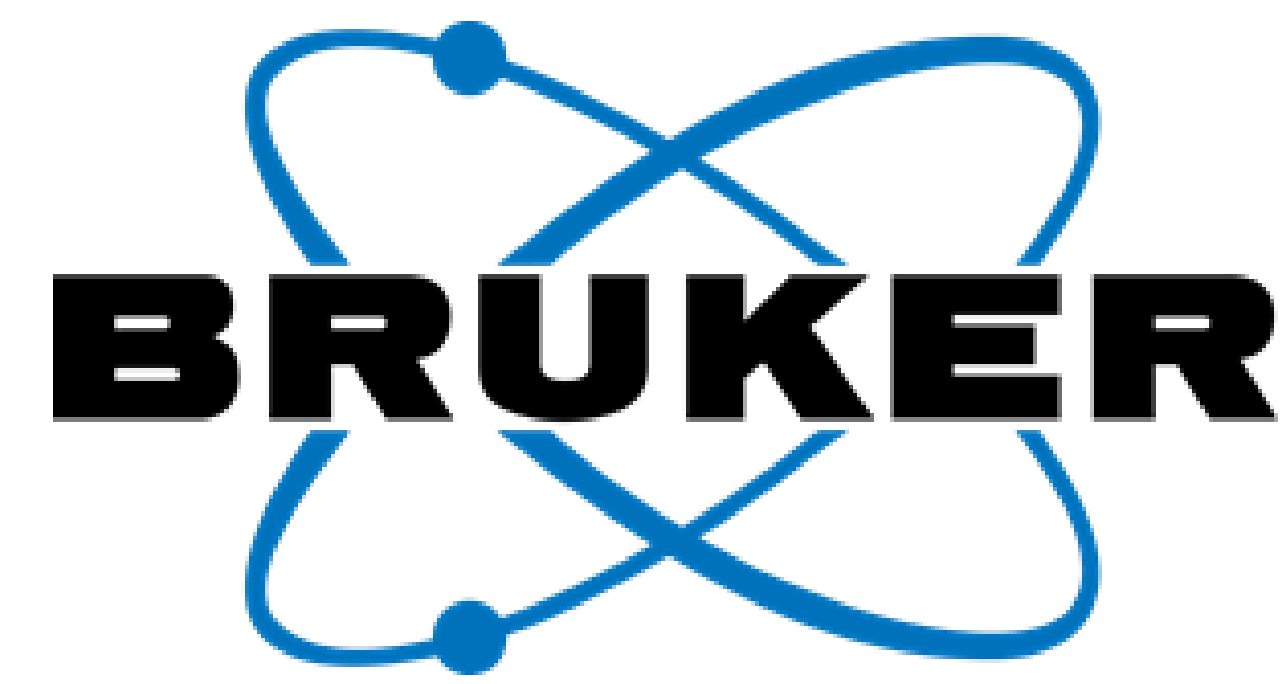


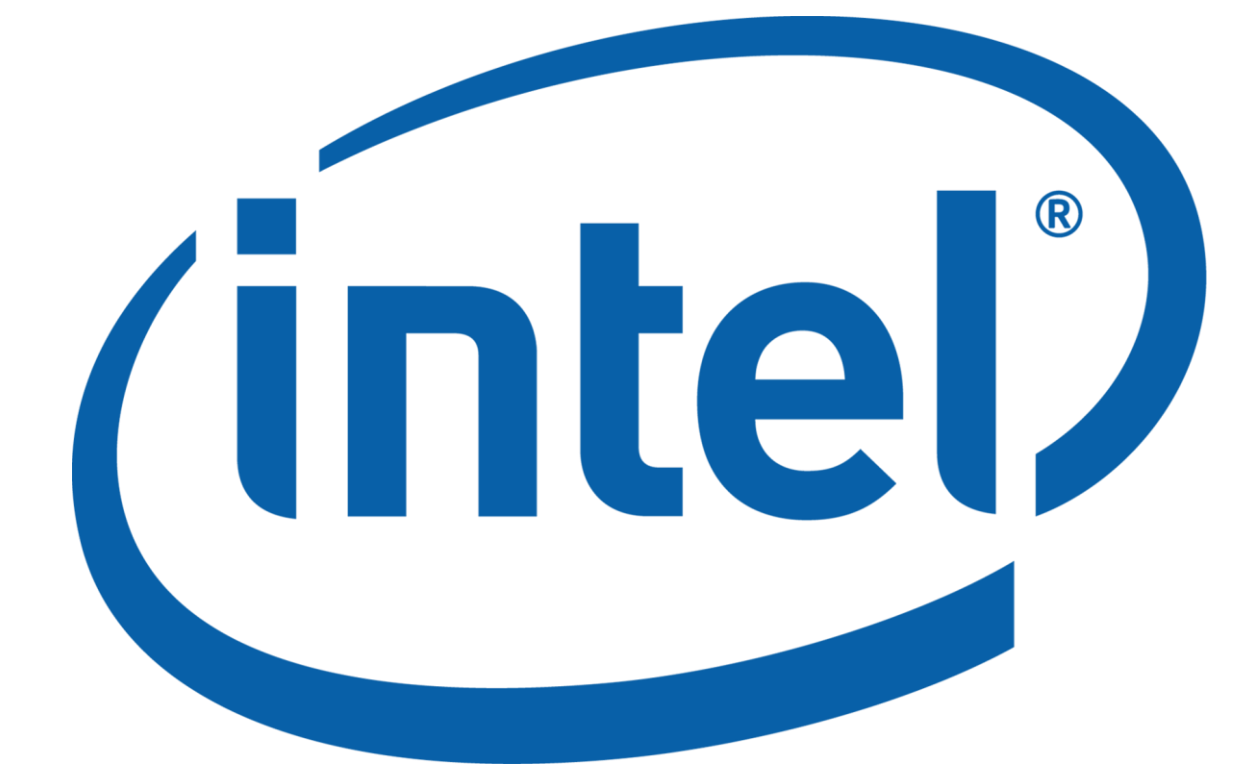
Characterizing interlayer sub- μm features in microelectronics devices using high