

Oil Sands and Coal Interfacial Engineering Facility (OSCIEF)



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- ❖ OSCIEF was established by Dr. Jacob Masliyah, Dr. Zhenghe Xu, Dr. Subir Bhattacharjee, Dr. Murry Gray etc.

We provide analytical instrument and training for academic and industrial users

Our previous projects include:

- Water Chemistry for:



- Colloids Science for:



- Mineralogy for:



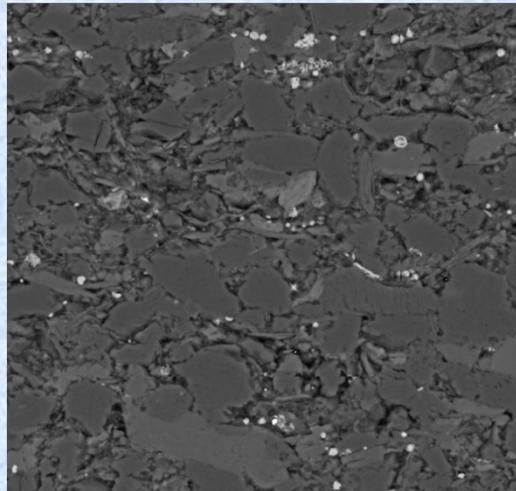
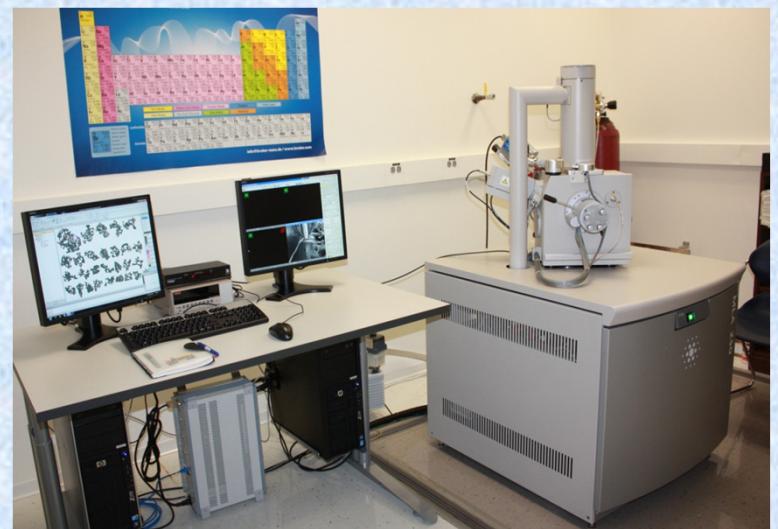
❖ OSCIEF instruments

- **Scanning Electron Microscope/Mineral Liberation Analyzer (SEM/EDX/MLA)**
- Total Organic Carbon (TOC) analyzer
- FTIR spectrometer and microscope
- UV-Vis spectrometer
- Fluorescence Spectrophotometer
- Dynamic Light Scattering/Static Light Scattering
- Electroacoustic Particle size and ζ -potential Analyzer
- Ellipsometer
- Brewster Angle Microscope (BAM)
- Micro-Particle Image Velocimeter (Micro-PIV)
- White Light Scanning Confocal Microscope (Optical Profilometer)
- Fluorescence Confocal Microscope and Optical Tweezer
- Zeiss Inverted Fluorescence Microscope
- Interfacial Shear Rheometer
- Langmuir Trough
- Auto-titrator
- Turbidity meter
- Brookfield Viscometer
- Differential Refraction Index meter

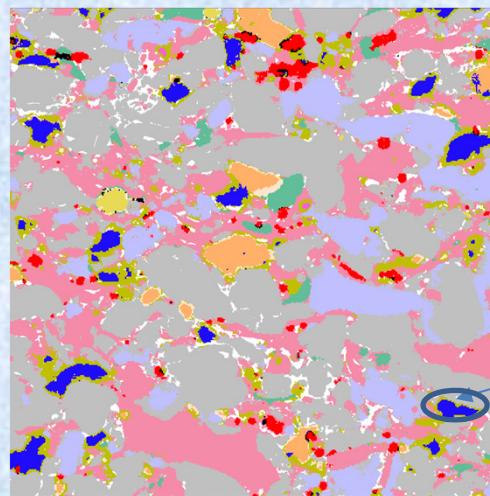
❖SEM/EDX/MLA

Quanta 250 Mineral Liberation Analyzer (FEI company).

- Scanning electron microscopy
- Energy-dispersive X-ray spectroscopy
- Quantitative mineralogy study
- Mineral liberation analysis



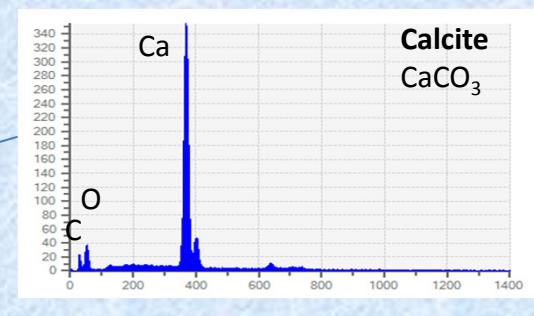
Back-scattered Electron Image of
a rock section



Processed Image / Mineral Map

Mineral
Unknown
Orthoclase
Quartz
Pyrite
Calcite
Ilmenorutile
Plagioclase
Almandine
Kaersutite
Jadeite
Dolomite
Apatite

