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BENCHTOP ATOMIC FORCE MICROSCOPE (AFM)

Benchtop Atomic Force Microscope (AFM) - ToronAFM™ 600

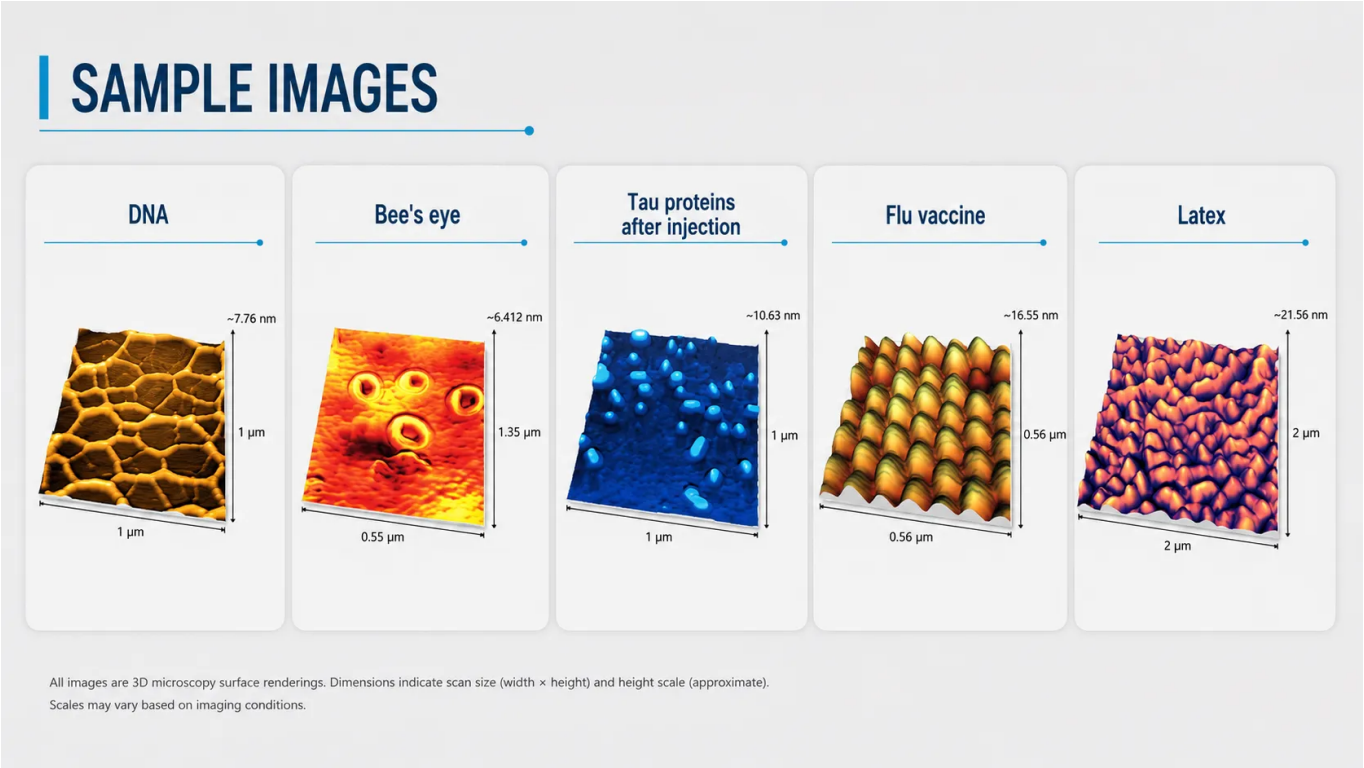
ToronAFM™ 600 benchtop atomic force microscope delivers nanoscale surface imaging from a standard laboratory bench. The system resolves 1 nm of lateral detail and 0.1 nm of vertical detail, producing quantitative topography without a dedicated instrument room. Materials scientists, semiconductor engineers, polymer chemists, and life science teams use it to map roughness, grain structure, and thin film uniformity. Control electronics, a 21-inch all-in-one computer, and imaging software ship as one plug-and-play package.

Three standard imaging modes cover most sample types: contact, non-contact, and tapping. Contact mode suits hard, flat surfaces, while tapping mode protects soft polymers and biological specimens that a dragging tip would damage. Optional functional kits add magnetic, electrical, and mechanical characterization, so one bench instrument can serve several research groups. The motorized stage travels 15 mm in each axis with 40 nm steps, letting operators reach any point on a 20 mm sample under software control.

