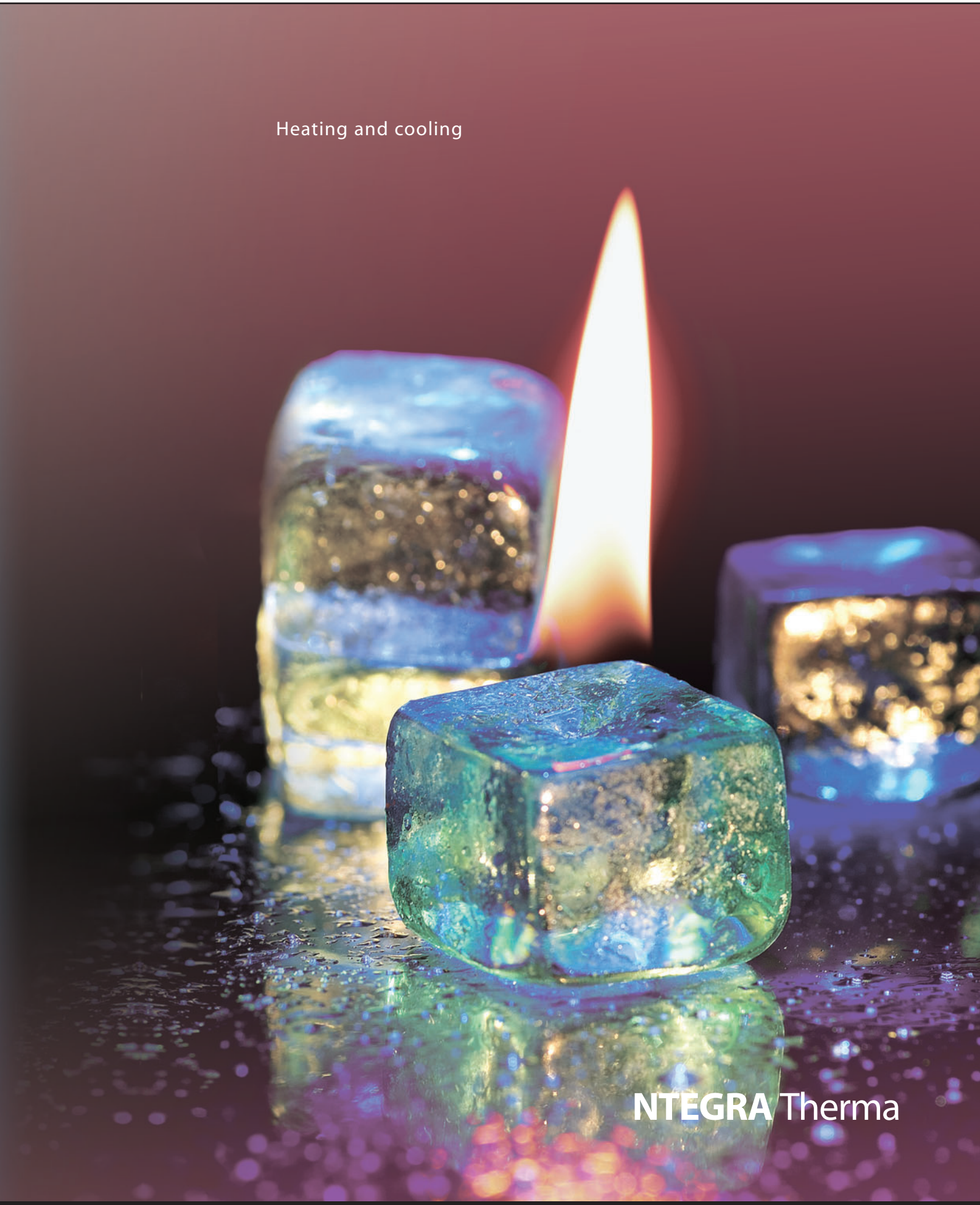
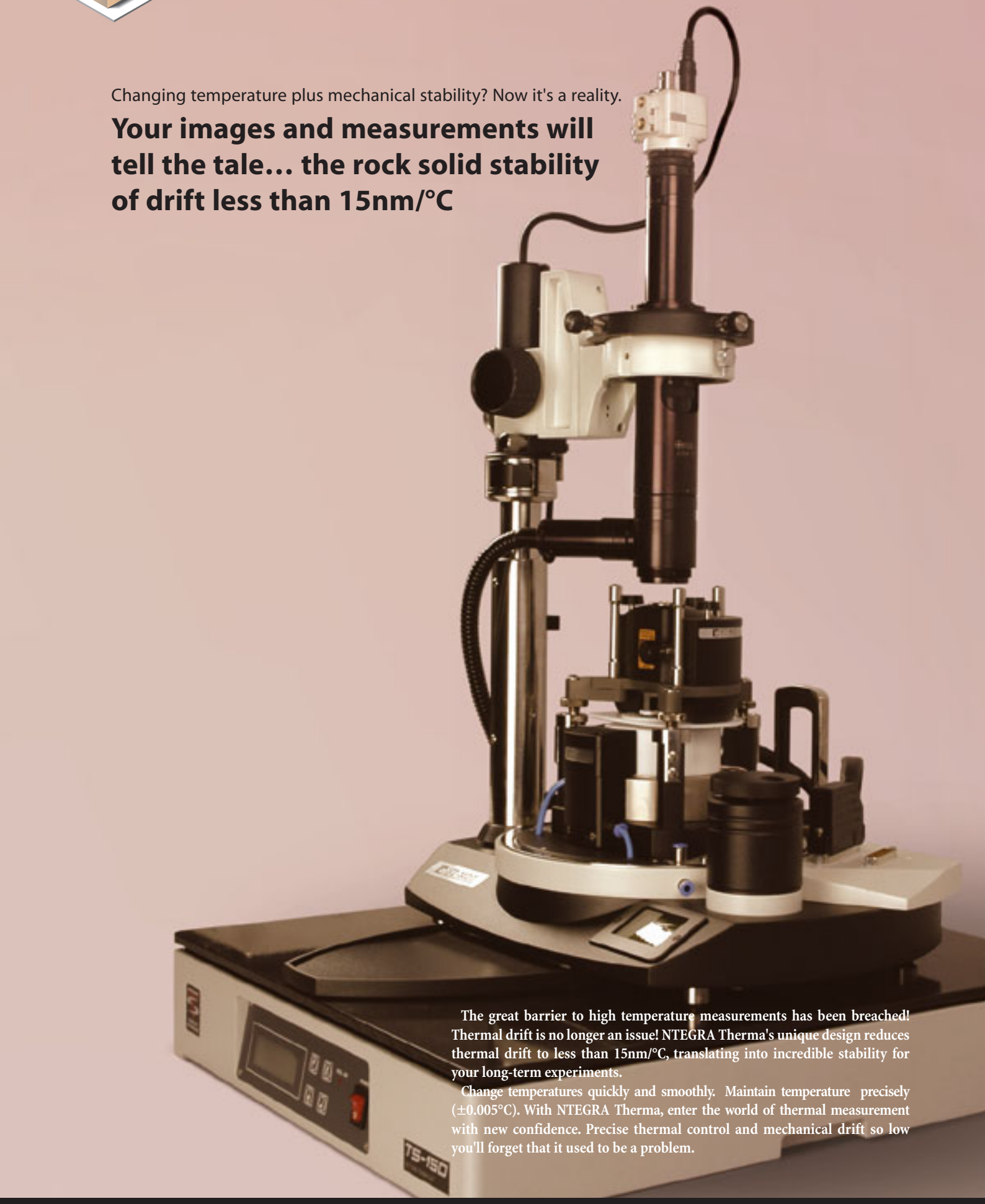
Heating and cooling