200 μm

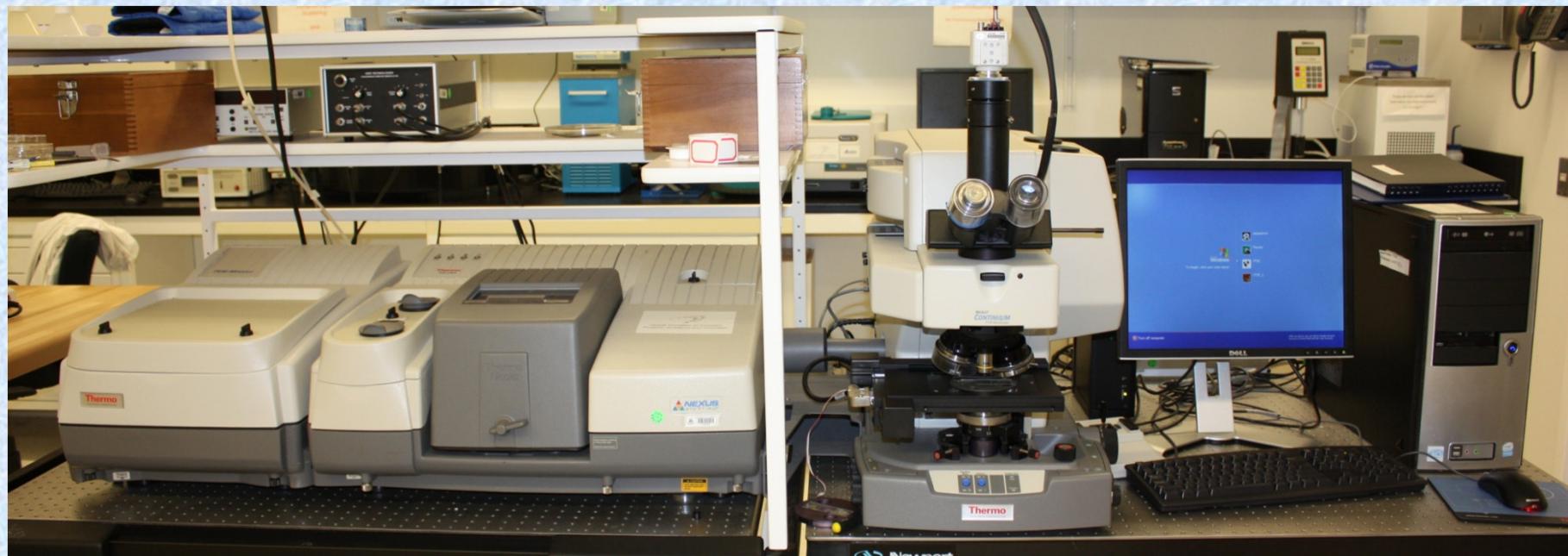


EDX spectrum

OSCIEF Lab Instruments (NINT 5-071)

❖ FTIR Spectrometer (Thermo)

- **FTIR Microscope:** Transmission, Reflection, ATR , FTIR Mapping
- **Spectrometer:** Transmission, Variable angle reflection, Single and Multi –Bounce ATR, Variable angle reflection, Diffuse reflection (DRIFTS).
- **Photoelastic Modulator (PEM) :** Polarization modulation-infrared reflection-adsorption spectroscopy (*PM-IRRAS*)



❖ FTIR accessories

➤ Attenuated total reflection (ATR)

Single Bounce

- Liquid sample including aqueous solution
- Powders samples
- Polymers



Multi Bounce



➤ Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS)

- Powders samples such as minerals
- Liquid sample (Non-aqueous sample)



➤ Variable angle specular reflectance accessory

- Thin films on solid substrate



OSCIEF Lab Instruments (NINT 5-071)

❖ UV-Vis Spectrometer (Varian Cary 50)

- Wavelength range (190-1100nm)
- Transmission
- Optical Fiber for in-situ UV-Vis measurement



Multicell holder can
be connected to a
water bath

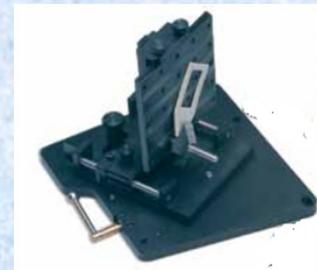


Fiber optic dip probe

OSCIEF Lab Instruments (NINT 5-071)

❖ Fluorescence Spectrophotometer (Varian Cary Eclipse)

- Wavelength range 190-1100 nm
- Liquid sample measurement (FEEM and Synchronous Ffluorescence)
- Solid sample measurement
- Optical Fiber Accessory for in-situ measurement



