Microtechnologies for neurophysiological applications

L. Berdondini

Sensors, Actuators and Microsystems Laboratory, Institute of Microtechnology, Université de Neuchâtel, Jaquet-Droz 1, 2007 Neuchâtel, Switzerland.

Micro- and more recently nano- fabrication technologies find constantly more applications in the bioengineering area. Their flexibility in terms of materials and realizable geometries down to the nano-meter scale as well as the constant improvement of the technological processes allow designing devices and microsystems with enhanced functionalities. One of the areas that has significantly benefited from this development is that of integrated microelectrodes for in-vivo and in-vitro neurophysiological studies. By integrating arrays of 60 – 120 microelectrodes on silicon, glass or polymer substrates, these devices provide a bi-directional electrical coupling with neuronal tissue.

This presentation will review the main technological developments in the field of MEAs and will provide an overview of the applied state of the art thin-film technology. This will include the modification of the electrode-electrolyte-neuron interface using thin-film and electrochemical methods and the combination of MEAs with network patterning techniques for the realization of new in-vitro experimental models.

The recent development of active, CMOS-integrated electrode arrays opens new perspectives for MEAs. Aimed at enhancing their functional characteristics with the integration of the amplification circuit and of a larger number of electrodes, this technology is particularly suited for increasing the spatial resolution. In this respect, this talk will conclude presenting the recently started EU-IDEA project aimed at developing high-resolution APS-MEAs technology.