Field-Effect Transistors for Future Clinical Applications

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ABTSRACT

Field-effect transistors (FETs) have been widely used for biosensors and demonstrated with high sensitivity. However, in physiological samples, high ionic strength severely screens off electric potential that are generated by biomolecules, leading to poor detection unless sample pre-treatments such as de-salting or dilution of the samples are conducted prior to detecting. We have developed a methodology that can overcome charge screening effect in physiological environment and demonstrated successful detection with clinical samples including human serum and whole blood, without sample pre-treatment. A handheld device that can detect cTnI and BNP in one drop of human whole blood, in 5 mins was developed. Micro-RNA (miRNA) for cardiovascular diseases were also detected with FETs with detection limit as low as 1fM. Cancer cells were studied with FETs by monitoring the change of transmembrane pontential and manipulating ion channels. Different tissues were identified with the FETs, which may be useful in surgery. In the talk, I will show that FET sensors have become a powerful tool and platform for studying proteins, RNA, cells, and tissues, which allows physicians and researchers to do many clinical applications and fundamental study.

BIOGRAPHICAL SKETCH

Yu-Lin Wang received his B.S. degree in chemistry at Tung-Hai University in 1993 and M.S. degree at National Taiwan University in 1995, respectively. He worked in the semiconductor industry in the research department, developing Si and III-V semiconductor-based electronic and photonic devices such as LOGIC, DRAM, LED, and HBT until 2006. He earned his Ph. D. in materials science and engineering in May 2009 in University of Florida where he studied wide bandgap semiconductor materials and devices, including ZnO LEDs, oxide TFTs and AlGaN/GaN HEMT-based sensor. From 2009 to 2010, he was a postdoctoral research fellow in Chemical Engineering and Chemistry Department, at University of Florida. He has been with the Institute of Nanoengineering and Microsystems, at National Tsing Hua University since Aug. 2010. His current research focuses on developing FET-biosesnors and devices for clinical applications and constructing theoretical models as well.