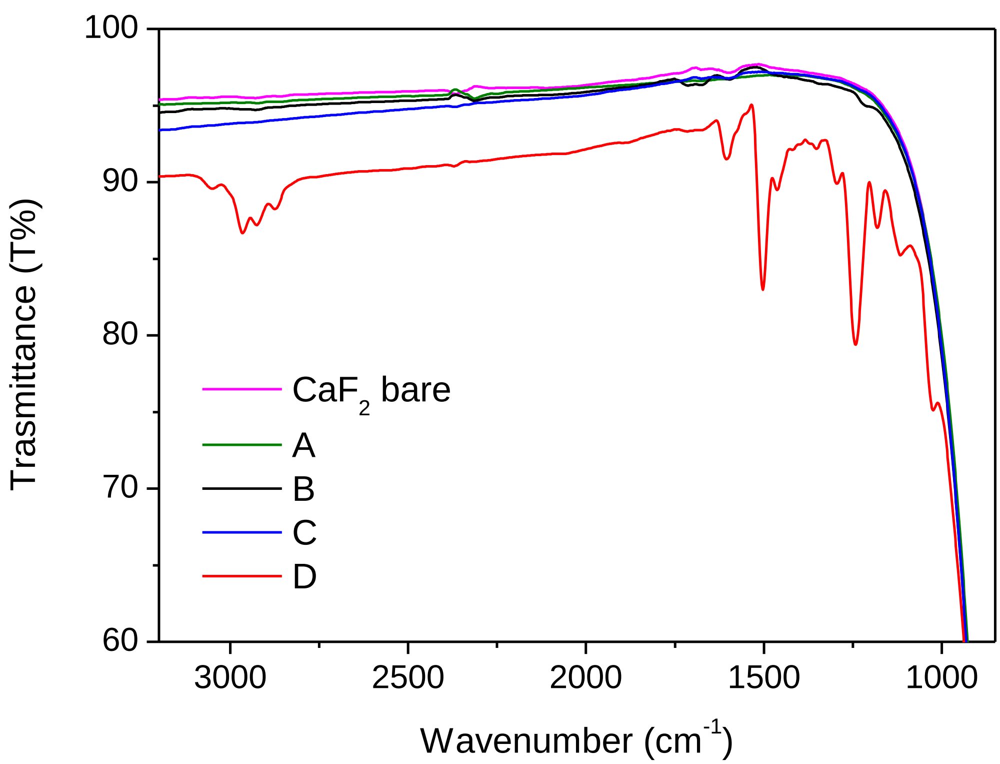
ESI 1: Effects of silicon layers and Omnicoat on the IR transparency of $CaF_2$

Graph 1 shows the transmittance curves of a $CaF_2$ optical window 1 mm thick, both bare and with different surface modifications, as listed in Table 1. The deposition of a thin silicon layer on top of the IR window causes negligible modifications of its optical properties in the mid-IR region. Noticeably, 30 nm thick Omnicoat layer is thin enough for being undetectable.
In curve D can be seen that even a thin layer of SU-8 polymer (300 nm) gives a background signal that super-imposes to and somewhere hides the one of the sample.

**Table 1:** Surface modifications

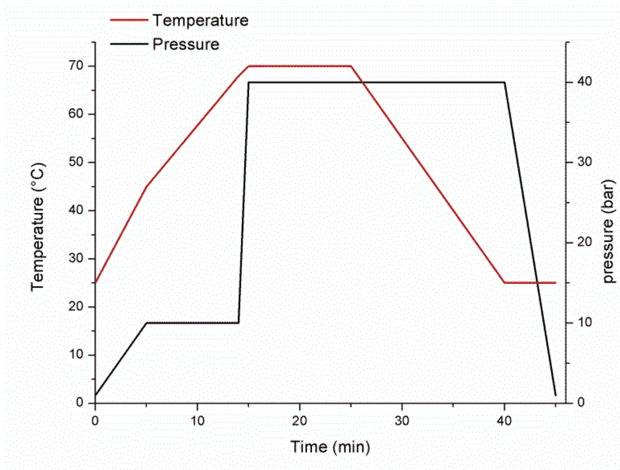
| Identifier | Surface modification |
|---|---|
| A | 10 nm of Sputtered silicon |
| B | 10 nm of Sputtered silicon + 30 nm of Omnicoat |
| C | 20 nm of Sputtered Silicon |
| D | 10 nm of Sputtered silicon + 30 nm of Omnicoat + 300 nm of SU8 |




**Graph 1**: IR transmittance of bare $CaF_2$ optical windows (1mm thickness) compared with different SM-$CaF_2$ windows, done as described in Table 1.

ESI 2: Device Fabrication and Assembly of the system

Graph 2 reports the thermo-mechanical cycle applied during the bonding process described in experimental section. The two halves of the device were bought into contact and temperature was raised to 45°C with a ramp-rate of 4°/min; a pressure of 10 bar was then applied and kept constant. Temperature is further increased till reaching 70 °C with a ramp-rate of 2.5°C/min; a pressure of 40 bar is applied. After 10 minutes the system was cooled down and at the end pressure is released




**Graph 2** thermo-mechanical cycle applied during the bonding protocol

The fabricated device was enclosed in a plastic holder made by two halves clamped together, which also provides for fluidic connections to the external pumping system through rubber O-rings (see inset of Fig. 1). During all the experiments this assembly was maintained at 37±0.2 °C with a heating strip controlled with a PT-100 thermocouple. Figure 1 shows the set up placed under the microscope.

