hpAFM

High Performance AFM

System Parameters

• Superluminescent diode (SLD)
• Position sensitive quadrant photo detector optimized for laser wavelength.
• <25 fm/Hz½ noise floor (noise level: 0.02 nm)
• Modular, flexible design to include optional modes
• Alignment free design. This is important as ease of operation and to avoid breaking of tips while alignment.
• Up 5 inch samples with up 30 mm thickness

Scanner

• 24 bit 120x120x15µm XYZ scanner.
• Cross-talk eliminated separate XY & Z flexure stages with closed loop capacitance sensor
• Highest resolution with open loop and closed loop
• XY IR Optical sensors for closed loop operation

Motorized Coarse and Fine Approach

• 50 mm range, 250 nm resolution motorized Z Stage
• 76 mm range, 50 nm resolution motorized XY Stage
• Adjustable speed and step size
• Automated approach to sample surface

The laser beam used to measure the cantilever deflection has 45 degrees of incidence on the sample surface normal to avoid errors that can result from feedback from the sample surface to the light source or to the detector.

Video Microscope

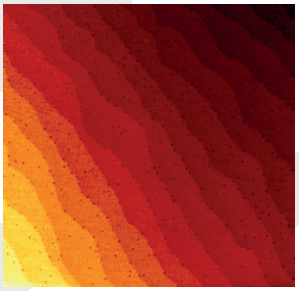
• 8 MP CMOS camera
• Recording and imaging with color CMOS camera
• Motorized Optical zoomx1-5
• 1 µm optical resolution. This is important.
• x10 long working distance objective
• Adjustable white light source

Spin Coater

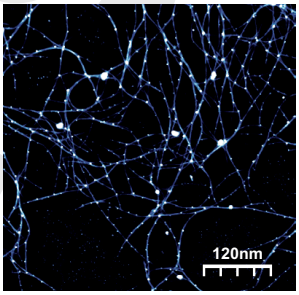
• Rotation speed: up to 6000 rpm
• Thin film application range from 10 nm to 10 um
• Rotary platform (carrier) for samples with 50 mm diameter
• Optional vacuum pump connection
• Potentiometer for speed control
• Digital display with rotation speed display

Acoustic and Vibration Isolation

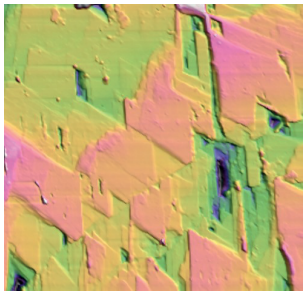
• Passive vibration isolation platform with acoustic enclosure design
• Acoustic/Thermal isolation cabinet, opening sideways for safety and ease of operation
• Heating stage from -30°C to +400 Deg °C (optional) and heater for biological samples up to 80°C (optional)
• Humidity, Gas pressure and Temperature control.



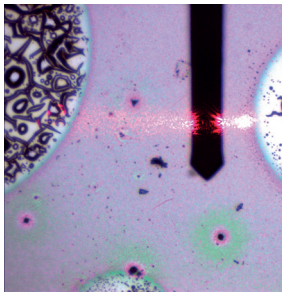
STO 3 x 3 µm



Carbon Nanotubes with polymer Image courtesy: Dr. Chris Roberts, Imperial College London



Etched Gypsum 45 x 45 µm



Cantilever under video microscope

Standard Imaging Modes

• Contact mode
• Non-Contact mode by Phase Locked Loop System(PLL)
• Dynamic Force / Intermittent Contact / Tapping Mode
• Lateral Force Microscopy (LFM)
• Phase Imaging and Q Control
• Magnetic Force Microscopy (MFM)
• f-d Spectroscopy
• Surface Potential Microscopy (SPM)
• Conductive AFM (c-AFM)
• Viscoelastic Mapping Mode
• Electrostatic Force Microscopy (EFM)
• Piezo Response Force Microscopy (PRFM) • Scanning Tunneling Microscopy (STM)
• NanoMechanical Imaging (NMI Mode) with Hertz / Sneddon, DMT, JKR and Oliver-Phar models Young Modulus, Adhesion, Cohesion, Force Mapping, Stiffness, Dissipation
• Liquid scan mode
• Advanced PFM (+/- 200V)*
• SthM mode

*NanoMagnetics Instruments supplies the advanced PFM mode with a High Voltage (+/-200V). The HV PFM operatres in a similar way as the Dual AC Resonance Tracking mode (DART). It allows us to use it in static mode, where a conducting AFM probe is scanned at constant force over the sample. A conducting probe is needed as a way of applying the bias voltage(up to+/-200V) over the sample while scanning.

