FLEXIBLE ORGANIC THIN FILM TRANSISTORS FOR HIGH-PERFORMANCE BIOSENSORS

Feng Yan, Department of Applied Physics, The Hong Kong Polytechnic University, Hong Kong
apafyan@polyu.edu.hk

Key Words: Organic Thin Film Transistor; Biosensor.

Solution-gated transistors have shown promising applications in biosensors due to the high sensitivity, low working voltage and the simple design of the devices. Solution-gated transistors normally have no gate dielectric and the gate voltages are applied directly on the solid/electrolyte interfaces or electric double layers near the channel and the gate, which lead to very low working voltages (about 1 V) of the transistors. On the other hand, the devices can be easily prepared by solution process or other convenient methods because of the much simpler device structure compared with that of a conventional field effect transistor with several layers. Many biosensors can be developed based on the detection of potential changes across solid/electrolyte interfaces induced by electrochemical reactions or interactions. The devices normally can show high sensitivity due to the inherent amplification function of the transistors. In this talk, I will introduce several types of biosensors studied by our group recently, including DNA[1], glucose[2], dopamine, uric acid[3], cell[4], protein [5] and bacteria sensors, based on flexible solution-gated organic thin film transistors. The biosensors show high sensitivity and selectivity when the devices are modified with functional nano-materials (e.g. graphene, Pt nanoparticles) and biomaterials (e.g. enzyme, antibody, DNA) on the gate electrodes or the channel. Furthermore, the devices are miniaturized successfully for the applications as sensing arrays [6]. The solution-gated organic devices are also used for voltage-controlled drug release in aqueous solutions [7]. It is expected that the solution-gated organic transistors will find more important applications especially wearable electronics for healthcare in the future [8,9].

Reference