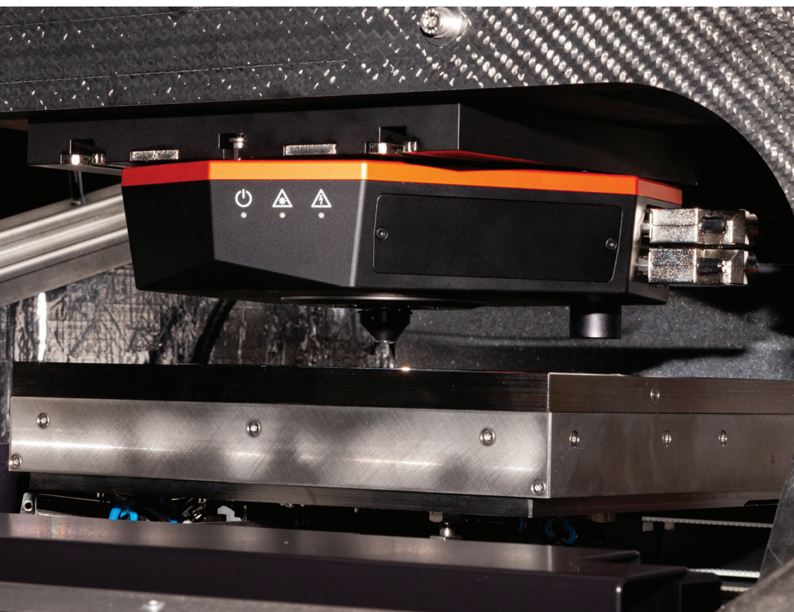
Alphacen 200 Drive

Your Wafers Analyzed

nanosurf



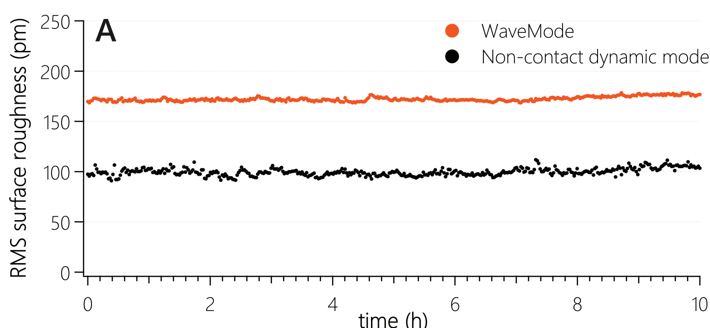
Your AFM for Versatile Wafer Characterization

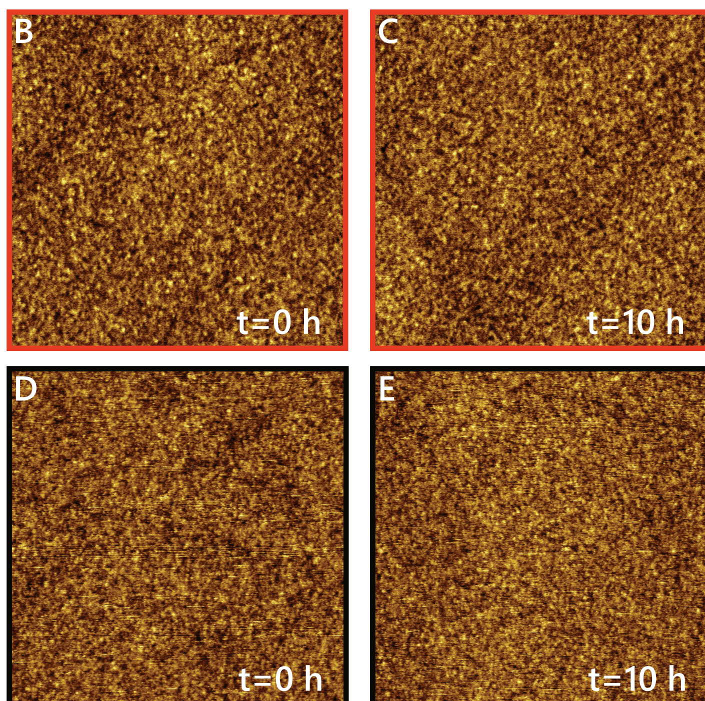
Based on our expertise designing industrial metrology systems, Nanosurf developed the Alphacen 200 Drive – an advanced AFM system engineered to meet the high demands of the semiconductor industry.

From unparalleled low-noise roughness analysis using wavemode to complex electrical characterization tasks with SMM, the Alphacen 200 Drive solves the challenges typically faced by semiconductor manufacturing and research.

Silicon Wafer Surface Roughness:

WaveMode vs. non-contact dynamic mode





A) Time series of 10 h continuous RMS surface roughness measurements on a silicon wafer using WaveMode (WM) off-resonance tapping (red) and non-contact dynamic mode (NC) using CleanDrive photothermal excitation (black). The average surface roughness (±SD) correspond to 172±2 pm and 100±4 pm, respectively. First and last images of the WM (B, C) and NC mode (D, E) measurement series.
Image size: 1 x 1 µm^2; full z color scale: 1 nm (WM) and 0.7 nm (NC). All images were recorded at 5 Hz line rate with 500 px x 500 px resolution using WM0.6AuD (WM, 70 pN contact force) or USC-F1.2-k7.3 (NC, 2.8 nm free amplitude, 87% setpoint) cantilevers.

