SemoFs

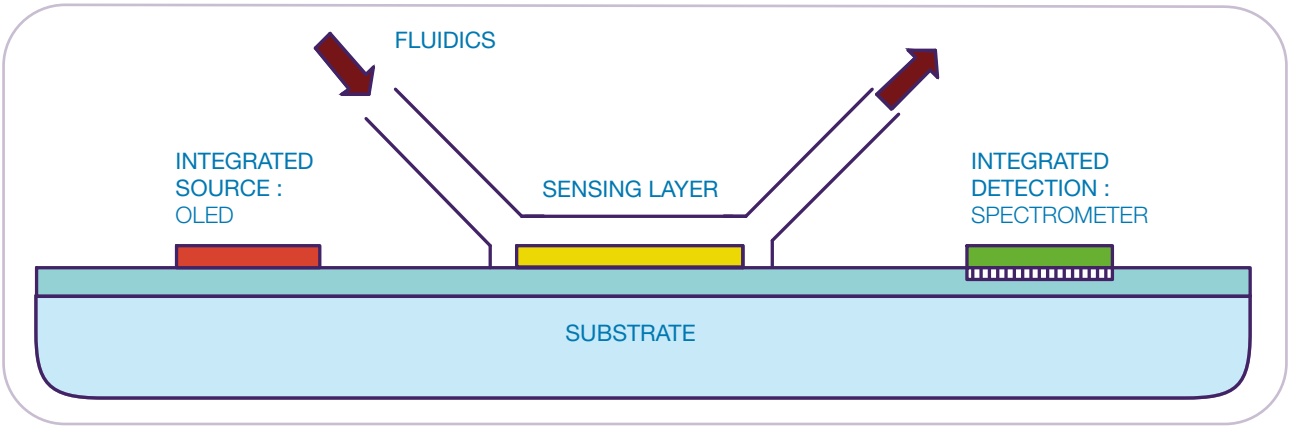
Integration for health diagnoses

A European SpecificTargeted REsearch Project supported through the Sixth Framework Programme for Research and Technological Development

Objectives, concept and advantages

The aim of the SEMOFS project is to develop a radically new concept for biosensors : a polymer-based card type integrated "Plasmon enhanced SPR"-sensor. The card will combine biologically active surfaces with integrated optics (light source, detection) and biocompatible multichanel micro-fluidics.

The project aims to achieve a significant breakthrough since all functions will be totally integrated on a single polymer-based chip. The final product shall be manufactured with large scale, mass production techniques. The card will therefore be extremely low cost and disposable while providing increased sensitivity and diagnosis possibilities.

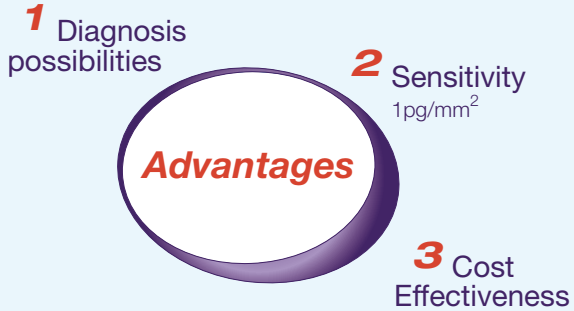


Significant perspectives

By enabling affordable **medical diagnosis at the point of care**, SEMOFS offers significant perspectives:

- **First** applications to be considered are in the study and treatment of human cancer using fresh tissue biopsies and bio-fluids. Particularly, in the field of biomarker-based diagnostics for the colon and breast cancer at different stages of the disease: non-invasive screening for early-stage disease, prognosis, therapeutic response and screening for disease recurrence.
- **In the medium term**, the other applications could be in the field of articular diseases (Poly-Arthritis) and gastro-intestinal disease (Crohn disease, Coeliac disease).
- **In the long term** it could be also possible to imagine transfering this technology basis in other fields such as food diagnostics and analytics, to control quality water or even to prevent bioterrorism

