薄膜トランジスター技術を良いた生体センサー

Bio-sensors based on Thin-Film-Transistor Technology

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In biological systems, information are created at the vicinity of the cells and coded with multiple modes like electrical and biochemical signals (ions, proteins, hormones, neurotransmitters, etc.). Therefore, investigation requires multi-modal sensing techniques. However, present devices are limited to low spatial resolution on very few parameters at once, due to fabrication technology constraints. Our laboratory is working on the development of highly performant customizable platform tools to acquire multiple information with high spatial resolution. We target the creation of an in-vitro biological model of myocardial infarction mechanism which is known to be related to a complex inter-organ interaction through the immune and neuronal systems.

The platforms we are developing are based on Thin-Film-Transistor (TFT) technology, which is the same technology as for Liquid-Cristal Displays (LCD) but adapted to biological applications. They offer a large surface (cm size) covered by high-resolution of thousands of microelectrodes in array, with dimensions until single cell (20µm), which can be individually selected and used either for sensing or stimulation. In addition the devices are transparent, so compatible for optical observation and optogenetics stimulation. During this presentation, we will present the state of the art of our research related to bio-sensing and cell electrical stimulation of cardiomyocytes, and pancreatic β-cell.

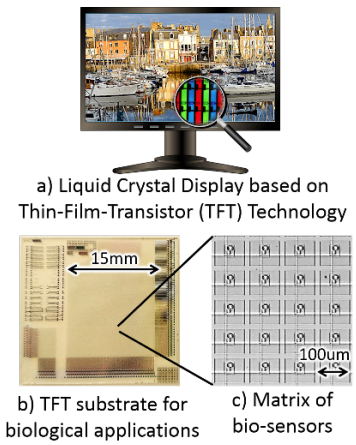

Fig. 1: Thin-Film-Transistor Technology used for: a) display, b) and c) bio-sensing.

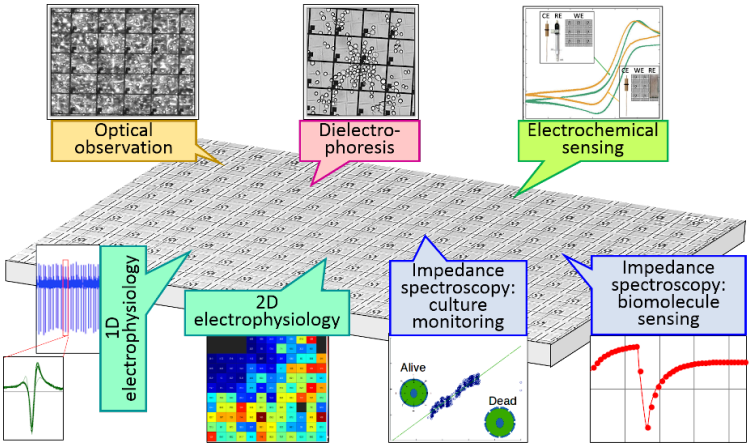

Fig. 2: Multiple bio-sensing performed by the authors with a TFT device.

[1] D. Zhu et al., Journal of Micromechanics and Microengineering, Vol. 31(11), 115002, (September 2021).

[2] A-C. Eiler et al., IEEE Trans. Electron Devices, Vol. 68(4), pp. 2041-2048, (April 2021).