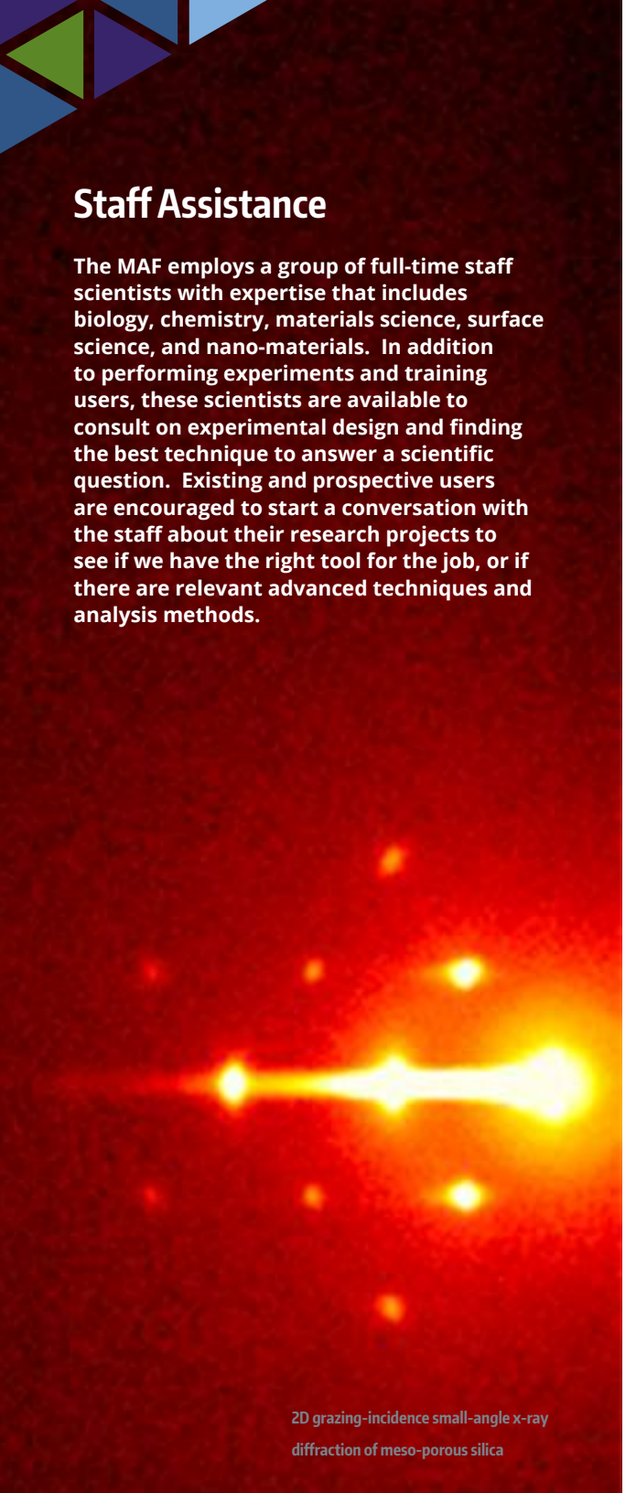
Staff Assistance

The MAF employs a group of full-time staff scientists with expertise that includes biology, chemistry, materials science, surface science, and nano-materials. In addition to performing experiments and training users, these scientists are available to consult on experimental design and finding the best technique to answer a scientific question. Existing and prospective users are encouraged to start a conversation with the staff about their research projects to see if we have the right tool for the job, or if there are relevant advanced techniques and analysis methods.



2D grazing-incidence small-angle x-ray diffraction of meso-porous silica

Staff Scientists

Liam Bradshaw ***XRD, XANES, TA/TRPL, GDOES, Ellipsometer***

Expertise: Spectroscopy, nanoparticles, optics, inorganic chemistry, metalloenzymes

Scott Braswell ***SEM, FIB, EDS***

Expertise: Electron microscopy, FIB imaging/ milling/lift-out, image processing, education, x-ray microanalysis

Micah Glaz ***AFM, Raman, Confocal Microscope, Profilometer***

Expertise: AFM, physical chemistry, organic/inorgani semiconductors, solar materials, microscopy, spectroscopy

Dan Graham ***ToF-SIMS, XPS***

Expertise: Surface analysis of polymer and biological materials, 2D and 3D imaging, multivariate data analysis methods

Gerry Hammer ***XPS, UPS***

Expertise: Surface and interface analysis, metals, films, polymers, fibers, composites

Ellen Lavoie ***TEM***

Expertise: Electron microscopy, TEM, including preparation of materials, biological, and polymer samples

