ANALYTICAL SEMINAR

Structural Elucidation of Microcrystals Using Small Molecule Serial Femtosecond X-ray Diffraction

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In the last 6 years, small-molecule Serial Femtosecond X-Ray Diffraction (smSFX) has gained interest to structurally characterize microcrystals. Several of these microcrystals are not amenable to traditional methods such as single crystal X ray diffraction (scXRD), powder XRD (PXRD), and 3-dimensional electron diffraction (3D microED) due to their size, radiation sensitivity, chemical composition, and thickness. Because smSFX uses an X ray free electron laser (XFEL), the sample exposure to the beam is given by a short pulse (10's fs) that minimizes radiation damage and enhances resolution. To date, two main research groups, Hohman (University of Connecticut, US) and Yonekura (Tohoko University, Japan) have independently worked on applying smXRD on various samples including organo-metallic frameworks, dyes, peptoids, and organic compounds, accomplishing successful elucidation of their structure. Though studies are recent and limited, smSFX has already shown progress that may be of use for future studies not only for micro and nanocrystals but also for time-resolved chemical dynamics studies.

Tuesday, November 26, 2024 *3:30 pm* *WTHR 172*

PURDUE UNIVERSITY | James Tarpo Jr. and Margaret Tarpo Department of Chemistry

ANALYTICAL SEMINAR

Ablating Boundaries: Exploring the Analytical Power of LA-ICP-MS

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Precision and adaptability are essential when conducting high-resolution elemental and isotopic analysis of solid samples across diverse scientific fields. LA-ICP-MS (Laser Ablation-Inductively Coupled Plasma Mass Spectrometry) has emerged as a pivotal tool in analytical chemistry, delivering trace-level sensitivity and detailed spatial resolution without the need for extensive sample preparation. Unlike traditional techniques, LA-ICP-MS can directly analyze solid samples, allowing researchers to generate comprehensive elemental and isotopic profiles with minimal pre-processing. This seminar will present a comprehensive overview of LA-ICP-MS, exploring its principles, technological advancements, and broad range of applications. LA-ICP-MS is ideal for single-cell elemental analysis, where it has become invaluable for investigating cellular metal ion distributions and biochemical processes at the microscale. Other applications, spans across diverse fields, for instance, studies have shown its ability to track essential minerals during cellular differentiation, particularly in neuron-like cells, revealing variations in elemental content that support cellular function and health, thereby redefining analytical standards in bioimaging, environmental analysis, and materials science, underscoring its invaluable role as a high-precision tool in cutting-edge research.

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ANALYTICAL SEMINAR

FTIR Nano-spectroscopy for Nondestructive Nanoscale Material Characterization

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Fourier transform infrared (FTIR) spectroscopy is a sensitive and versatile analytical technique that has been widely used for chemical identification and characterization across the fields of materials science and chemistry. However, the spatial resolution of FTIR spectroscopy is determined by the Abbe diffraction limit, which restricts the resolution to be on the micron-level for most commercial instruments. This spatial resolution prevents the application of conventional FTIR spectroscopy on nanoscale structures. To overcome this limitation, FTIR spectroscopy was combined with scattering-type scanning near-field optical microscopy (s-SNOM) to develop a correlated technique that can provide nano-resolved infrared spectra. This technique is FTIR nano-spectroscopy. As a near-field optical technique, the spatial resolution of FTIR nano-spectroscopy is dictated primarily by the radius of the probe tip, thus allowing a spatial resolution of tens of nanometers to be routinely achieved. This technique, although less than a couple of decades old, has achieved great success in the fields of material science and nanotechnology, where it has been used to characterize various semiconductor materials, polymers, and nanocomposites. Furthermore, FTIR nano-spectroscopy has been shown to be a powerful tool for the chemical characterization of organic thin films and for probing the solid electrolyte interface (SEI) of lithium solid-state batteries.

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