User Kit

• Calibration samples for AFM Cantilever
• User manuals
• Petri dish holder
• Tweezers, wire cutter, silver paste, sample holders, sample holder box,etc..
• 10 Nos each of tips(cantilevers) for each mode

Computer

• Intel Core i7 quad core processor
• 8 GBRAM
• 1 TB hard drive space in two partitions • Windows 10(64 Bit) operating system • USB Drive and CD/DVD Burner
• 27'' LED Monitor
• Keyboard and mouse

AFM Control Software

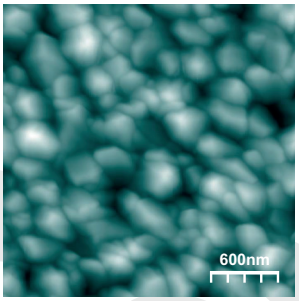
• Built-in manipulation software
• 3D imaging
• Image processing, analysis, and recording functions
• Simultaneous data gathering
• Minimum 8,192 X 8,192 pixels imaging 2MHZ
• Automatic finding of cantilever frequency
• Multi-user license
• Lifetime free software updates
• High pass, band pass filters,
• Median filters and custom convolution filters
• Wiener filter for 1/f noise cancellation
• Slope correction
• Band elimination
• Thermal drift compensation
• Zoom/Crop, Cross-section, etc.
• FFT analysis and FFT filters etc.
• Roughness calculation
• Histogram calculation
• Image contrast reversal
• Image transpose
• Sader's hydrodynamic method of spring constant calibration
• Automatic probe sensitivity calibration
• Drift compensation function (1nm accuracy)

SPM Controller Electronics

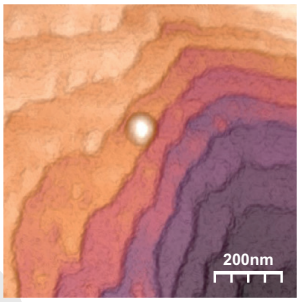
• State of the Art FPGA Based Controller
• Reconfigurable digital hardware for flexible and ultimate performance
• 32 Bit Realtime Processor with 128MB DDR SDRAM
• USB2.0 High Speed Interface, 480Mbps for PC Interface
• STM / AFM / KPFM / ncAFM etc...
• G = −1V/nA , 1pA – 1nA Range, < 5fA/fHz noise floor, no visible line or harmonics
• Sample bias ±10V / 16 bit Fast DAC, Digital Modulation for KPFM & STS
• Hardware Implemented 7 Independent Channels of Digital PID Loops
• INPUTS: Any 24/32 Bit digital inputs from PLL etc.
• OR any Analog input (with 16Bit or 24Bit ADC)
• OUTPUTS:16or24BitDigitaltoAnalogConverters& 48 Bitstruncatedinto24 or 32BitsDigitalOutputs
• 2 Digital Lock in Amps, 32Bit digital output (one is for PLL)
• Frequency Range : 0.1Hz – 1kHz
• Resolution : 40nHz
• Demodulation Bandwidth: 50Hz – 5kHz
• Input: ±10V, Sampling Rate: 90MHz @ 16Bit resolution
• Output: 32 Bit digital ΔF and Phase / 16 Bit Analog ΔF and Phase
• Constant amplitude feedback or Constant Excitation
• LabView scripting (programming)
•AFM head, scanner, sample holders and other accessories are recognized by the plug and play software
• Free software upgrades for Lifetime