Performance

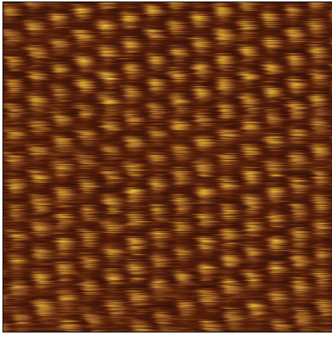
- Large sample system with flexure tip scanner capable of atomic resolution.
- Highest measurement stability with CleanDrive photothermal excitation.
- WaveMode: Fastest off-resonance imaging for reproducible and fast measurements.

Versatility

- Large scan range: 100 x 100 x 20 µm^3.
- Compatible with broad selection of nanoelectrical characterization methods (NEC), such as Nanosurf's SMM solution.
- Expandable functionality with accessories and software options.

Automation

- Fully automated laser alignment and cantilever calibration.
- Automated imaging on every region of interest within fully addressable XY sample area of 200 x 200 mm^2.
- Accurate and consistent roughness measurements with WaveMode.



Atomic lattice resolution of gypsum crystal measured in liquid, dynamic mode. Image size: 8 x 8 nm².

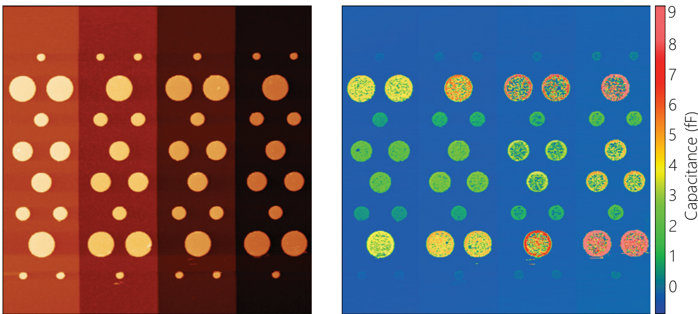
Obtaining Highest Resolution with a Large Scanner

Thanks to the superior technology of the DriveAFM scan head, imaging at atomic resolution is possible, even on this large-stage system.

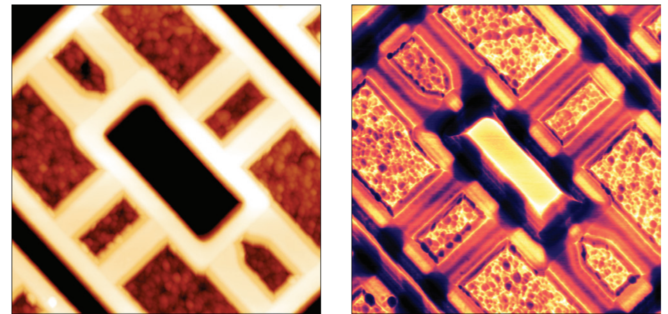
This powerful combination allows for the observation of feature sizes covering several orders of magnitude, making a wide variety of structures accessible for analysis.

Gain Insight into the Local Nanoelectrical Properties with Nanosurf's User Friendly Scanning Microwave Microscopy (SMM) Solution

- Obtain local capacitance, carrier density, resistance, conductivity, and dielectric constant.
- Analyze sub-surface structures prevalent in modern multilayered integrated circuits.
- Fastest time-to-results with Nanosurf's in-house SMM solution.



Topography (left) and capacitance (right) image of the MC2 Technology capacitance calibration sample.
Image size 52 x 52 µm², height range topography: 430 nm, smallest capacitance 0.3 fF, steps between terraces 0.04 fF.



Topography (left) and imaginary (right) part of the complex S11 parameter on an SRAM sample. In a calibrated measurement, the imaginary part reports differences in capacitance while the real part (not shown) reflects local sample resistance. Image size 10 x 10 µm².

System Functionality

Imaging modes	Static force, dynamic force, phase contrast, WaveMode, MFM, friction force, force modulation, EFM Optional modes: KPFM, PFM, SSRM, C-AFM, SMM
Spectroscopy modes	Force–distance, amplitude–distance, phase–distance Optional: tip current–tip voltage
Sample approach	Fast home, retract, and advance movement Automatic step-by-step approach
Sample observation	Top view camera for cantilever and sample observation (<2 µm resolution)

Scan Head specifications

Scan range XY	100 µm
Maximum Z-range	20 µm
Scanner technology	Direct drive piezo-based flexure scanner, tip-scanning configuration
DC detector noise (deflection noise)	<5 pm rms (0.1 Hz – 10 kHz)
AC detector noise floor @ 100 kHz	<25 fm/√Hz above 100 kHz
Detector bandwidth	≥8 MHz
Read-out light source	840 nm SLD
Photothermal light source	785 nm laser
Light source spot size	~10 µm

System Specifications

Z-travel	13 mm
XY-travel	200 mm
XY repositioning accuracy	2 µm
Sample platform size	200 x 200 mm²
Sample size	Max. 200 x 200 x 10 mm³
Sample weight	Max. 2 kg
Vacuum chuck for	4, 6, 8 inch wafer
Stage technology	Stepper motor / belt / air bearings
Z-noise (RMS dynamic mode)	< 20 pm, VC-G
Acoustic isolation STC rating	48
Vibration isolation	Active damping
Floor vibration requirements	VC-E or better

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