



ML² – MultiLayer-MicroLab

Roll-to-roll lab-on-chip production

Design platform for economic production of multilayer Micro-Nano-Bio Systems

Microfluidics and lab-on-chip are enabling technologies with great growth potential. The life sciences industry has come to realize the trends and potential of miniaturization which already have affected the information and communication industry in the last decades. Combinations of microfluidics, microelectronics and microoptics provide striking opportunities for advancing biomedical research and creating new markets for the medical sciences industry. In terms of economical and ecological worthwhile processes, complex Micro-Nano Bio Systems (MNBSs) have the greatest potential to enhance processes for cell-based assays, chemical analytics and medical diagnostics.



The project is funded until autumn 2016 by the seventh framework programme (Contract No. 318088) and addresses the work topic „Smart components and smart systems integration - Micro-Nano Bio Systems (MNBS)“

The challenge

However, there are three main challenges for such MNBSs: First, a lack of economic micro-fabrication methods hamper the implementation of lab-on-chip solutions in an industrial scale. Second, inefficient interfaces between laboratory equipment and microfluidic devices cause a lack of interoperability. Third, there is no integrated manufacturing platform that provides flexible and cheap design and re-design opportunities.

Our solution

The EU-funded research project ML² (MultiLayer – MicroLab) will overcome these three main challenges by developing a cost

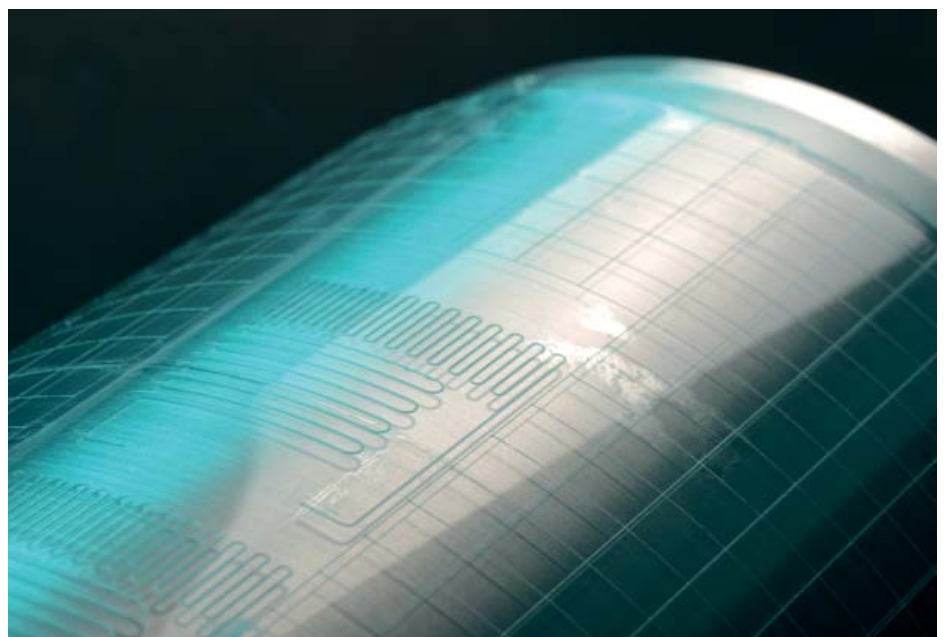
efficient production system for new generation MNBSs, combining microfluidics, microoptics and microelectronics. The MNBS devices are based on a multi-layer concept. The overall function of the smart device is split into several sub-functions, which can be of fluidic, optical or electronic nature. Multiple foils transfer the functionality into technical solutions. Economic roll-to-roll processes are being developed for the production of microfluidic and optic functional layers. In combination with high-end inkjet solutions the layers offer functionalities of printed electronics and bio-chemical functionalization. Interconnections between the layers realize a fully integrated system.

