

# LAB-ON-A-CHIP (LOC) DEVICES FOR INFRARED SPECTROMICROSCOPY OF LIVE SINGLE CELLS: ADVANTAGES, DISADVANTAGES AND FUTURE PERSPECTIVES

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The high brilliance of InfraRed Synchrotron Radiation (IR-SR) has made possible to operate IR microspectroscopy (IRMS) at diffraction limited lateral resolution, allowing to perform single-cell analysis in the MIR regime, possibly reaching sub-cellular details. However, the upgrade of (SR-)IRMS toward a label-free single-cell based assay is still limited by the immaturity of the microfluidic devices for IRMS of live cells and by the so-called *water absorption barrier*.

Microfabrication technologies have had a great impact in many fields of sciences over the past decades. They have allowed to miniaturize entire laboratories in few millimeters, known as Lab-On-a-Chip (LOC). LOC has improved efficiency and throughput of many diagnostic techniques by reducing both chemicals' consumption and analysis' costs. IRMS stood watching without benefit from miniaturization. Nowadays, *in vitro* IRMS experiments are still in their infancy since biocompatible, MIR substrates are not standard for microfabrication, that mostly uses silicon, glass or plastic substrates.

The advantage to couple microfabrication and IRMS relies on the superior flexibility in the design of experiments and on the fact that it allows a precise control of the device geometry, helping to overcome the spectroscopic constraints imposed by water absorption. The present lecture will be focused on this topic, based on the most recent published investigations.

In particular, the biological relevance of IRMS of live cells will be discussed showing the effects of formalin and ethanol fixation on cellular samples. Special attention will be devoted to nucleic acid conformation, particularly affected by fixation-dehydration procedures. Several examples where this information can be successfully exploited will be presented. In particular, the possibility to use IRMS of live cells as an alternative tool for determination of the cell cycle stage will be shown.