resolution scanning probe-IR spectroscopy and imaging



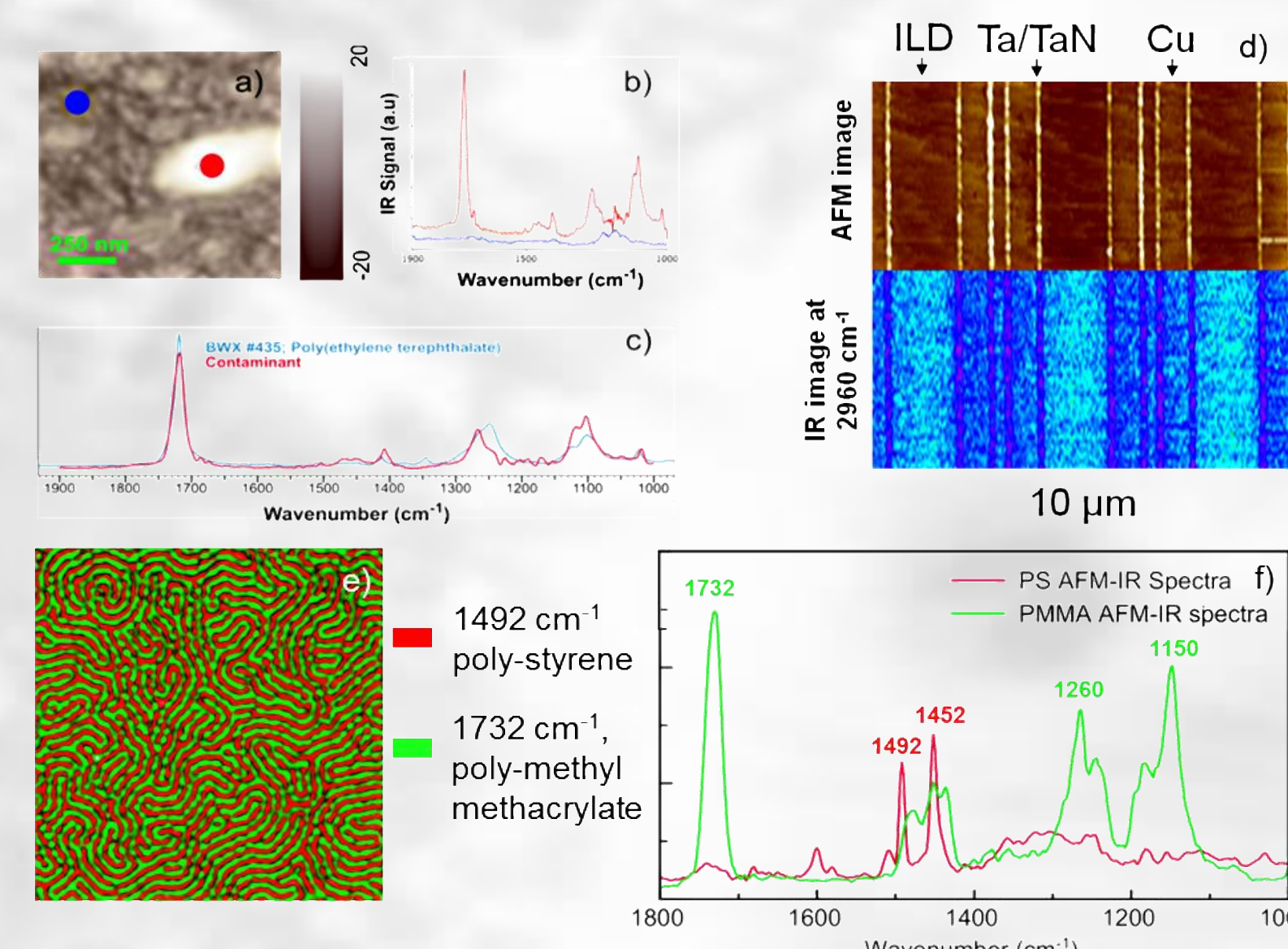
Anirban Roy¹, Qichi Hu¹, Honghua Yang¹, Peter De Wof¹ and Sean W. King²

