Nanobiotechnology Center
Shared Research Facilities

“Instrumentation and capabilities for integrated nanobiotechnology research”
Imaging Ellipsometer

Spectroscopic Imaging Ellipsometry (S-IE)
A powerful non-destructive technique for measuring dielectric properties or thickness of thin films of almost any material adsorbed/deposited on a reflective substrate.

The EP3 Imaging Ellipsometer uses analysis optics in combination with a CCD camera to provide spatial resolution down to 2 micrometer and <0.1nm thickness resolution (SiO2 on Si) with a real-time view of the sample, providing the user with unprecedented measurement control and information on sample homogeneity.

Optical Microscopy

Microscopy Resources
The NBTC shared facilities have a number of high quality optical microscopes with fluorescence, transmitted and reflected light optical configurations. Digital image capture and image analysis software allow measurement and other image processing.

Total Internal Reflection (TIRF) Microscopy
TIRF is an excellent technique for exciting and imaging fluorophores within ~100nm of a coverslip (for example, labeled membrane proteins). Since excitation of fluorophores in the bulk of the specimen is avoided, a very high signal-to-noise ratio is achieved, making it possible to detect single-molecule fluorescence with TIRF.

The NBTC TIRF microscope is a Nikon Ti-E/B with Andor iXON+ camera, available laser wavelengths of 405, 488, 561, 635 nm, and can also perform FRET, FRAP, or PALM microscopy.

Infrared Spectroscopy

Fourier Transform Infrared Spectroscopy
FT-IR is an analytical technique that can be used for identification of chemical functional groups based on their adsorption of infrared radiation.

The NBTC facilities provide access to an advanced, high resolution research Vertex V80v system with a mid-IR source (450-7000cm-1) and vacuum evacuated optics/sample chamber.

Available sample accessories
• Diamond ATR
• Germanium ATR (60 deg)
• Transmission sample holder
• Variable grazing angle (IRR5)
• Variable polarization

Typical samples
• Films of polymers or other organics on various solid substrates
• Monolayers (SAMs of silanes, thiols etc)
• Biomolecules (dry and in aqueous solutions)
• Carbon nanotubes
• Powders and nanoparticles
• Gels
• General organic materials (liquids/solids)
Dynamic Light Scattering (DLS) provides the ability to measure three important characteristics of particles or molecules (polymers, proteins etc.) over a wide range of concentrations in a liquid medium:

- **Particle size** (hydrodynamic radius: 0.6-6000 nm)
- **Zeta potential** (surface charge)
- **Molecular weight**

Being able to heat the sample cell from 2 to 90 degrees Celsius, the zetasizer also enables determination of the protein melting point and the ability to perform trend measurements (size vs time, size vs. temp etc.)

**Atomic Force Microscopy**

**DI-3100 & MI PicoPlus AFM’s**

Two versatile atomic force microscopy systems that in combination accommodate all types of samples from large wafers to single strands of DNA. The PicoPlus system is specially designed for biological applications and imaging in liquids. There are a number of accessories for electrochemistry in combination with AFM, as well as integrated software for measuring cantilever force constants.

**Versatile for many applications:**

- Life science
- Material science
- Polymer science
- Electrochemistry
- Force spectroscopy
- Physics
- Chemistry
- Nanosciences

**BioPlex 200**

The Bio-Plex 200 system with high-throughput fluidics is a suspension array system which offers protein and nucleic acid researchers a reliable multiplex assay solution that permits analysis of up to 100 biomolecules in a single sample. This system allows researchers to multiplex:

- Immunoassays
- Enzyme assays
- Receptor-ligand assays
- Nucleic acid hybridization assays
NBTC shared labspace

Integrated Research Labs
Provide a versatile biological/chemical laboratory environment to facilitate nanobiotechnology research

• General Chemistry (Acid/Base, Organic)
• Biotechnology
• Microbiology
• Bacterial and Eukaryotic Cell Culture Capabilities
• Analytical Instrumentation
• Micromachining Facilities
• PDMS station for fluids and mCP/mFP applications etc.
• Walk-in coldroom
• Staff support to assist users in cross-disciplinary research and help with fabrication and analysis

Training and Research Assistance
In addition to full training which is available on the tools and equipment listed here, the NBTC also provides minicourses on the following topics

• Mammalian Cell Culture
• Cell Staining and Processing
• Electronic Testing
• Fluorescence Microscopy
• Surface Modification
• Microfluidics

NBTC staff can develop workshops tailored to your lab’s needs.

Equipment
Optical/fluorescent microscopy
Potentiostat
Electronic test equipment
Centrifuge
Microplate readers
Electrophoresis
PCR
Freeze dryer
Nitrogen glovebox
Spectrophotometer
Fluorometer

Critical point dryer
Gel imaging system
Parylene coating systems
Spin-coater
Probe-tip sonicator
Profilometer
Plasma cleaner
Drying/vacuum ovens
Laminar-flow sterile hoods
Autoclaves
Profilometry

CHA Mark50 Electron-beam metal evaporation
• Conformal films - 50 wafers capability
• Lift-off - 12 wafers capability
• 6 material pockets
• Materials include: Al, Au, Cr, Ti, Pt, Ni, Cu, SiO₂

PDMS casting station
• Fabrication of MEMS devices
• Stamp making for microcontact printing