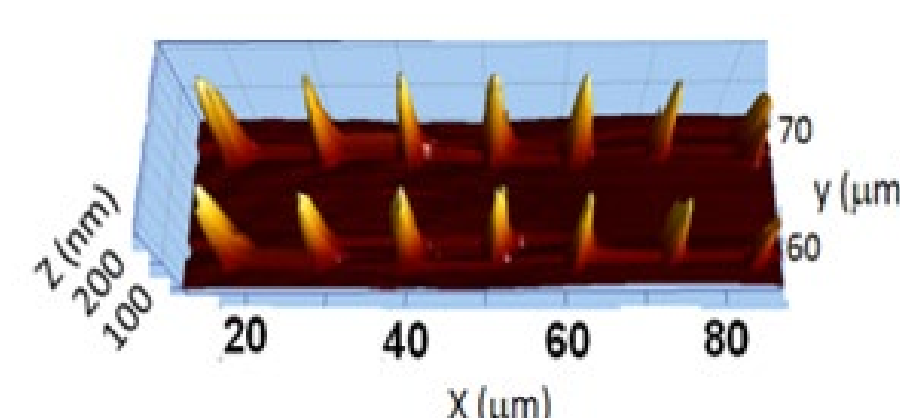


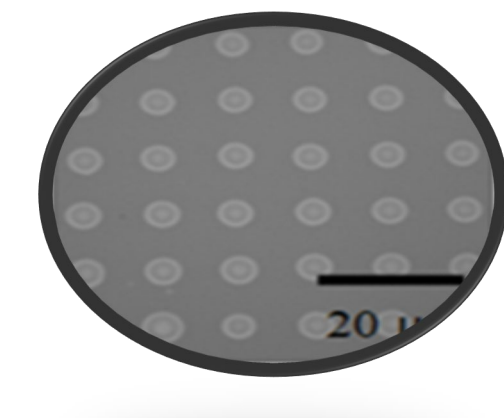
Nanoscale Materials Synthesis & Fabrication Services:

Dip- Pen Nanolithography (DPN):

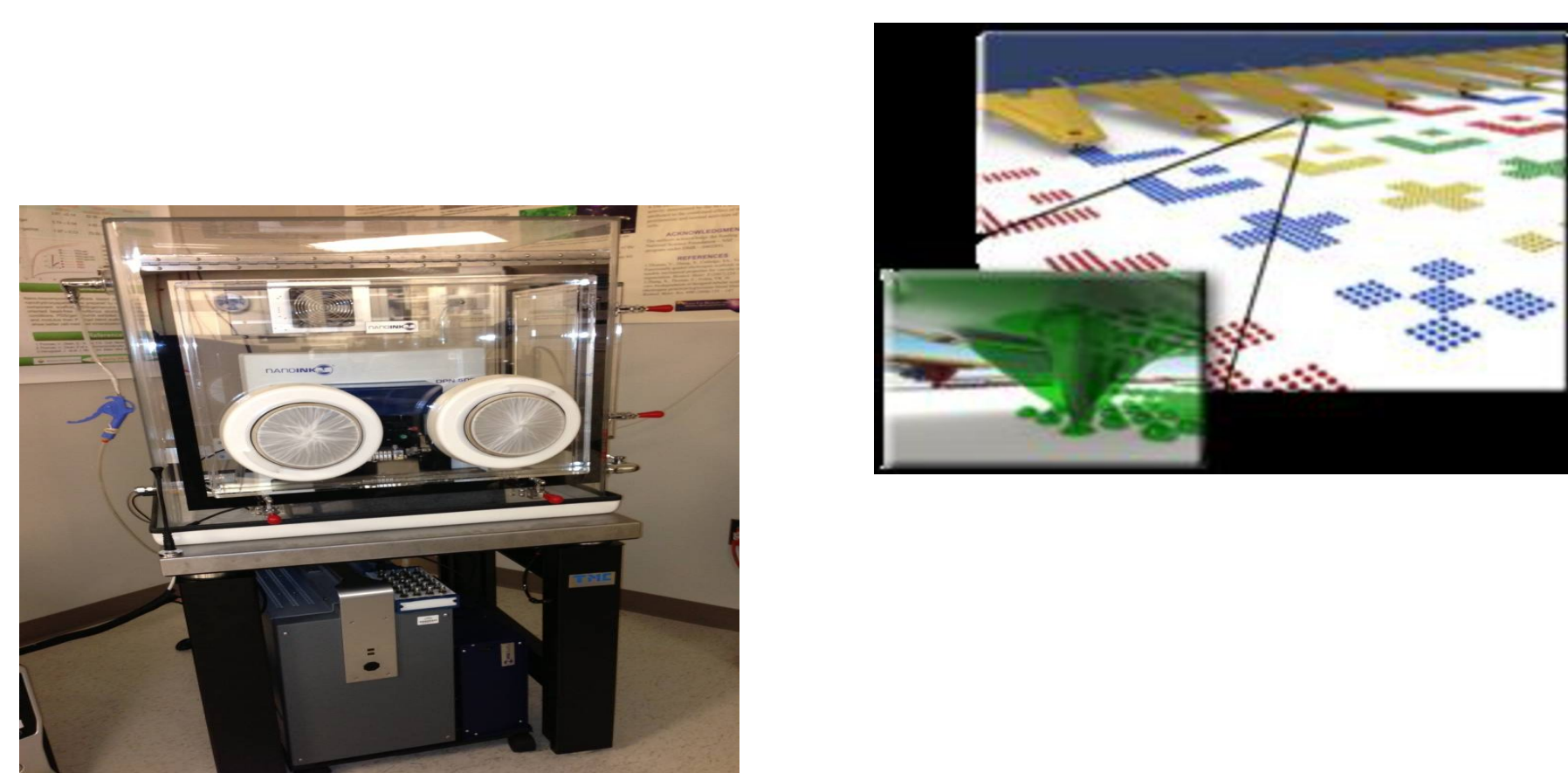
- DPN is a direct write, tip based lithography technique that can make an pattern-array of molecules (organic, inorganic, and biological) or nanoparticles generating features as small as 15 nm



