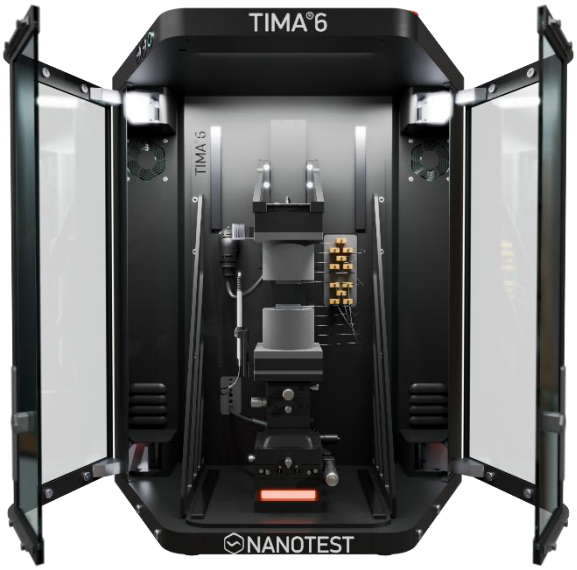
Description

TIMA is a fully ASTM D5470–compliant measurement system designed for comprehensive thermal performance characterization and reliability testing of thermal interface materials (TIMs), featuring precise control of mechanical and thermal test conditions.



Technical Specification

System

System type	Benchtop material characterization system	
Footprint (w × d)	65.4 × 58	cm^2
Height	81.2	cm
Weight	75	kg
Power supply	100 … 230	VAC
	50 … 60	Hz
	1200	W

Measurement type	Thermal steady-state characterization	
Applied standards	ASTM D 5470-17	
Output	Thermal resistance	mm^2K/W
	Thermal conductivity	W/(m·K)
	Thermal interface resistance	mm^2K/W
Resolution	0.4	mm^2K/W
Precision	± 3	%

Sample Properties

	min	max	
Sample size (round, diameter)	12.7	38.1	mm
Sample size (square, edge length)	10	38.1	mm
Sample thickness	0.001	10.0	mm

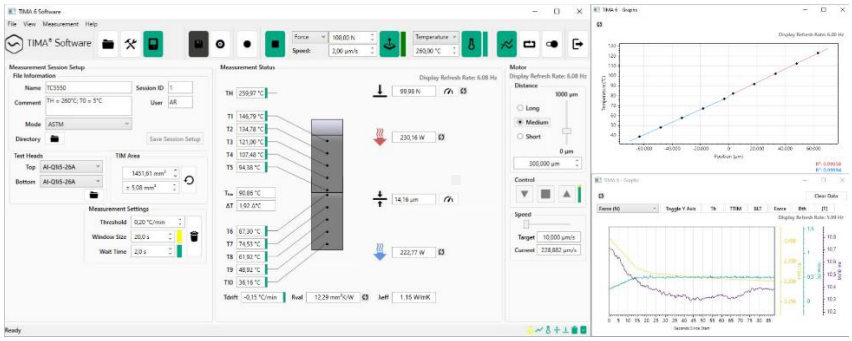
Measurement Conditions

Force (continuous)	-400 … 900		N
Force (short-term)	-500 … 1000		
Pressure (short-term)	☐ 10 mm	9.5	MPa
		1378	Psi
	Ø 38.1 mm	0.83	MPa
		120	Psi
Sample temperature	10 … 200		°C

Measurement Accuracy

Sensor temperatures		± 0.1	K
Sample temperature		± 0.2	K
Sample thickness	load-free	± 1	µm
	force load of *x* N	± 2 · 0.02*x*	µm
Mechanical load		± 1	N
Thermal resistance		< ± 5	%

Software Screenshots



Key Features

- Full ASTM D 5470 compliance
- Compact and all-in-one
- Automated & scheduled testing
- Swiftly exchangeable test heads
- High precision thickness and temperature monitoring
- Ease of use, optimized for user experience

Key Output Material and Compound Properties

- Effective thermal resistance
- Bulk thermal conductivity
- Thermal interface resistance