Setup time stays short because the ToronAFM™ 600 connects to any Windows computer over a single LAN cable. A top-view optical microscope with 8-megapixel color imaging and 60X to 600X zoom lets the operator pick a scan site before the probe engages. Automatic fast approach then brings the cantilever to the surface without manual adjustment or risk of tip damage. Laboratories gain usable images in minutes and keep the bench space they would otherwise surrender to a floor-standing platform.

APPLICATIONS

Benchtop Atomic Force Microscope (AFM) - ToronAFM™ 600 Applications



The ToronAFM™ 600 supports surface characterization wherever features below the optical diffraction limit determine performance. Its compact footprint and short setup cycle suit shared laboratories that run mixed sample types across several projects.

- **Semiconductors and Integrated Circuits**: measures step heights, line edge roughness, and wafer surface quality during process development and failure analysis
- **Solar Cells and Photovoltaics**: maps texture, grain boundaries, and local conductivity across absorber layers and transparent electrodes
- **Surface Engineering and Materials Science**: quantifies roughness, wear tracks, and grain morphology on treated and untreated metal surfaces
- **Ceramics and Coatings**: verifies coating uniformity, porosity, and adhesion-related surface texture on thin and thick films

- **Polymers and Chemical Products**: resolves phase separation, crystallinity, and blend morphology using phase imaging on soft samples
- **Nanoscale Mechanical and Electrical Characterization**: acquires force curves, stiffness maps, and local current data with optional functional kits
- **Biotechnology Research**: images DNA strands, proteins, cell membranes, and viral particles in air with minimal sample preparation
- **Pathology and Medical Science**: examines tissue structures, protein aggregates, and drug delivery carriers at nanometer scale
- **Pharmaceutical and Vaccine Development**: characterizes particle size, surface morphology, and aggregation behavior in formulations
- **Academic Teaching and Research Laboratories**: gives students hands-on scanning probe experience on an instrument small enough for a shared teaching lab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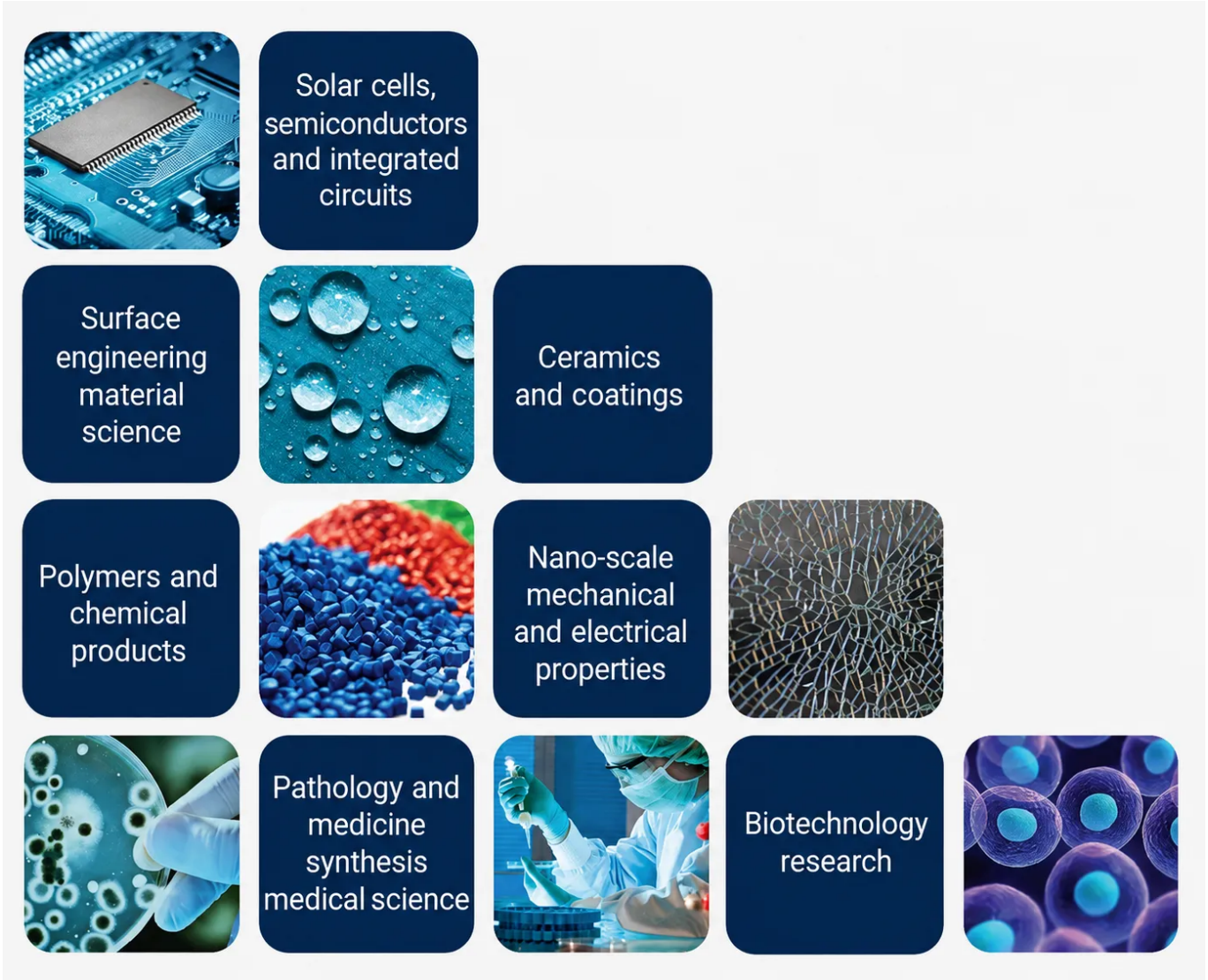
FEATURES