Patterned diamond array



Patterned polymer array



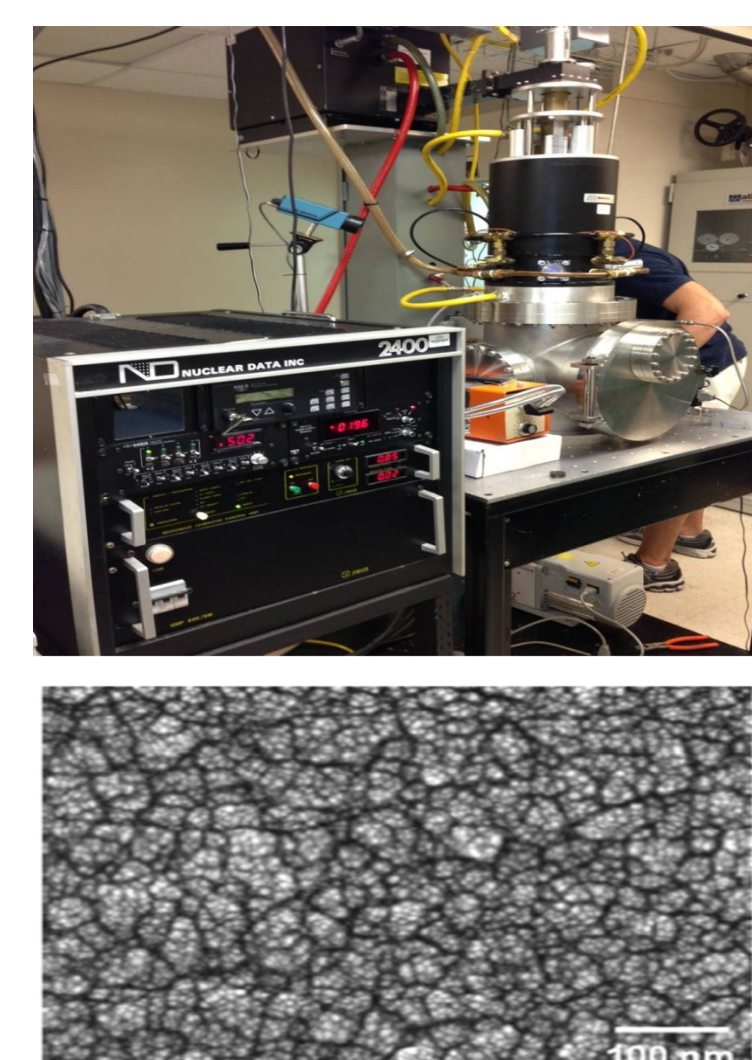
Diamond Microfabrication Lab:



- The Polaris sputtering system can deposit metal films of thickness in the range 0.2 μm – 2 μm using the DC power source.
- The maskless lithography system has the capability to create features with a resolution of 5 μm . The innovative smart filter on this system eliminates the need for expensive physical masks for creating desired patterns. The lab has both wet-etch and lift-off processes for creating patterns/circuits on 2D and 3D substrates.