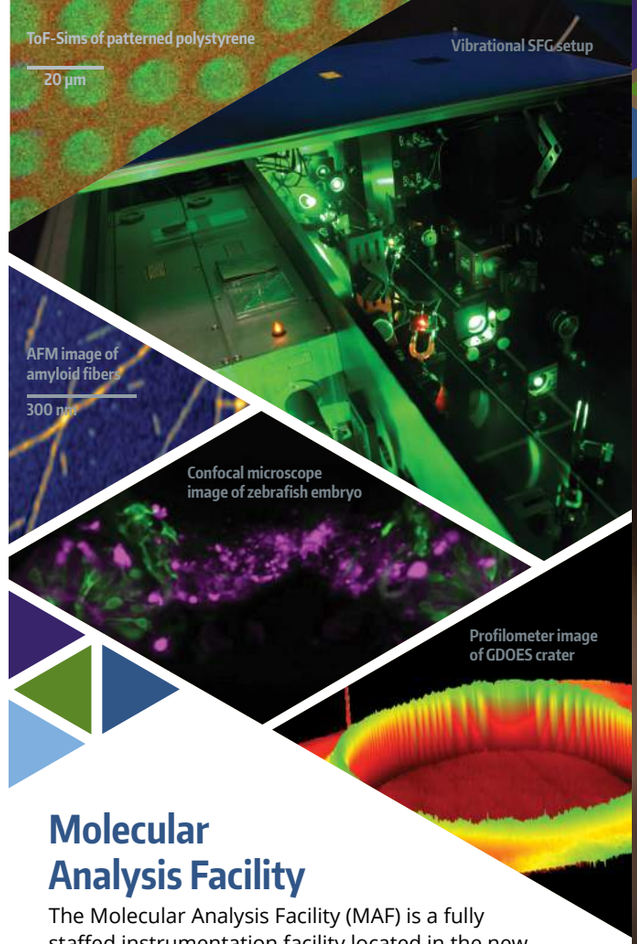
John Sumida ***AUC, ITC, DSC, SPR, Fluorescence (TRSCP, Phase fluorimetry, Stroboscopic methods, FRET)***

Expertise: hydrodynamics, calorimetry, fluorescence spectroscopy, muscle regulation, biopharmaceutics.

Facility Directors

David Castner ***Director***

Lara Gamble ***Associate Director***



Molecular Analysis Facility

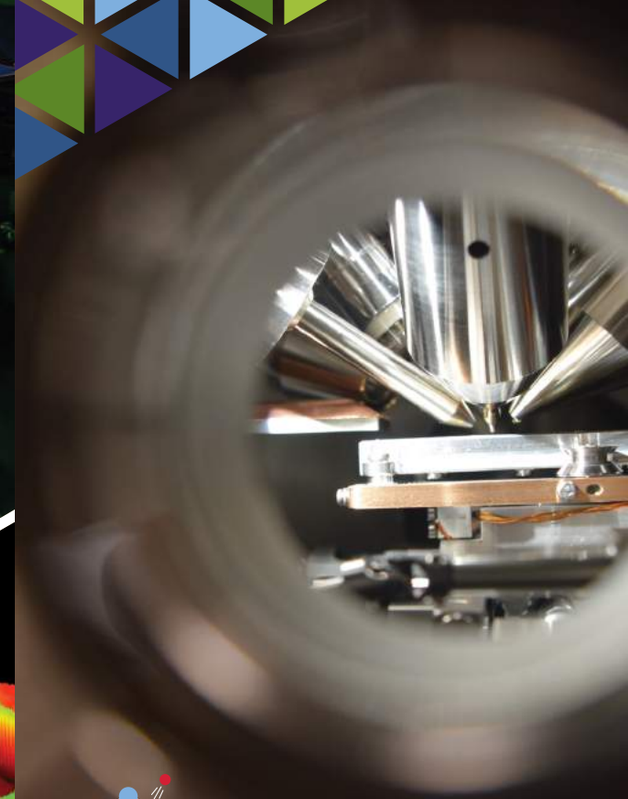
The Molecular Analysis Facility (MAF) is a fully staffed instrumentation facility located in the new Molecular Engineering and Sciences building for users from the University of Washington, other universities, and industry. Capabilities include microscopy, spectroscopy, and surface science. Users can be trained to independently perform experiments, or an experienced staff member can perform experiments for you.

For more information visit:

www.moles.washington.edu/maf
UWMAF@uw.edu

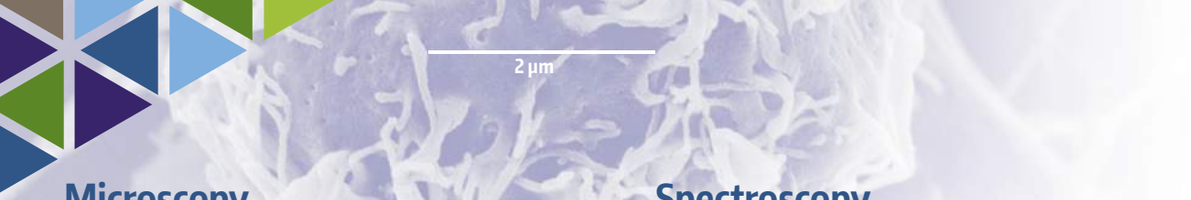
Molecular Engineering & Sciences Institute

UNIVERSITY of WASHINGTON



Molecular Analysis Facility

RESOURCES FOR MICROSCOPY, SPECTROSCOPY, AND SURFACE SCIENCE



Microscopy

Transmission Electron Microscopy (TEM)