NTEGRA Therma

Changing temperature plus mechanical stability? Now it's a reality.

Your images and measurements will tell the tale… the rock solid stability of drift less than 15nm/°C



The great barrier to high temperature measurements has been breached! Thermal drift is no longer an issue! NTEGRA Therma's unique design reduces thermal drift to less than 15nm/°C, translating into incredible stability for your long-term experiments.

Change temperatures quickly and smoothly. Maintain temperature precisely (±0.005°C). With NTEGRA Therma, enter the world of thermal measurement with new confidence. Precise thermal control and mechanical drift so low you'll forget that it used to be a problem.

Rigidity and stability

High temperature measurements are always a challenge. Different components of the system respond differently to heat, creating a mechanical drift that confounds long term measurement. **NTEGRA** Therma solves that problem, providing unprecedented low thermal drift and high stability.

Therma's design and composition are the keys. First, the THead construction separates a working cell with a measuring part and includes an independent registration unit. The tight construction of the cell provides negligible temperature difference while temperature variations. This compact unit is very proof against external vibrations. The temperature of probe and sample are the same as the temperature of the cell. The scanner with integrated capacitive sensors is confined to a separate block made of invar alloy carefully formulated with coefficient of thermal expansion near zero. Moreover, placed outside a working cell the scanner stays at room temperature.

The ultimate test: your results. Whether you are working at constant, elevated temperatures over long time periods or are running variable thermal programming, **NTEGRA** Therma provides the stability for impressively clear images and precise, repeatable measurements.

