



**Polymer Surface &
Interface Group**

POLYMER SURFACE & INTERFACE GROUP

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RESEARCH FOCUS

The primary focus of our work in the Polymer Surface & Interface Group is the physics of polymer and biopolymer thin films and interfaces. Both polymer and biopolymer films are very important in technological applications ranging from adhesion to optical coatings to information storage to biofilm contamination to self-assembled morphologies in bionanotechnology. In our research, we fabricate and evaluate films that have unique and desirable properties, and we work toward achieving a fundamental understanding and predictive power. We achieve unique properties using a variety of approaches, including the use of novel film geometries, confining the molecules to dimensions comparable to the overall size of the molecules, and incorporating molecules that have themselves unique properties.

Using a variety of sophisticated, in-house techniques, we probe the mechanical properties, morphology and dynamics of polymer and biopolymer films. Potential applications and benefits of this work include:

- self-assembly & pattern formation in thin polymer and biopolymer films
 - control of instabilities in thin polymer multilayer films to achieve unique film morphologies and topographies
 - stability of interfaces in polymer multilayer films
 - microencapsulation of polymer molecules and biomolecules
 - control of surface sheen
 - novel active packaging systems
 - effects of confinement on phase separation in thin polymer blend films
 - self-assembly of colloidal particles
 - improvements in drying of paint films
- mechanical properties of thin polymer and biopolymer films
 - effects of interfaces and confinement on glass transition temperature of polymer films
 - effectiveness of polymer film/substrate adhesion
 - adhesion, mechanical properties and biocide resistance of biofilms
 - effects of physical aging on polymer thin films
 - improved hardness of thin coatings
- sensor properties of thin polymer and biopolymer films
 - surface-sensitive chemical sensors
 - polymeric membranes for gas separation
 - barrier properties of thin polymer films
- environmental relief due to reduction of polymer packaging material
- miniaturization of photoresist features in microelectronics

EXPERIMENTAL FACILITIES AND EQUIPMENT

We have sophisticated sample preparation facilities and a wide variety of experimental techniques for the characterization of thin polymer films in the Polymer Surface and Interface Group and within the Centre for Food & Soft Materials Science and the Electrochemical Technology Centre.

- ellipsometry
 - custom-built ellipsometer for precise measurements of film thickness (< 0.1 nm resolution) and refractive index
 - Optrel Multiskop imaging ellipsometer/Brewster angle microscope/surface plasmon spectrometer
- optical microscopy
 - Olympus BX-60 with 3-color CCD camera, frame grabber & Image Pro Plus acquisition software
 - Wyko NT 3300 optical profiler with 0.1 nm vertical resolution
- scanning probe microscopy
 - Digital Instruments Dimension 3100 scanning probe microscope
 - Molecular Imaging PicoSPM environmental scanning probe microscope
- light scattering techniques
 - custom-built Brillouin light scattering spectrometer for measurement of mechanical properties of thin polymer films
 - custom-built small angle of incidence light scattering spectrometer to measure evolution of micrometer-scale structure
- Q-Sense quartz crystal microbalance for measurements of absorption and adhesion of molecules
 - fluid flow cell for biomolecule work
- custom-built differential pressure experiment for measurement of mechanical properties and stability of polymer membranes
- Fourier transform infrared reflectance with polarization modulation

All of the experiments have integrated hot stages to allow measurements as a function of temperature.

CONTACT INFORMATION

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