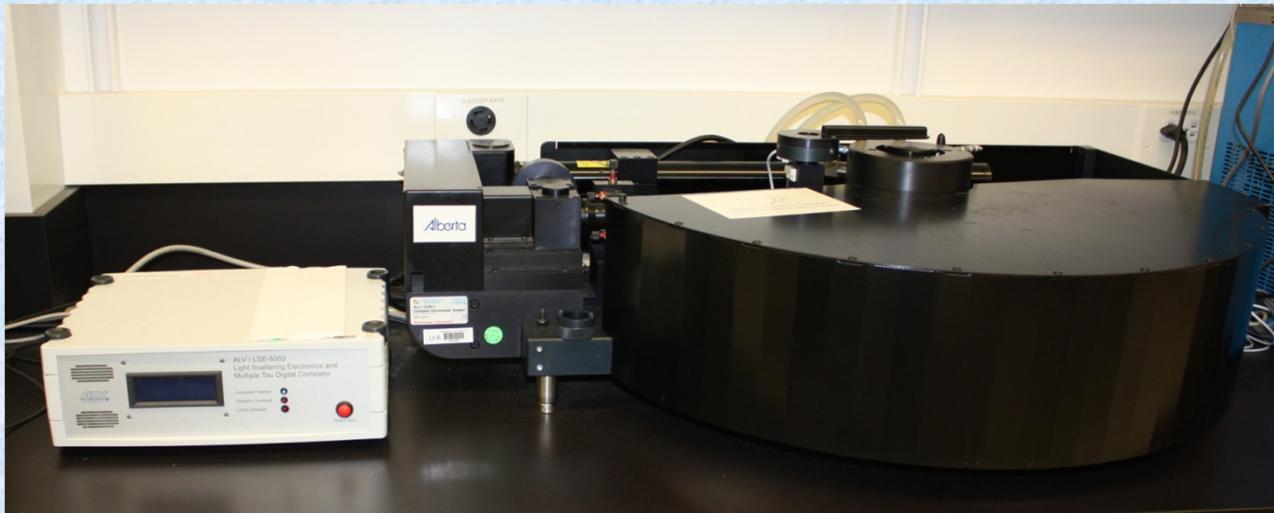
Solid sample holder



Fibre optic coupler

OSCIEF Lab Instruments (NINT 5-071)

❖ Dynamic/Static Light Scattering (ALV/CGS-3 Goniometer)



Dynamic light scattering (DLS)

- Measure intensity fluctuation of scattered light
- Particle size distribution
- Hydrodynamic radius (R_h)
- Diffusion coefficient (D)

Static light scattering (SLS)

- Measure light intensity at variable angles
- Polymer molecular weight (M_w)
- Radius of gyration (R_g)
- Second virial coefficient (A^2)

OSCIEF Lab Instruments (NINT 5-077)

❖ Total Organic Carbon Analyzer (SHIMADZU)

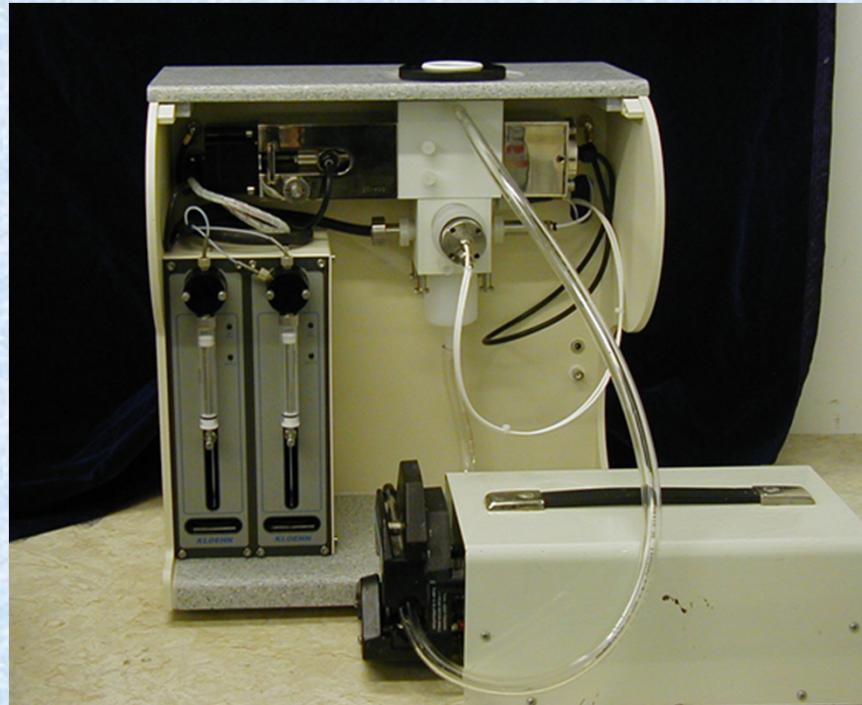
- Use the 680 °C combustion catalytic oxidation method to determine the amount of carbon in aqueous solution
- Determine:
 - Total Carbon (TC)
 - Inorganic Carbon (IC)
 - Total Organic carbon (TOC)
 - Non-Purgeable Organic Carbon (NPOC)
 - Purgeable Organic Carbon (POC)



OSCIEF Lab Instruments (NINT 5-077)

❖ Particle Sizer and Zeta Potential Analyzer (Dispersion Technology)