Your Contact

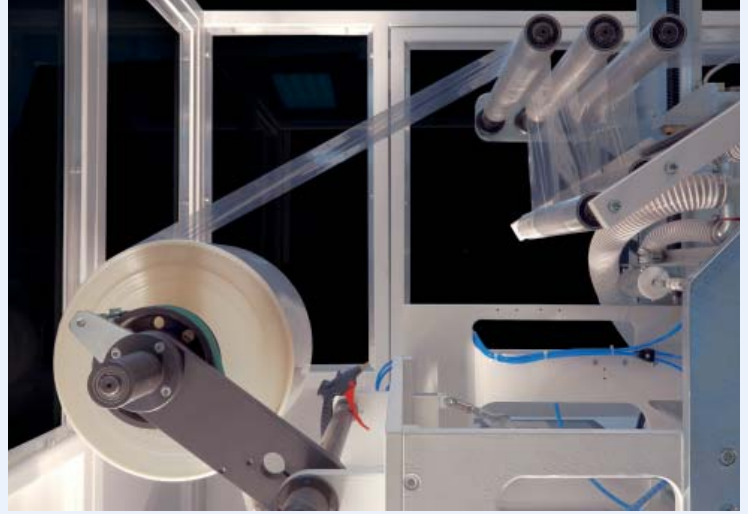
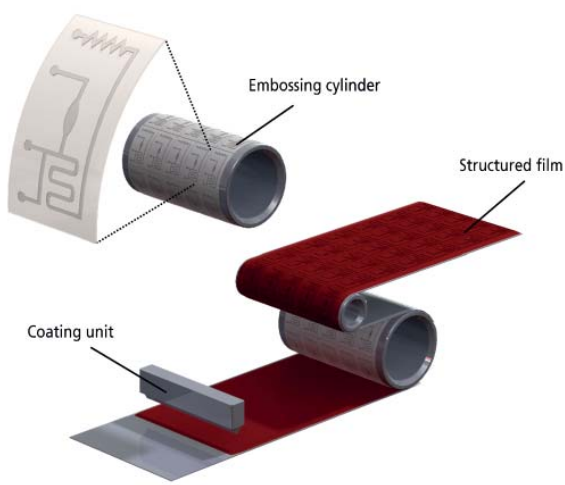
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Embossing roll with microfluidic structure



Production steps for high volume production of optical and microfluidic layers

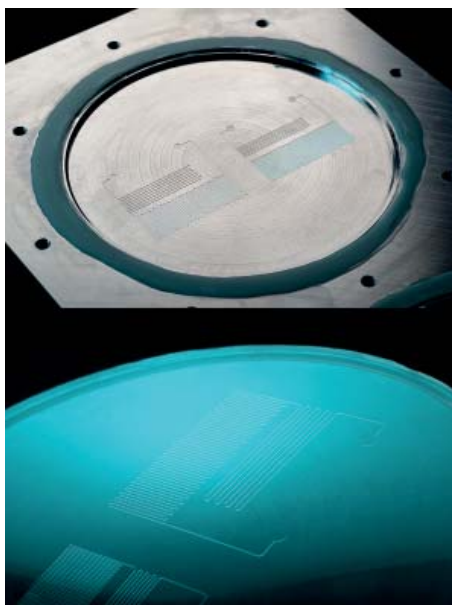
Roll-to-roll production line

Thus, ML² provides a design and manufacturing platform for the production of sophisticated devices which combine microfluidics, optics and microelectronics. The according ML² devices are compact and with increased performance at lower prices while at the same time providing higher sensitivity compared to existing MNBSs. The packaging method and fully automated production will lead to higher reproducibility, increased integration of bioactive components and higher intelligence of the devices.

laboratory equipment and allow for onsite analysis of blood. This demonstrator can be used in order to avoid exaggerated medication with antibiotics or other drugs. The individual needs for medication of patients can be analyzed by means of an onsite blood analysis. The second demonstrator is a portable mini-lab for environmental tests. By onsite analysis of drinking water, the demonstration addresses a crucial high volume application with greatest impacts all over the world. The third demonstrator is an autonomous lab-on-chip device for digital immunodiagnostic rapid tests, thus for applications with very high volumes of disposable lab-on-chip equipment.



Schematic exploded view of a lab-on-Chip with microfluidic, microoptic and micro-electronic layers



Mould for preliminary prototyping of microfluidic channels

The future applications of the developed technology will be especially relevant for the fields of health-care diagnostics and therapeutics, early detection and prevention of disease, and pathogen detection in the food market. Nevertheless the versatility of the technology will allow expecting early applications in the field of genetic modifications and personalized medicine.

The Consortium

The consortium of ML² is integrated by fully recognized partners in the field of Micro and Nano Bio-Systems with a right-balanced combination of Academia, Research Establishment and Industry (especially SMEs) and fully capable to collectively address all relevant aspects of the innovation value chain. The 12 partners are from countries all over Europe: England, Finland, France, Germany, Italy and Spain.

Our Demonstrators

Within the ML²-project three different demonstrators are developed which will prove the efficiency of the new multi-layer approach. The first demonstrator is a pathogen diagnostic lab-on-chip. The functionality of this chip will replace expensive



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