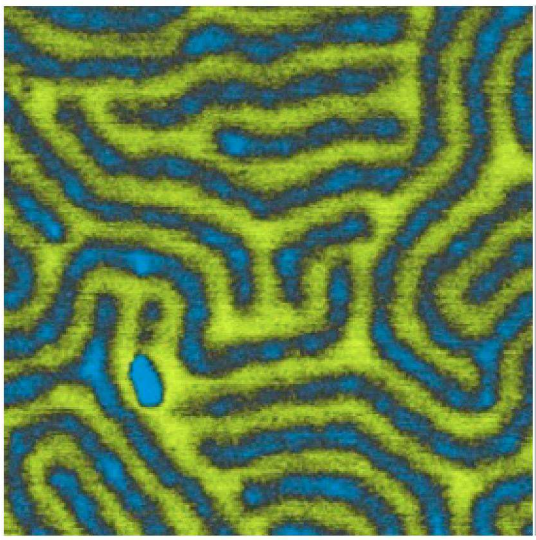
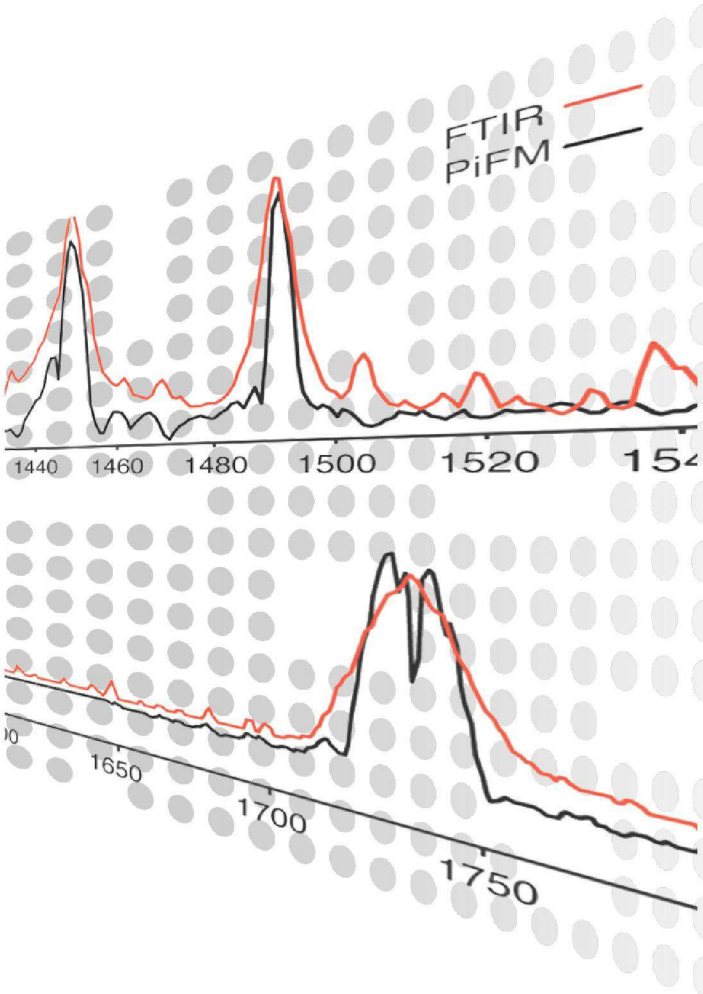
molecular VISTA

PiFM / AFM-IR / s-SNOM / Raman





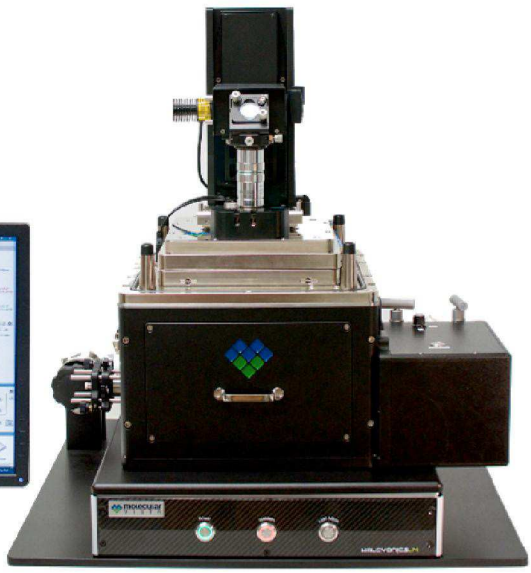
VISTASCOPE

Photo-induced Force Microscope

Sub-10nm FTIR Imaging & Spectroscopy

Scattering SNOM

AFM-Raman & TERS



Nanoscale Chemical & E-field Imaging

PiFM / AFM-IR / s-SNOM / Raman

AFM & PiFM (specific wavelength absorption / polarization)

