The 49th JUACEP Seminar

第 49 回 名古屋大学日米加協働教育プログラムセミナー

13:30-15:00, Thursday, February 21, 2019
Lecture room 221（2F, Eng.Bldg. II）

High-Performance Nanoplasmonic Biosensors for Critical Medicine

Prof. Katsuo Kurabayashi

Department of Mechanical Engineering
Department of Electrical Engineering
and Computer Science
University of Michigan, U.S.A.

Abstract

In recent years, substantial research has focused on developing nanoplasmonic biosensors aimed at point-of-care (POC) immunological testing due to their robustness, label-free nature enabling rapid analysis, ease of integration in a miniaturized system, simple optics. However, their implementations in real clinical settings are yet to be realized due to their limited speed and sensitivity. To fill the gap between laboratory-based proof of concept and translational biosensor implementation, we have developed a method to control mass transport of biomolecules under micro- to nanofluidic environments with AC electroosmosis flow. Our new device integrates AC electroosmosis flow-inducing microelectrodes with plasmonic nanoparticle biosensors. Additionally, we have proposed synergetic integration of nanoplasmonic label-free biosensing structures and an ultralow noise MoS_2 photoconductive nanosheet channel. Structurally-engineered metallic nanoparticles used for our device yield a 1000-fold amplification of near-field light localization at their surfaces. This results in a shift of light transmission through the antibody-conjugated nanoparticles, which is extremely sensitive to protein surface binding The nanosheet channel in our device has a few atomic layers of MoS_2. The assembled MoS_2 nanosheet shows unique structural and electrical properties that permit high-sensitivity photo signal detection. As a result, our biosensors have shown the ability to detect protein concentrations in the femto-to-pico molar range (~ a few molecules per cell) with a short (< 15 min) sample-to-answer time.

Biography

Katsuo Kurabayashi is Professor of Mechanical Engineering and Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor. He received his BS in Precision Engineering from the University of Tokyo in 1992, and his MS and PhD in Materials Science and Engineering from Stanford University, CA, in 1994 and 1998, respectively. His current research focuses on optofluidics, nanoplasmonic and biomolecular biosensing, and BioMEMS/microsystems for immunology, clinical diagnosis, and analytical chemistry. He received the 2001 NSF Early Faculty Career Development (CAREER) Award, and the Robert Caddell Memorial Award in 2005, the Pi Tau Sigma Outstanding Professor Award in 2007, the Mechanical Engineering Outstanding Achievement Award in 2013 from the University of Michigan, and the Ted Kennedy Family Team Excellence Award in 2015 from the College of Engineering at the University of Michigan.

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