SPM Controller Electronics

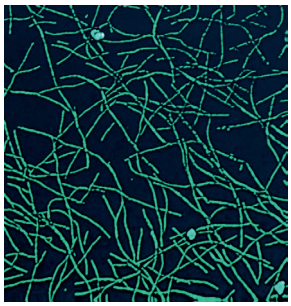
• Digital Filter Bandwidths: 10Hz – 3kHz adjustable
• 2 Channels of 16Bit Analog to Digital Converters @ 90MHz;
• ±10V Input range; 1MHz 4thorder Butterworth LPF
• 2 Channels of 16Bit Digital to Analog Converters @ 90MHz;
• ±10V Output range (One used for Bias Voltage);
• 4 Channels of 24Bit Digital to Analog Converters @ 62.5kHz;
• ±10V Output range (XYZ & SPARE or NSEW)
• Simultaneously sampled 16 Channels of True 24 Bit Analog to Digital Converters@ 175kHz;±10VInputrange;
• 10kHz 4th order Butterworth LPF
• 2 Channels of 24Bit and 12 Channels of 16Bit Digital to Analog Converters;±10V Output range
• Joystick and Software user interface
• Simultaneous Scan of 16 channels 24 bit ADCs and Digital Inputs like Δf, Amplitude etc @ 4096x4096 pixels
• 100/110/220/240 Vac, 50/60 Hz, 400 VA
• 150mm Height x 483mm Width x 520mm Depth
• Source code written in C # and DirectX 11 for 64Bit OS
• Access to major signals on BNC connectors through front panel