¹Bruker Nano Surfaces, Santa Barbara, CA 93117, USA

²Intel Corporations, Hillsboro, OR 92124, USA

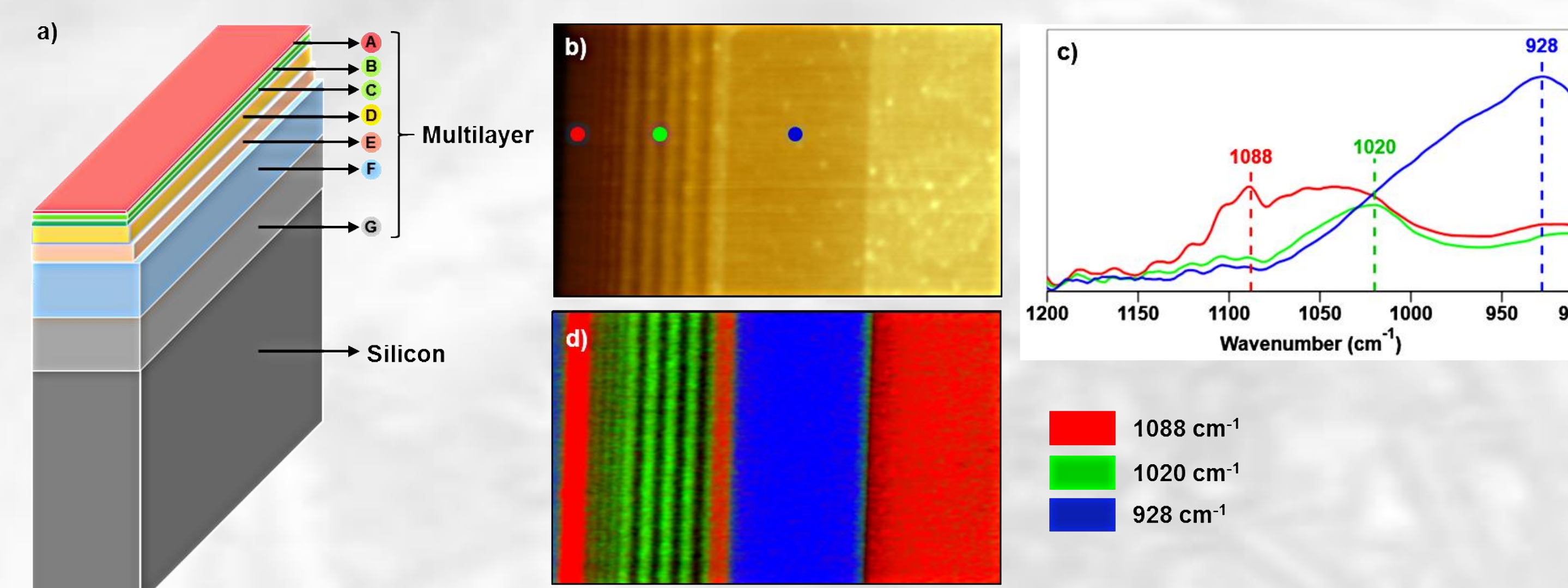


Introduction

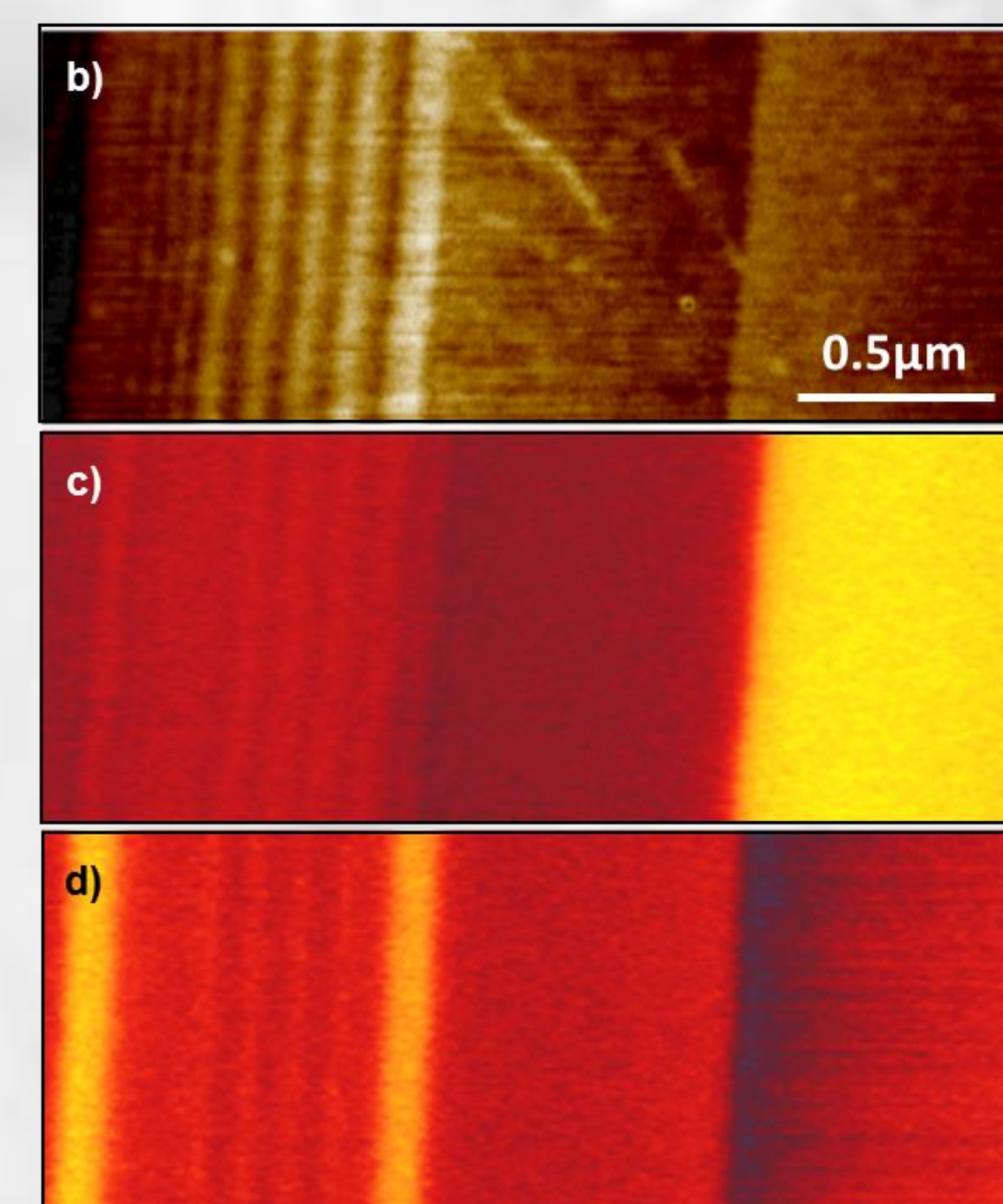


We are demonstrating two complementary nanoscale chemical analysis techniques, photothermal AFM-IR and scattering type Scanning Near-field Optical Microscopy (s-SNOM) to isolate and characterize microelectronic device cross-sections