Key Testing Schemes

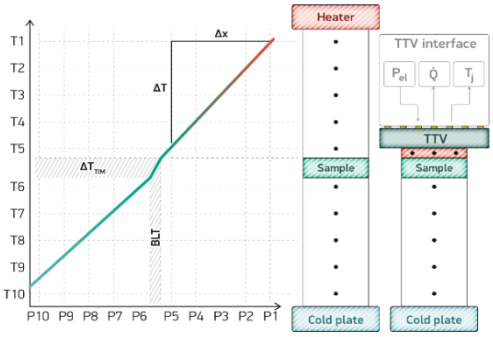
- Temperature dependence
- Thickness dependence
- Pressure dependence
- Thermal performance
- Interface quality
- Thermo-mechanical stability
- Aging behavior / End of life

Scope of Samples

- Thermal interface material
- Pastes, greases and putties
- Phase Change Material
- Gap pads and gap filler
- Graphite sheets and thin foils
- Adhesive and cured material
- Insulating and underfill material
- Liquid metal
- Substrates and interposer

The Principle of ASTM D5470 & Thermal Test Vehicle TTV addition

Samples are measured between two metal test heads that are known in geometry (length L, area A) and physical properties (thermal conductivity λ). Five temperature sensors track the axial temperature gradient ΔT to determine the contacting surface temperatures while the heat flow $\dot{Q}$ is determined using Fourier's law. Measuring both temperature gradient over and heat flow through the sample returns its effective thermal resistance Rth_{eff}. Repeating such measurement for multiple sample thicknesses allows to calculate the resulting linear fit to obtain the sample's bulk thermal conductivity λ_{bulk} (k_{bulk}). Beyond the standard, TIMA enables TTV testing, providing authentic TIM1 application data. Thermal test vehicles (TTVs), available in 9.8 × 9.8 mm² or 24.9 × 24.9 mm², enable thermo-mechanical cycling that reproduces the warpage behaviour of real packages under application-relevant conditions, thereby enabling realistic long-term reliability testing.



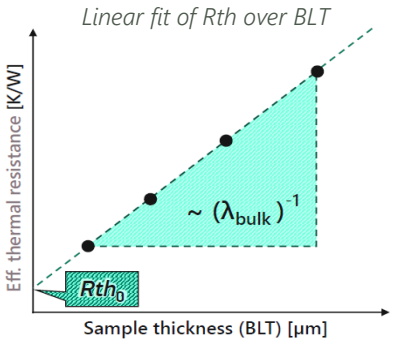
$$\dot{Q} = -\lambda A \frac{dT}{dx} \approx -\lambda A \frac{\Delta T}{\Delta x}$$

$$Rth_{eff} = Rth_{bulk} + Rth_0$$

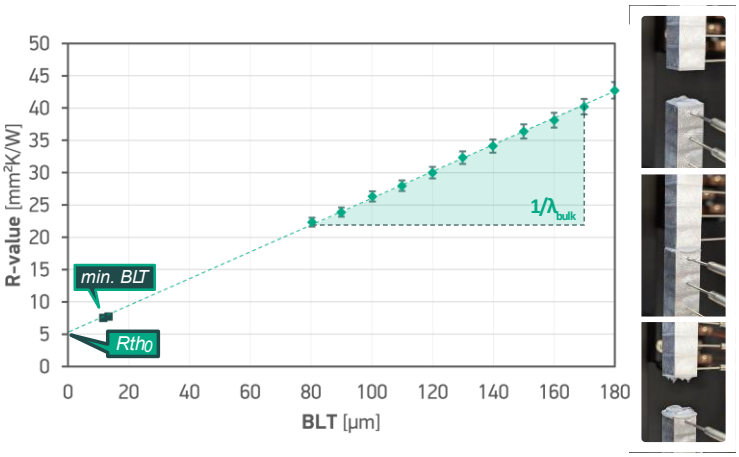
$$Rth_{eff} = \frac{\Delta T}{\dot{Q}}$$

