Atomic Force Microscope (AFM)

Bruker Dimension Edge – ScanAsyst

- The Atomic Force Microscope (AFM) is a high-resolution scanning probe instrument capable of imaging, measuring, and manipulating matter at the nanoscale.
- Bruker's **Dimension Edge (ScanAsyst)** model provides advanced automated imaging, minimal user intervention, and extremely high accuracy for surface topology characterization.
- AFM works by scanning a sharp cantilever tip across the sample surface; the deflection of the tip is recorded to generate 3D nanoscale images.
- ScanAsyst technology automatically optimizes imaging parameters (setpoint, gains, scan rate), ensuring **reproducible and artifact-free measurements**.

Instrument Capabilities

- High-resolution 3D surface topography at **sub-nanometer vertical precision**.
- Automated ScanAsyst mode for consistent imaging without complex parameter tuning.
- Multiple imaging modes possible:
- Peak Force Tapping
- Contact mode
- Tapping mode (AC mode)
- Capable of mapping mechanical, electrical & magnetic properties.
- Suitable for both soft biological samples and hard materials.
- Nano-indentation and force-curve analysis for material mechanics.
- Capable of quantitative nanomechanical mapping (QNM).

Sample Type

- Thin films
- Polymers
- Metals & alloys
- Semiconductors
- Nanomaterials (nanotubes, nanoparticles, graphene, etc.)
- Biological samples (cells, membranes)
- Coatings & surface-treated materials

Sample Preparation

- Samples should be flat, clean, and firmly mounted on AFM sample stubs.
- Remove dust or particles using nitrogen/air blow.
- For soft biological samples, fix and dry properly to avoid motion during imaging.
- Conductive samples may require grounding to avoid charging.
- Ensure sample size fits the AFM sample stage (typically < 10–15 mm).
- Thin films should be uniformly coated and dried.
- Magnetic/electrical property studies may require coated probes.

Applications

- High-resolution surface roughness and texture analysis.
- Thickness and morphology study of thin films.
- Nanomechanical property mapping (modulus, adhesion, stiffness).
- Semiconductor and microelectronics defect inspection.
- Characterization of polymer blend phases, crystallinity, and microstructure.
- Biological surface analysis at the cellular and subcellular level.
- Nanoparticle size and distribution measurement.
- Tribological studies (friction, wear).
- Surface contamination analysis.
- 3D metrology for nanotechnology research.

References

- Bruker AFM Technology Overview
- Dimension Edge ScanAsyst User Manual
- https://www.brukerafm.com