

HITACHI
Inspire the Next

TMA7100 & 7300

VISIBLY BETTER



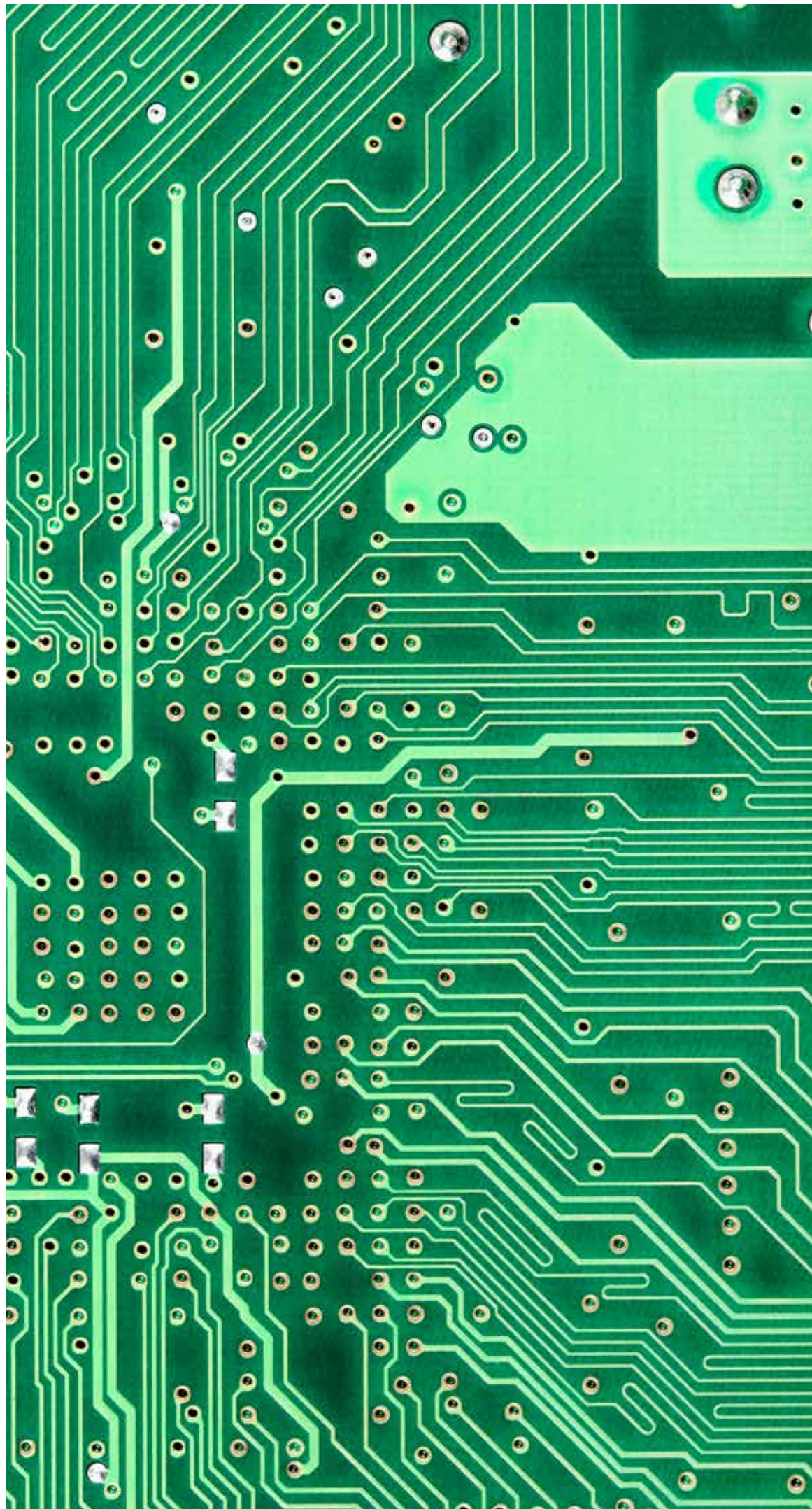
THERMAL ANALYSIS

High-sensitivity thermal analysis for all TMA applications

Thermo-mechanical analysis is a key part of determining a material's characteristics – both for new materials in development and routine quality control in production. Today's complex polymers and alloys must perform in demanding environments, which means instruments used in their characterisation must emulate those environments while detecting the smallest of changes. Hitachi's TMA7000 series is designed with the flexibility and sensitivity needed to pick up the smallest levels of expansion or shrinkage across a wide temperature range.

There are two instruments in the series: the TMA7100 has a temperature range of -170 to 600°C, and the TMA7300 that covers ambient temperatures up to 1500°C. Both instruments have extremely low levels of noise and a wide load range, making them able to determine the smallest of mechanical changes, even on thin films.