$$Rth_{eff} = \frac{1}{\lambda_{bulk} \cdot A} \cdot BLT + Rth_0$$

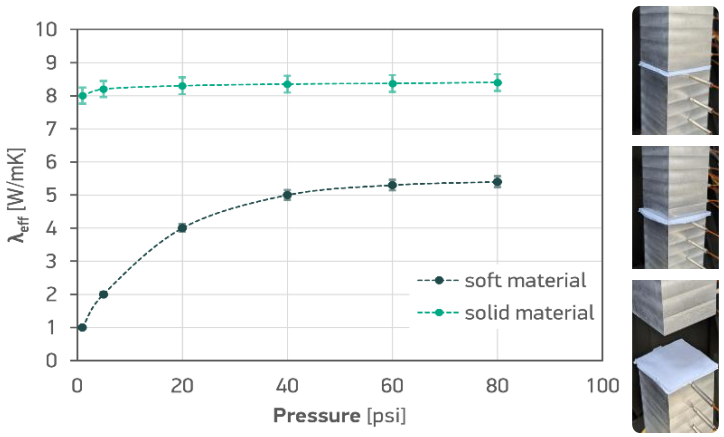
The linear fit of thermal resistance over the thickness bears information about bulk thermal conductivity and interface resistance.



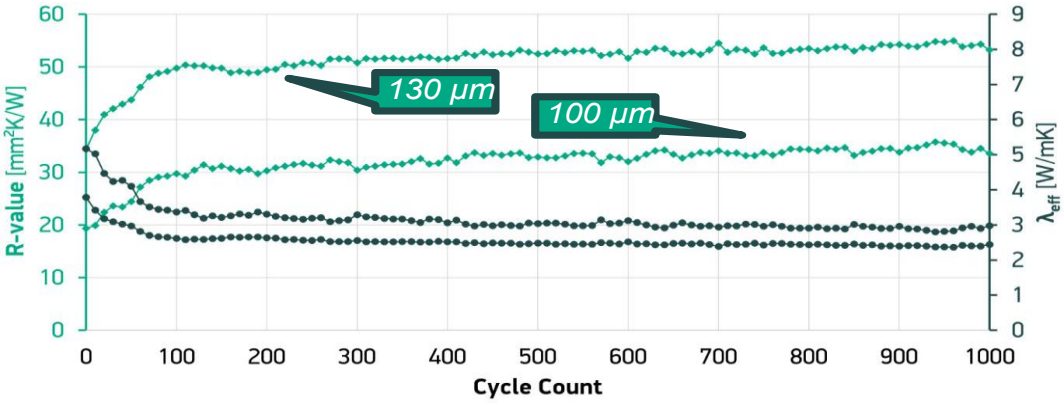
Determination of Bulk Thermal Conductivity

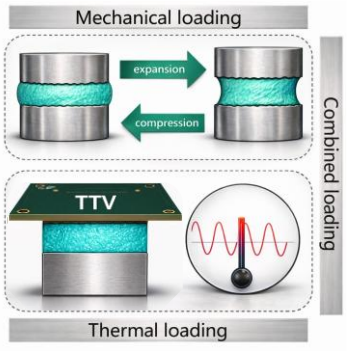


Testing of Solid and Compressible Materials

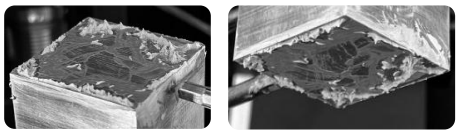


Reliability Testing – Aging Behavior / Life Expactation





TIMA performs accelerated lifetime characterization of TIMs under defined thermo-mechanical load profiles that replicate application-relevant strain conditions or power conditions. Precise programmable cycling control enables detailed reliability assessment and accurate evaluation of pump-out behavior and other relevant degradation and failure mechanisms, including dry-out, material migration, void formation and interfacial delamination. Thermal resistance evolution is continuously monitored over time. Visual inspection of the TIM under a microscope can be performed by removing the test heads for detailed material analysis.



Grease Pump-Out