

Supplementary information

Fabrication

A scheme of the fabrication process, described in the technical notes, is reported in Fig. S1.

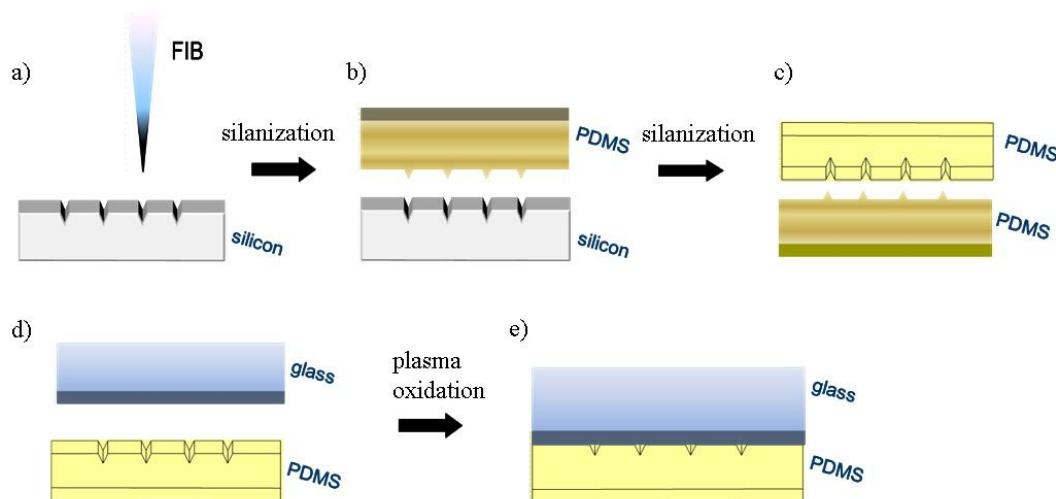


Fig. S1 a) Nanostructures are patterned on a silicon mould using a Focused Ion Beam (FIB) and silanized with FOTS; b) Fabrication of the polymeric negative replica: a thin layer of h-PDMS or 3:1 PDMS is deposited, by spin coating, on the silicon mould, and baked at 60 °C for 30 minutes, then a thick layer of 10:1 PDMS is poured on the mould. After baking at 60 °C for 4 hours, the negative replica is peeled off from the silicon master, treated with an oxygen plasma and exposed to FOTS vapours; c) Fabrication of the polymeric positive replica: the procedure, described at point b), is repeated using the negative replica as a mould (for composite replicas, made of a thin layer of 3:1 PDMS, a bake overnight at 150 °C is performed); d) Sealing of the nanostructures requires the oxidation of the polymer surface, thus the positive replica is exposed to an oxygen plasma treatment and brought into contact with a glass cover slip or a thin oxidized PDMS layer; e) Sealed polymeric nanofluidic device.

Characterization of the nanostructures fabricated on the polymeric device

The profile of the polymeric replica, used for the fabrication of nanochannels, as small as 50 nm (shown in Fig. 2 d of the technical notes), is reported in Fig. S2.

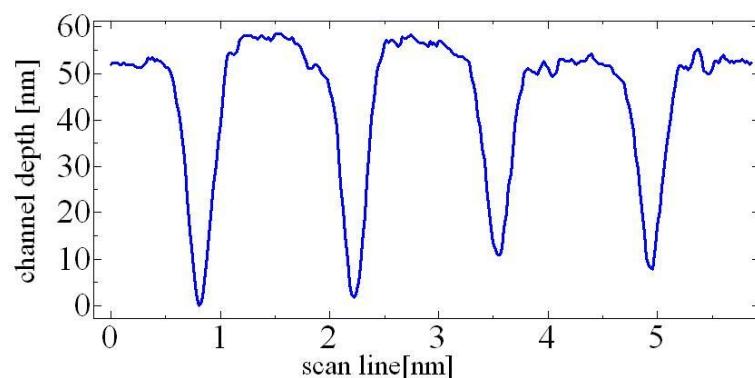


Fig. S2

AFM measurements, performed on the nanochannels used for DNA stretching experiments, are depicted in the following figures.

