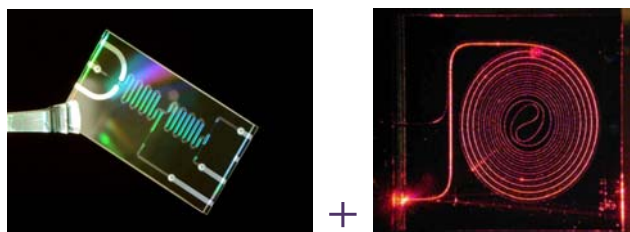


HYBRID INTEGRATED BIOPHOTONIC SENSORS CREATED BY ULTRAFAST LASER SYSTEMS

INTEGRATION OF OPTICS AND μ -FLUIDICS

The integration of microfluidics and optics is being considered as a technology and application *driver* which perfectly fits LioniX' core competences, being *Integrated Optics for Telecom* and *Microfluidics / Lab-on-a-Chip*. It enables new applications with extreme miniaturization and replaces existing technologies.



INTEGRATED OPTICS FOR SENSING

A key factor for the successful breakthrough of *Lab-on-a-Chip* technology in products, such as medical and food diagnostics will be the ability to combine all the required functions in a miniaturized, automated system. Replacement of electrical functions by optical ones and the potentials of miniaturization have been the driving force for the development of optical detection devices in analytical systems.

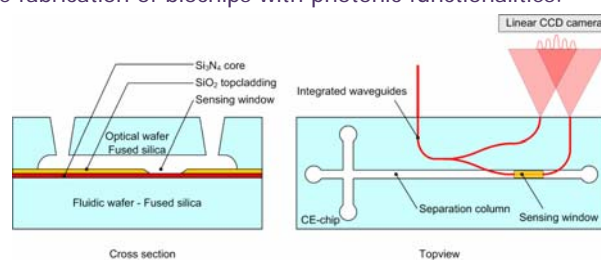
Planar light waveguides have the same functionality as classical optical fibers, but provide large-scale integration of functions in the optical domain, analogous to electronic chips. The HIBISCUS technology will enable this without the need of an expensive cleanroom facility.

A good example is a Mach-Zehnder interferometer (MZI) for the measurement of (bio)chemical parameters in Life Sciences (genomics and proteomics, pharma, medical, food) and Industrial Process Control (fine chemistry, bioprocessing). Because it has appeared to be (too) difficult to develop 'stand-alone', stable and robust (bio)chemical sensors the trend is to build complete analysis systems with help of microfluidics technology in which sensing and fluidic control are combined. Lab-on-a-chip based systems promise to be responsible for a revolutionary change in (bio)chemical processes and analysis.

HIBISCUS GOALS

We concentrate on two prototypical devices, available as demonstrators at the end of the project: microreactors for chemical synthesis of polypeptides and proteins, and biomolecule assays based on capillary electrophoresis.

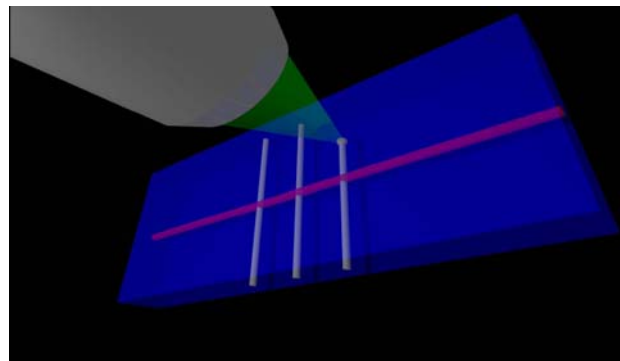
We propose two new technologies, based on high intensity femtosecond laser pulses, providing an integrated platform for the fabrication of biochips with photonic functionalities.



Capillary electrophoresis combined with optical sensing.

The first technology integrates a network of femtosecond laser written optical waveguides on a standard capillary electrophoresis microfluidic chip. The waveguides can be arranged in different configurations with respect to the microfluidic channels, exploiting the unique three dimensional capabilities of the femtosecond writing technique, to implement photonic biosensors. The second technology makes also use of the femtosecond laser technology to directly write the microfluidic channels.

If both technologies can be demonstrated, we can envisage a single production machine for the biophotonic chips, based on a high-power femtosecond laser that can manufacture both the microfluidic channels and the optical waveguides. In case the quality of the microfluidic channels obtained by the femtosecond technique is not sufficient for the applications, they will be produced by standard techniques.



Concept of integration between microfluidic channels and laser written optical waveguides.

REFERENCE

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www.fisi.polimi.it/hibiscus