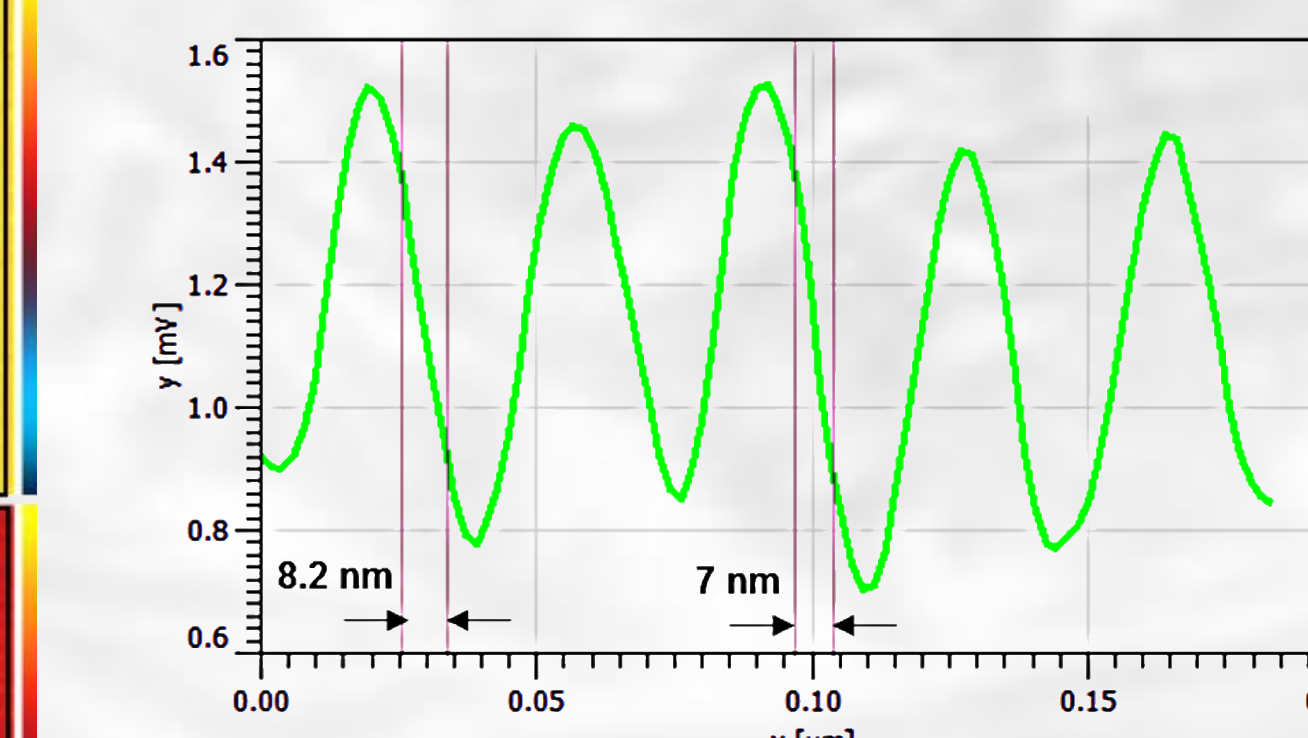
Measurements & Results



Chemical characterization of Multilayer cross-section sample. a) Schematic of typical multilayer structure on Silicon wafer. b) AFM topography image (3 μm x 2 μm) of the sample. The sites indicated in the image highlights the location of Tapping AFM-IR spectra (color coded) acquired in c). Subsequent Tapping AFM-IR images at specific wavenumbers combined constitute the chemical composition map shown in d).