While ultra-low noise and high sensitivity is key to the performance of these instruments, there has been no compromise on the range of applications. Both models can perform creep, stress-relaxation, heat shrinkage stress, stress-strain and DMA measurements. And with Hitachi's intuitive NEXTA software, these advanced instruments can be used by non-specialists and experts alike.



Comprehensive materials characterization made easy



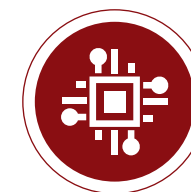
WIDE RANGE OF APPLICATIONS

A wide measurement range of +/- 5mm, load range of +/-5.8N, choice of cooling systems and seven optional measurement probes allows for a huge range of applications.



EASY TO USE

The intuitive NEXTA TA software simple mode intuitive interface and easy sample loading makes the TMA7000 simple to use and increases throughput.



EXPANDABLE SYSTEM

In addition to optional cooling systems and measurement probes, other features such as swelling measurements, vacuum measurements, volume expansion and curing measurement accessories are available.



HIGH PERFORMANCE

Optimisation technology reduces the level of noise of the output signal, ensuring you can pick up the tiniest of material changes, making the TMA7000 ideal for low-expansion materials and thin films.



PRECISE HEATING / COOLING CONTROL

The TMA7000 series offers precise temperature control over the entire temperature range and retains its high sensitivity capability at very low and very high temperatures.



COST EFFECTIVE

An optimised furnace design with automatic temperature control helps to increase cooling efficiency, reducing liquid Nitrogen consumption by 30%, keeping running costs down. Air and electrical cooling are also available depending on your temperature requirement.

TMA7000 Series technical specifications in detail

NEXTA TA Software: simplifying complex procedures

	TMA 7100	TMA 7300
Sample cylinder	Quartz, metal	Alumina
Temperature range	-170 to 600°C	Ambient to 1500°C
Probe supporting method	Cantilever	
TMA measurement range	± 5 mm	
RMS noise / sensitivity	0.005µm / 0.01 µm	
Load range / resolution	± 5.8 N / 9.8 µN	
Scan rate	0.01 to 100°C / min	
Maximum sample size	Expansion, penetration: Φ 10 x L 25 mm Tension: W 1x T 5 x L 25mm	Expansion: Φ 10 x L 25 mm
Sample length measurement	Automated	
Atmosphere	Air, inert gas, vacuum (to 13Pa)*, swelling measurement*	Air, inert gas, vacuum (to 13Pa)*
Stress control mode	Constant: ±5.8N, constant rate loading: 9.8x10 ⁻² to 9.8x10 ⁶ mN/min Sinusoidal loading: 0.001 to 1Hz, combination: maximum 40 steps	
Strain control mode	Constant: ±5000 µm, constant rate strain control: 0.01 to 106 µm/min Sinusoidal strain control: 0.001 to 1Hz, combination: maximum 40 steps	
Gas purge control	Flow meter*, gas cooling unit*, mass flow cooling unit*	
Cooling unit	LN2 dewar vessel, auto LN2 cooling unit*, electrical cooling unit*, auto fan cooling unit*	Auto fan cooling unit*
Dimensions	390(W) x 550(D) x 740(H) mm	

*available as an option

Complete range of measurement modes with one system



- With a choice of cooling units and options for additional measurement probes and furnaces, you can cover the complete range of measurements, including:
- Thermal Expansion