Sub-10nm IR Hyperspectral Imaging & UV-Vis Spectral Imaging

Scattering SNOM (optical amplitude & phase)

AFM-Raman & Fluorescence (TERS & TEFS)

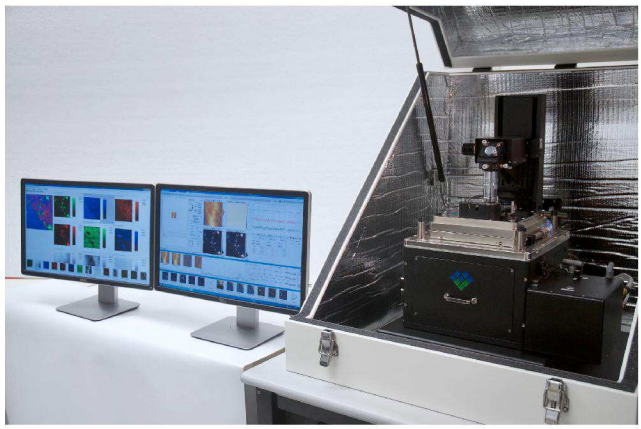
Full Optical Access(Top, Side, Bottom)

Optical Beam Deflection & Tuning Fork

Vaccum, Atmosphere, Liquid

Multi-frequency SPM (KPFM, EFM, MFM)

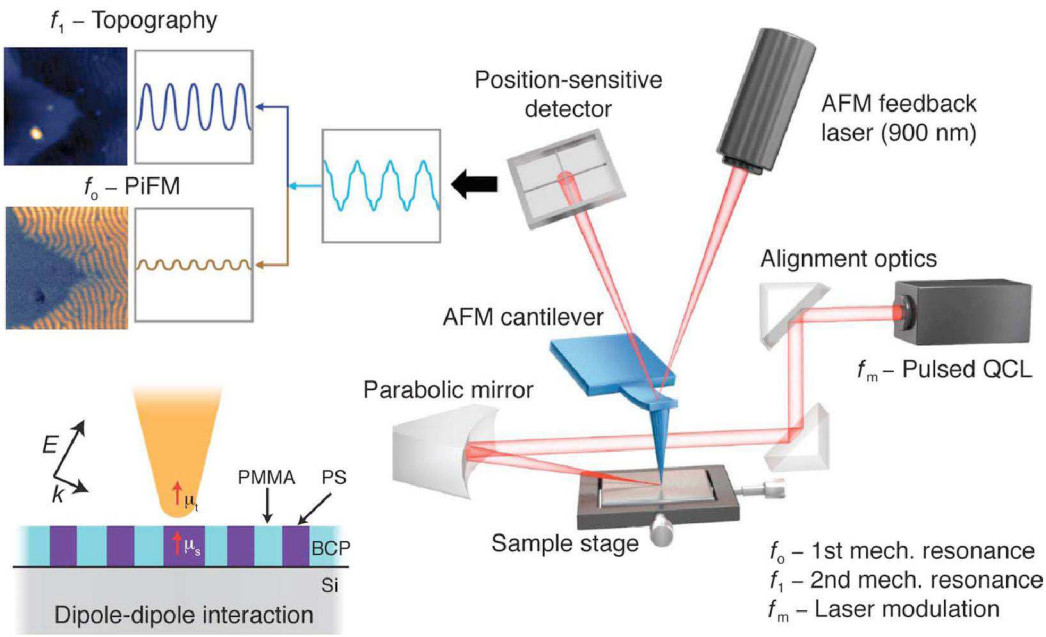
CAFM, PFM, Contact Resonace, Force Curve



Configuration with VistaScope

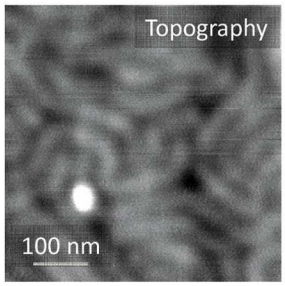
PiFM, Photo-induced Force Microscopy, Non-contact dipole-dipole Interaction Without Thermal Diffusion or Far Field Optical Detector, used as easy as AFM

A tunable quantum cascade laser illuminates on the sample and tip from side by parabolic mirror. It measures photo-induced dipole-dipole interaction between the tip with sample via mechanical force detection by using AFM cantilever in a multi-frequency mode. PiFM can generate amazing results with topography and chemical hyperspectral imaging or plasmonic polariation in sub-10 nm spatial resolution reliably.