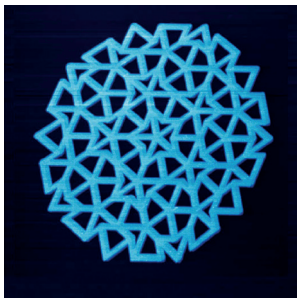
Copper coated HOPG in EC-Cell



HF Etched Mica

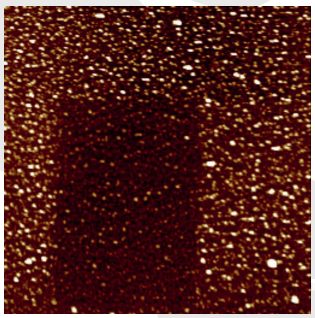


Polymer Brush 5 x 5 µm

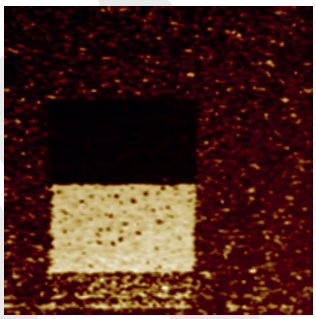


Nanomagnets 10 x 10 µm

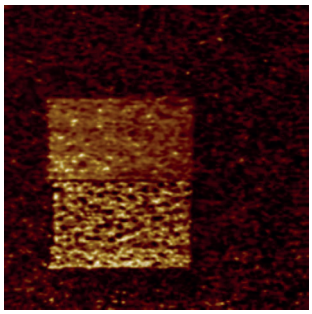
PRFM images of BCFO



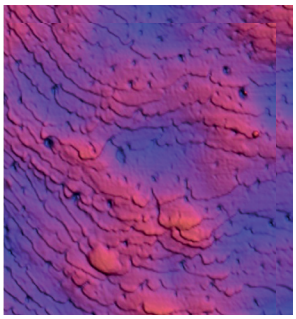
Topography of BCFO 10 x 10 µm



Phase of BCFO 10 x 10 µm

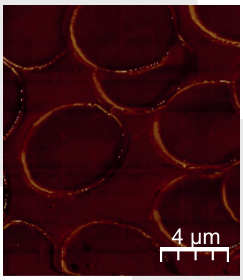


Amplitude of BCFO 10 x 10 µm

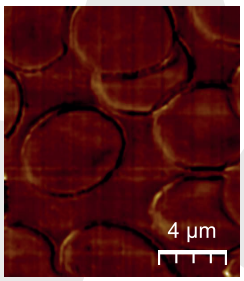


Barium Ferrite 10 x 10 µm

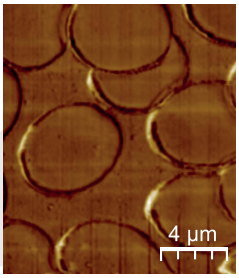
Deformation



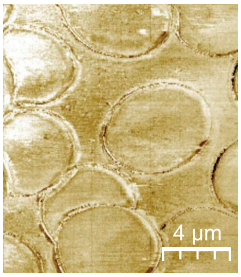
Young Modulus



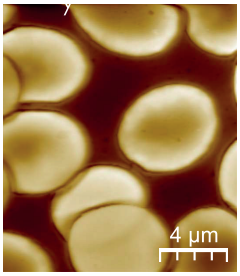
Dissipation



Adhesion

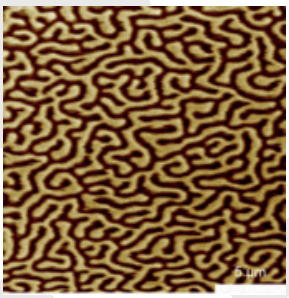


Topograph

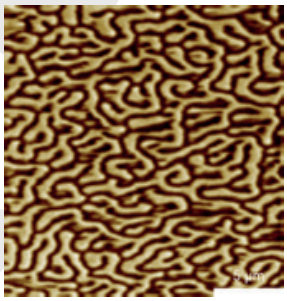


Nano Mechanical Imaging

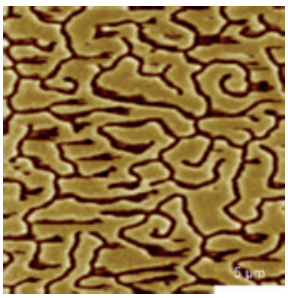
MFM Results with Vector Magnet



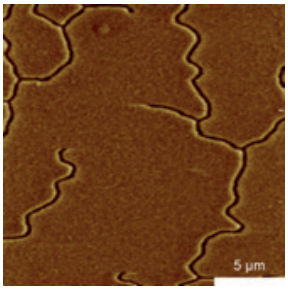
B_X: 200 Gauss
B_Z: 200 Gauss



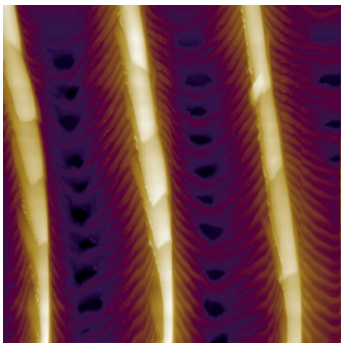
B_X: 300 Gauss
B_Z: 300 Gauss



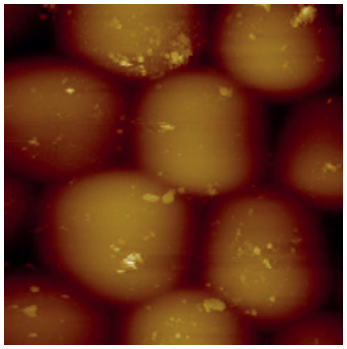
B_X: 400 Gauss
B_Z: 400 Gauss



