Join us Tuesday, May 7th, for a free lunch and learn seminar at the MIT NanoTechnology Center (MIT.nano) where we explore the latest advances in AFM nanomechanics, nanoindentation, and nanoscale infrared spectroscopy technologies.

Space is limited, register today!

**Agenda**

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<td>Recent Developments in Nanomechanical Testing from High Throughput Property Mapping to In-Situ Characterization</td>
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**Organizers**

- Anna Osherov, Ph.D., Assistant Director of User Services-Metrology.nano, MIT.nano
- Shereece Beckford, Administrative Coordinator, MIT.nano
- Robert Fucci, North East Accounts Manager, Bruker
  
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**REGISTER NOW**

See Next Page for Abstracts
Innovation with Integrity

MIT Nano Technology Center and Bruker Present a Lunch and Learn Seminar:

Latest Advances in AFM Nanomechanics, Nanoindentation, and Nanoscale IR Spectroscopy Technologies

Abstracts

New AFM Modes for Data Mining Approaches and Soft Matter Nanomechanics
Thomas Mueller, Ph.D., Director of Product Management and Applications Development, Bruker

Atomic force microscopy is known to provide extremely high spatial resolution images of surface topography, and even of electrical properties, mechanical properties, and nanoscale chemistry. But does it intersect with data mining and machine learning? In this seminar we will present a new family of AFM modes that provide hyperspectral data cubes amenable to spectral analysis and data classification schemes. We will show that the approach works for many AFM modes and gives rise to new types of property maps that are of interest for nanoscale electrical devices and smart materials.

Studying confinement and interphase effects in soft matter requires not just nanoscale spatial resolution, but also quantitative property data that ties directly to bulk measurements. Building on data cubes and scripting, we have developed an AFM-based dynamic mechanical analysis (nanoDMA) measurement mode enabling nanoscale rheological analysis. We will show that this new technology opens the door to AFM-based time-temperature superposition analysis and quantification of viscoelastic property changes in multiphase solid materials.

Latest Advances in Nanoscale IR Spectroscopy and Imaging
Anirban Roy, Ph.D., Applications Scientist, Bruker

For the last few decades the rapid growth in the field of nanoscience and technology has led to the development of new characterization tools for nanoscale materials. Traditional IR and Raman spectroscopy and imaging offer excellent chemical insights; however, the spatial resolution is limited by the optical diffraction limit (~\(\lambda/2\)). Although, recent super-resolution microscopy techniques [1, 2] offer superior spatial resolution, they are primarily implemented in fluorescence imaging, hence need an external fluorophore tag for detection. Alternatively, nanoscale IR spectroscopy/imaging offers “tag free” spectral detection with high spatial resolution beyond the optical diffraction limit (2-5 µm) by exploiting an atomic force microscope (AFM) probe [3] to detect either photothermal expansion force (PTIR/AFM-IR) or near-field scattered IR light via scattering scanning near-field optical microscopy (s-SNOM).

Recent developments in PTIR/AFM-IR and s-SNOM technology have significantly augmented the speed and spatial resolution for chemical analysis. One of the new developments (tapping AFM-IR) allows acquisition of IR images at a specific absorption band simultaneously with sample topography and nanomechanical properties, providing a complete set of topographical, chemical and mechanical insights with ~10 nm spatial resolution. These high-resolution measurements are currently accomplished by using high-speed tunable laser sources with broad spectral coverage ranging from 800-3800 cm\(^{-1}\), encompassing full capacity of traditional FT-IR characterization for dimensions orders of magnitudes smaller than the diffraction limit. In this presentation, we will highlight the technical background and applications of these emerging technologies in different fields, including nanomaterials, life sciences, polymers, and microelectronics.

Recent Developments in Nanomechanical Testing from High Throughput Property Mapping to In-Situ Characterization
Mike Berg, NI Sales Manager - North America, Bruker

Materials behavior is often dominated by highly localized phenomena, and the ability to probe these local properties to perform advanced materials research and development is critical. Nanomechanical testing is a widely utilized technique for the quantitative measure of mechanical properties at sub-micrometer length scales. Recent instrument advancements have greatly increased the resolution of these measurements, improved measurement throughput by 500x, and have allowed researchers to characterize materials in a wide range of operating environments (low temperature, high temperature, humidity, customized gaseous and inert atmospheres, electrochemical, vacuum, etc.). A broad range of hybrid (electrical), correlative (Raman), and in-situ (SEM, TEM) nanomechanical testing techniques promise to deliver new insight and understanding of material behavior.

A second part of the presentation will focus on coupling small-scale mechanical measurement devices with advanced microscopy platforms to allow for more comprehensive analyses of advanced material systems. For example, tests can be performed inside of electron microscopes to both aid test placement while also providing the capability to directly observe how a small volume of material deforms under applied load. Test types often include nanoindentation, bending, compression, tension, and scratch. These so-called “in-situ” tests also provide validation to the acquired mechanical data, and are very much complementary to high-throughput nanomechanical testing methods as a result. To that end, we will discuss the latest developments in small-scale mechanical testing for a diverse mix of microphone platforms, while also demonstrating the power of combining in-situ testing methods with ultra-high throughput nanoindentation data provided by dedicated standalone nanomechanical systems.