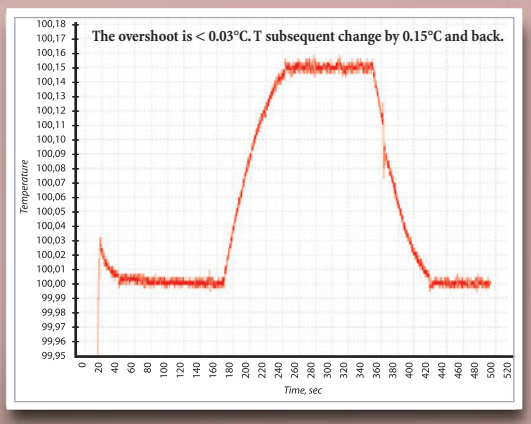
A new level of thermal control

The special smart heating algorithm ramps the temperature quickly and precisely to a given value with minimal overshooting. This algorithm provides much less overshooting comparing to the common PID (Proportional Integral Differential) control, thus ensuring no unwanted overheating.

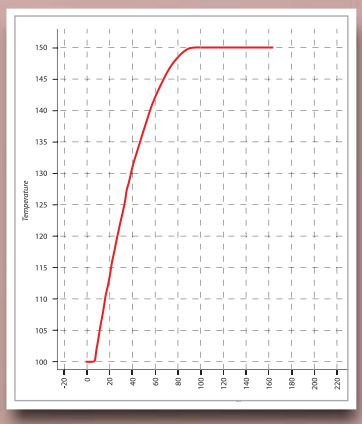
Nova PowerScript: the power to integrate and manage

The Nova PowerScript is a software tool specially designed for the **NTEGRA** line, opening the interface to external devices through the TTL[1] synchronization. Determine your own signal. When it reaches the pre-defined value, it will initiate your own user-defined program, sending a TTL signal and activating an external device. For example, integrate a high-speed oscilloscope for external fast response to initiate a specific process at a defined temperature. Nova PowerScript can be used to integrate a number of external devices.

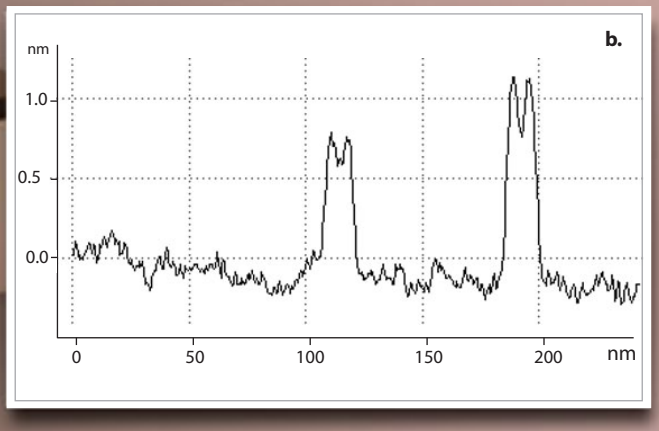
[1] Transistor-Transistor Logic



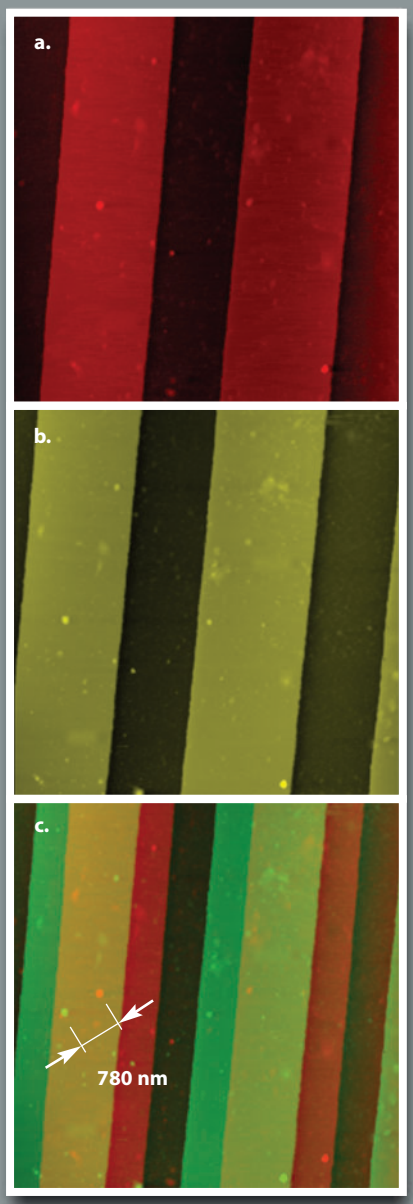
Temperature rise from 50°C (beyond the plot range) to 100°C .



