Electronic Biosensors Based on Graphene Field-Effect Transistors

by

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Abstract
Probing biosystems with two-dimensional (2D) materials provide tremendous opportunities for highly sensitive detection of physiological properties at the molecular level, which can pave the way towards early-stage disease diagnosis and improved healthcare outcomes. In this talk, I will introduce the process we have developed for scalable fabrication of 2D-biosensor arrays for multiplexed detection of disease biomarkers, such as oligonucleotides and Lyme disease antigens. During sensing, a graphene field-effect transistor (GFET) is utilized for signal transduction, and a biomolecular layer, e.g., protein, nuclide acid, serves as the biological recognition element. Further, integration of the hybridization chain reaction (HCR) process with GFET readout leads to oligonucleotide detection with sensitivity at the sub-fM level. Looking to the future, I will report on the synthesis of crystalline multilayer graphene materials with a tunable energy band gap, which provides a pathway towards next-generation biosensors with even greater performance.

Biography
Dr. Gao completed his Ph.D. with Prof. Matthew Yuen in the Department of Mechanical and Aerospace Engineering at Hong Kong University of Science and Technology in 2014. Since that time, he has been a Post-doctoral Researcher in Prof. Charlie Johnson’s group in the Nano/Bio Interface Center and Department of Physics and Astronomy at the University of Pennsylvania. His research interests include all-electronic biosensors for disease diagnosis and healthcare, wearable electronics, and two-dimensional (2D) nanomaterials. In Oct 2019, Dr. Gao joined the Department of Biomedical Engineering at the Chinese University of Hong Kong as an Assistant Professor. Dr. Gao currently serves on the editorial board of PLoS ONE in the area of Biosensors and Nanomaterials.