Sub-10nm Chemical Spectral Imaging of Polymer and Biology

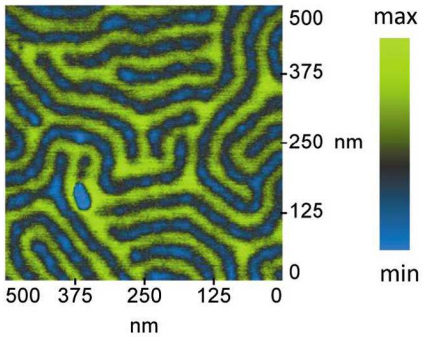
PS-b-PMMA Fingerprint Patterns

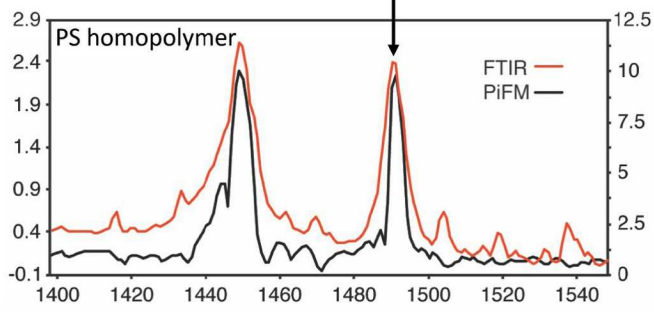


PS-b-PMMA is of interest for applications in nextgeneration lithography for semiconductors. A lamellae-forming film of PS-b-PMMA with a thickness of approximately 30nm.

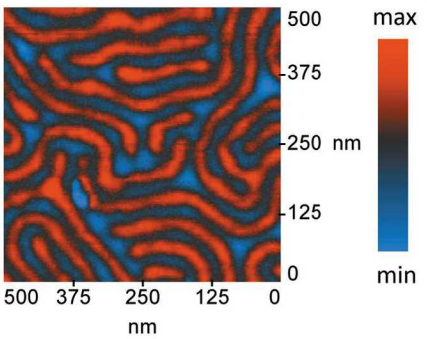
Tuning the excitation laser to one of its absorption bands at 1492cm-1 or 1733 cm-1. PiFM selectively images the PS and PMMA polymer domains showing the predicted periodicity, in -cluding the ability to resolve a small bridge defect, measured to be only ~7 nm wide.

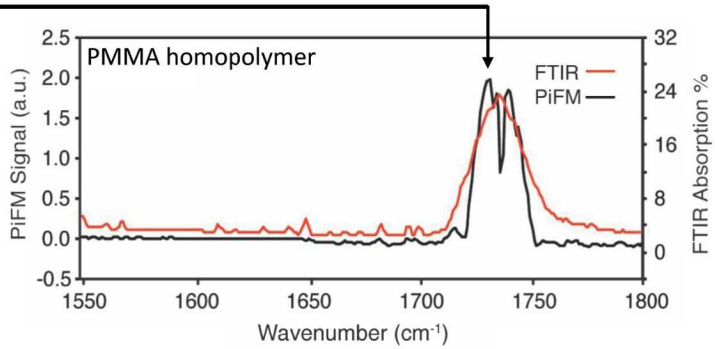
Polystyrene highlighted @ 1490 cm^{-1}





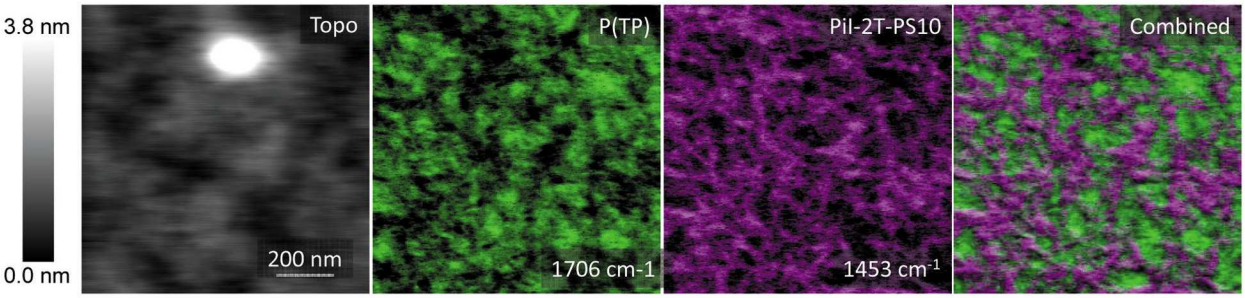
Polymethylmethacrylate highlighted @ 1733 cm^{-1}