Nanostructured Diamond by CVD:



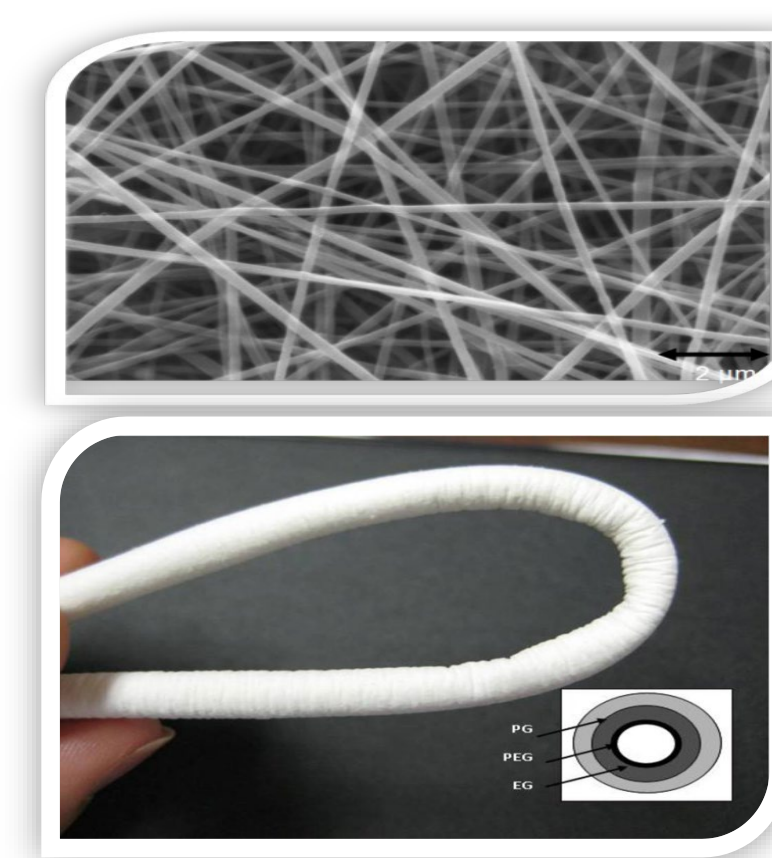
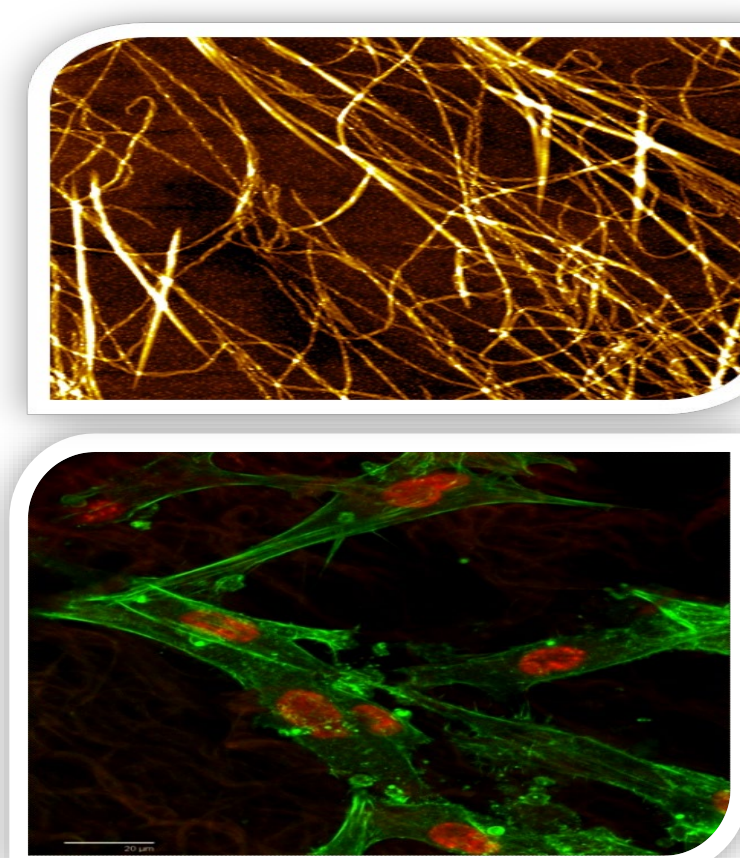
CVD reactor & Nanostructured diamond

- Nanostructured diamond coatings with characteristic grain dimensions in the 5-7 nm range. Deposits on a variety of metallic substrates like titanium alloys, cobalt chrome, molybdenum, and steel.
- 1.2 kW and 6 kW Microwave Plasma Chemical Vapor Deposition (MPCVD) systems for diamond growth



Nanostructured diamond on dental implant

Fabrication of 2D & 3D Nanofiber Scaffolds:

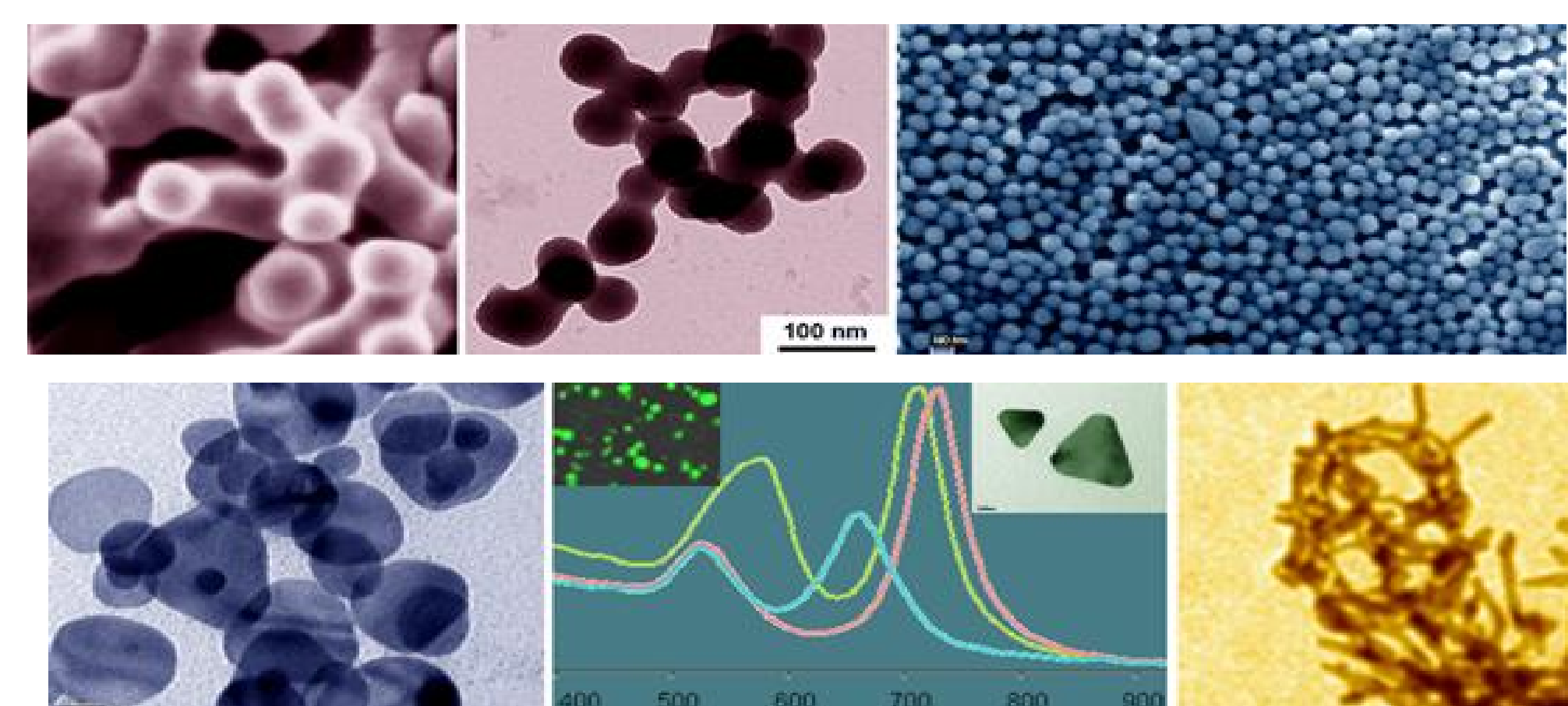


- ECM mimicking multifunctional 2D and 3D scaffolds by electrospinning
- Synthetic and biopolymers including proteins and their blends with nanoparticles, growth-factors etc by co-electrospinning
- Ceramics nanofibers by sol-gel electrospinning
- Carbon fibers by PAN electrospinning
- Fabrication of Nanofilters for adhesion and absorption

Native collagen and ECM mimicking electrospun 2D biomatrix & 3D vascular graft

Synthesis of Nanoparticles:

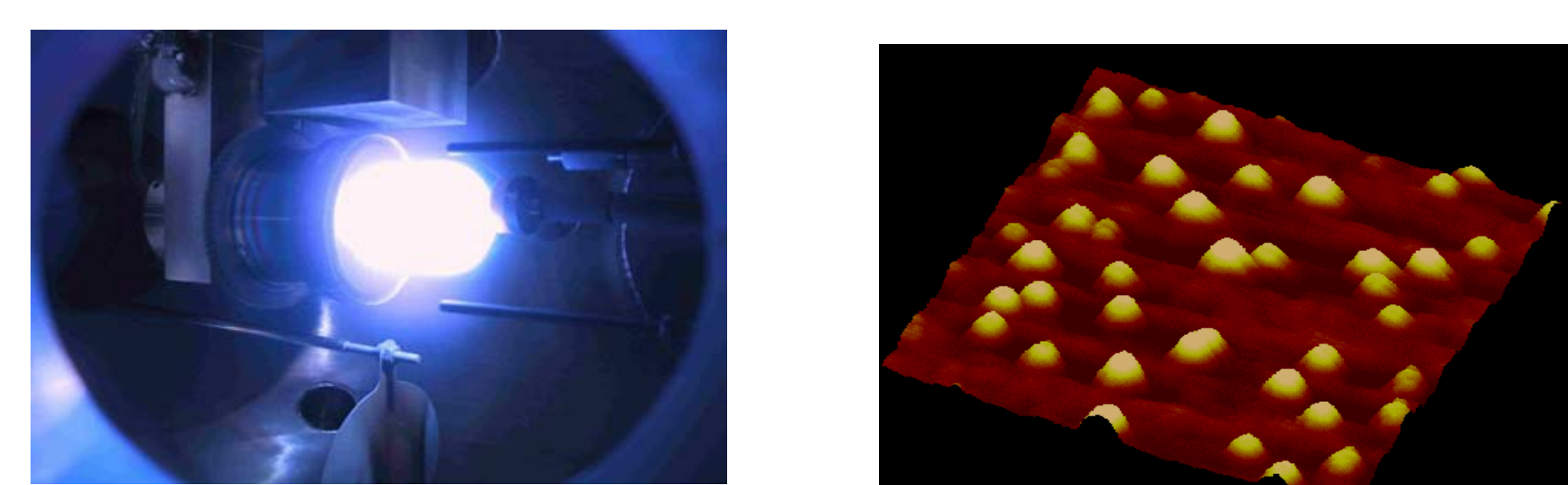
- Designed Gold nanoparticles, rods, magnetic nanoparticles, metal oxides, quantum dots (various size and shape) for imaging and therapeutic delivery applications
- Drug/peptide/ siRNA encapsulated and/ or conjugated biodegradable polymeric nanoparticles for cancer therapeutic and other applications (growth factor delivery for tissue engineering)



