Supplementary Material (ESI) for Lab on a Chip

Tunable Separation in Elastomeric Microfluidic Devices

Jason P. Beech *[a] and Jonas O. Tegenfeldt[b]

[a] *Division of Solid State Physics, Lund, Sweden. Fax: 46 2223637; Tel: 46 222 1472; E-mail: jason.beech@ftf.lth.se*
[b] *Division of Solid State Physics, Lund, Sweden. Fax: 46 2223637; Tel: 46 222 8063; E-mail: jonas.tegenfeldt@ftf.lth.se*

1. Device Fabrication.

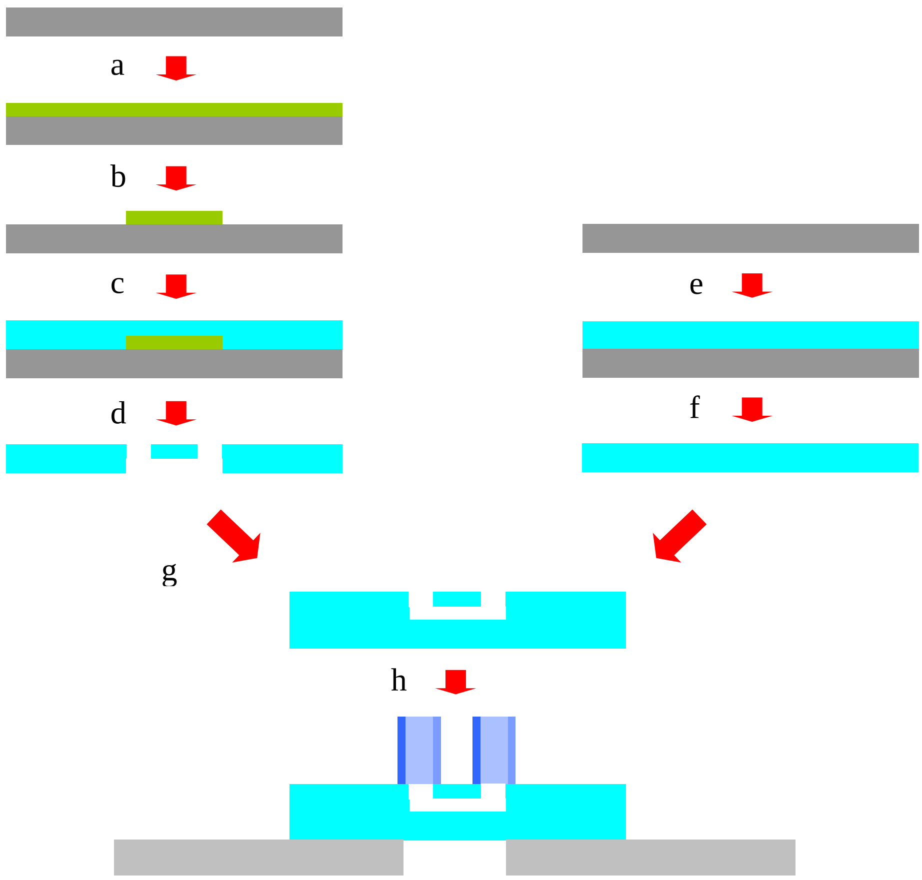

Figure 1.1. Fabrication of Elastic Deterministic Lateral Displacement device (Elastic DLD).

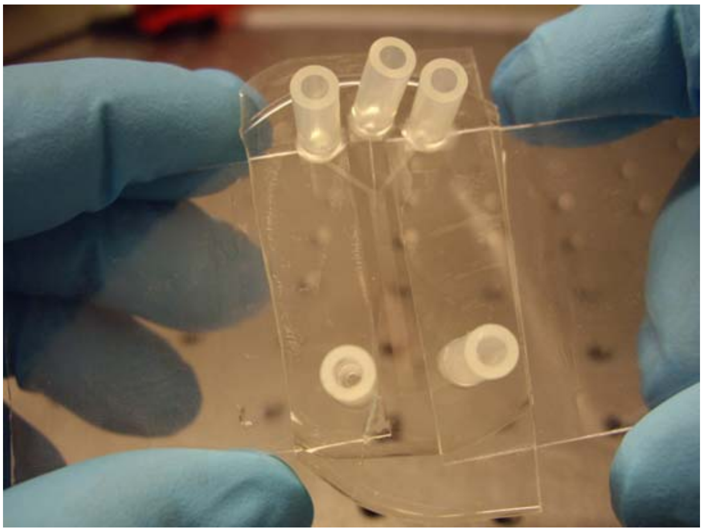

Figure 1.2. Photograph of Elastic DLD device, ready for mounting in stretcher chuck.

