NANOTEST
Berliner Nanotest und Design GmbH

TIMA® 5

Thermal Interface Material Analyzer

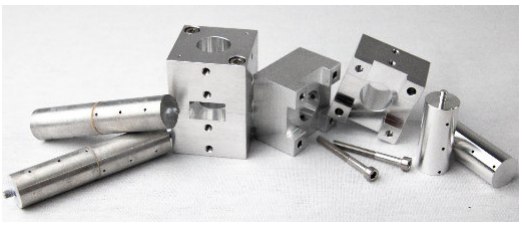
Model 5

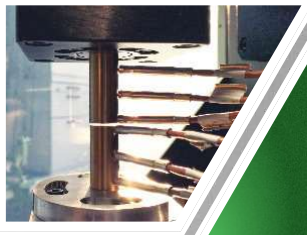
The first convenient
automated
all-in-one
ASTM D 5470 test system.

Simple yet versatile

TIMA is a comprehensive laboratory and industrial measurement tool providing a wide range of thermal measurements and analyses to be performed with highest scientific standard.

- Greases and pastes
- Cured gap fillers and adhesives
- Anisotropic composites
- Phase change materials
- Overall thermal resistance
- Effective thermal conductivity
- Thermal interface resistance
- Bulk thermal conductivity
- Curing parameters study
- Boundary conditions study
- In-situ reliability investigation
- Extreme conditions testing

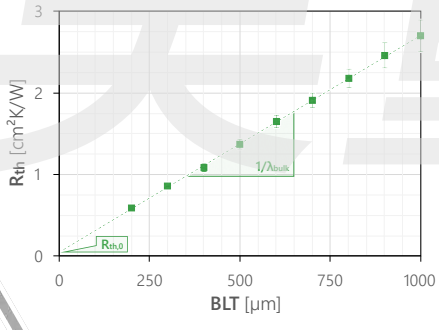



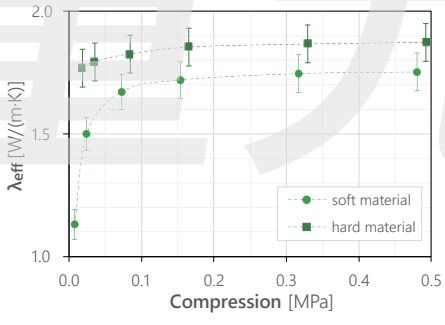


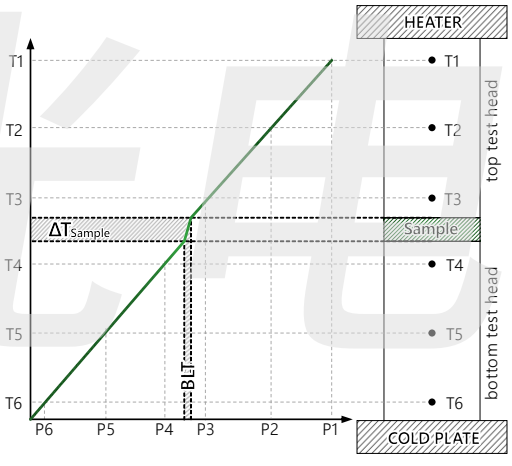
ASTM D 5470 Standard Conforming and Beyond

TIMA 5 fully meets the established test methodology described in ASTM Standard D 5470-17, while also providing fully automated characterization and many additional features not described in the ASTM Standard.

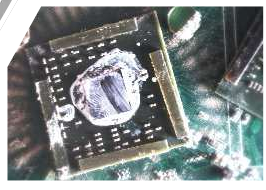
- Full coverage of specification range
- Up to 150°C sample temperature
- Scientific standard accuracy estimation
- Fully automated measurement
- ± 300 N clamping and tensile force
- Highly user-friendly, robust, and reliable



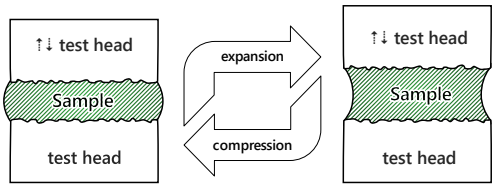




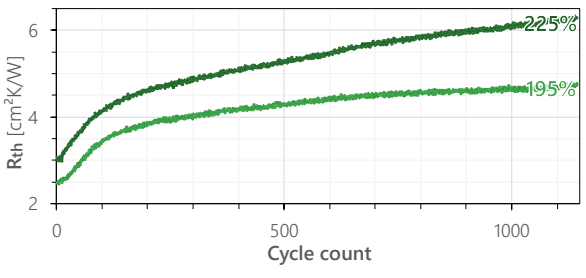
Ageing and Reliability Investigations



TIMA allows accelerated lifetime testing for thermal interface materials exposed to thermo-mechanical stress by emulating mechanical strain from in-field application.