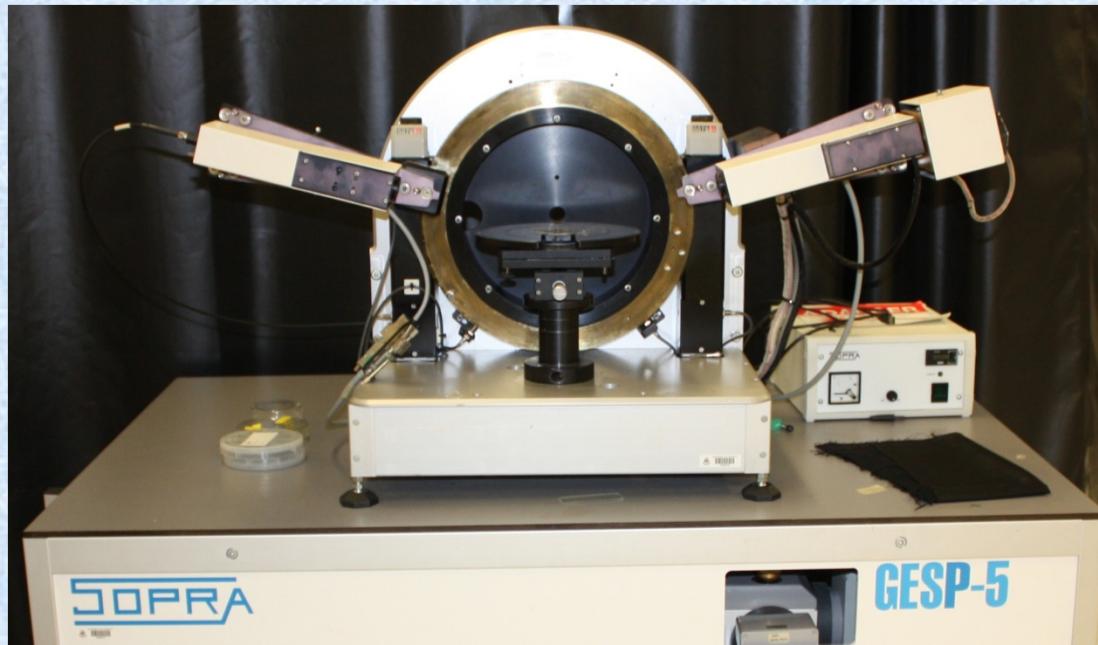
- Measure acoustic attenuation spectrum to determine **particle size distribution**.
- Use electroacoustic technique to determine **zeta-potential**.
- Applications in coagulation and flocculation of concentrated fluid systems (with particle concentration above 10 wt%)



OSCIEF Lab Instruments (NINT 5-077)

❖ Ellipsometer (Sopra)

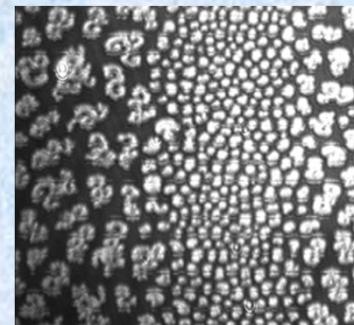
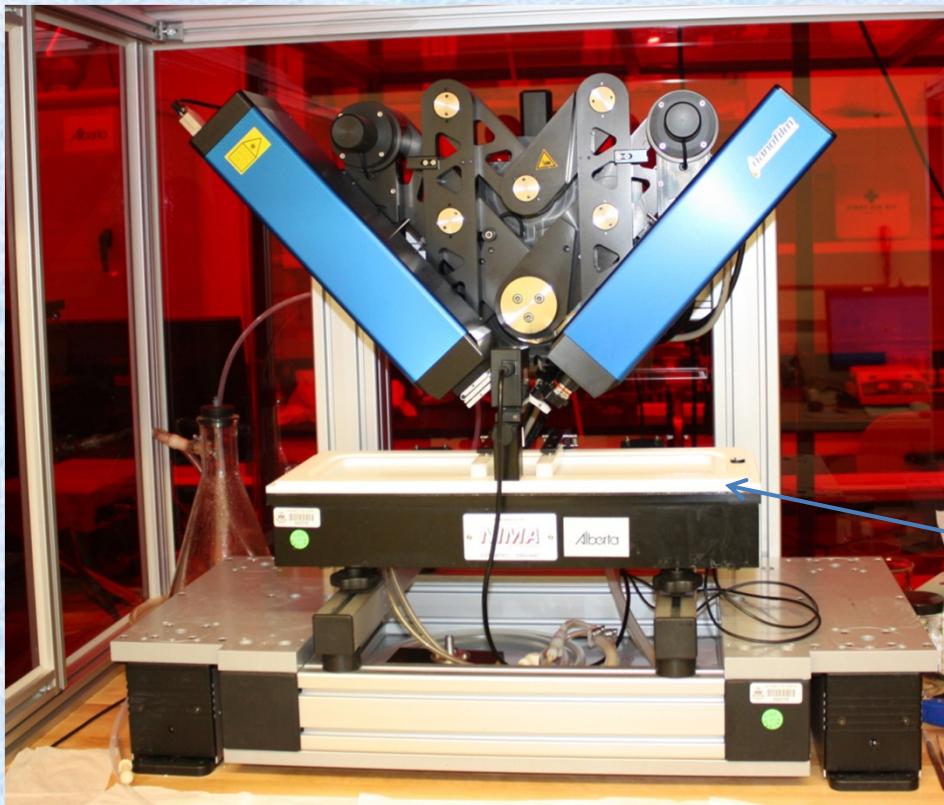
- A non-contact , non-destructive optical technique
- Spectroscopic ellipsometry (wave length range: 210nm to 900nm)
- Measure the change in polarization of light beam upon reflection from a sample
- Determine: **film thickness and refractive index**



OSCIEF Lab Instruments (NINT 5-028)

❖ Brewster Angle Microscope -BAM (Nanofilm, EP³)

- Use microscope to record the p-polarized reflectance of the sample film at the Brewster angle of the substrate
- Light source: 532nm green laser
- Measure the **film thickness** and **topography** of thin films on a dielectric substrate



BAM image of DPPC thin film
at air/water interface when
surface pressure was at 10mN