Benchtop Atomic Force Microscope (AFM) - ToronAFM™ 600 Key Features



The ToronAFM™ 600 combines a redesigned scan head, 24-bit control electronics, and a single-cable interface to shorten the path between sample loading and finished image.

- **1 nm XY and 0.1 nm Z Resolution**: resolves surface features well below the optical limit for quantitative roughness and step height work
- **Automatic Fast Approach**: engages the cantilever to the sample surface from any starting distance without operator input, cutting setup time and protecting the tip
- **Simplified Tip Fixation**: a spring lever holder and vacuum pen let operators seat a probe quickly with low risk of breakage
- **Chip Alignment Template**: positions the cantilever chip repeatably so laser alignment carries over between probe changes
- **Reduced Head Weight**: lighter scan head makes handling and micrometer adjustment easier during routine operation
- **Adjustable Laser Optical Path**: operators tune the optical alignment by shifting the beam path instead of repositioning the detector
- **8-Megapixel Top-View Optical Microscope**: 60X to 600X color zoom with integrated dimmable lighting shows the scan site before the probe engages
- **Single LAN Cable Connection**: one network cable carries all data and control traffic at 100 MB/sec, removing the usual cable bundle from the bench
- **Remote Network Operation**: any workstation on the network can run the instrument, and a technical specialist can join the same session for troubleshooting
- **24-Bit Data Conversion**: four ADC and four DAC channels at 24-bit depth preserve fine signal detail across the full scan range
- **Zynq Signal Processing Platform**: handles feedback and acquisition in real time for stable imaging at speed
- **Integrated Signal Oscilloscope**: displays every system signal live so operators can diagnose scan quality while the image forms
- **Zoom Rescan of Captured Images**: select a region on a finished scan and acquire it again at higher pixel density without reloading the sample
- **Automatic Image Gallery Saving**: captured scans store themselves in an organized library, reducing the chance of lost data

- **Independent Analysis Software**: a separate processing package handles flattening, measurement, and presentation, and exports image data in several formats
- **Sample Bias Control**: applies -10 V to +10 V across the sample for electrical characterization work
- **Three Standard Modes**: contact, non-contact, and tapping ship with every unit, covering hard, soft, and delicate samples
- **Modular Functional Kits**: add magnetic, electrical, mechanical, and lithography techniques to the same platform as research needs grow
- **Compact 300 x 400 x 300 mm Footprint**: fits on a shared bench at 20 kg, so no dedicated instrument room is needed
- **Windows Compatibility Across Hardware**: runs on desktops, laptops, and all-in-one machines, and ships with a dedicated 21-inch all-in-one computer

THEORY & METHOD

Theory and Method

Atomic force microscopy maps a surface by measuring the force between a sharp tip and the sample rather than by focusing light or electrons. The tip sits at the free end of a flexible cantilever only a few micrometers thick. As the tip nears the surface, van der Waals attraction, electrostatic forces, and short-range repulsion bend the cantilever by a fraction of a nanometer. That deflection carries the topographic signal.

