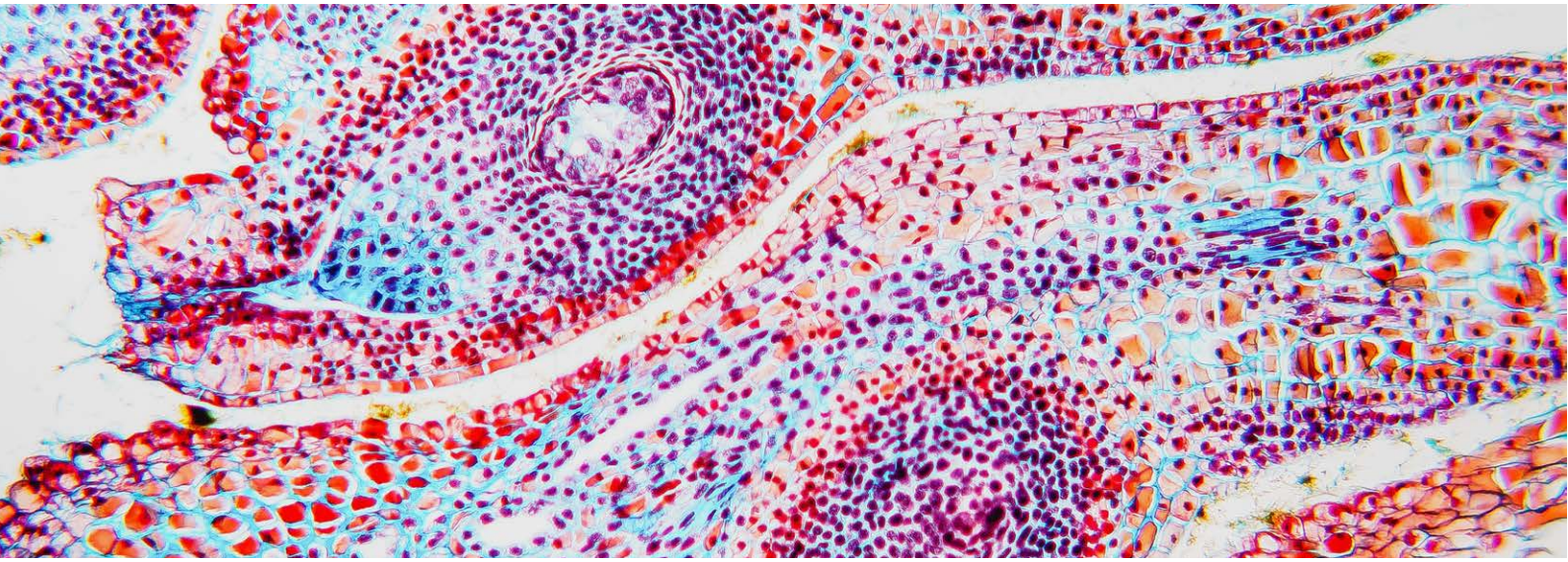


Measurements of the initial deflection of a nano pressure sensor for biological applications

The Barcelona Microelectronics Institute (IMB) is the National Microelectronics Centre (CNM)'s Barcelona location and a member of the Spanish Research Council. IMB-CNM has a focus on basic and applied research and development, in addition to education and training in micro and nanotechnologies, components and systems. Our mission is to expand the knowledge available in this field and to contribute to the implementation of solutions and new products based in these technologies in order to resolve the challenges faced by society today. Project currently being undertaken by Ms. Marta Duch.

In the fabrication of nano pressure sensors for biological applications, the sacrificial layer etching and the sealing of the two membranes separated by a vacuum gap to form a Fabry–Pérot resonator is critical. Knowing the exact timing of the initial deflection of the membrane after the fabrication process is also key.

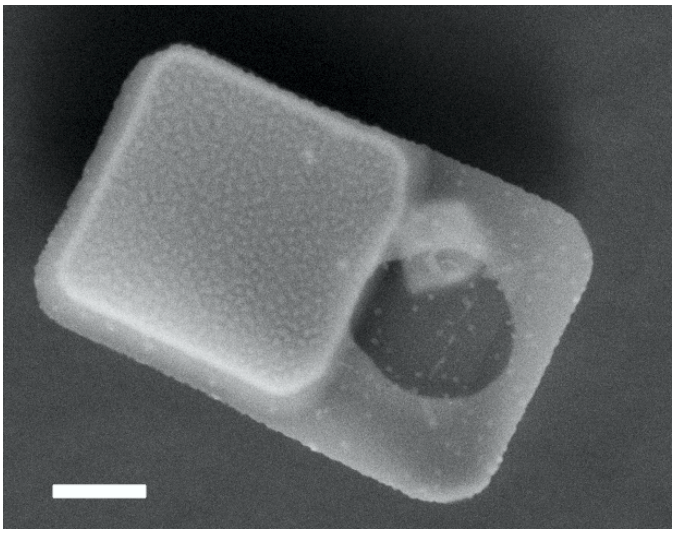


Figure [1] *SEM image of the fabricated pressure sensors. Bar scale 1 µm.*

Measurements

The pressure sensor is a 6x10 µm chip comprised of a mechanical sensor defined by two polysilicon membranes separated by a vacuum gap, and an optical reference area. The membranes act as parallel reflecting mirrors, constituting a Fabry–Pèrot resonator that is partially transparent for some wavelengths. An external pressure P deflects the membranes and changes the gap. This device was designed to measure pressure changes inside the different components of a living cell.

