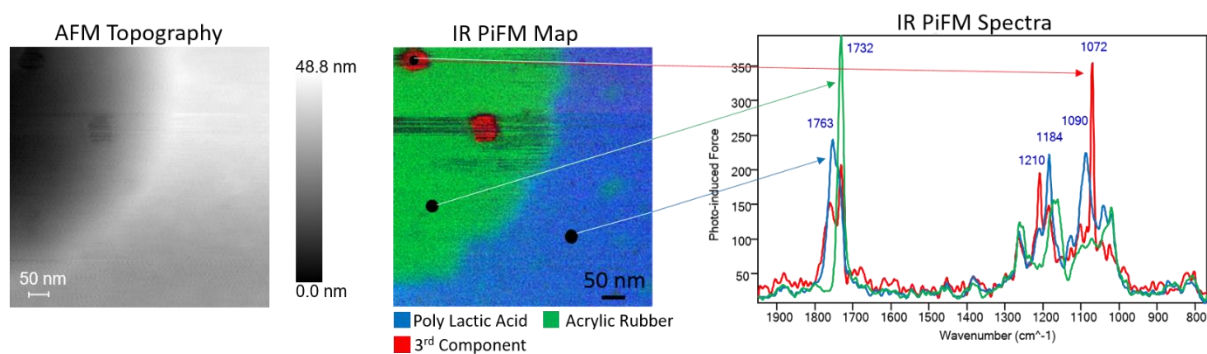


## Title: AFM + Nanoscale vis-IR Spectroscopy via Photo-induced Force Microscopy

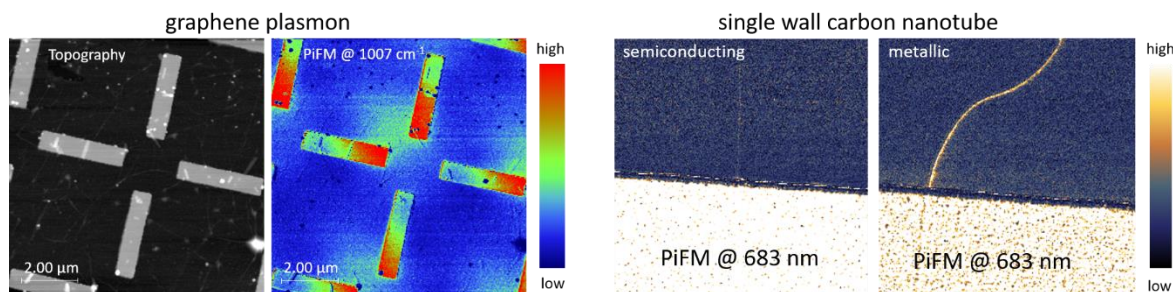
Presenter: **Derek Nowak**, Ph.D., Director of Applications, Molecular Vista, Inc.

Photo-induced Force Microscopy (PiFM) achieves nanoscale visible-infrared optical spectroscopy and atomic force microscopy (AFM) concurrently. With infrared (IR) excitation source, PiFM maps the IR absorption of the sample as a function of IR wavelength and position with sub-10 nm spatial resolution, highlighting (1) the locations of heterogeneous organic and inorganic materials and (2) the local chemical information via IR PiFM spectra, which show excellent correlation with bulk FTIR spectra on homogeneous samples. PiFM is surface sensitive with  $\sim 10$  nm depth sensitivity, making it an excellent technique to complement other molecular analysis techniques such as nano-SIMS and XPS. Examples from various classes of samples including rock, plant, single molecules of protein, tissues, organic solar cells and semiconductors, and self-assembled monolayers (SAM) will be presented.

Since PiFM measures the complex polarizability of the sample, it can also map surface plasmons, nano-plasmonic fields, and index of refraction, all with  $\sim 10$  nm spatial resolution from visible to infrared wavelength. Comparison to other near-field techniques such as TERS, s-SNOM, and PTIR will be also presented.



**Image Caption:** IR PiFM analysis of PLA/rubber blend shows AFM topography and chemically mapped components based on the IR peaks from nanoscale regions. See video on how the images and spectra were acquired: abridged version <https://youtu.be/m4FeQjJ-wsg>; full version [https://youtu.be/ZK\\_dC2EHvpk](https://youtu.be/ZK_dC2EHvpk)



**Image Caption:** Topography and PiFM image, displaying graphene plasmon on gold structure on graphene monolayer (left two images); PiFM images of two individual single wall carbon nanotubes, showing different absorption strengths depending on whether it is semiconducting or metallic (right two images)



QR code links to the full version of the video

#### Derek Nowak – Short Bio

- 2012 – Actual: Director of Applications at Molecular Vista, manufacturer of a Flexible Hybrid AFM and Optical Spectroscopy Platform.
- 2010-2012: Research Assistant Professor at Portland State University
- 2005-2010: PhD at Portland State University in Physics