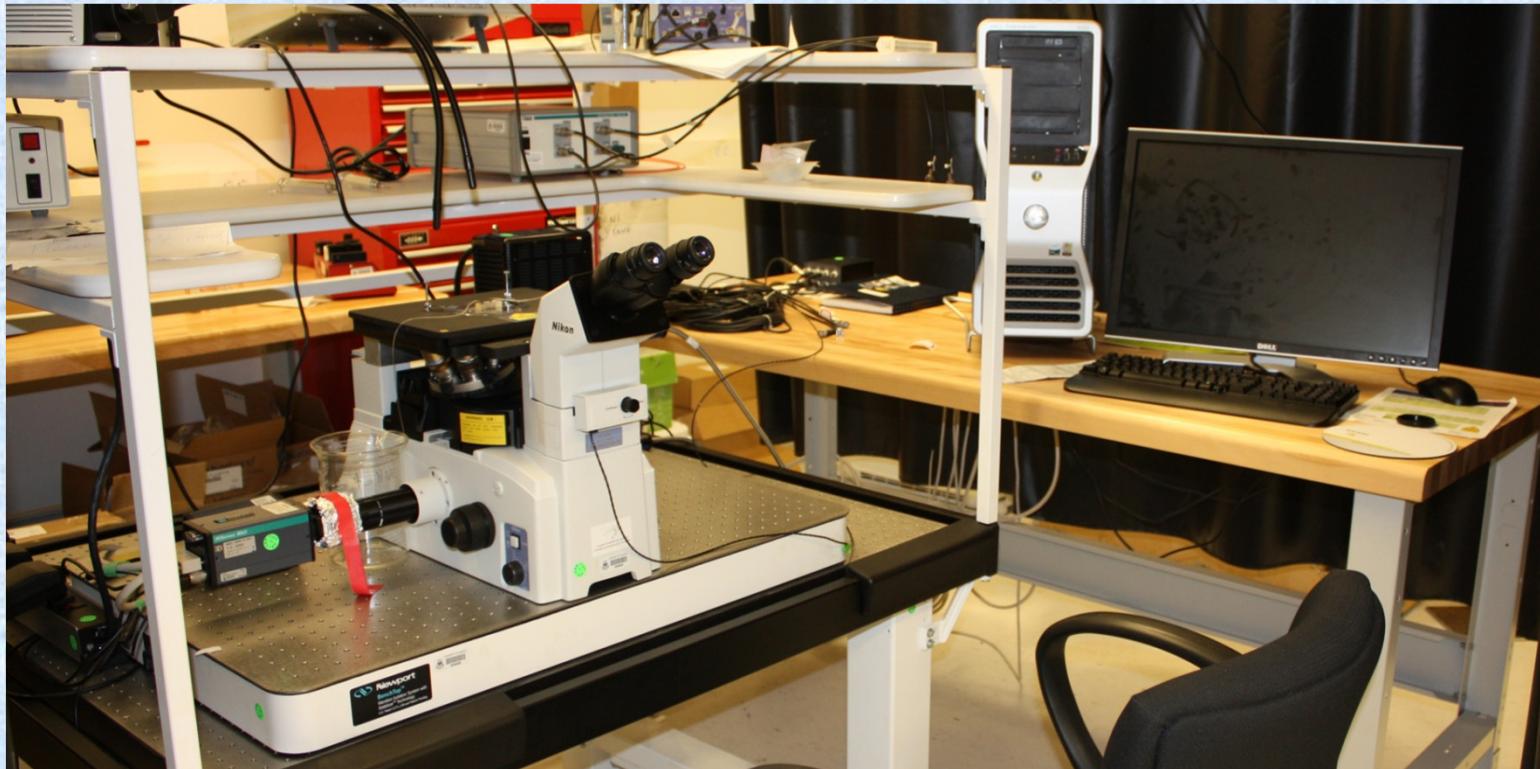
❖ Langmuir Trough (Nima)

- Measure surface pressure of thin film at air/water or oil/water interface.

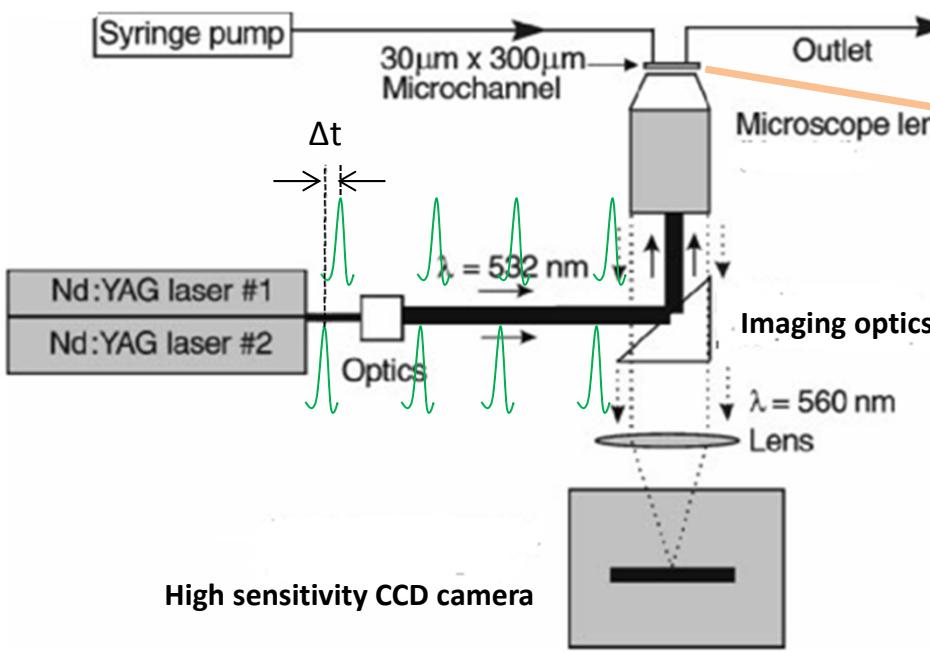
OSCIEF Lab Instruments (NINT 5-077)

