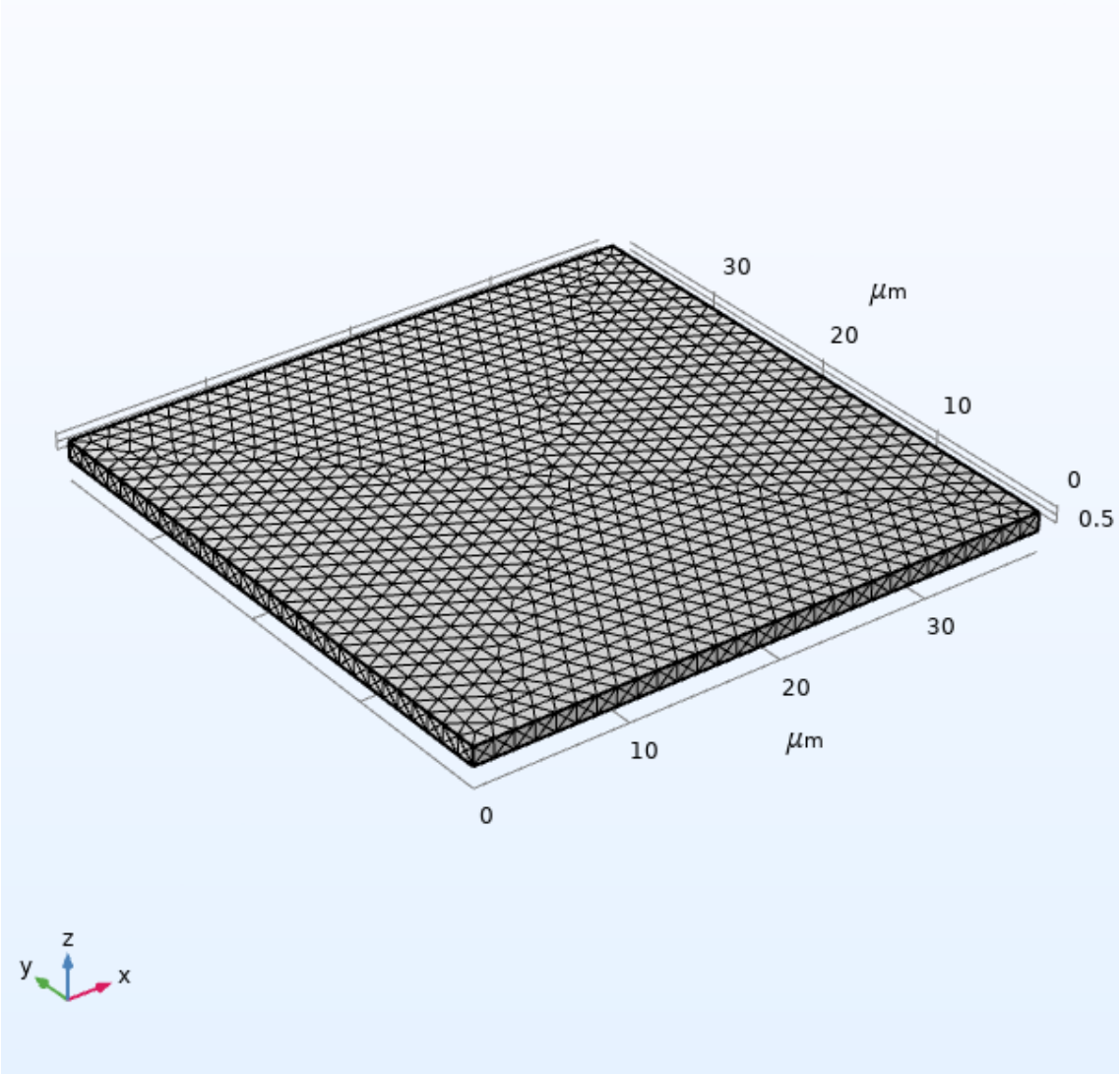

Figure S3: Meshing for the finite elements calculation for an example plate used in the simulation of the Von Misses stresses.

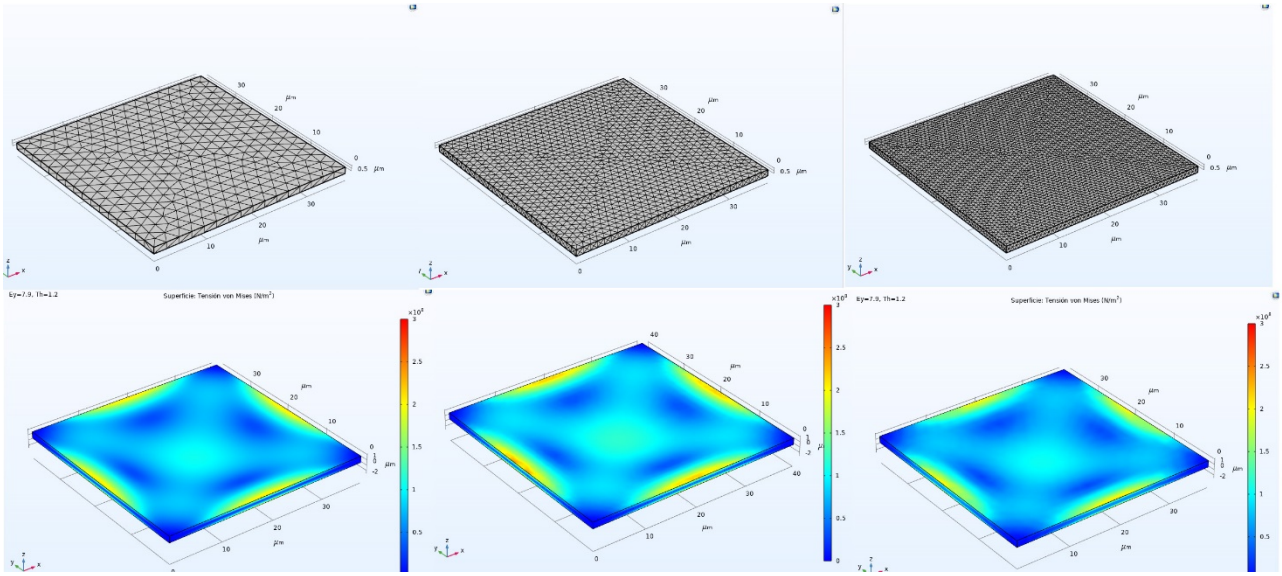

Figure S4: Simulations obtained for different mesh sizes, smaller and larger than the one presented in the main text. Quantitatively similar results are obtained.