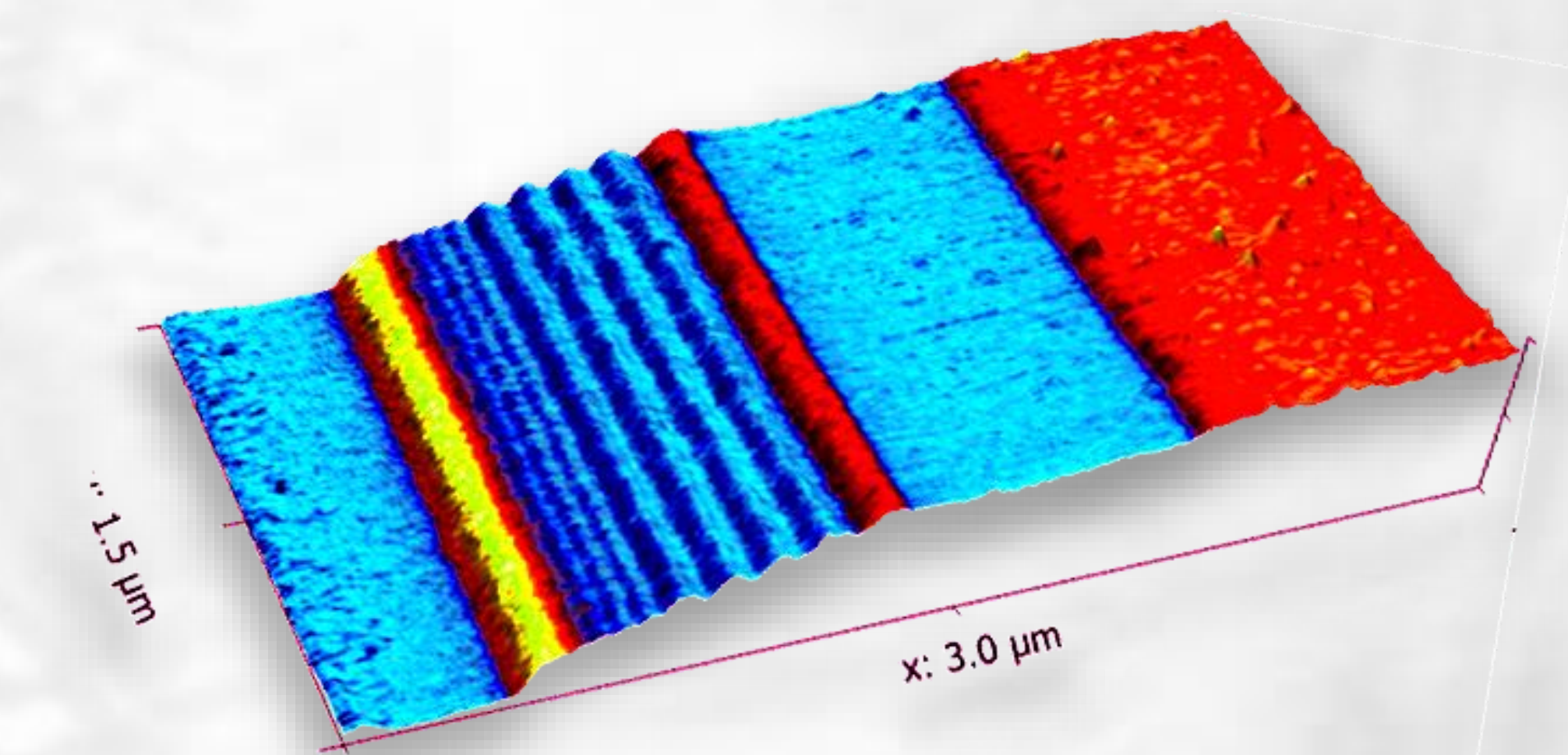
b) AFM topography image of the multilayer cross-section. c), d) Subsequent reflection and absorption image at 1088 cm^{-1} (c and d, respectively)



