No.5

エクストリームフォトニクスセミナー
Extreme Photonics Seminar

日時: 平成21年 7月 6日(月)
14:00 ～ 15:00, July 6th(Mon), 2009

場所: 研究交流棟5階会議室 W524
Cooperation Center, 5F Meeting Room, W524

題目: Quantum Semiconductor Biosensor Technology:
A missing link to total solutions
by micro-Total Analysis Systems

講師: Prof. Jan J. Dubowski （Université de Sherbrooke ）

要旨: The conventional schemes for detection of viruses, bacteria, fungi and toxins include cell culture, immunological methods and molecular methods such as polymerase chain reaction [1]. These techniques, however, require much time and expertise in both sample preparation and data analysis. Development of alternative methods of detection that would be easy (automated), fast and specific for targeted biomolecules would be advantageous for medical diagnostics, clinical analysis or field tests.

Optical and electronic properties of III-V and II-VI semiconductor quantum well (QW) and quantum dot (QD) microstructures are potentially attractive for building biosensing devices where miniscule perturbations of the semiconductor surface, induced by selectively trapped biomolecules, could be monitored rapidly and in-situ by measuring some of these properties. For instance, bright photoluminescence (PL) of colloidal CdSe QD has been investigated to develop fluorescent probes in sensing, imaging, immunoassay, and some other diagnostics applications [2]. We have proposed that templates of epitaxial QD, such as InAs QD in a GaAs matrix, offer a significant advantage in designing a biosensor for rapid detection of numerous pathogens in parallel [3,4]. Biofunctionalization and stabilization (passivation) of the GaAs (001) surface is one of the key elements of this approach [5,6]. Also, we have demonstrated that plasmonic effects can be taken advantage of in designing a monolithically integrated, highly compact, quantum semiconductor (QS) surface plasmon resonance biosensor [7]. Thus, we find that some QS-based microstructures could offer potentially attractive solutions for designing fully operational micro-Total Analysis Systems [8]. I will discuss the results of our research addressing both fundamental and practical aspects of biofunctionalization of GaAs and Au surfaces - a study that plays pivotal role in advancing a technology of biosensor arrays. Specific immobilization and detection of the Influenza A virus on the GaAs (001) surface has provided us with a proof-of-concept of a photonic (optical) biosensor. Obviously, more research is required, but we have already reached the stage allowing us to advance the development of photonic biosensor arrays for multipathogen detection in parallel.

連絡先: 緑川レーザー物理工学研究室 杉岡(8542)
Laser Technology Lab.