The profile of the nanochannels used to stretch the λ -DNA molecules (reported in Fig. 5 c of the technical notes) are shown in Fig. S3.

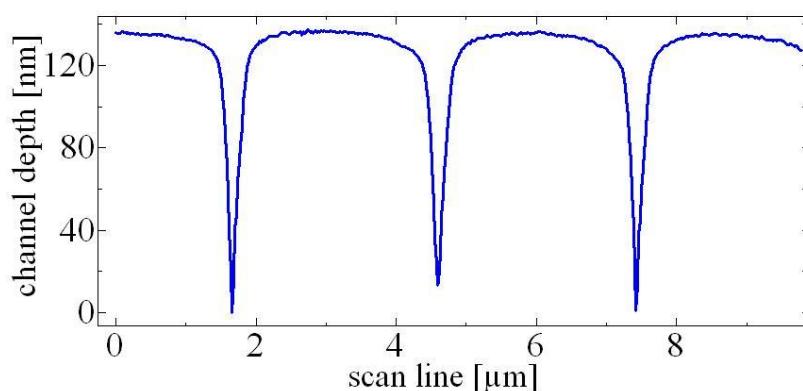


Fig. S3.

The profile of the nanochannels used to stretch the λ -DNA molecules (reported in Fig. 5 d of the paper), are shown in Fig. S4.

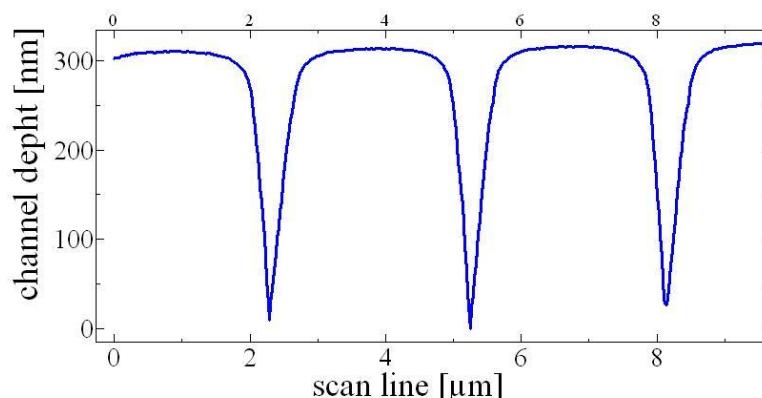


Fig. S4.

Electrical measurements

Ionic current measurements were performed to estimate variations of the nanochannels cross section during the application of compressive stress.

We used a composite device (3:1 PDMS/10:1 PDMS) with ten channels 1 μm wide and 290 nm deep and three larger channels (1.6 μm wide, 290 nm deep). The dimensions of the reliefs on the positive replica were measured by AFM.

A solution of KCl 1M was inserted into the device and the resistance of the nanochannels was measured applying a voltage of 50 mV.

With no pressure, the measured resistance was about 7.3 $M\Omega$, a higher value (nearly 5%) compared to the expected one calculated considering the dimensions of the nanochannels and the conductivity of the solution (10 S/m at 25°C). This slight discrepancy was probably due to a partial collapse of the nanochannels during the sealing process.

When a compressive stress was applied, we measured an increase of the resistance, which was related to a temporary reduction of the cross section of the nanochannels (up to 30%).

After the removal of the compressive stress from the device, the resistance recovered its initial value confirming that cross section tuning can be reversible.

Movies on DNA molecules behaviour inside nanostructures

Movies on λ -DNA migration through nanochannels and nanostructures are provided with the paper:

File name: nanochannel

This file shows the passage of a λ -DNA molecule inside a nanochannel 290 nm deep and 1 μm wide when electric field is applied.

File name: nanostructures

This file shows the passage of a λ -DNA molecule inside nanostructures of variable cross section, whose cross section is shown, in Fig. 3 a, when an external voltage of 50V is applied.