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Miniaturized Mid-Infrared Sensors: Potential And Perspectives

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Venue: **Billings Room 3.04, 3rd floor. Electrical & Electronic Engineering Building**
University of Western Australia, Crawley
This seminar is open to the public and admission is free to all IEEE members and non members

Abstract

State-of-the-art biodiagnostic platforms increasingly take advantage of miniaturized and integrated sensing and assay technologies ideally providing direct access to molecule-specific information. With point-of-care and personalized medicine becoming more prevalent, detection schemes that do not require reagents or labeled constituents facilitate on-site analysis providing close to real-time information, or may be used in a continuous monitoring mode e.g., in intensive care scenarios.

However, decreasing the analytically probed volume may adversely affect the analytical figures of merit such as the signal-to-noise-ratio, the representativeness of the sample, or the fidelity of the obtained analytical signal. Yet, probing minute samples volumes facilitates rapid analysis, minimally intrusive or even non-invasive sampling, and a rapid diagnostic response. Consequently, the guiding paradigm for the miniaturization of diagnostic devices should be creating analytical platforms that should be as small as still useful, rather than as small as possible by smartly balancing the benefits and disadvantages of small device dimensions.

Optical/spectroscopic sensor technology taking advantage of the mid-infrared (MIR) spectral range (3-20 µm) is increasingly adopted in bioanalytics due to the inherent molecular specificity enabling discriminating constituents at ppm-ppb concentration levels in condensed and vapor phase media. Recently emerging strategies take advantage of innovative waveguide technologies such as MIR transparent hollow waveguides and planar semiconductor waveguide structures in combination with compact FT-IR spectrometers or highly efficient broadly tunable quantum cascade lasers, thereby facilitating highly miniaturized yet robust MIR diagnostic platforms providing sensitive and selective access to (bio)molecular signatures [1-7].

Selected application examples and novel optical sensing strategies will highlight the most recent advances in miniaturized IR sensor technology toward establishing next-generation optical sensing platforms.

About the speaker:

Dr. Boris Mizaikoff received his Ph.D. in Analytical Chemistry at the Vienna University of Technology in 1996. Heading the Chemical Sensor Laboratory (CSL) he has been responsible for numerous research projects in the field of chemical IR sensors, including 4 multinational projects funded by the European Union. In 1997, he has been with the University of Texas, Austin/USA as a postdoctoral fellow. In October 2000 he finalized his Habilitation (Assoc. Prof. for Analytical Chemistry) at the Vienna University of Technology. Since Fall 2000 he was faculty member at the Georgia Institute of Technology, School of Chemistry and Biochemistry, heading the Applied Sensors Laboratory (ASL). Since 2004 he was Director of the Focused Ion Beam Center (FIB2 Center) at Georgia Tech, and since 2005 member of the Center for Cell and Molecular Signaling at Emory University, School of Physiology. In Fall 2007, he has joined the faculty at the University of Ulm, Germany, as a Chaired Professor heading the Institute of Analytical and Bioanalytical Chemistry. Today, his research interests focus on optical sensors, biosensors, and biomimetic sensors operating in the mid-infrared spectral range, applications of novel IR light sources (e.g., quantum cascade lasers), system miniaturization and integration based on micro- and nanofabrication, multifunctional scanning nanoprobes (e.g., combination AFM-IR and AFM-SECM-IR), scanning probe tip integrated nano(bio)sensors, focused ion beam (FIB) microscopy, development of chemical recognition interfaces for separation and sensing applications (e.g., molecularly templated materials), chemometric data evaluation, advanced vibrational spectroscopic techniques (e.g., SEIRA), environmental analytical chemistry, process analytical chemistry, and biomedical diagnostics. Dr. Mizaikoff is author/co-author of over 160 peer-reviewed publications, 15 patents, and numerous invited contributions at scientific conferences.