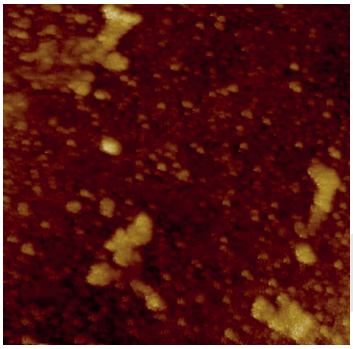
B_X: 500 Gauss
B_Z: 500 Gauss



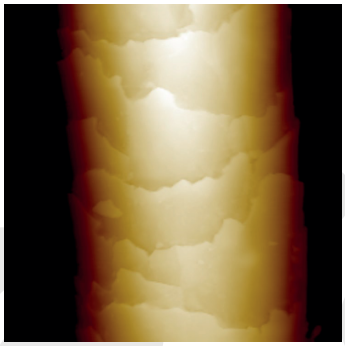
Butterfly Wing 4 x 4 µm



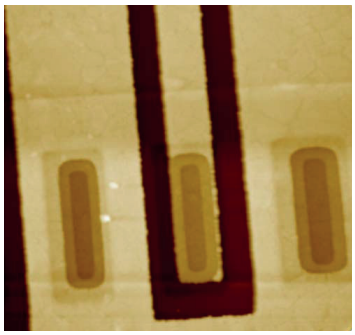
Eye of Cicada 60 x 60 µm



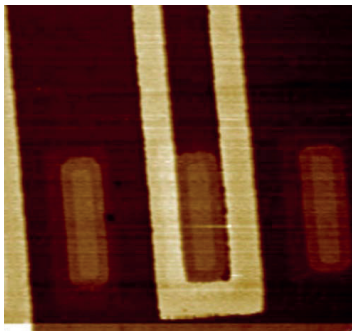
Wing of Cicada 15 x 15 µm



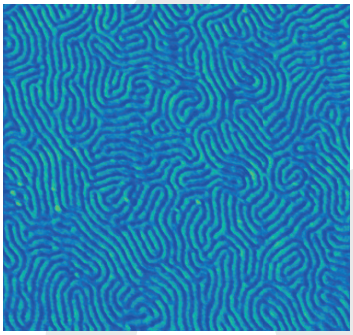
Human Hair 30 x 30 µm



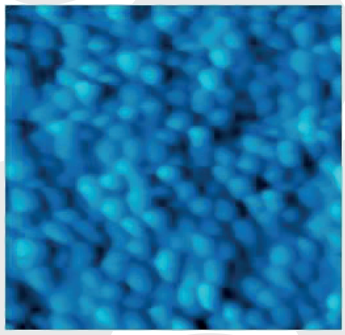
OPA 111 OpAMP, SCM 80 x 80 µm



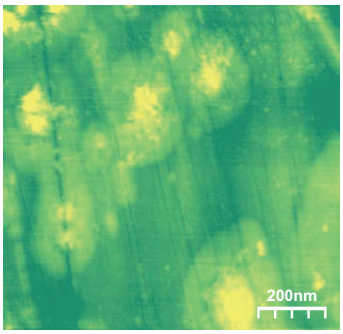
SCM Phase 80 x 80 µm



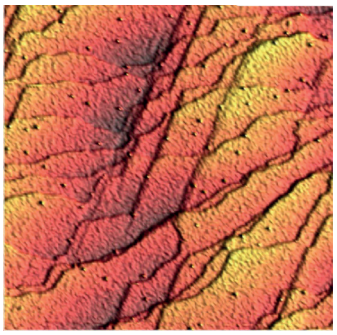
Phase Image of PS-b-PMMA Block Copolymer 2 x 2 µm



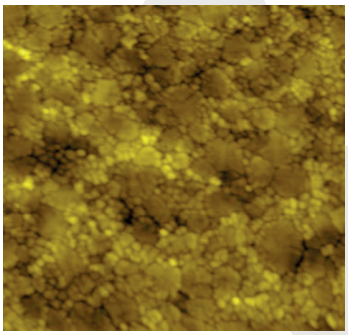
Staphylococcus Aureus (Negative) 15 x 15 µm



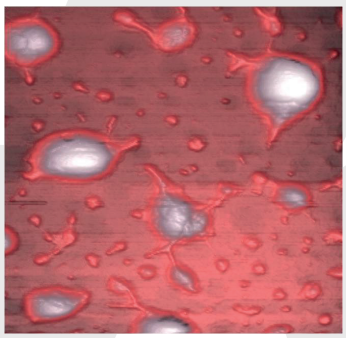
BN in PBS solution



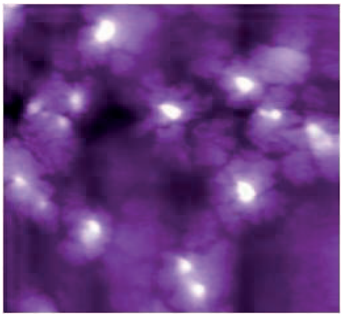
Organic Single Crystal 1 x 1 µm



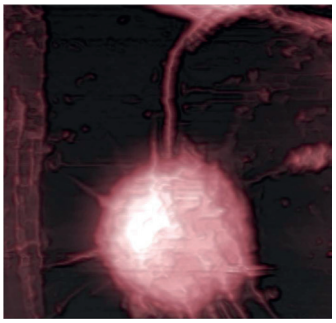
LCMO 3 x 3 µm



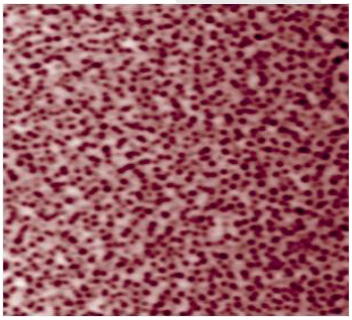
Phosphorylcolamine Coated Line 30 x 30 µm



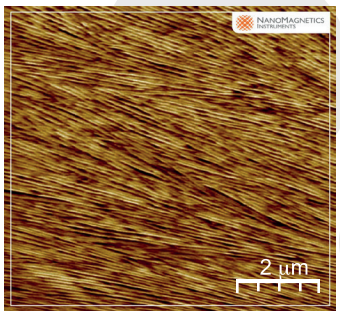
Fish Bacteria 25 x 25 µm



Cancer Cell 50 x 50 µm



$CoCl_2$ Doped Silicon-Urea 10 x 10 µm



Triblock Copolymer Phase Image