Electronic Supplementary Information

A pressure-actuated flow cell for soft X-ray spectromicroscopy in liquid media

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S1. Description of the silicon chips

Both chips were purchased from Norcada (Edmonton, Canada). The tolerances given in the two tables below are the ones guaranteed by the provider. The exact composition of the SiO_xN_y hydrophilic layer that helps filling the flow cell with aqueous solutions, as well as the one of the SiN_x/SiO_2 multilayer spacer, have not been disclosed to us.

Back chip

Part	Material	Thickness	Size
Frame	Si	200 ± 10 µm	6 x 3 ± 0.05 mm
Membrane	$Si_{0.98}N$	50 ± 5 nm	
Membrane coating	SiO_xN_y	8 ± 3 nm	
Window			0.1 x 0.3 ± 0.01 mm
Inlet/outlet			0.1 x 0.1 ± 0.01 mm

Front chip

Part	Material	Thickness	Size
Frame	Si	200 ± 10 µm	6 x 3 ± 0.05 mm
Membrane	$Si_{0.98}N$	50 ± 5 nm	
Membrane coating	SiO_xN_y	8 ± 3 nm	
Window			0.1 x 0.3 ± 0.01 mm
Spacer	SiN_x/SiO_2	3 ± 0.2 µm	

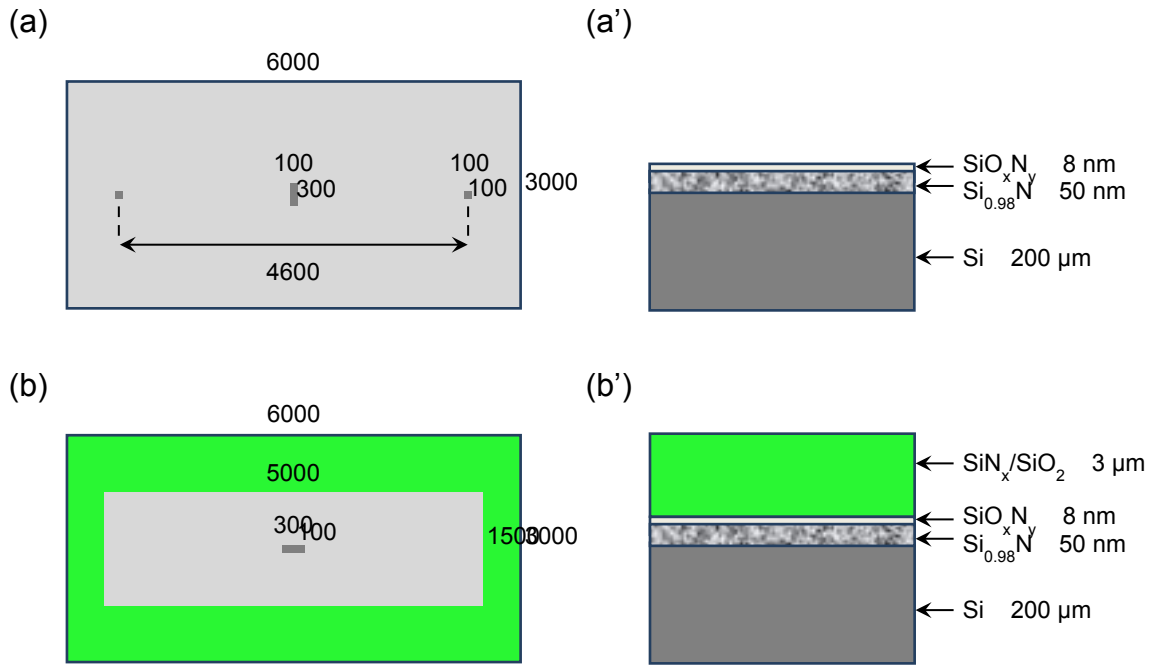


Fig. S1 Layout of the silicon chips. (a) Top and (a') cross-section views of the back chip – not to scale. (b) Top and (b') cross-section views of the front chip – not to scale.

S2. Protocol for the fabrication of the PDMS gaskets

Molds corresponding to negative replica of the back and front gaskets were designed in FreeCAD (Fig. S2a,a' and 2b,b'). Then, they were either fabricated by stereolithography on a Form2 3D printer (FormLabs, Sommerville, MA) using a UV-polymerizable methacrylate resist, or ordered from Sculpteo (Villejuif, France) which realized them relying on the 3D Polyjet technology.