- FEG TEM and s/TEM with capabilities for atomic resolution imaging, diffraction, tomography with 3D rendition software, in-situ liquid and heating, cryo transfer, HAADF imaging, and EDS elemental analysis
- A full suite of sample preparation tools for materials, polymer, and biological samples

Atomic Force Microscopy (AFM)

- Measures surface topograhy with sub-nanometer resolution
- AFM suite with multiple instruments specializing in hardness, electrical, and chemical mapping for samples in liquid or under laser illumination.
- Photo-Induced Force Microscopy to map molecular infrared absorption fingerprints down to 10 nm spacial resolution and coupled with confocal microscopy

Scanning Electron Microscopy (SEM/FIB)

- Image 0.8nm surface details on semiconductors
- Accomplish 1.8nm resolution on difficult polymers and ceramics without conductive coatings
- Analyze sample microstructure by low kV backscatter imaging or elemental mapping with EDS
- Direct pattern and sculpt structures or expose cross-sections for s/TEM studies using FIB

Profilometer

- Rapidly measures topography and surface roughness
- Often used to measure film thicknesses

Confocal and Light Microscopes

- Images fluorescently labeled samples
- Optical upright, inverted, and dissecting microscopes available

For more information on our techniques, capabilities, or how to use the facility, please visit *www.moles.washington.edu/maf*

Spectroscopy

2D X-Ray Diffraction (XRD)

- Has a high intensity collimated spot to rapidly measure XRD from only a few milligrams of sample
- Measures crystal phase, mixture composition, crystallite orientation, and residual stress
- Advanced measurement techniques including, GIXRD, GI-SAXS, XRR, and Rietveld refinement.

Raman Spectroscopy/Microscopy

- Measures vibrational information from molecules on a surface
- Can differentiate chemically similar molecules
- Sub-micron imaging capability

X-ray Absorption Near Edge Spectroscopy (XANES)

- Measures core electron adsorption energies and intensities to determine element specific oxidation state and coordination environment

Ultrafast Transient-Absorption and Photoluminescence

- Excite samples with 50 fs pulses of tunable light from UV to IR
- Transient absorption kinetics and spectra (broadband probe Vis to IR) from 150 fs to 1 ms
- Streak-camera detected PL with 2 ps resolution

Nanoindenter

- Measures hardness, elastic modulus, creep, stress relaxation, and fracture toughness.
- Ultra low and high forces from nN to 10 N
- Topographic imaging and high speed data collection.

Ellipsometry

- Measures the optical properties (e.g., n and k) of materials and thin films
- For thin film applications, non-destructively measures film thickness

Biophysics

Surface Plasmon Resonance (Biacore T200)

- Quantitates high affinity interactions, measuring kinetic “on” and “off” rates, and affinity constants.
- Quantitates sub micromolar reagent concentrations in both pure and complex mixtures.
- 0.1 nM ≤ KD ≤ 1 mM

Analytical Ultracentrifugation

- Molecular characterization of submicron molecules in terms of size, MW, and shape factor
- Detects interference, absorbance and fluorescent signals
- Aggregate analysis of subvisible aggregates ≤ 100 um

Differential Scanning Calorimetry

- Quantitate Tm and thermodynamic parameters for protein unfolding and particle stability in the range between 7 °C-120 °C (±0.1 °C),
- Quantitate ultra-high affinity (sub nanomolar) interactions.

Isothermal Titration Calorimetry

- Characterizes the thermodynamics of molecular interactions in terms of enthalpic and entropic contributions.
- 0.01 µM ≤ KD ≤ 10 µM.

Densitometry/Viscometry

- Measurement of dilute solution densities in the range from 0 – 3 g/cms^3 (precision to 6 decimal places)
- Current capillary system is capable of measuring viscosities in the range of 0.3-10 centipoise.

Dual Beam UV/Vis instrument

- Absorbance and transmittance measurements in the range 190 nm- 1100 nm (±0.5 nm), spectral bandwidth 1-2 nm.

Surface Science

X-Ray and UV Photoelectron Spectroscopy (XPS/UPS)

- XPS measures the energy of core electrons from elements on the surface of a sample for quantitative elemental analysis and identification of oxidation states
- XPS imaging with lateral resolution down to 5 µm
- UPS to measure work functions and band potentials
- Can be used with frozen/biological samples

Time of Flight-Secondary Ion Mass Spectrometry (ToF-SIMS)

- High-resolution mass spectra for analysis of surface modifications, contamination, or immobilized biomolecules
- Imaging with lateral resolution down to 1 µm
- Fingerprint identification of polymers

Glow Discharge Optical Emission Spectrometry

- Plasma etches a crater up to 1 mm into a sample while measuring atomic emission
- Gives depth resolved elemental analysis with depth resolution down to 7 nm

Vibrational Sum Frequency Generation

- Surface specific vibrational spectroscopy at solid/air, solid/liquid, liquid/air, and liquid/liquid interfaces