Various inorganic nanoparticles synthesized by sol-gel techniques and polymer particles by double emulsion

Pulsed Laser Deposition

- Nanoparticles produced by a laser in the form of an aerosol
- Make semiconductor materials
- Make hybrid nanomaterials and energy materials



Uni-disperse hydroxyapatite deposited by PLD

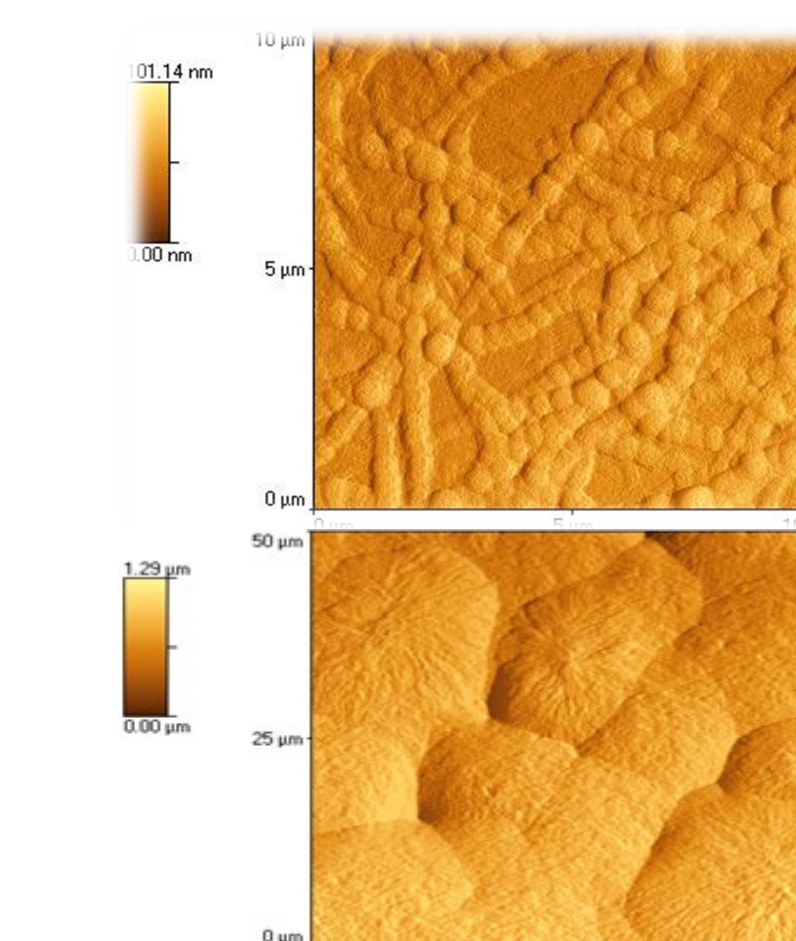
Nanoscale Materials Characterization Services:

Atomic Force Microscopy (AFM):