Increased performances

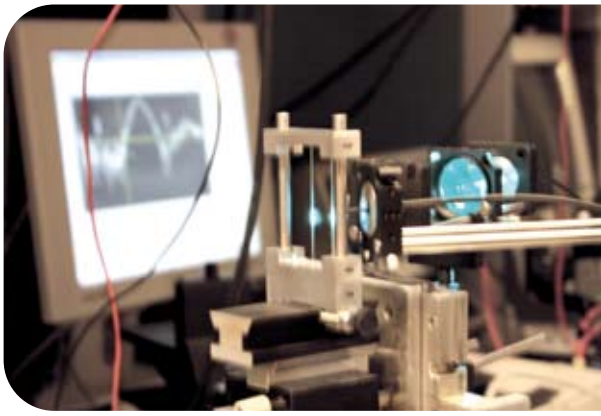


- Low sample volume (few microliters), ideally capillary blood
- Minimized sample conditioning
- Detection limit : < 1pg/ml, Dynamic range 4 orders of magnitude for marker concentration
- Parallel detection of at least 10 relevant markers
- Short time to result (about 10min)
- Competitive price ; readout device about 1000€, disposable cartidge about 5€ per information.

SEMOFS technologies and innovations

Project concept is based on the integration of several innovative technologies: plasmonics, active optics and micro-fluidics totally integrated on a polymer-based chip.

The project work plan has been designed in 2 loops :
- one aiming at releasing an intermediate prototype around fall 2007, which will be used to assess the validity of the different components investigated;
- the second aiming at proving the validity of the SEMOFS concepts (sensitivity, cost, stability,...) around spring 2008. It will be used for a pre-test on short populations of patients.



Health diagnoses Oncology (breast and colon cancer), leukemia

Plasmonics

Enhanced Surface-plasmon resonance (SPR) sensor

- Label-free optical detection system based on SPR. Biochemical interactions at the sensor surface are monitored by observing the resonant behaviour of surface waves at a thin metal film

Active Micro Optics

Fully integrated active and passive optical components

- Loop 1: hybrid optics (conventional inorganic light sources and detectors, integrated waveguide and gratings for coupling)
- Loop 2: integrated optics (Integrated OLED, wave-guides and detectors)

CONCEPT

Integration on polymer chip

Encapsulation:
Protection of active organic optics against water and oxygen degradation

Mounting of components (microfluidics with microoptics):
Cost-effective, biocompatible, low temperature bonding approaches

Interfaces:
Electrical contacts for fluidic actuation and active micro optics, inlet for sample, access to optical detector, ...

Functionalisation

Biotechnological functionalisation of sensor surface

- Creation of a chemical interface between the sensor surface and the antibody (covalent bond)
- Grafting of the antibody using a spotting technology

Active Micro Fluidics

Biocompatible microfluidics with fully integrated fluidic actuators

- Passive microfluidics system with hydrophilic channels inlet and sample volume definition and hydrophobic sections (e.g. passive valves)
- Active microfluidics based on low-cost electrochemical actuation principles and hydrogels
- Glass thermoplastic bonding

Consortium

The consortium of the project involves multi-disciplinary expertise split among 8 partners from 5 European countries .

4 research centers
2 industrials
1 hospital
1 consulting company

- **Chemnitz University of Technology :** micro fluidics, technical coordinator
- **CEA :** surface functionalisation, biochemistry, encapsulation
- **CSEM :** micro optics, micro-fluidics
- **Cardiff University :** production technologies, micromachining
- **Eurogentec :** development of biological probes/targets
- **Zeptosens – a division of Bayer Schweiz AG :** bio sensing solutions
- **Hospital of Liege :** medical expertise – pre-validation tests
- **ALMA :** communication and management.

Acknowledgements

The SEMOFS project targets the general objective to strengthen the European Research Area by addressing the cross-priority actions IST-NMP.

Selected topic: IST-NMP-2 Bio-sensors for diagnosis and healthcare

Budget : 2 955 931€
Grant :1 899 956€

SemoFs
Integration for health diagnoses
www.semofs.com

Project Coordinator :
Dr. Karla Hiller, semofs@tu-chemnitz.de
Chemnitz University of Technology

Project Leader :
Contact at ALMA : Eric Victor-Pujebet
evictorpujebet@almacg.com