Design and characterization of an organic transistor based pH sensor for tissue engineering applications

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Bioreactors and organs on a chip have been widely adopted in the field of tissue engineering and biomedicine as platforms for studying cell and tissue in vitro. Their equipment with biosensors is required to favor the on time monitoring of some biochemical-physical parameters.

In this context, organic electronics offer interesting features in the field of tissue engineering, thus allowing an innovative approach to bioreactor sensorization for the continuous monitoring of different parameters.

The main goal of this project is the realization and the complete characterization of an array of pH sensors based on an organic transistor device called Organic Charge Modulated FET (OCMFET), specifically designed for tissue engineering applications. Besides being highly sensitive and biocompatible, the final device will also have the feature of being ultra-flexible thanks to a particular polymeric sub-micrometric substrate. In fact, the substrate extreme flexibility will allow the device to perfectly conform to the internal walls of a bio-reactor, thus allowing a continuous monitoring of the culture medium pH over a period of several weeks.

The student will be in charge of the whole fabrication process, the transistors characterization, and the sensors calibration, together with their stability assessment over a period of at least 4 weeks.

The student will learn:
- to fabricate organic transistors onto polymeric micro- and nano-films using techniques such as (but not limited to) thermal evaporation, spin coating, photolithography, oxygen plasma activation, and chemical vapor deposition;
- to fully electrically characterize organic transistors;
- to characterize and calibrate pH sensors;
- to design and fabricate simple electronic circuits for analog signals conditioning on printed circuit boards (PCBs).

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