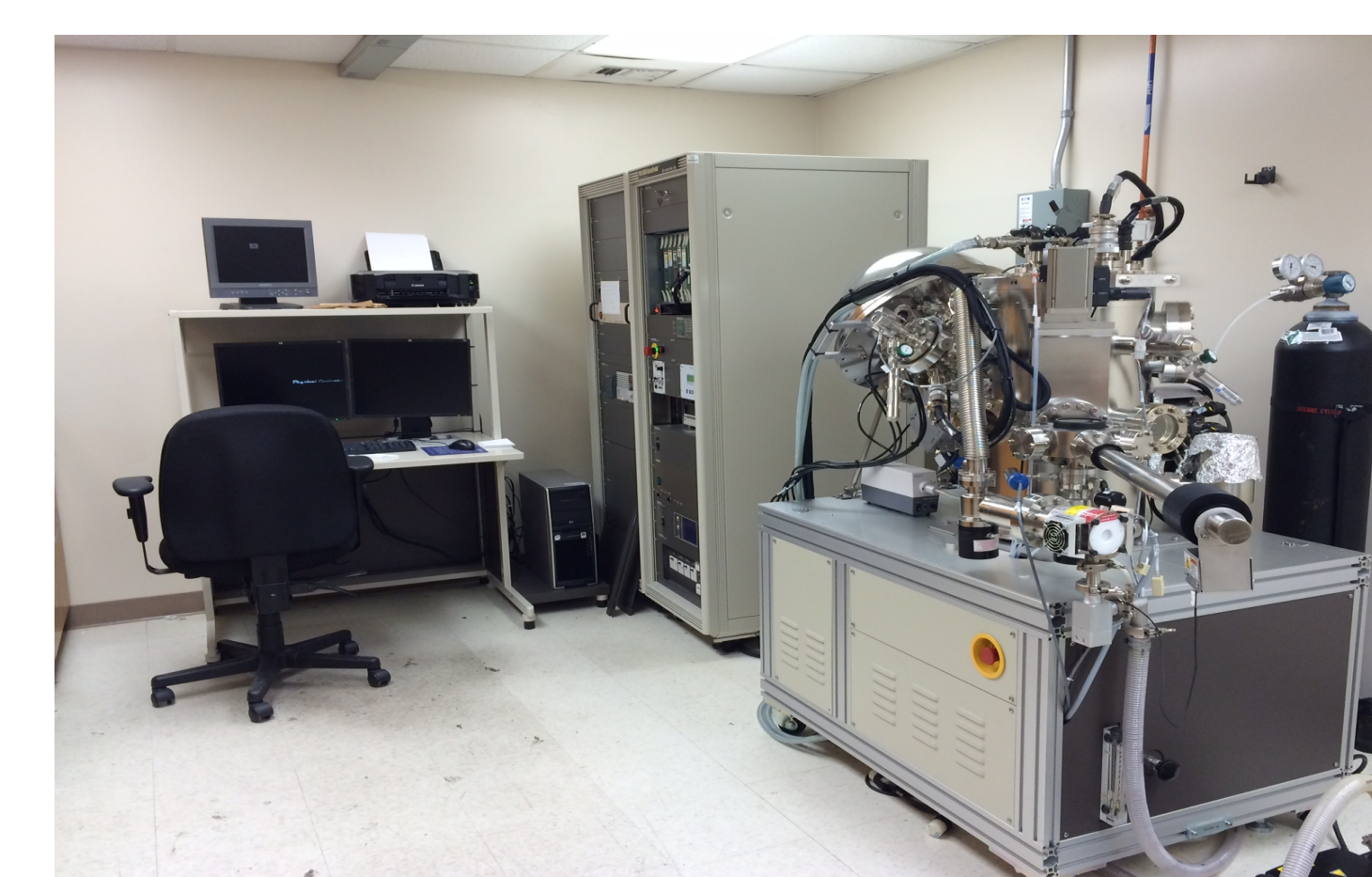
- Image nanoscale surface features and morphologies of metals, biomaterials, thin films, particles, polymers, proteins and other biomaterials, grain boundaries, composites etc.
- Two AFM instruments with tapping and contact modes are available for topographic and phase imaging and roughness measurements



AFM instrument and images of collagen nanomatrix and polymer spherulites



X-ray Photoelectron Spectroscopy (XPS):