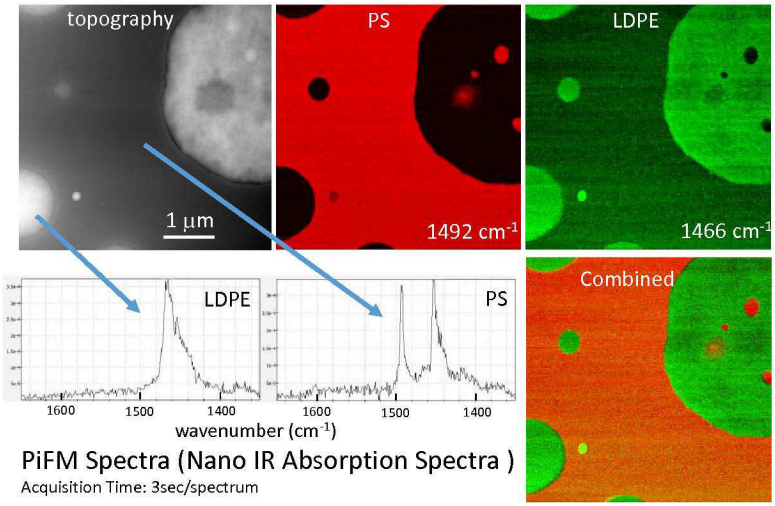
Polymer Polymer Blend Solar Cell

The two polymer components can not be indentified via AFM topography or AFM phase imaging. That can be uniquely indentified via PiFM.



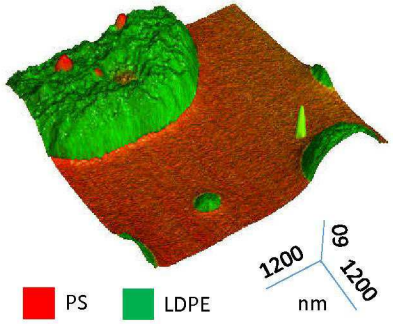
PS-LDPE Blend Copolymer

Polystyrene (PS)-Low Density Polyethylene (LDPE) blend copolymer is imaged via PiFM. Revealing PS and LDPE components unambiguously on their bulk absorption bands PiFM spectra for each component from the indicated nanoscale region match the bulk absorption spectra.

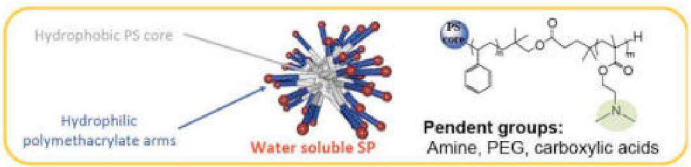


PiFM Spectra (Nano IR Absorption Spectra)
Acquisition Time: 3sec/spectrum

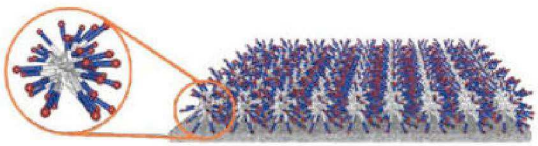
Combined chemical map overlaid on 3D topography



