

● Environmental Control 1-ppm Turnkey Solutions

Bruker's Environmental Control packages for atomic force microscopes (AFMs) enable a wide range of new AFM research. Available for Bruker's Dimension® Icon®, Dimension Edge™, and MultiMode® 8 AFMs, the packages provide turnkey solutions for the most stringent 1-ppm gas purity requirements. In combination with Bruker's exclusive PeakForce TUNA™ module and electrochemical accessories, the Environmental Control packages fully address the challenges of sample preservation and artifact avoidance, enabling for the first time the in situ nanoelectrical and electrochemical characterization of organic photovoltaics (OPVs) and Lithium ion cathodes.

- Most stringent environmental control augments exclusive AFM capabilities
- Turnkey solutions guarantee performance of integrated systems
- Critical functionality enables organic photovoltaics and Li battery research

New Research Opportunities

Polymer-based samples are often complex, with multiple components and property-relevant structures at multiple length scales, including the nanoscale. With its ability to provide not only nanoscale topography but also mechanical, electrical, and electrochemical information, atomic force microscopy is uniquely positioned to provide critical information on many materials that have recently received increasing attention, including OPVs and Lithium ion cathodes, where such property information is related to device performance.



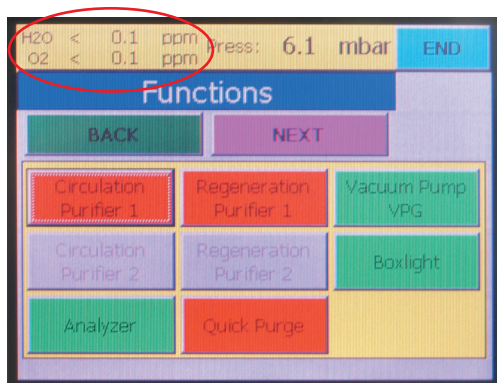
Turnkey 1ppm environmental control for Dimension Edge (left) and MultiMode 8 (right) systems.

The Challenge

Organic photovoltaics and Lithium ion cathode materials are sensitive to both chemical and mechanical disturbance and are therefore usually sealed and isolated from the outside environment when used in real-world devices. This presents an intrinsic challenge for atomic force microscopy, where a physical probe needs to interact mechanically with an exposed surface.

The AFM Breakthrough

To overcome the challenge of a low mechanical damage threshold, Bruker's exclusive PeakForce TUNA Imaging Mode utilizes breakthrough PeakForce Tapping™ technology. It eliminates damage from tip-sample forces on even the softest materials during conductivity mapping. The other advantages of this technology include direct, precise force control, complete elimination of lateral forces, dramatically improved ease of use



Glovebox touch-panel control showing <0.1ppm levels of O₂ and H₂O maintained while AFM operating inside.

Cover images

Foreground: High-resolution current map of PEDOT-P3HT overlaid on topography (2µm image size), suggesting the presence of a nanoscale conductive network. Crystalline areas are seen to exhibit higher conductivity (yellow). Imaged in a glovebox at <1ppm O₂ and H₂O with PeakForce TUNA. Local current maxima (yellow) provides evidence of partially sub-surface conductive networks. Sample courtesy of Prof. Nguyen, UCSB.

Background: Turnkey environmental control enables the Dimension Icon's unmatched AFM performance and features, while maintaining <ppm levels of O₂ and H₂O.

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with ScanAsyst™, and highest resolution quantitative nanomechanical properties with PeakForce QNM™.

Best Environmental Control

Overcoming the chemical sensitivity challenge in green energy research requires the highest grade environmental control. Bruker has teamed up with MBraun, the leader in glove box systems and inert gas technology, to provide solutions for the most stringent atomic force microscopy environmental control requirements. The MBraun Labmaster series glove box, in conjunction with the MB 20G inert gas purification system, guarantees levels below 1ppm for both, oxygen and water. The integration of Bruker AFMs with this glove box enables seamless 1ppm gas control from sample preparation to characterization, so the sample is never exposed to an uncontrolled environment.



Complete AFM signal feedthrough enabling all AFM modes and accessories

The Turnkey Solution

The systems, which come complete with antechambers, pumps, and high-capacity, automatically regenerating purifiers, deliver full, uncompromised functionality of the AFM. A custom-designed, extremely rigid support structure combined with integrated, active vibration control guarantees the highest resolution performance. A custom vacuum-quality feedthrough maintains environmental integrity while allowing full functionality for all standard and optional AFM modes and features.