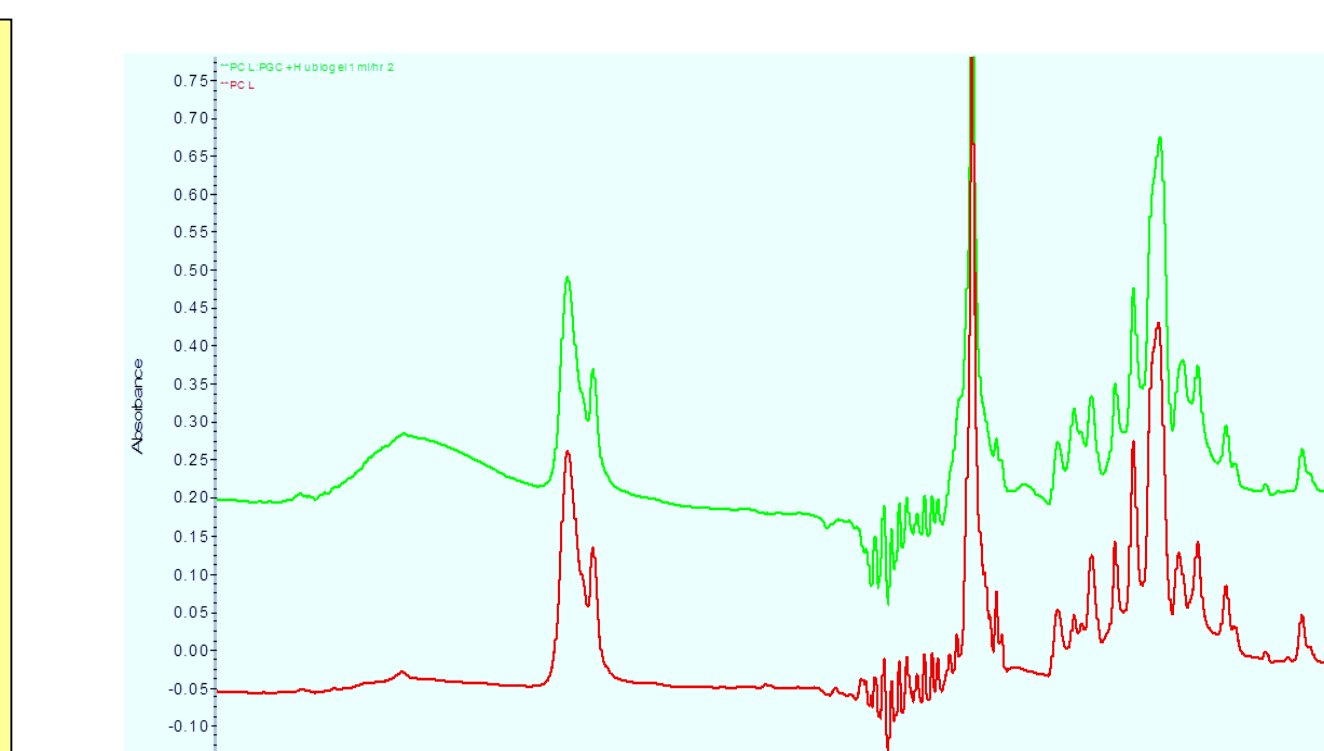


- PHI-5000 Versaprobe is equipped with dual Al/Mg anode, focused (10 - 100 μm) and scanned X-ray beam for sample imaging and analysis, hemispherical energy analyzer with multi-channel detection, depth profiling capability
- Useful for chemical elemental analysis and quantification, Bonding characteristics
- Operative Modes- Qualitative survey scan, quantitative high resolution scan and depth profiling by simultaneous surface etching scanning.

Infrared Spectroscopy (Micro-FTIR):



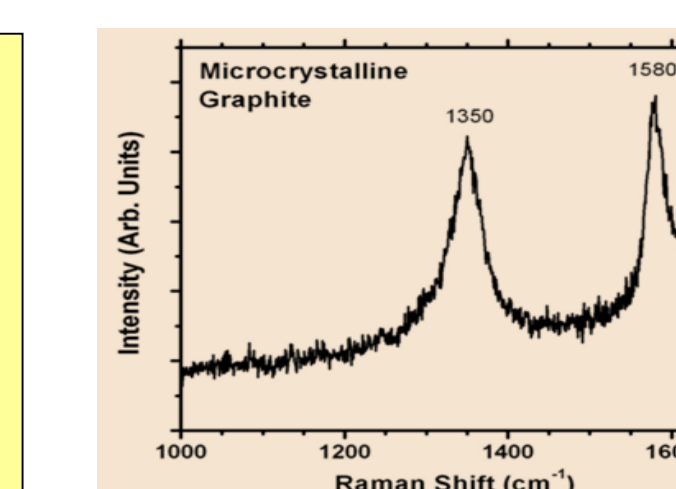
- The instrumentation includes the Bruker Optics Hyperion 3000 infrared microscope and Vertex 70 FTIR spectrometer with numerous options for infrared imaging and composition mapping with down to 2-micrometer resolution, in addition to organic functional group analyses.
- Both transmission and reflection modes available.