Observed spatial resolution ~ 10 nm

Conclusions

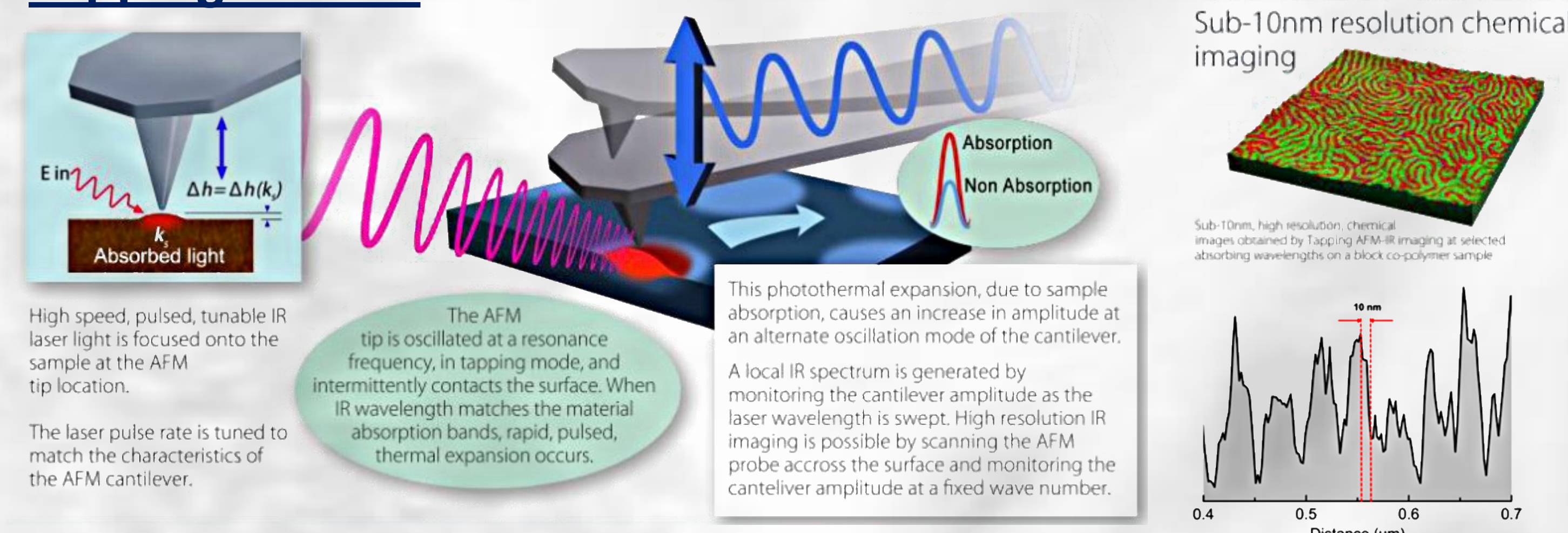
- Scanning Probe Microscopy coupled with mid-IR light sources is emerging as a leading analytical technique for test/failure analysis of sub- μm microelectronic devices
- Photothermal IR (PTIR/AFM-IR) and scattering SNOM techniques deliver chemical insights into multilayer structures, interconnects and nanocontaminations essential for device characterization and FA