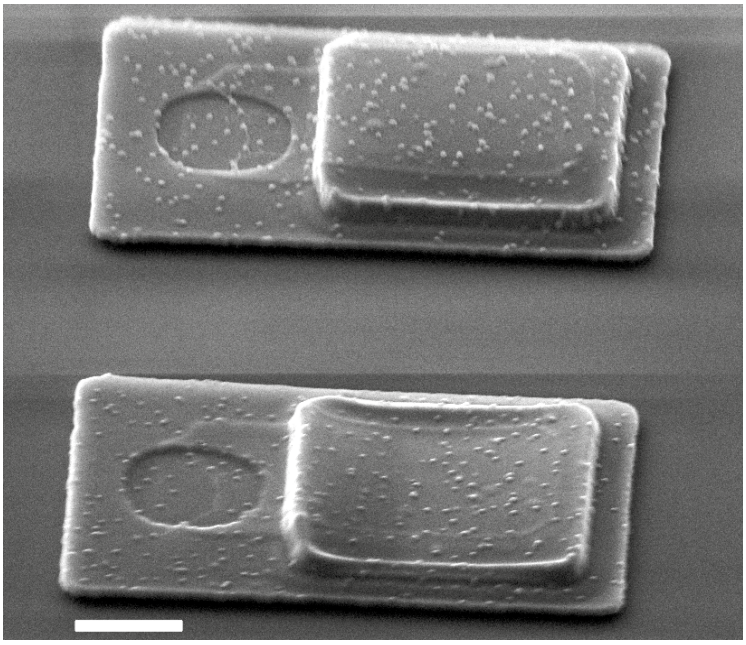


Figure [2] *Device with a non-collapsed membrane (top) and a device with a collapsed membrane (bottom). Bar scale 1 µm.*

Currently, membrane deflection measurements are carried out using Scanning Electronic Microscopy (SEM) before being internalized, but in the SEM, samples must be under vacuum pressure which may alter their initial state.

Using a Sensofar optical profiler we were able to measure, in a quick and non-intrusive way, the deflection of the membranes after manufacturing. The dimensions of the chip are only a few microns, but the curvature of the membrane is closer to tens of nanometres, so it's necessary to use a high magnification lens.

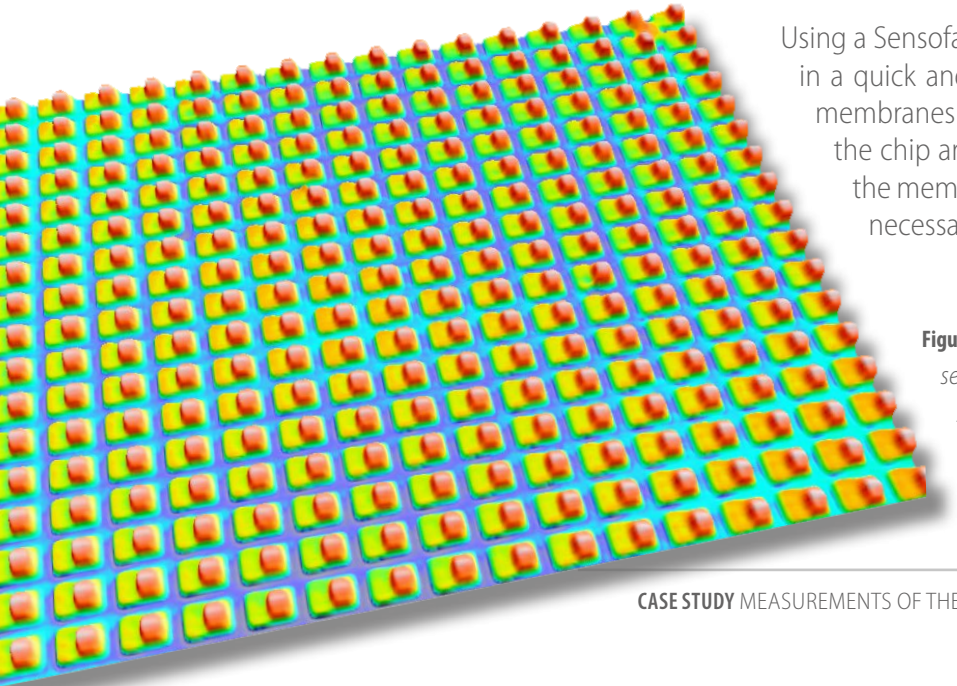
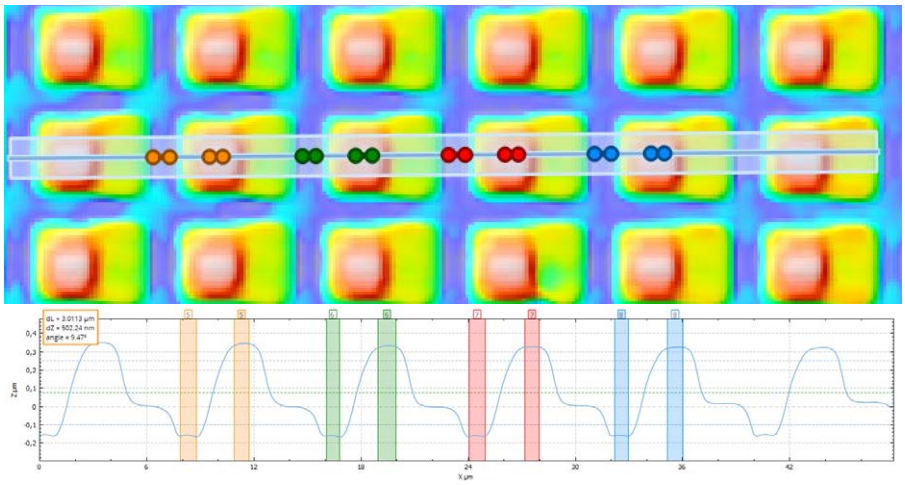