A 670 nm laser diode reflects off the back of the cantilever onto a four-segment photodiode. Bending shifts the reflected spot across the detector segments, and the difference in segment currents scales with deflection. The controller compares this signal against a setpoint and drives the Z piezoelectric scanner up or down to hold the force constant. Recording the Z voltage at every XY position builds the height map. Optical lever amplification turns sub-nanometer bending into a measurable signal.

Contact mode holds the tip against the surface and tracks deflection directly, which gives fast scans on rigid samples. Tapping and non-contact modes drive the cantilever near resonance with a dithering mechanism and track changes in oscillation amplitude or phase. Because the tip touches only briefly or not at all, soft biological and polymer samples survive imaging intact. Lift-mode techniques such as MFM and KPFM run a second pass above the recorded topography, separating magnetic or electrostatic signals from surface shape.

TECHNICAL SPECIFICATIONS

Benchtop Atomic Force Microscope (AFM) - ToronAFM™ 600 Technical Specifications

Parameter	Specification
Scanner	
XY Scan Range	20 µm to 70 µm maximum
XY Resolution	1 nm
Z Movement Range	4 µm maximum
Z Resolution	0.1 nm
Stage	
XY Stage Type	Motorized, software-controlled
XY Travel Range	15 mm
XY Movement Step	40 nm
Z Travel Range	15 mm

Parameter	Specification
Z Movement Step	40 nm
Cantilever Engage	Automatic (Auto Fast Approach)
Sample Mount	
Maximum Sample Diameter	20 mm
Maximum Sample Thickness	10 mm
Sample Holder	Light magnetic sample holder included
Sample Bias Voltage Range	-10 V to +10 V
Scan Head	
Adjustment	High-precision micrometer
Laser Wavelength	670 nm
Maximum Laser Diode Power	5 mW
Photodetector	High-grade quadruple photodiode
Excitation	Dithering mechanism
Optical Path	Optimized design
Tip Holder	Spring lever mechanism
Top-View Optical Microscope	
Camera Resolution	8 megapixel, color
Optical Zoom	60X to 600X
Illumination	Integrated, with dimmer

Parameter	Specification
Electronics	
Control Box	Plug and play
ADC Channels	4 channel, 24-bit
DAC Channels	4 channel, 24-bit
Signal Processing	40 MHz Zynq processor
Data Transfer	100 MB/sec via LAN
Software	
Data Acquisition	Real-time, 100 MB/sec, Microsoft Windows compatible
Optical View	Integrated windows for sample and cantilever vision
Signal Monitoring	High-rate oscilloscope across all system signals
Image Storage	Automatic saving to software gallery
Zoom Scanning	Rescan of a selected area on captured images
Approach	Automatic fast approach of cantilever to sample surface
Image Processing	Independent software for processing, analysis, and presentation
Data Export	Multiple image data export formats
Operating System	Compatible with all Microsoft Windows versions
Imaging Modes (Standard)	Contact, Non-Contact, Tapping
Dedicated All-in-One Computer	
Display	21 in, 1920 x 1080

Parameter	Specification
Processor	Latest generation
Memory	8 GB RAM
AFM Unit	
Installation	Plug and play
Dimensions (W x D x H)	300 x 400 x 300 mm
Net Weight	20 kg

Included Accessories

Item	Description
Sample Mounting Kit	Hardware for securing samples to the stage
Sample Substrate	Substrate for sample preparation and mounting
Cantilevers	Assorted probe types for the standard imaging modes
Tweezers and Magnet Box	Handling tools and storage for probes and magnetic holders

Optional Upgrades

Item	Description
Extended XY Scanner	Customizes the XY scan range to 100 µm
Tip Changing Kit	Tooling for faster probe exchange
Vacuum Pen	Pick-and-place tool for low-risk tip handling

Functional Kits

Kit	Included Techniques
Dynamic Modes Kit	Magnetic Force Microscopy (MFM), Electric Force Microscopy (EFM), Phase Imaging
Contact Modes Kit	Lateral Force Microscopy (LFM), Force Spectroscopy, Mechanical Nano-Lithography
Advanced Research Kit	Chemical Nano-Lithography, Force Modulation Microscopy (FMM), Conductive AFM (C-AFM), Kelvin Probe Force Microscopy (KPFM), Piezoresponse Force Microscopy (PFM)

Custom configurations and application-specific modifications are available on request.

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