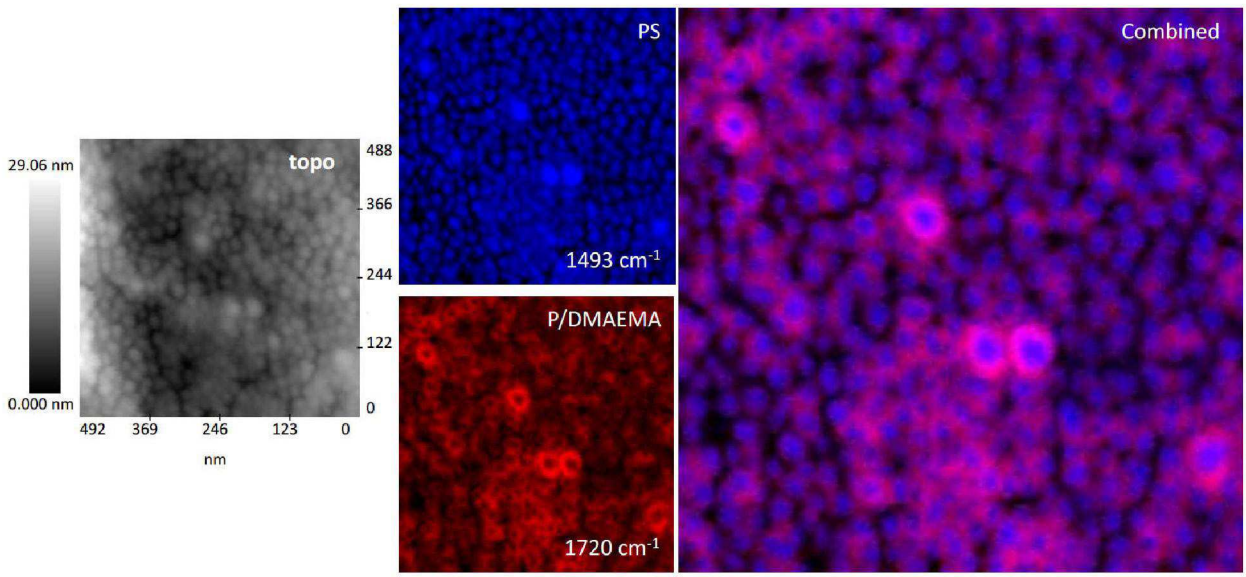
Core-Shell Star Block Copolymer (Drug Delivery)



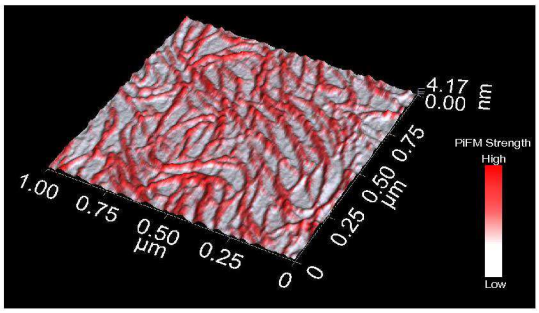
Star polymer, 500nm field, PS-P/DMAEMA Whether the P/DMAEMA as shell is correctly attached on the PS as core.



AFM can not answer this question but PiFM can. PiFM imaging breakthrough: clear imaging of PS core VS P/DMAEMA shell never seen before.

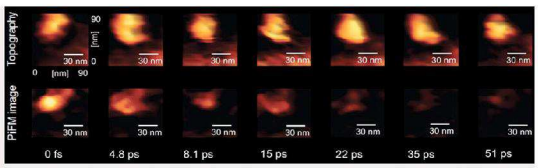


Single Collagen Molecules

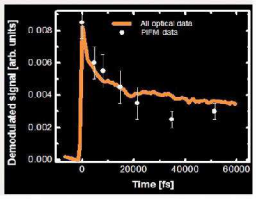


Excitation laser set to 1666 cm-1, Amide I peak

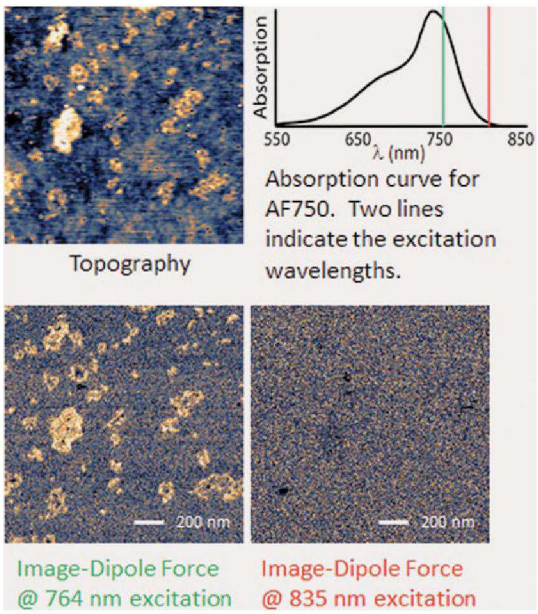
Time Resolved PiFM



Time-resolved PiFM images of Si-naphthalocyanine molecules at different probe delay (above) and comparison with all optical data (right). Data courtesy of Eric Potma lab at UC Irvine.