Heat Shrinkage

Softening Point

Stress/Strain measurements

Stress Relaxation Measurements

Creep Measurements

DMA Measurements

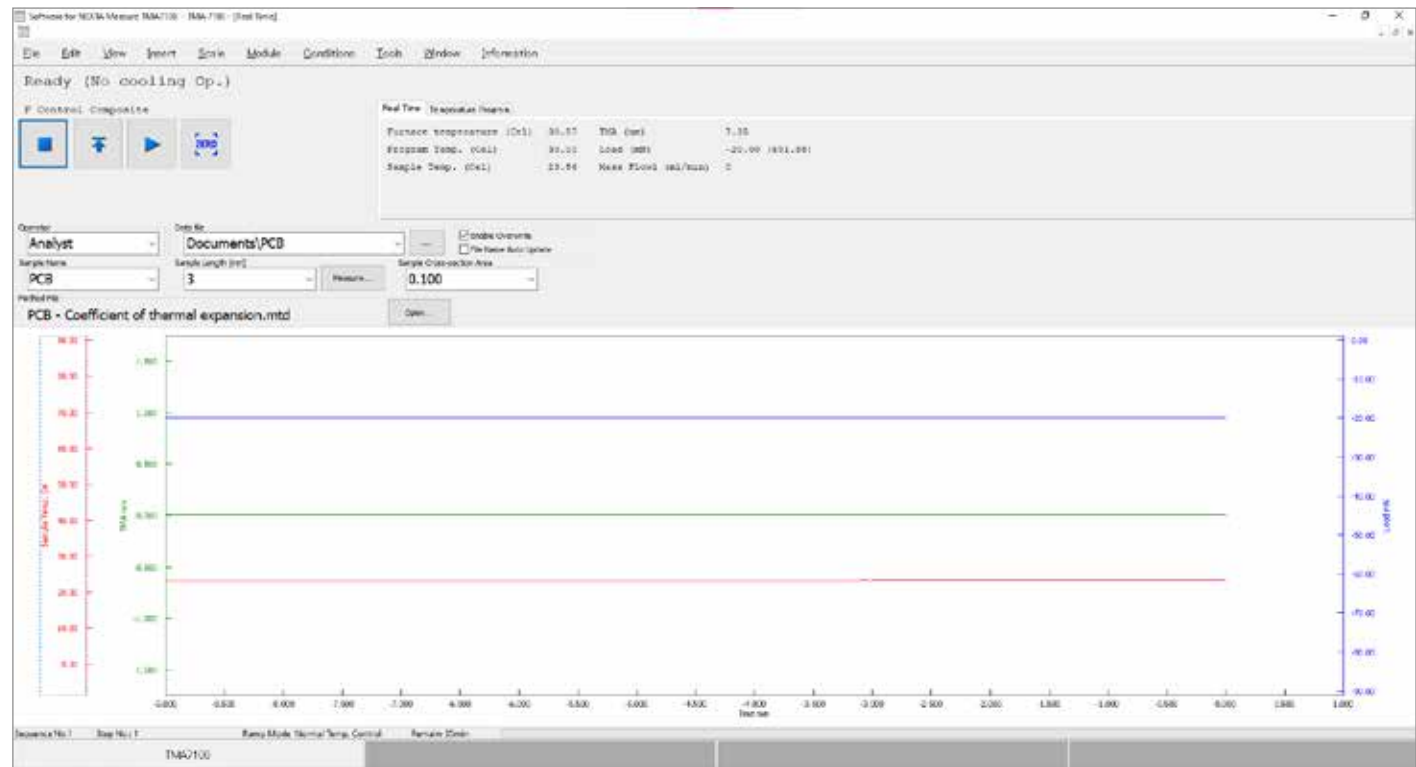
Curing Measurements

Measurements under vacuum

Immersion measurements

Swelling measurements

Volume Expansion Measurements

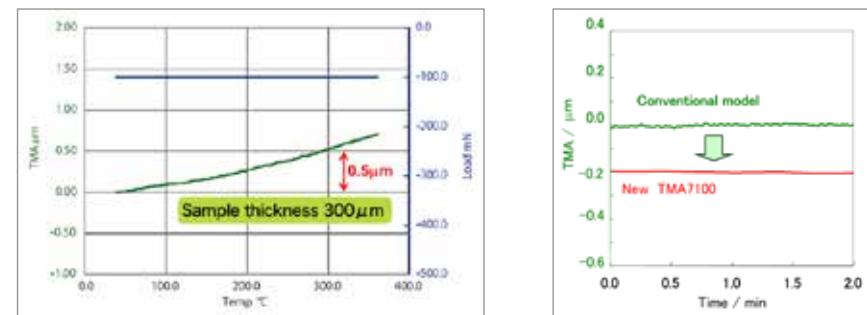


The NEXTA software included with the TMA7000 instruments is designed to make running a measurement as easy as possible, whether you are a new or advanced user. The software has two modes to choose from:

Simple mode is ideal for analysts performing QC tasks, and teaching labs. All important measurement features are visible, and all options are available and easy to find.

Standard mode gives you complete flexibility within an easy-to-use interface and is for more advanced users who want to tailor their own measurements.

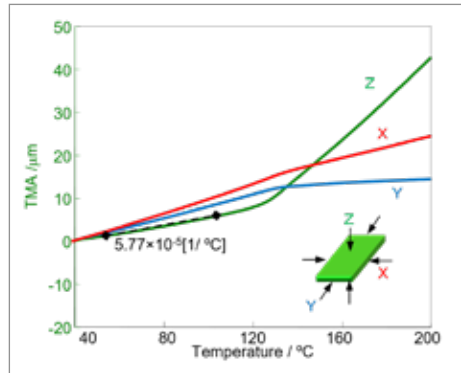
Low noise design for high sensitivity and performance



When measuring very stiff samples or thin films, the amount of expansion and compression is tiny. Within this range, there is always the risk of losing the signal within the baseline noise level of the instrument. To combat this, the TMA7000 series has been optimized to reduce the noise level of the TMA signal, effectively doubling the sensitivity of the instrument, making it ideal for low-expansion material and thin films.