❖ Micro Particle Image Velocimetry – microPIV (Dantec)

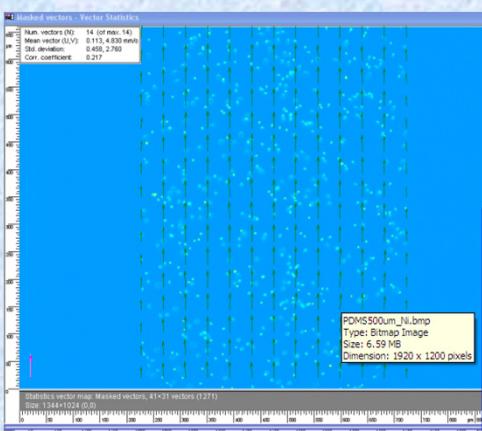
- Applications in **microfluidics, flow dynamics**
- Nikon inverted fluorescence microscope
- Use seeding particles (Fluorescent particles) to trace a fluid flow
- Obtain the **velocity and vorticity map** of the fluid flow



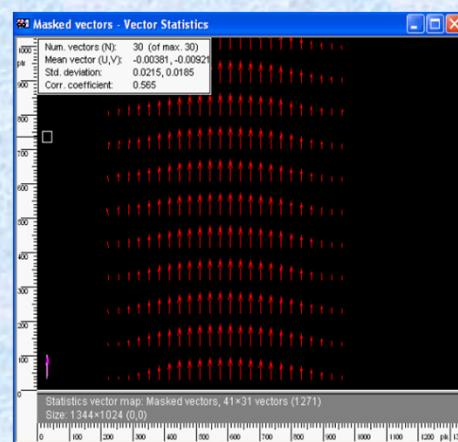
❖ Schematic diagram and Data of a micro PIV system



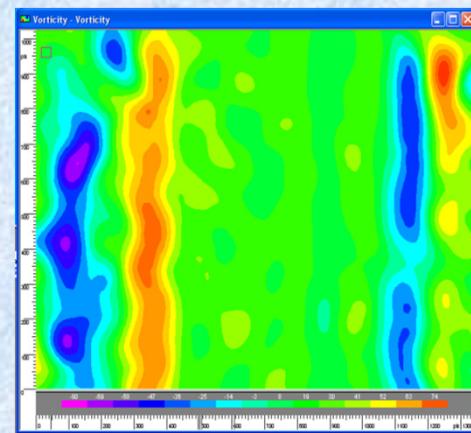
Microfluidic chip



Fluorescent particle image in a micro channel



Velocity map



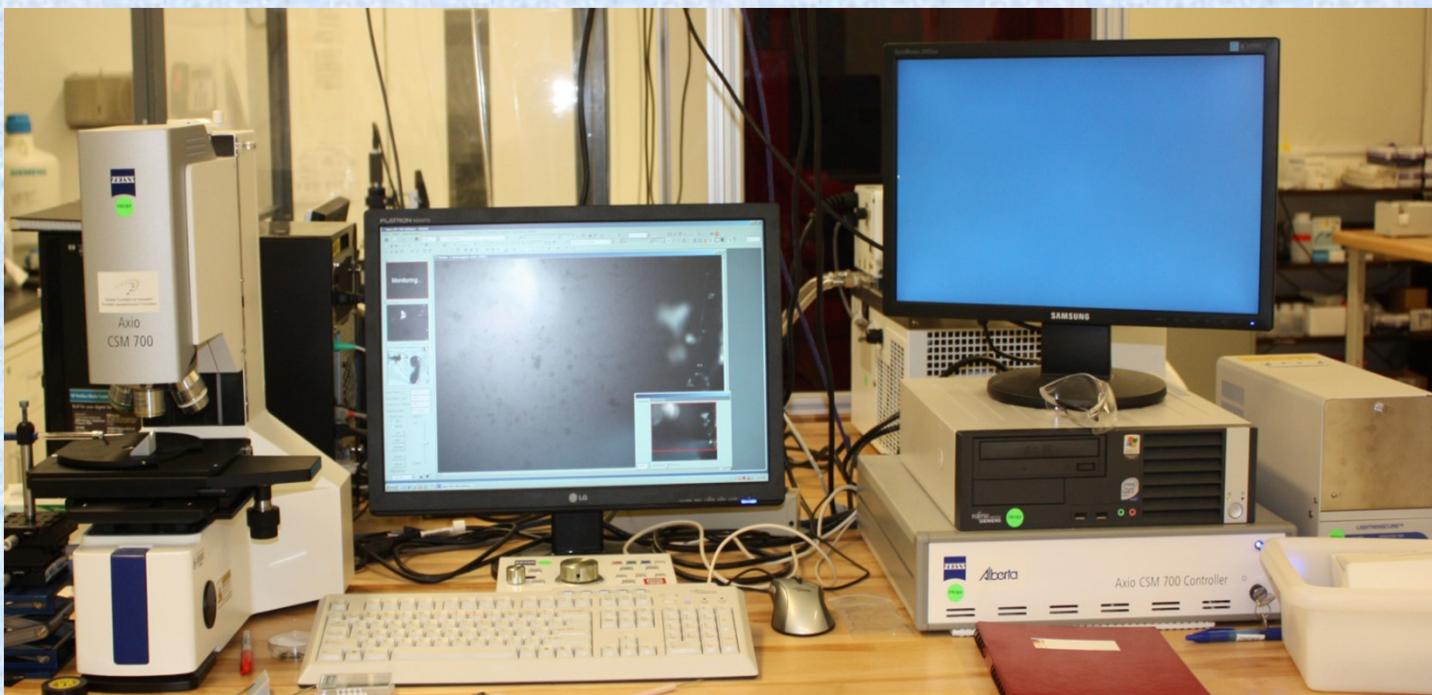
Vorticity map

OSCIEF Lab Instruments (NINT 5-028)