Fluorescent Dyes



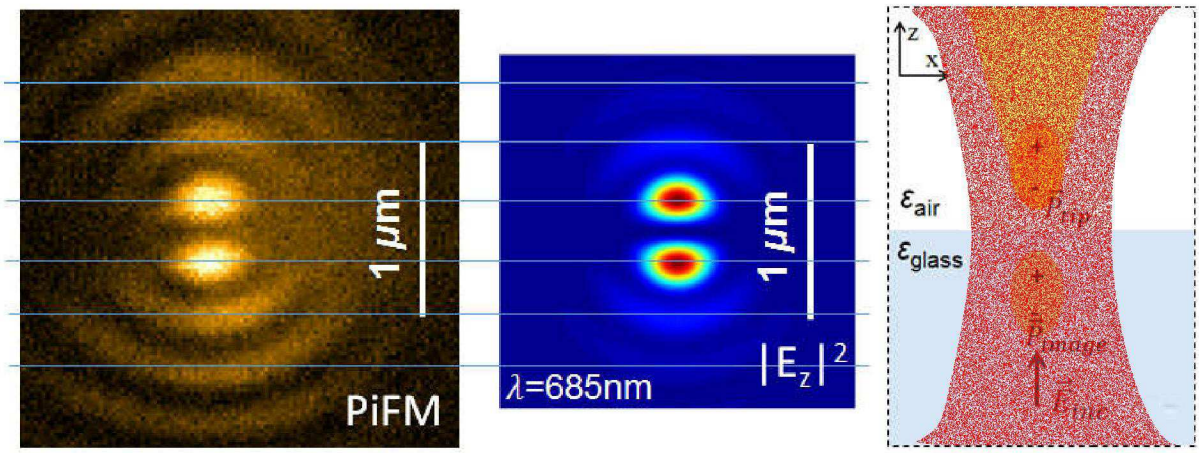
764nm strongly absorption 835nm no absorption PiFM imaging matches the vis-spectrum well

Ultrafast Spectroscopy !
Liner & Nonliner Spectroscopy !
All of them are available for PiFM !

Direct Optical Field Imaging of Nanoplasmonics and 2D Materials

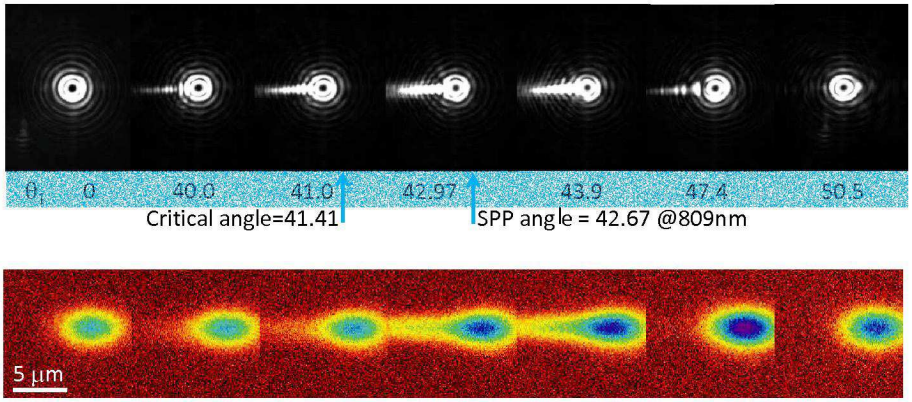
Longitudinal Focal Field of Laser Beam

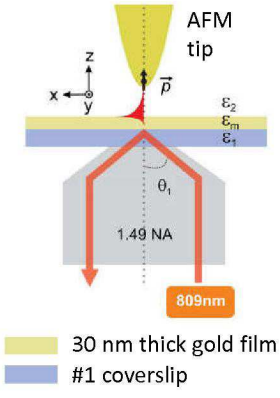
The longitudinal focal field of a tightly focused light via high NA (1.45 NA) objective lens is imaged via PiFM. The measured PiFM result agrees well with the longitudinal field calculated from the dipole-dipole interaction between the polarized tip and the glass substrate.



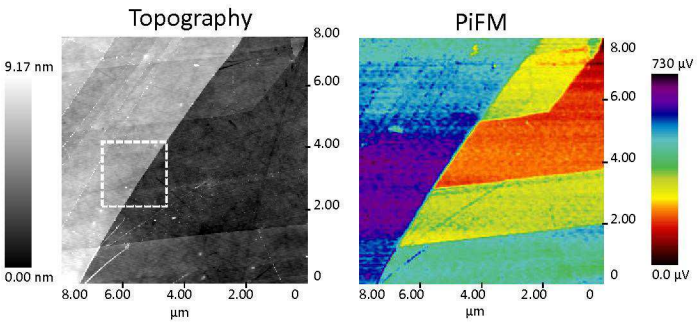
Surface Plasmon Polaritons of Gold Film

Surface plasmon polaritons (SPP) at the gold/air surface imaged via PiFM. p-polarized 809 nm laser beam is focused via 1.49 NA objective lens with a varying incident angle (controlled via a linear translation stage). (bottom) images show the CCD (PiFM) images of the illumination spot.