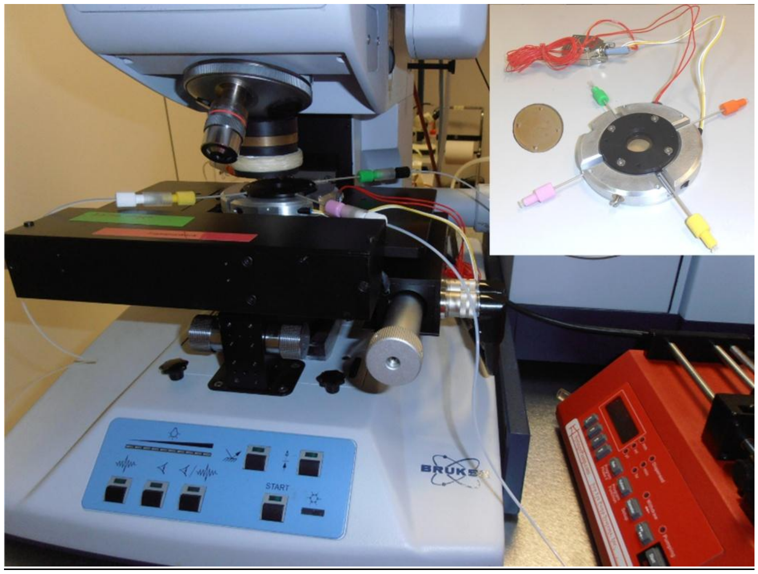


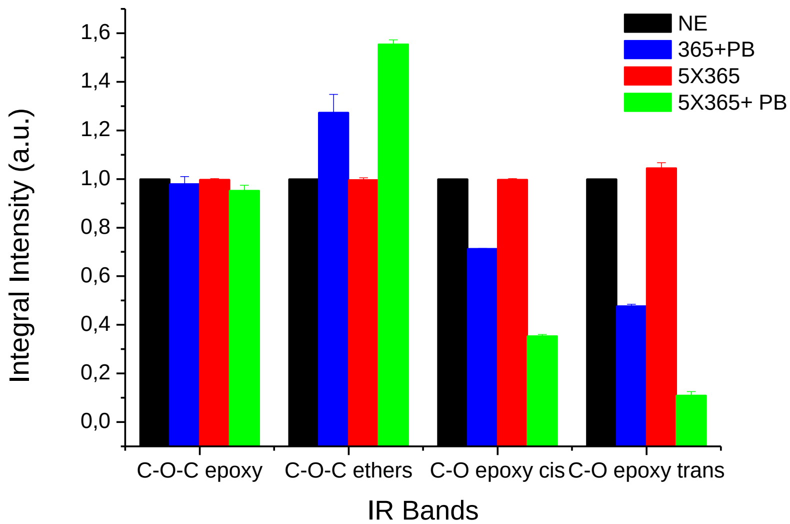

**Figure 1:** Experimental set up at SISSI Beamline, ELETTRA-Trieste. The Bruker Hyperion 3000 Vis–IR microscope is equipped with 15X Schwartzchild optics, a HgCdTe (Mercury-Cadmium-Telluride, MCT) detector and encoded stage. The inset shows the microfluidic device clamped into the plastic holder and accommodated in the heating system.

ESI 3: Behavior of SU-8 resist upon exposure at UV light of different wavelength

Graph 2 reports the effects of an overexposure to 365 nm on SU-8. As can be seen there is an increase in the conversion efficiency of epoxy to ether C-O-C linkage; however, the post-exposure bake is necessary to promote it.

**Table 2** Exposure conditions

| #Identifier | Conditions |
|---|---|
| NE | Not exposed |
| 365+PB | Exposed to 365 nm at recommended dose (120 mJ/cm$^2$) and post-baked |
| 5X365 | Exposed to 365 nm, 5 times the recommended dose (600 mJ/cm$^2$) |
| 5X365+PB | Exposed to 365 nm, 5 times the recommended dose (600 mJ/cm$^2$) and post-baked |




**Graph 2:** Integrated intensities of selected peaks of SU-8 spectra (C-O-C bonds in epoxy rings, C-O bond in *trans*- and *cis*- substituted epoxy rings, C-O-C in ethers) for different exposure conditions. All spectra were normalized to the area of the peak centered at 1500 cm$^{-1}$, related to the C-C stretching of the aromatic rings of bisphenol, that are not involved in the polymerization reaction.

ESI 4: Behavior of the device under experimental conditions

The tightness of the sealing was tested by following two different strategies.

- FPA images of the device continuously fed with DI water were collected. The images were obtained by integrating the spectral region between 3000-2800 cm$^{-1}$, where vibrational bands of aliphatic SU-8 chains are, and water bending band centered at ~1645 cm$^{-1}$. As can be seen from movie1_ESI, signals of water are detectable only inside the channels, while signals of the resin are only detectable outside the channels

- A continuous flow of DI water at 8 µl/h was applied by a syringe pump connected to the central in-let channel for 48 h. Optical images were then collected at 10x magnification with a Leica stereoscopic microscope and a CCD camera with PC control every 15s for the first 2h of experiments, then the time frame was set to 15 min for the remaining observation period up to a total of 48h. Images were then loaded into ImageJ software and mounted as a movie with a time label to show the time course.

Movie1_ESI shows the 3D chemical map of the water filled device based on IR images obtained as described before. The water layer is blue, while the SU-8 layer yellow.

Movie2_ESI shows the in-let channel at the intersection with lateral channels; the device is filled with DI water and the flow rate is 8 µl/hr.

Movie3_ESI shows the exit part of the central chamber after the injection of an air bubble through the lateral channel. The removal of the air by the flowing water demonstrates the good sealing achieved.