❖ Confocal scanning microscope (Zeiss Axio CSM 700)

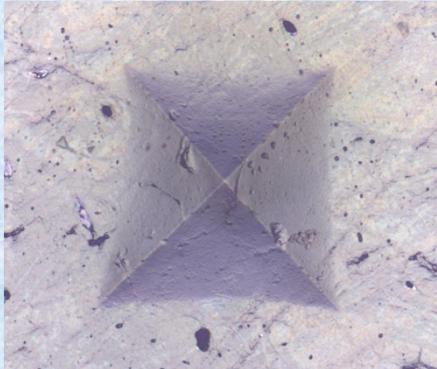
Advantages

- High acquisition speed (7.5 fps, high-speed color mode)
- True colour confocal microscopy
- High resolution (Lateral resolution 0.16 um)
- Optical 3D profilometer

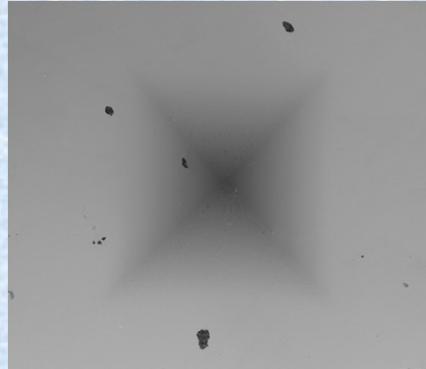


❖ Confocal scanning microscope -DATA

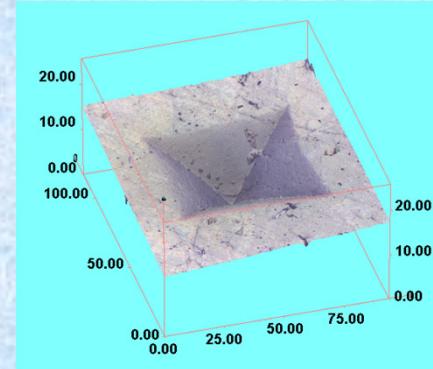
Chicken bone section with a micro-indent for hardness measurement