Figure 1.1 illustrates the fabrication process used for the tunable separation devices. In order to fabricate the master for soft lithography SU8 50 (MicroChem, Newton, MA) was spin coated onto a 2” silicon wafer to a thickness of 50µm (a) and patterned using UV light in a contact mask aligner (Karl Suss) (b). Before casting the master was given an anti-adhesion layer of Tridecafluoro-(1,1,2,2)-tetrahydrooctyl-trichlorosilane (F_{13}-TCS) to facilitate demolding. PDMS (RTV 615 A&B General Electric) was mixed to a ratio of 9:1, degassed, poured onto the master and baked for 1 hour (c). A PDMS blank was fabricated using a blank, F_{13}-TCS treated silicon wafer (e and f). Access holes where punched in the patterned PDMS slab (g) using a 1mm hollow steel tube. After surface treatment with oxygen plasma (Plasma Preen II-862, Plasmatic Systems, Inc, North Brunswick, NJ) the patterned and blank slabs were bonded, forming closed channels (h). Finally, silicone tubes for fluidic contacts and glass slides where glued to the device using silicone adhesive (Elastosil AO7, RTV-1 silicone rubber, Wacker Silicones). The glass slides functioned both as anchor points that could be easily clamped into the stretcher chuck and also to ensure that strain was applied as homogeneously as possible to the part of the device that contained the post array.

Figure 1.2 shows a finished device. The image shows the three entrance reservoirs at the top. The two outer most reservoirs were filled with an aqueous 0.1% solution of Pluronics F127 (BASF) and the central reservoir was filled with a 0.001% mass/volume suspension of polystyrene beads (Duke Scientific). Flow was created by use of a vacuum pump (Laboport, model N86KN18, KNF Lab Neuberger). Attached to the two outlet reservoirs that can be seen at the bottom of the image.

2. Stretcher Chuck

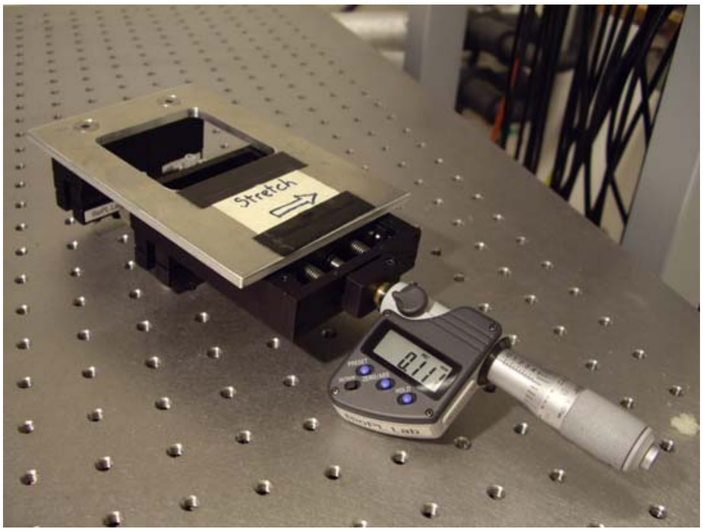

Figure 2.1. Photograph of stretcher chuck.

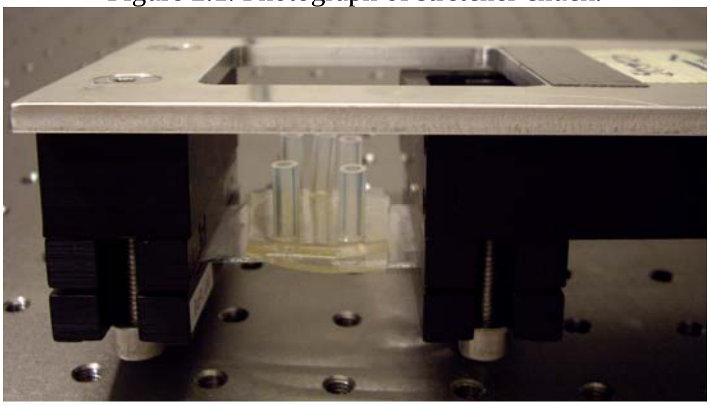

Figure 2.2. Elastic DLD device, mounted in stretcher chuck.

3. Film of stretching in real time.

The film (real time elastic dld device.mov) shows beads, smaller than the cutoff in a device with strain applied, flowing from left right following the direction of the pressure driven flow. Starting at 15s the strain is removed from the device and at 25s the cutoff in the device has decreased to below the size of the beads. From 25s onward the beads, being smaller than the cutoff, follow the post array. Figure 3.1 is a colour-enhanced image showing the sum of the frames both before (red) and after (green) the removal of strain from the device highlighting the difference between the two modes.

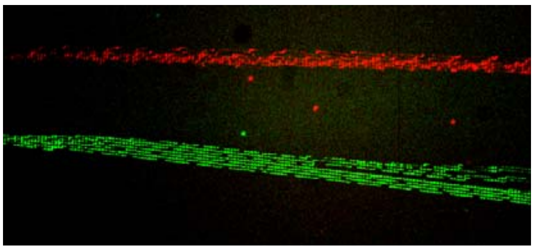

Figure 3.1. Trajectories of beads before (red) and after (green) relaxation of the device.