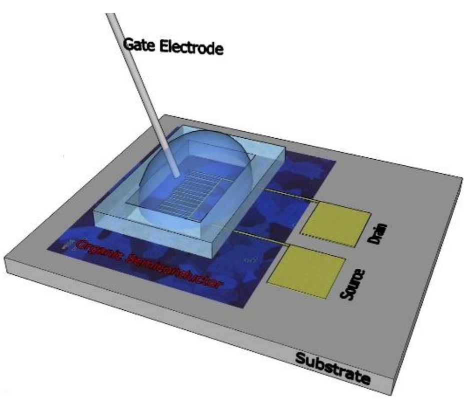
Master Thesis & Research Internship topics available on Biosensors and EG-FETs

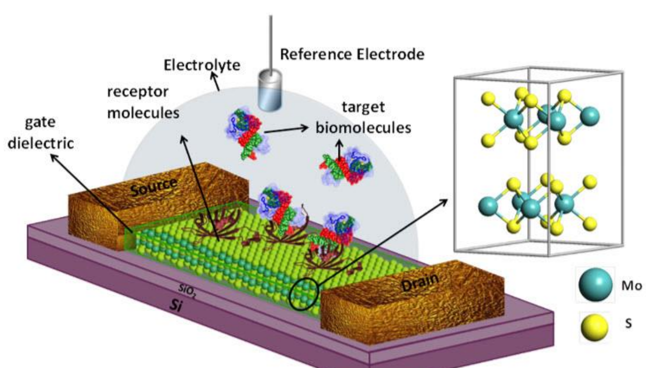
Biosensors are promising analytical tools for healthcare, monitoring food toxins and pathogens, and environmental screening due to their unique characteristics of affordability, portability, disposability, and simple construction. From the first biosensor reported (enzyme-coated oxygen electrode), more and more biosensors were reported, mostly for medical applications: blood gases, hemoglobin, glucose, calcium, urea and many other critical analyses. Biosensors are also able to sense basic parameters such as humidity or pH, but also numerous types of non-biological compounds such as heavy metals or small organic pollutant molecules such as bisphenol A. However, until now, biosensors have not invaded the market. This may be due to a still too high production cost, at least for most everyday life applications.

In the past few years, field-effect transistors have been intensively investigated for biosensing applications, because of their natural integration into portable electronic devices, but also because the field effect is capacitance-related, and this capacitance is known to be very sensitive to surface changes. For example, the presence of guest molecules over one of the gate/dielectric or dielectric/semiconductor interface would result in a shift of the conductance of the semiconductor. However, the main drawback with conventional silicon-based transistors is the high cost of silicon microlithography operated in clean room, which is prohibitive for disposable sensors.

Electrolyte-gated OFETs are significantly different from classical FETs; indeed, the semiconducting layer is in contact with an electrolyte instead of a classical dielectric. In EGFETs, the conductivity of the semiconducting channel is modulated by a solid or a liquid electrolyte put in between the semiconductor and the gate. They display much a higher gate capacitance (up to ~1000 higher) than other types of FETs, which use traditional inorganic or organic non-electrolytic dielectrics; as a consequence, biasing voltages used for EGFETs are typically much smaller than those necessary for FETs (10 V or even higher). These two characteristics (electrolyte—possibly water—and low potential) make EGFETs ideal candidates for the next generation of biosensors, particularly suitable for the detection and quantification of biological molecules inside aqueous media. The extremely good sensing capabilities of EGFETs rely on the possibility of properly functionalizing the gate electrode by means of specific molecules or functional groups able to interact with the target molecules present inside the electrolyte. The most common architecture is the top-gate, bottom-contact configuration.

We use random CNT network as the active semiconducting channel. There are available master thesis and research internship topics on understanding behavior of EGFETs and on making biosensors from CNT-EGFETs.





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