A standard microfabrication protocol was subsequently applied. A homogeneous mixture of monomer and curing agent (10:1 ratio) was prepared from the Sylgard 184 silicone elastomer kit. It was degassed for about 45 min before being poured into the mold cavities. The PDMS-filled molds were then heated at 65 °C in an oven for at least 12 h. After careful unmolding, openings were punched at the center of both gaskets, so as to allow the x-ray beam to pass through the sample, and on both sides of the back gasket to provide accesses to both fluidic inlet and outlet.

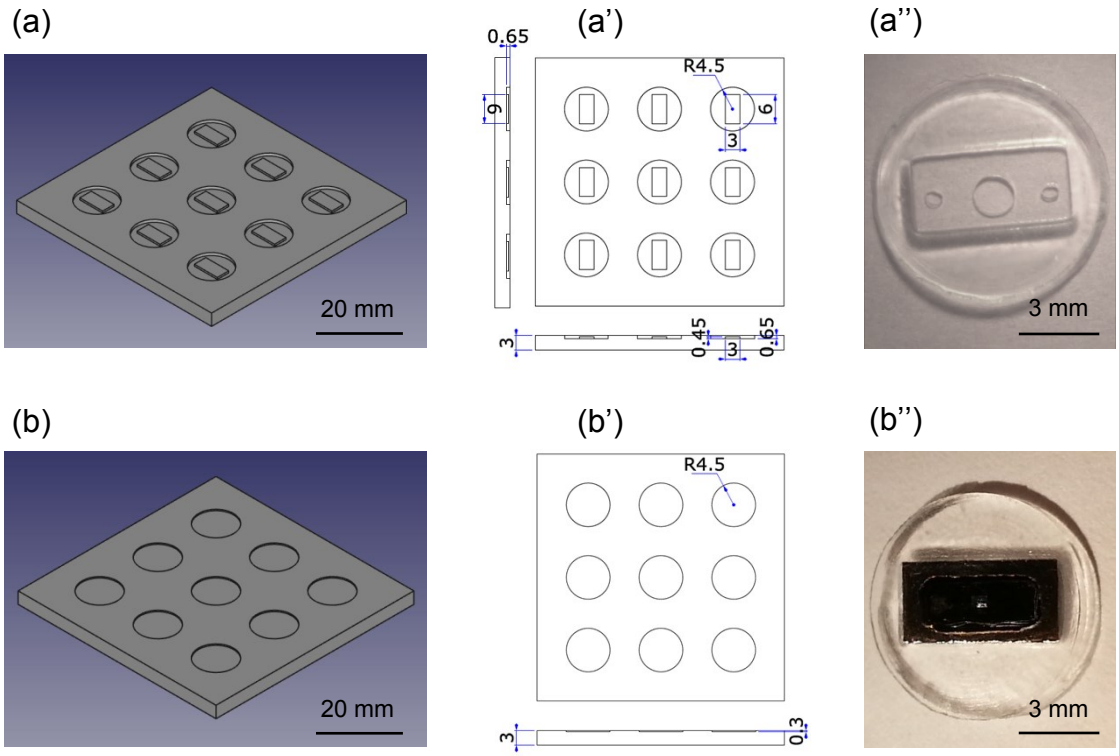
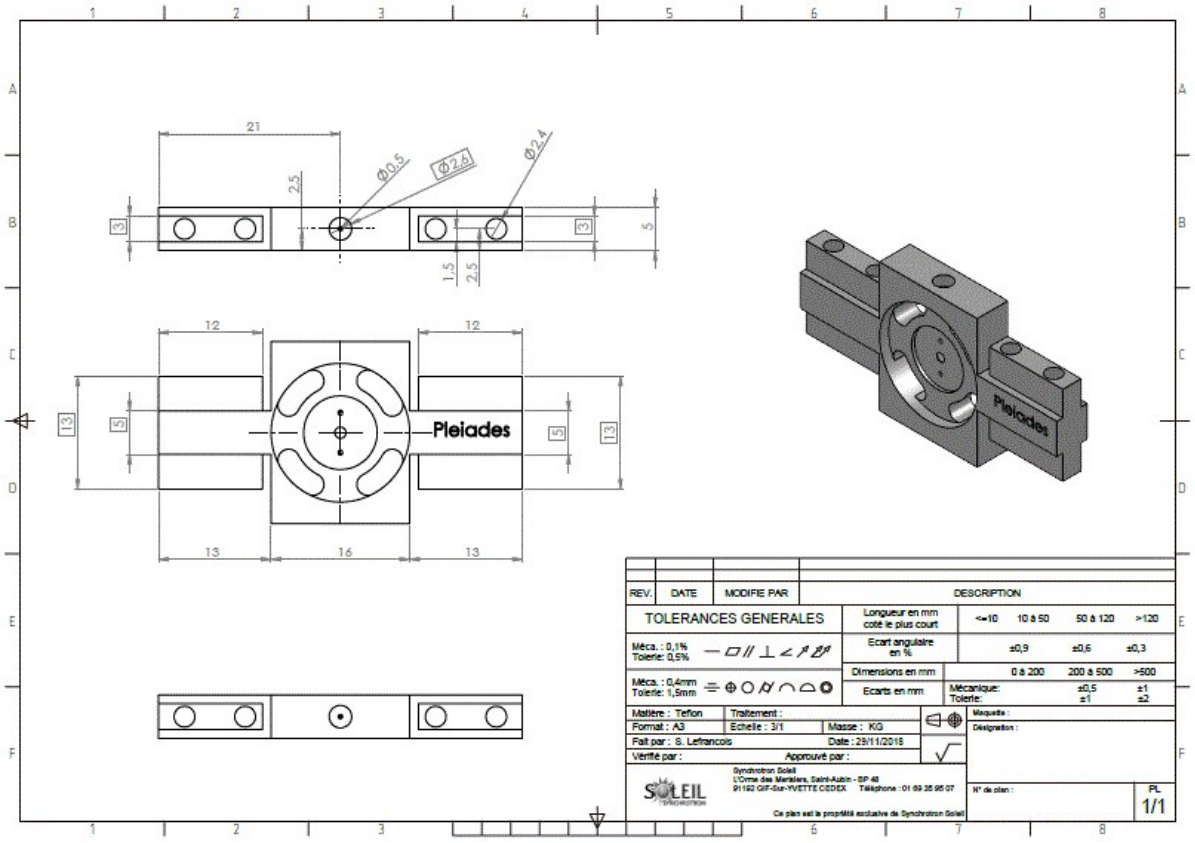
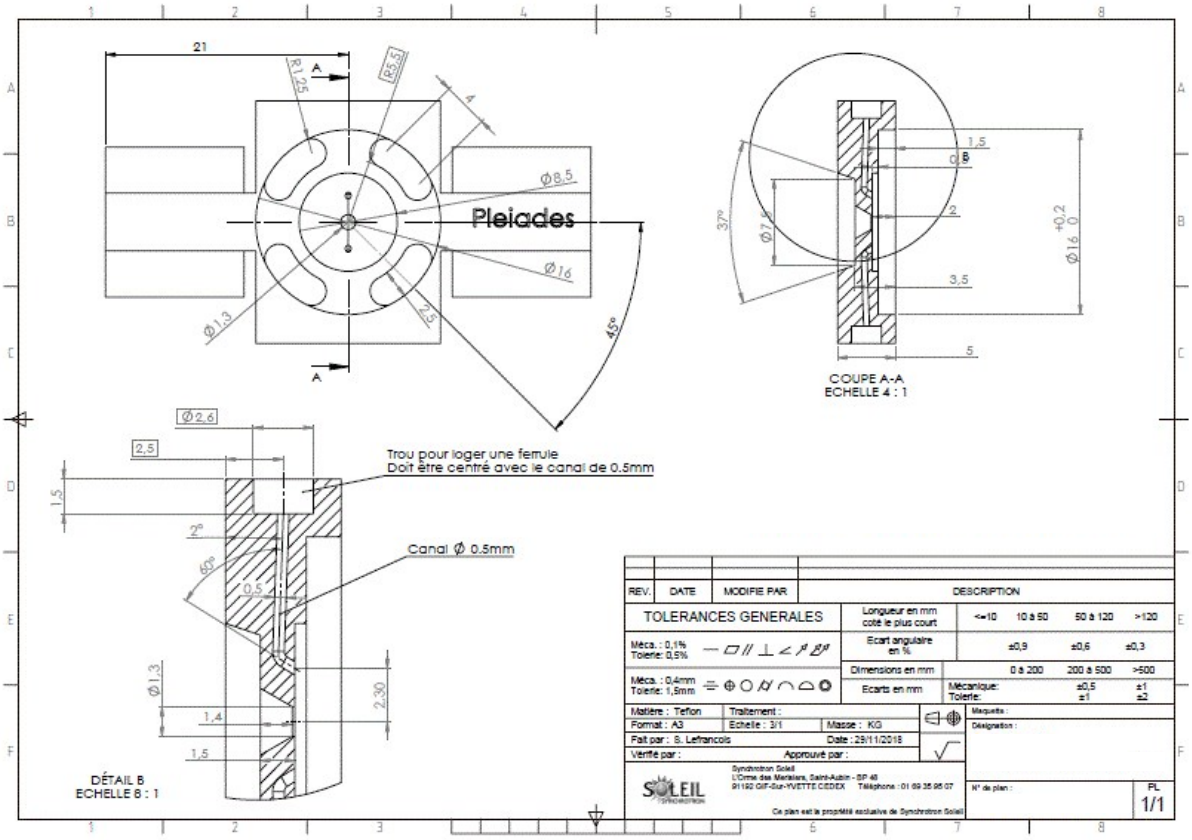