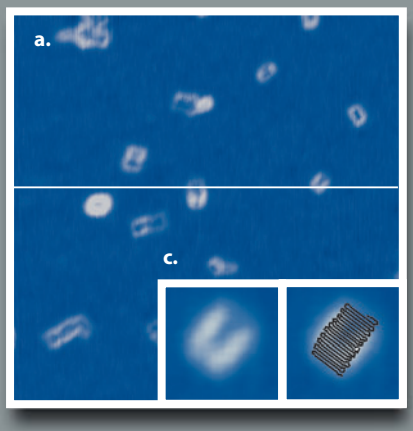
Temperature rise from 100°C to 150°C for ~ 90 sec.

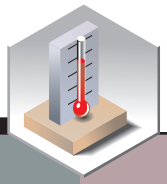


IPP single-molecule nanocrystallites on mica.
(a) AFM Topography image. Scan size: 240x240 nm.
(b) Height section drawn through the white line.
(c) The interpretation of the intramolecular substructure seen on AFM images.



Silicon wafer.
(a) Topography image at 28 °C
(b) Topography image at 130 °C
(c) Composed picture consisting of two images (at 28°C and at 130°C respectively), white arrows indicate initial (28°C) and final (130°C) position of the same feature.
Thermal drift is less then 8 nm/°C.
Scan size: 7x7 µm





Scanning probe microscopy

STM/ AFM (contact + semi-contact + non-contact) / Lateral Force Microscopy / Phase Imaging/Force Modulation/ Adhesion Force Imaging/ Magnetic Force Microscopy/ Electrostatic Force Microscopy / Scanning Capacitance Microscopy/ Kelvin Probe Microscopy/ Spreading Resistance Imaging/ Lithography: AFM (Force and Current),STM

Specification / Scan type		Scanning by sample	Scanning by probe*
Sample size	Ambient environment	Up to ∅40 mm, up to 15 mm in height	Up to ∅100 mm, up to 15 mm in height
	Heating or cooling	10x10x1.5 mm 15x12x1.5 mm	Up to 15x17x1.5 mm
XY sample positioning range, resolution		5x5 mm, 5 µm	
Positioning sensitivity		2 µm	
Temperature control	Range	From -30°C to +80°C/ RT – +150 C	From RT to 300°C
	Stability	±0.005 (typically), ⩽ ±0.01°C	±0.01°C (typically), ⩽ ±0.02°C
Scan range	-30 C – +80 C	10x10x5 µm	—
	Ambient conditions/ RT – +150 C	100x100x10 µm 3x3x2.6 µm	50x50x5 µm
	RT – +300 C	—	50x50x5 µm
	DualScan™ mode	Up to 150x150x15 µm** (DualScan™ mode)	
Thermal drift* ** (typically)	XY	15 nm/°C	
	Z	10 nm/°C	
Non-linearity, XY with closed-loop sensors		<0.1%	<0.15%
Noise level, Z (RMS in bandwidth 1000Hz)	With sensors	0.04 nm (typically), ⩽0.06 nm	0.06 nm (typically), ⩽0.07 nm
	Without sensors	0.03 nm	0.05 nm
Noise level, XY** (RMS in bandwidth 200 Hz)	With sensors	0.2 nm (typically), ⩽0.3 nm (XY 100 µm) 0.025 nm (typically), ⩽0.04 nm (XY 10 µm)	0.1 nm (typically), ⩽0.2 nm
	Without sensors	0.02 nm (XY 100 µm) 0.002 nm (XY 10 µm) 0.001 nm (XY 3 µm)	0.01 nm
Linear dimension estimation error (with sensors)		±0.5%	±1.2%
Optical viewing system	Optical resolution	1 µm/ 3 µm	3 µm
	Field of view	4.5–0.4 mm	2.0–0.4 mm
	Continuous zoom	available	available
Vibration isolation	Active	0.7–1000 Hz	
	Passive	above 1 kHz	

* Scanning head can be configured to serve as a stand-alone device for specimens of unlimited sizes.
** Optionally can be expanded to 200x200x20 µm.
*** For temperature range –30°C – +80°C
**** Built-in capacitive sensors have extremely low noise and any area down to 50x50 nm can be scanned with closed-loop control.

Articles:

• *C.A. Cooper, S.R. Cohen, A.H. Barber and H. Daniel Wagner. Detachment of nanotubes from a polymer matrix. Appl. Phys. Lett. 81, 3873-3875 (2002).*
• *M. Tian, M. Dosiere, S. Hocquet, P. J. Lemstra, and Joachim Loos. Novel Aspects Related to Nucleation and Growth of Solution Grown Polyethylene Single Crystals. Macromolecules 2004, 37, 1333-1341.*