Figure [3] *3D topography of a pressure sensor's array before the release from substrate.*



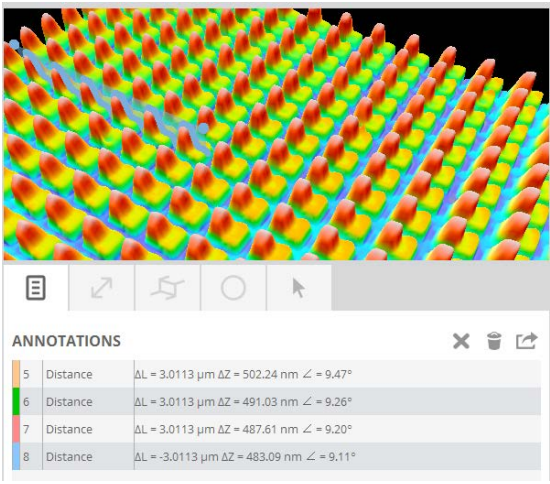


Figure [4] *Profile analysis of several pressure sensors.*

Conclusions

With this technique, it's possible to obtain a fast and non-destructive measure of the deflection of the released membrane before and after sealing to check if membranes have collapsed. Previously, they had to be inspected by SEM which produced changes in the deflection of the membrane due to the vacuum and the value of the deflection was not as reliable. These measurements were obtained with a Plμ 2300 using a confocal technique with a 100X brightfield objective.

Sensofar equipment provides non-contact 3D surface profilers based on three technologies: Confocal, Interferometry and Focus Variation techniques. With Sensofar equipment, high-resolution measurements can be made quickly and in a non-destructive way, and user-friendly software provides technical support as needed.

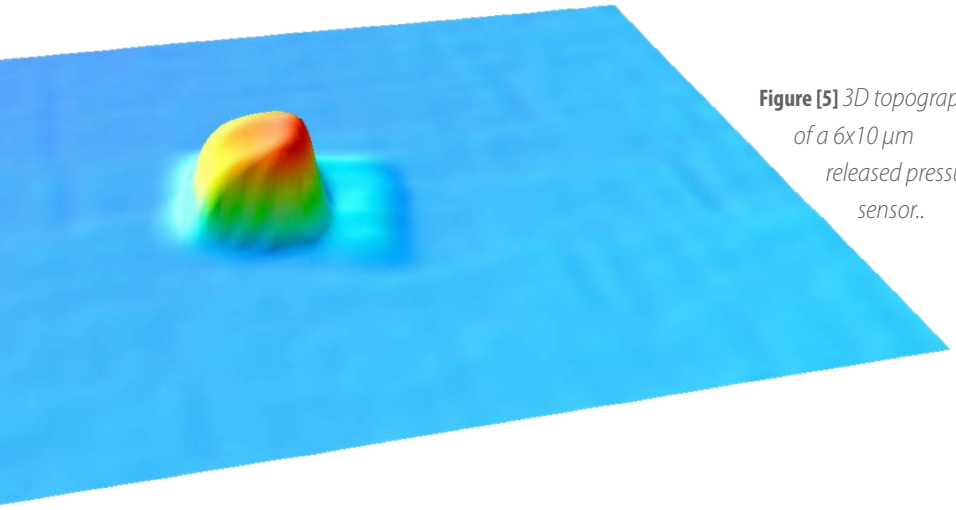


Figure [5] *3D topography of a 6x10 µm released pressure sensor..*

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The Sensofar Group has its headquarters in Barcelona, also known as Spain's technological heart. The Group is represented in over 30 countries through a global network of partners and has its own offices in Asia.

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