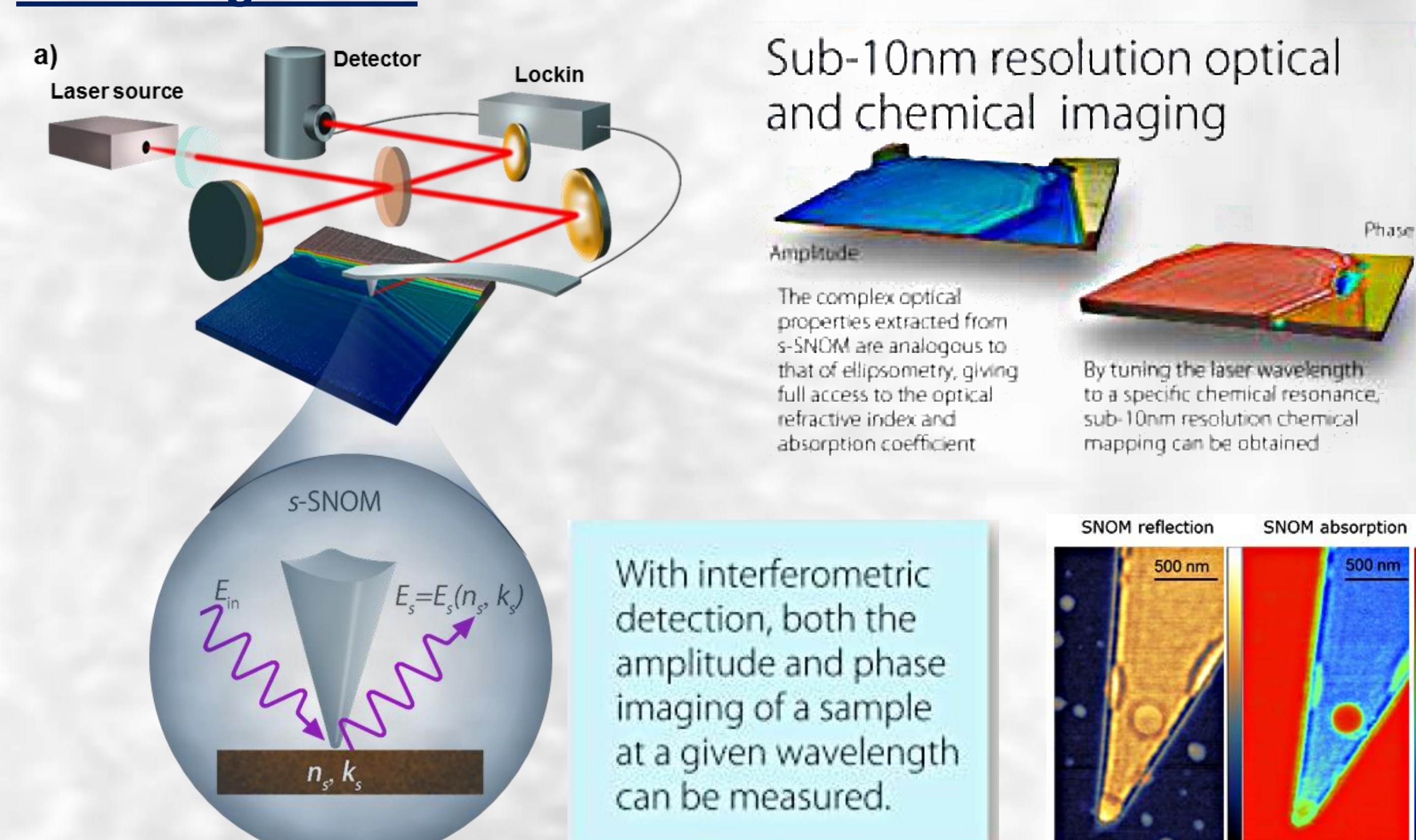
- These new age hybrid SPM technologies can also be exploited to design and characterize nanoscale lithographic patterns consisting complex molecular assemblies (DSA) with excellent spatial resolution (<10nm)

Techniques

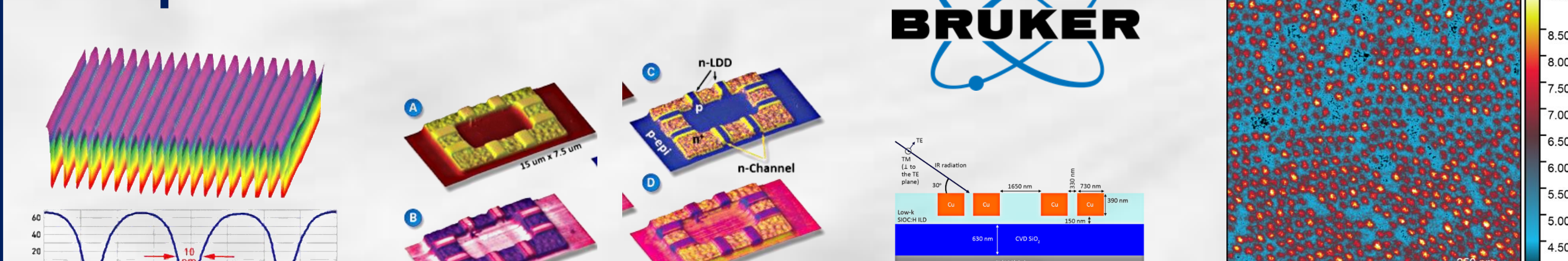
Tapping AFM-IR



Scattering-SNOM



Complete Nanoscale Solutions



Acknowledgement

- Dr. Markus Kuhn
- Dr. Marie Tripp
- Dr. Névine Rochat
- Dr. Giles Pacastings