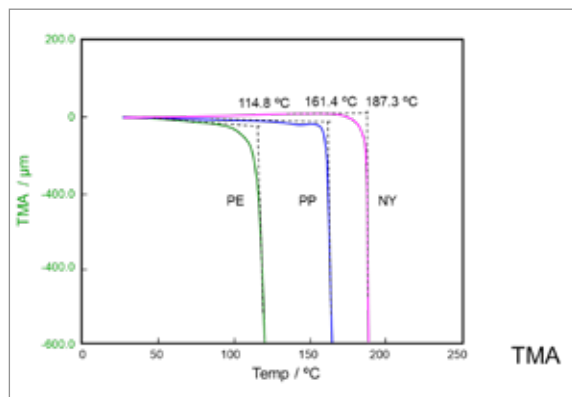
Application Examples

The sheer versatility and flexibility of the TMA7000 means that virtually all TMA applications can be covered by the two models within the series. Here are a few examples of how these instruments are used for materials characterisation.



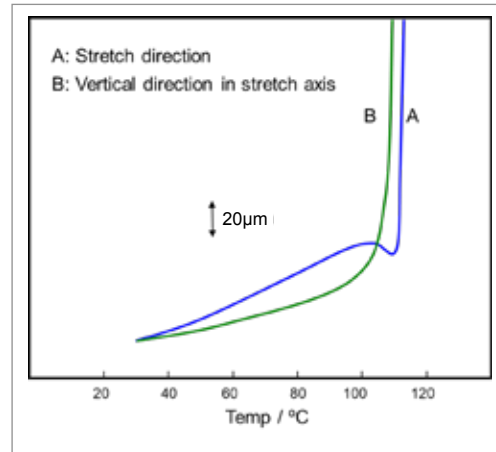
Thermal expansion of printed circuit board (PCB)

In this example, we're evaluating the coefficient of thermal expansion (CTE) of a PCB. The Z direction undergoes the least amount of expansion until the glass transition temperature due to its small dimension. However, beyond the glass transition temperature, the coefficient of linear expansion increases. In contrast, the coefficient of linear expansion in the X and Y directions decreases above the glass transition temperature. To protect the conducting layers on the PCB, the layout of epoxy resins is set such that it can restrain the thermal expansion even when the temperature is over the glass transition.



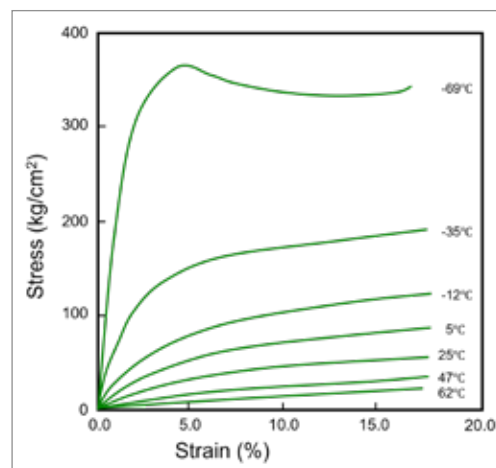
Softening point of polymer film

A penetration probe is used to compare the softening temperature between different polymer films. The graph shows the softening temperature for polyethylene, polypropylene and nylon using the TMA7000 in penetration mode.



Anisotropy of polyethylene (PE) film

Typically, polymer films stretch more easily in the direction they are drawn during manufacture. TMA analysis can be used to determine the difference in stretching parallel and perpendicular to the drawn direction. The above trace shows that the drawn direction (MD) stretches more than the transverse direction (TD).



Stress-strain characteristic of polyethylene (PE) film

In this example, the TMA7000 is used in stress-strain mode to evaluate the characteristics of polyethylene film at different temperatures, both below and above ambient. The TMA output shows that as the temperature drops below -35 $^{\circ}\text{C}$, a dramatic change in the stress-strain behaviour can be seen.

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What next?

Contact one of our experts today at contact@hitachi-hightech.com to discuss how the TMA7000 series could support your materials evaluation, quality control and development work.

MORE INFORMATION

To find out more about the TMA7000 series and other instruments in the Thermal Analysis range, visit hhtas.net/TMA



Other products

We have been providing materials characterization instruments to a wide range of industries for over 45 years.

- | **Thermal Analysis:** We offer a range of other thermal analysis instruments including DSC, STA, DMA and TMA. All of these work on the NEXTA TA software platform, allowing continuity across your analysis without extra training.
- | **Bulk XRF:** for rapid and powerful elemental analysis for a wide range of applications.
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