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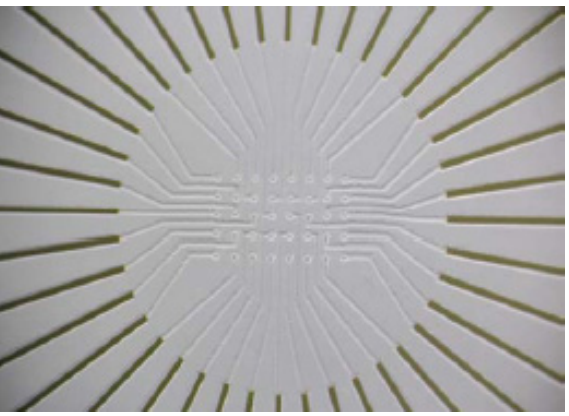

CADEMPO

Development of a technology platform for polymer membrane based transducers

Project Summary

The traditional microfabrication techniques to add and structure different layers on top of a substrate are limited, especially when attempting to integrate transducers on top of thin polymer substrates such as membranes. Such "active membranes" meet specific needs by integrating sensing or actuating functions in low cost devices for an increasing number of applications. In bioengineering a new generation of disposable devices is expected allowing a strong increase in tests pertinence, as well as in productivity. This is made possible with improved methods to quantify biological parameters of significance, and with a better control of testing conditions.

This project made the development of a technology platform possible, namely a series of fabrication processes to be combined together and allowing the production of transducers and sensors on top of polymer membranes. These processes are based on pad printing or microstamping. Their performances and limits have been studied. The deposition of up to three aligned layers of conductive and non-conductive layers has been achieved. The compatibility of these processes with standard microfabrication processes has been demonstrated while the alignment issues addressed and solved (as illustrated in the above picture showing a sputtered transparent ITO microelectrodes array on top of a transparent PET porous membrane with printed transparent insulator surrounded by printed opaque connection lines using a conductive ink). In addition the mechanical properties of polymer membranes could be used as sensitive element for the sensing of a mechanical parameter. To illustrate these developments three demonstrators have been developed and tested: a flow sensor, a transparent array of microelectrodes, and a pressure sensor. These three demonstrators are envisioned to permit monitoring of the perfusion of in vitro cell cultures, as well as pressure control to be applied to the tissue, and even bioelectrical interfaces with excitable tissue and fully compatible with combined "electrical-optical" observations.

Valorisation

This generic project opens a new avenue for applied research projects in micro- and bioengineering, as well as for teaching activities. Two consecutive research projects exploiting the results of this project did already start before the end of this project and two additional are to be started in 2014. The lecture on transducers for microengineering students at hepia also benefits from the results of this project through a small teaching project allowing them to rapidly develop and test simple devices. These results are also being valorised by students through bachelor thesis projects.

Further processes based on this technology platform are still being developed in these new projects increasing the know-how at hepia in microsystems printing. Some elements are to be communicated in industrial conferences (e.g. MEDTEC France 2014), though many elements are still being assessed for intellectual property protection. Contacts under secrecy agreements with the industry have already started in order to develop technology transfer projects.

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This project has been developed by the team of Prof. Ph. Passeraub at inSTI (hepia) in collaboration with the team of Prof. H. Keppner at IMA (HE-Arc)

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