Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **116** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

Advancing Surface-Enhanced Vibrational Spectroscopy for Molecular Detection

Monday 9 June 2025 15:00 (15 minutes)

Vibrational spectroscopy techniques, including Raman and infrared (IR) spectroscopy, have gained significant attention for their ability to provide molecular fingerprints with high specificity. By leveraging plasmonic nanostructures, Surface-Enhanced Raman Spectroscopy (SERS) and Surface-Enhanced Infrared Absorption (SEIRA) further enhance the detection sensitivity, enabling trace-level molecular analysis. In this study, we explore the potential of SERS and SEIRA for the sensitive and selective detection of target molecules, demonstrating their application in bio-chemical sensing domains.

To develop the sensor, we deposited gold thin film substrates using the pulsed laser ablation technique suitable for resonance with the excitation 785 nm Raman lasers. Graphene-integrated substrates were utilized to achieve optimal enhancement for IR sensing modalities. The study involves systematic concentration-dependent investigations to evaluate detection limits and spectral reproducibility. Computational support via Density Functional Theory (DFT) aids in the assignment of characteristic vibrational peaks, ensuring accurate molecular identification and interpretation.

By integrating experimental and computational methods, this study aims to establish a robust vibrational spectroscopy platform for the analysis of molecular system. The findings contribute to the development of advanced sensing strategies with potential future applications in biomedical diagnostics and pharmaceutical analysis.

Keyword-1

SERS

Keyword-2

SEIRA

Keyword-3

Plasmonic substrates

Author: BALASUBRAMANIAN, Janani (Nano-imaging and Spectroscopy Laboratory, Faculty of Science, University of Ontario Institute of Technology)

Co-authors: Dr BAJRAMI, Diellza (Institute of Analytical and Bioanalytical Chemistry, Ulm University, Germany); Dr GALIMBERTI, D.R. (Theoretical and Computational Chemistry, Radboud University, Netherlands); Dr TOMMASINI, M. (Department of Chemistry, Materials and Chemical Engineering "G. Natta", Politecnico di Milano, Milan, Italy); Dr TRUSSO, S. (CNR-IPCF, Institute for Chemical-Physical Processes, Messina, Italy); Dr

MIZAIKOFF, B. (Institute of Analytical and Bioanalytical Chemistry, Ulm University, Germany/ Hahn-Schickard, Ulm, Germany); AGARWAL, Nisha (Faculty of Science, University of Ontario Institute of Technology)

Presenter: BALASUBRAMANIAN, Janani (Nano-imaging and Spectroscopy Laboratory, Faculty of Science, University of Ontario Institute of Technology)

Session Classification: (DPMB) M2-8 | (DPMB)

Track Classification: Technical Sessions / Sessions techniques: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)