Plasmonic Opto-microfluidic Sensors for Point-of-Care Testing

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Testing blood samples at point-of-care (POC) settings remains a significant challenge due to strong optical interference from light absorption, scattering, and autofluorescence inherent to blood matrices. To overcome these obstacles, we developed near-infrared (NIR) fluorescence and surface-enhanced Raman spectroscopy (SERS) probes that are specifically designed to reduce light absorption, scattering, and autofluorescence. By carefully engineering plasmonic nanostructures, we successfully enhanced the signal intensity and reliability of both fluorescence and SERS probes. Notably, we discovered that plasmonic effects can effectively mitigate fluorescence attenuation caused by blood components. Next, we designed microfluidic platforms that incorporate plasmon-enhanced probes, fluid handling components and a blood separation unit. Integrating this assay platform with a compact reader and smartphone, we created a compact, portable detection system capable of rapid screening acute and infectious diseases, including COVID-19, HIV, and traumatic brain injuries at point-of-care settings.

Speaker Biography:

Dr. Nianqiang (Nick) Wu is Inaugural Armstrong-Siadat Endowed Chair Professor at University of Massachusetts Amherst, USA. He received his Ph.D. degree in Materials Science & Engineering from Zhejiang University, China in 1997. He was a Postdoctoral Research Fellow at University of Pittsburgh from 1999 to 2001. Afterwards he directed Keck Surface Science Center at Northwestern University in USA in 2001-2005. He then joined West Virginia University (WVU) as Assistant Professor in 2005, promoted to Associate Professor in 2010 and Full Professor in 2014. He was named George B. Berry Chair Professor at WVU. Dr. Wu moved to UMass Amherst in 2020.

Dr. Wu is Fellow of the Electrochemical Society (FECS), American Institute for Medical and Biological Engineering (F-AIMBE), and Royal Society of Chemistry (FRSC). He has received prestigious awards and honors, including the Electrochemical Society (ECS) Sensor Division Outstanding Achievement Award, Highly Cited Researcher by Clarivate Analytics, Benedum Distinguished Scholar Award, Alice Hamilton Award for Excellence in Occupational Safety & Health, and WVU Statler College Outstanding Researcher Award. He serves on Editorial Boards for several journals.

Dr. Wu's research interest lies in the intersection of plasmonics, electrochemistry, and materials science. He discovered the mechanism of plasmon-induced resonance energy transfer (PIRET), which is a common energy transfer process from plasmon to semiconductor. He also discovered the "Giant Red Edge Effect", which is the mechanism of photoluminescence from graphene oxides, graphene quantum dots, carbon dots and aromatic molecules. He is recognized for plasmonic photocatalysis, plasmon-enhanced optical sensors and point-of-care testing devices. His publications are cited about 40,000 with *h* index of 93.