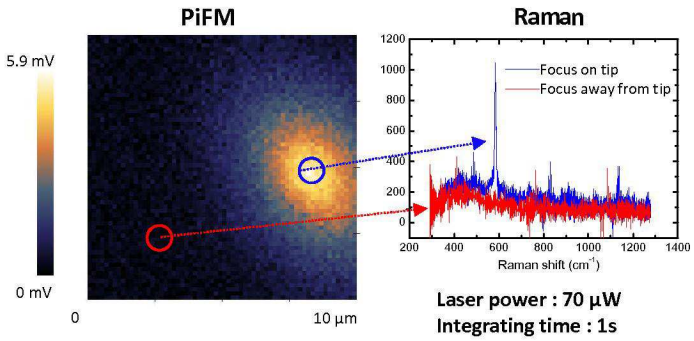


Graphene Plasmonics



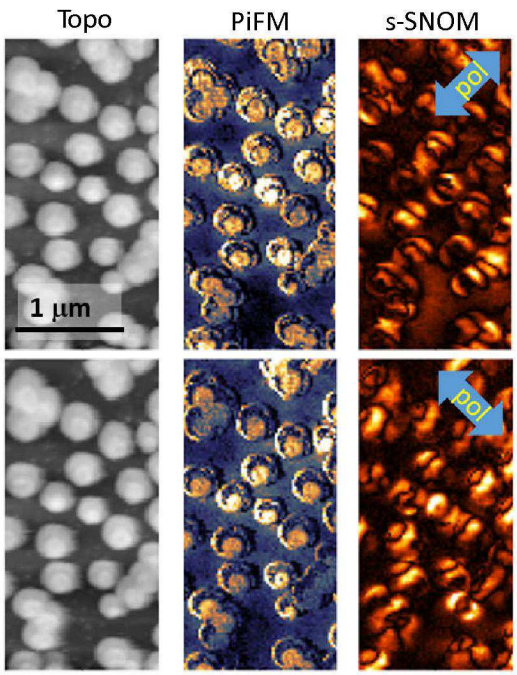
Excitation laser set to 800 cm-1
PiFM strength indicates the layer number

PiFM & TERS



TERS signal is observed when we align the tip to the maximum of the PiFM signal. Raman signal from BCB on Au is strongly enhanced at weak laser power.

