4 - Organic thin-film transistors for biological applications

Abstract:
In the past few years biosensing concepts based on organic field-effect transistors (OFETs) have attracted more and more attention. Here organic electronics benefit especially from the fact that solution-processable organic thin films can be used in flexible and disposable sensors. Additionally, the outstanding biocompatibility of many organic materials allows the use of organic sensing devices for in-vivo applications and permits the design of biodegradable sensors. Starting from the basic principles of organic thin-film transistors, this chapter will present the state of the art of biosensing approaches based on OFETs, either back-gated or electrolyte-gated, focusing in particular on different functionalization methods to achieve a selective response of the OFET towards biologically relevant molecules. We present recently published applications of organic thin-film transistors ranging from the detection of biomolecules such as DNA, proteins, and enzymes to the sensing and stimulation of electrical activity potentials of neurons. The sensing mechanism and the influence of the Debye screening length on the detection of biomolecules will be discussed.

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