ULTRASENSITIVE OFET ARCHITECTURES TO PROBING BIOMOLECULES INTERACTIONS

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Electronic detection of biologically relevant species performed by means of disposable organic devices has the potential to revolutionize the current approach to strip testing. Bio-systems interfaced to an electronic device is presently one of the most challenging research activity that has relevance not only for fundamental studies but also for the development of highly performing bio-sensors. Completely novel approaches either involving OFET devices comprising a Functional Biological Interlayer (FBI-OFET) or Electrolyte gated-OFET (EGOFET) integrating bio-recognition elements were recently proposed by our group. Specifically, in the FBI-OFET device configuration a biological layer, acting as biosensor recognition element, is fully integrated into the device structure, residing underneath the organic semiconductor film, right at the interface were the OFET two-dimensional transport occurs. While in the EGOFET structure the bio-recognition layer is deposited directly on the organic semiconductor using a strategy that allows a well-oriented immobilization of the biological molecules. Both the structures have been successfully employed for the detection of biological molecules reaching very low detection limits (few part per trillion concentration range). The specific features of each configuration as well as their performances in terms of device operation, selectivity and sensitivity will be presented. Besides, the proposed bio-electronic FBI-OFET platform, besides resulting in extremely performing biosensors, can open to gather insights into biological relevant phenomena involving interfacial modifications that can be electronically detected. The proposed device configurations are also implementable with organic electronic printing processes using paper and other flexible substrates.