Fig. S2 Fabrication of the PDMS gaskets. (a) Perspective view of the mold used for the back gasket, (a') corresponding technical drawing, and (a'') photograph after holes punching. (b) Perspective view of the mold used for the front gasket, (b') corresponding technical drawing, and (b'') photograph after assembly with the silicon chips and with the back gasket.

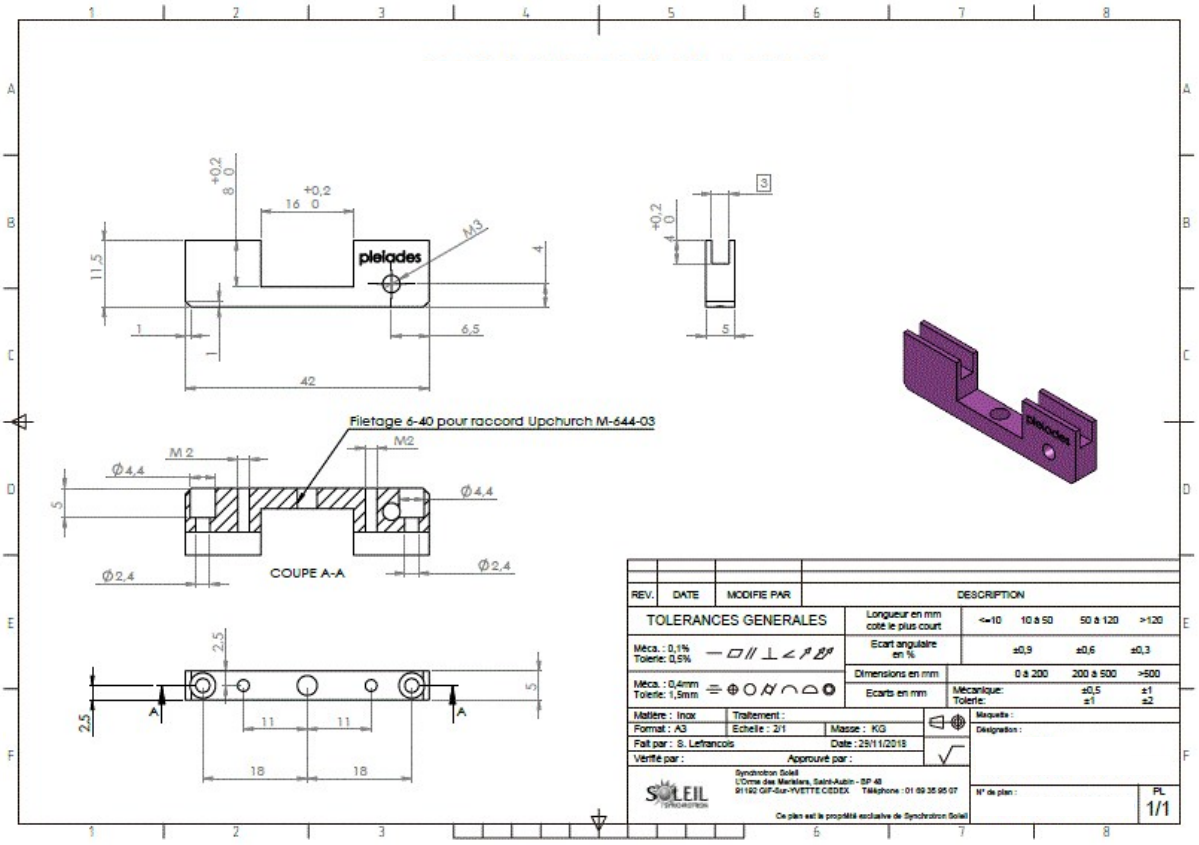
S3. Technical drawings of the flow cell housing and clamping system