All-in-focus image

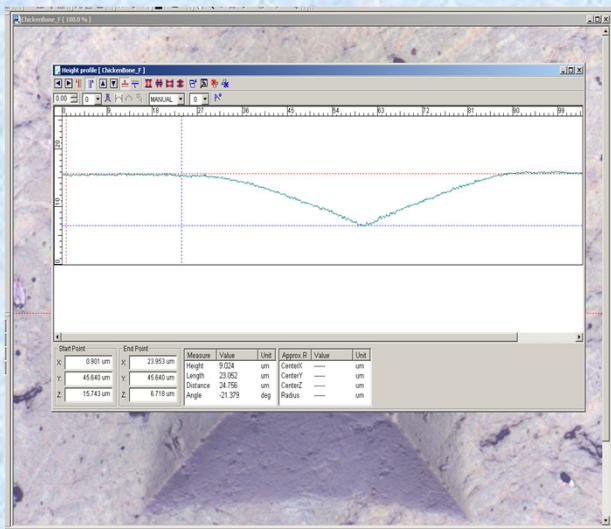


Z image

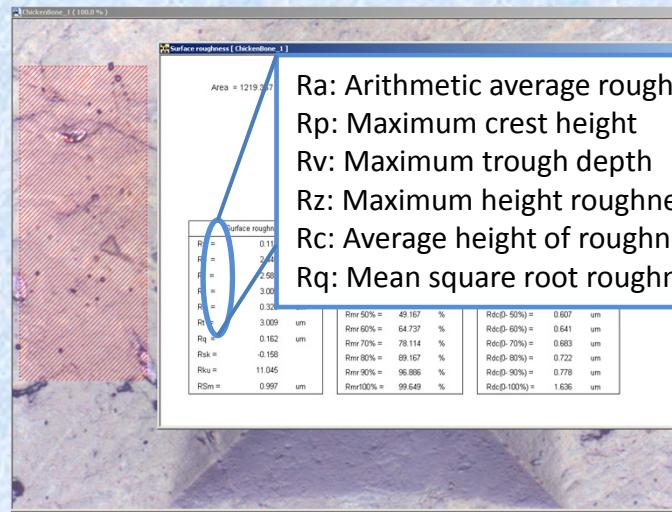


3D image

➤ Height Profile Measurement



➤ Roughness measurement



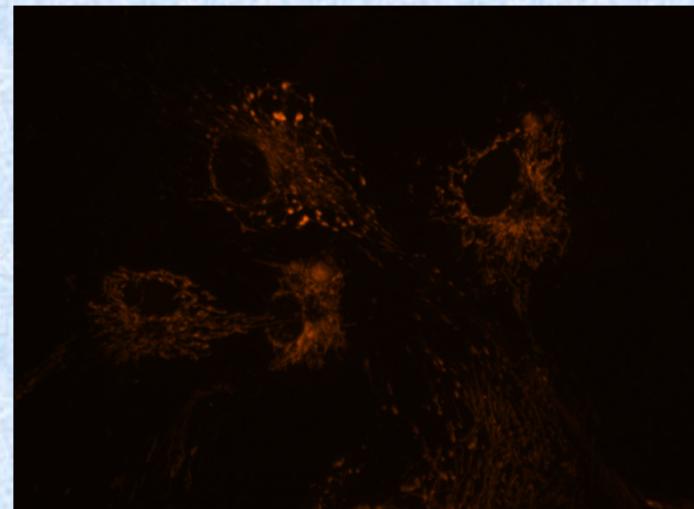
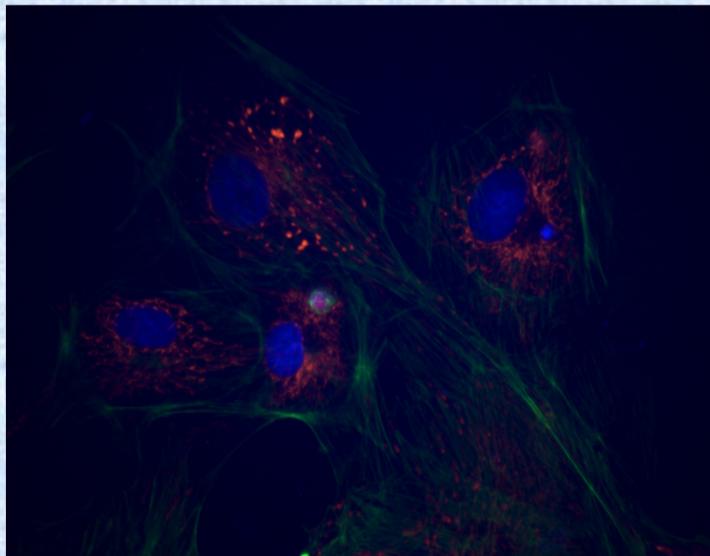
- R_a: Arithmetic average roughness
- R_p: Maximum crest height
- R_v: Maximum trough depth
- R_z: Maximum height roughness
- R_c: Average height of roughness curve element
- R_q: Mean square root roughness

OSCIEF Lab Instruments (NINT 5-028)

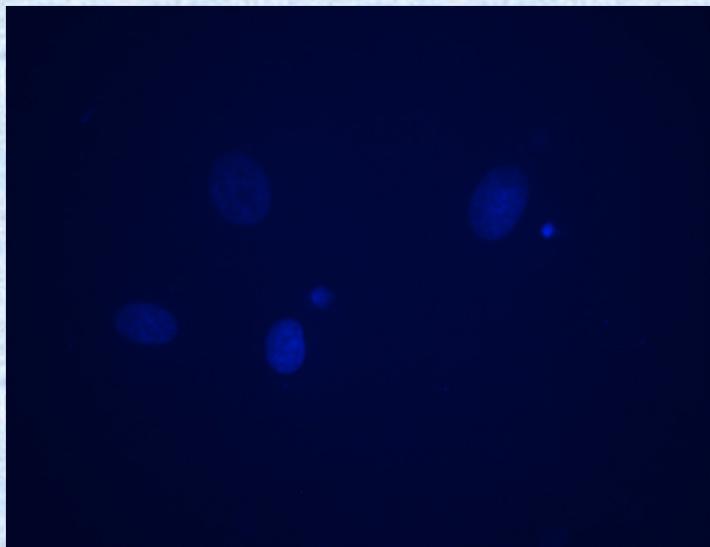
- ❖ Spinning-Disk confocal Fluorescence Microscope and optical tweezer



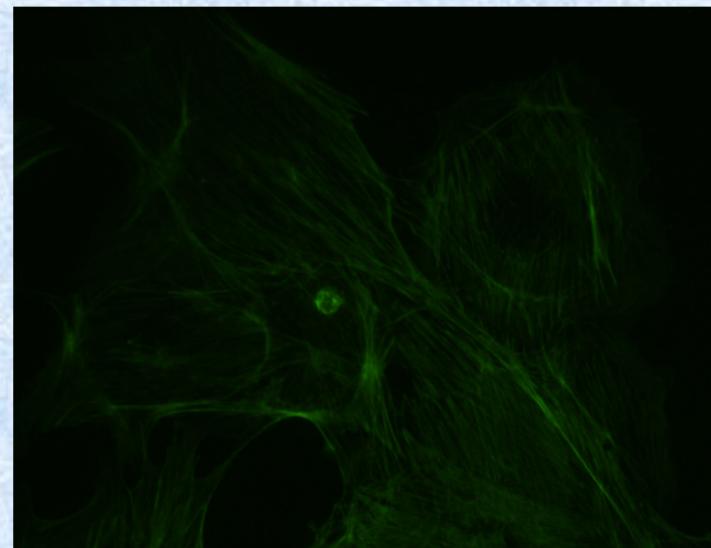
❖ Example: Bovine pulmonary artery endothelial cells



Red fluorescence image of mitochondria



Blue fluorescence (DAPI) image of nuclei



Green fluorescence image of F-actin

❖ Interfacial Shear Rheometer (KSV)

- Measure the viscoelastic properties of film at fluid interfaces (air/liquid and liquid/liquid)
- Viscoelastic properties and surface pressure can be measured simultaneously.