Plasmonic Gold Discs

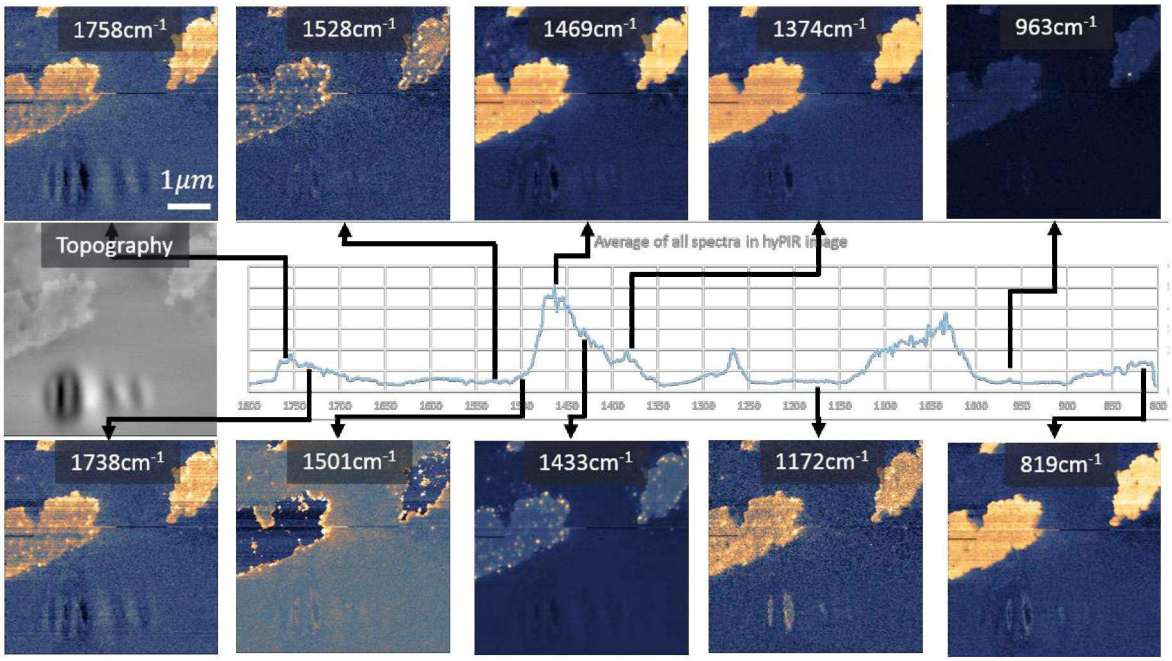


Excitation laser set to 652nm
PiFM & s-SNOM imaging simutanously
Longitudinal field of PiFM is not polarization dependent
Horizontal field of PiFM is polarization dependent

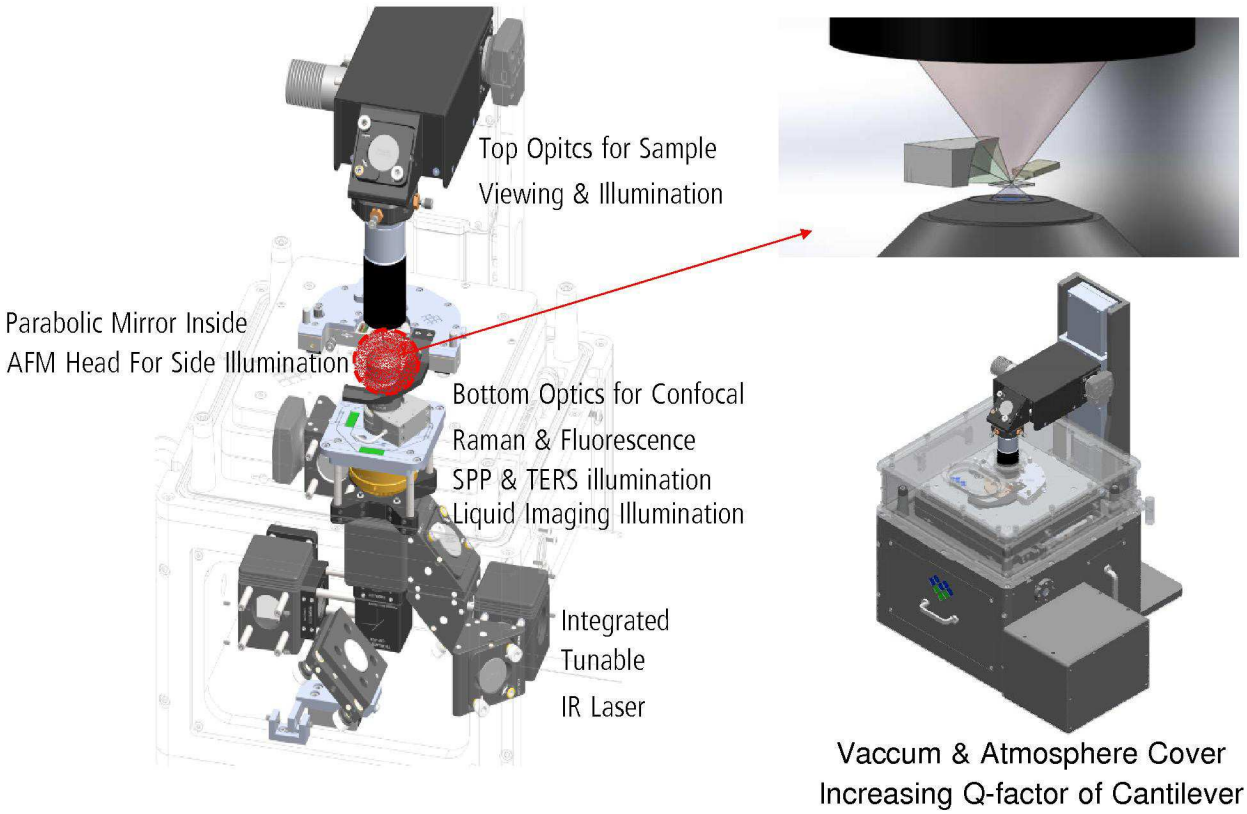
hyPIR™ Imaging - A spectrum at every pixel !

IR Hyperspectral Imaging of Asphalt Binder

Each of the intensity maps above is generated from the same hyPIR image. This single hyPIR image allows us to observe all the relevant chemical signatures of a sample, an asphalt binder in this example.



Full Optical Access(Top, Side, Bottom), Vaccum, Atmosphere, Liquid



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