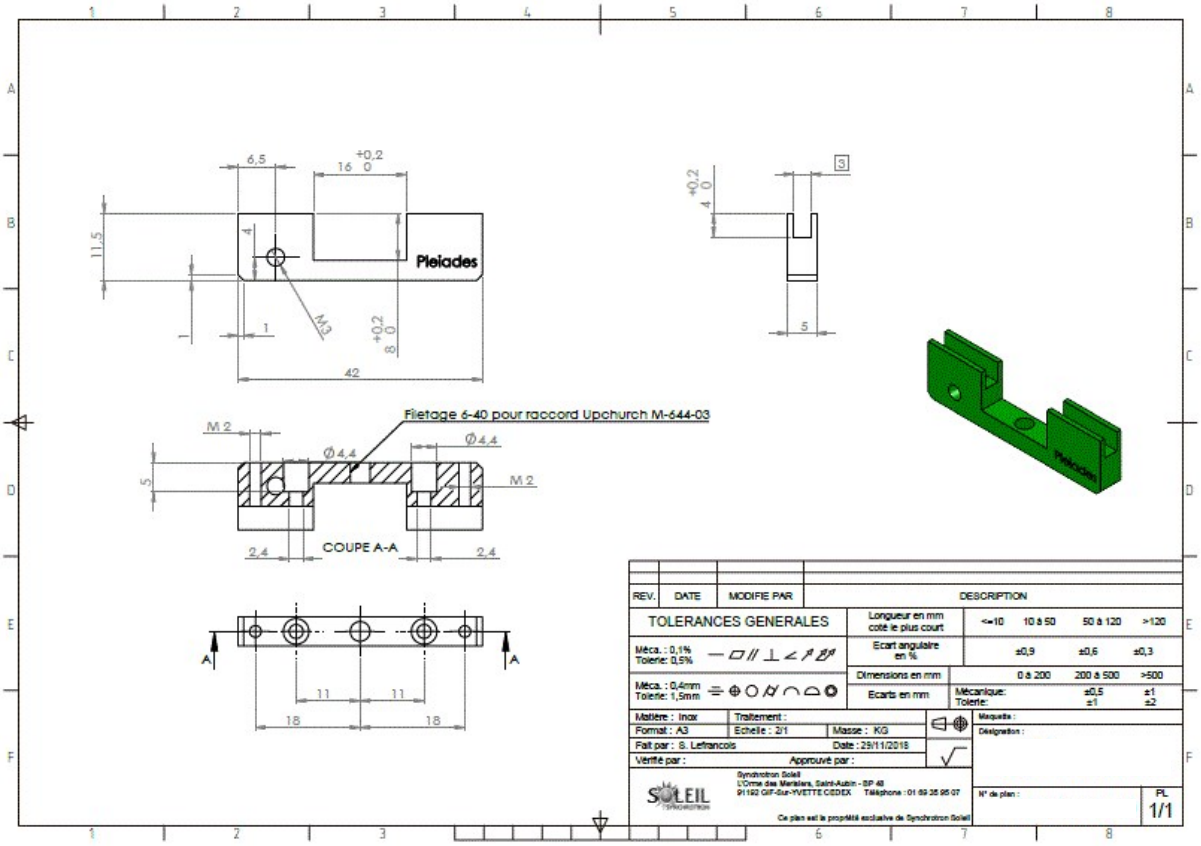
(1) PTFE housing





(2) Stainless steel frames: left and right sides





(3) Clamping system: stainless steel bolt and brass nut