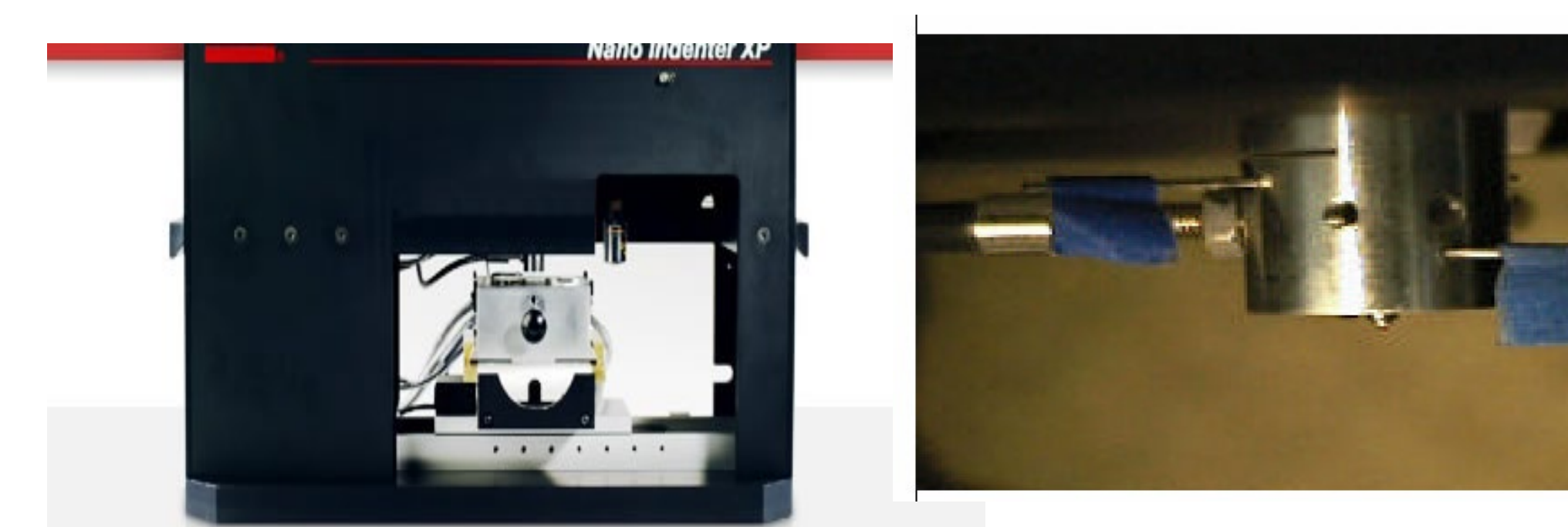
Typical FT-IR spectra of polymer and protein

Raman Spectroscopy and X-ray Diffraction (XRD):

- Micro-Raman/Photoluminescence Spectrometer for non-destructive characterization of materials.
- Very effective in characterizing carbon materials (CNTs and Diamonds)
- Complimentary to FT-IR.
- Thin Film X-ray Diffractometer is non-destructive method to characterize materials' composition, crystal structure, phase change, grain-size and stress analyses of thin films, polymers and ceramics



Nano-indenter :



- Measurement of nanomechanical properties such as hardness and Young's modulus of nanostructured materials and thin films by a nano-tip indentation

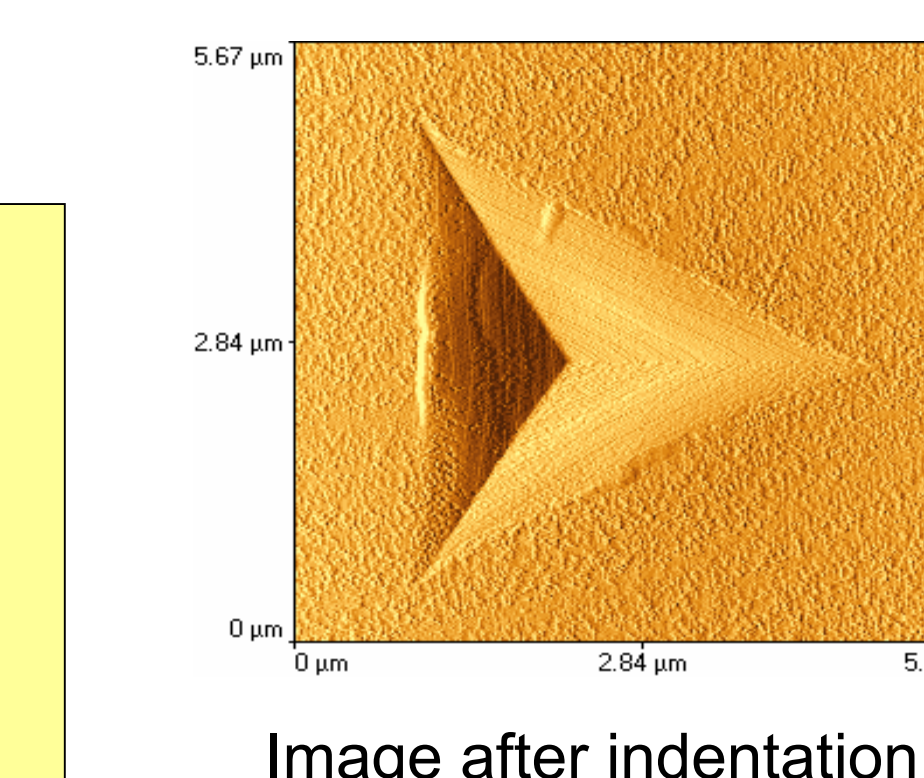


Image after indentation

Orthopedic and Dental Joints Wear Simulator:



AMTI Force 5

- AMTI Force 5 - An industry standard simulator which can replicate the loading and multi-axis motions associated with joints (Hip, Knee & TMJ)
- Performs wear simulation of articulation components such as metal-on-metal, diamond-on-metal, metal-on-polymer, and diamond-on-diamond
- Operated in both force and displacement control modes and allows the continuous or periodic measurement of the forces and moments of the x, y, and z axes under physiological serum conditions