- In-situ monitoring of aging / degradation
- Application-related testing conditions
- Highly accelerated: 500 cycles per day
- Thickness- and pressure-controlled cycling



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TIMA 5–21

Description

TIMA is a fully ASTM D 5470 compliant measurement system for thermal characterization of thermal interface material and other material with low to mid-ranged thermal conductivity.

Technical Specification

System

System type	Benchtop material characterization system	
Footprint (w × d)	35 × 40	cm^2
Height	75	cm
Weight	50	kg
Power supply	100 … 230	VAC
	50 … 60	Hz
	600	W

Measurement

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	1.0	mm^2K/W

Sample properties

	min	max	
Sample size (round, diameter)	13	25.4	mm
Sample size (square, edge length)	10	25.4	mm
Sample thickness	< 0.001	10.0	mm

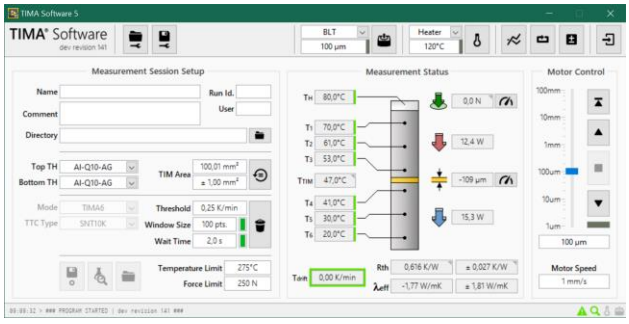
Measurement conditions

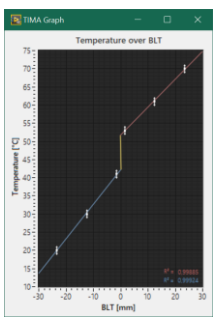
Force (continuous)	-300 … 300		N
Force (short-term)	-450 … 450		
Pressure (short-term)	☐ 10 mm	4.5	MPa
		652	Psi
	Ø 25.4 mm	0.9	MPa
		130	Psi
Sample Temperature	20 … 150		°C

Measurement accuracy

Sensor temperatures		± 0.2	K
Sample temperature		± 0.05	K
Sample thickness	load-free	± 1*	µm
	force load of x N	± 2 * 0.02x	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 monitoring
- Ease of use, optimized for user experience

Key output material and compound properties

- Thermal resistance
- Bulk thermal conductivity
- Thermal interface resistance

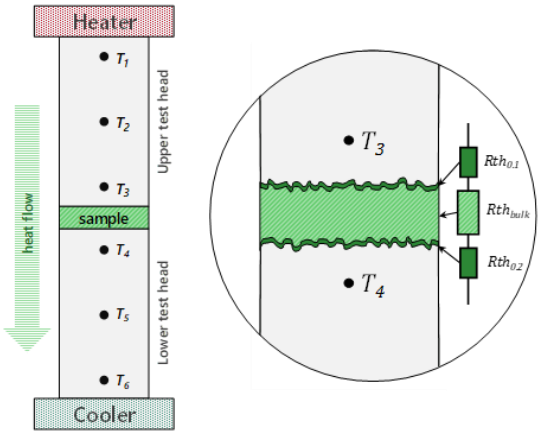
Key testing schemes

- Temperature dependency
- Pressure dependency
- Thermal performance
- Interface quality
- Thermo-mechanical stability
- Aging behavior / life expectation

Scope of samples

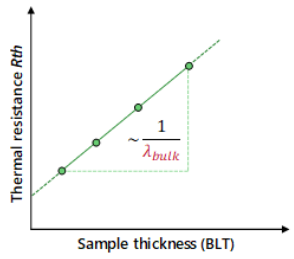
- Thermal interface material
- Pastes and greases
- Gap pads and gap filler
- Foils and sheets
- Adhesive and cured material
- Mold compound
- Underfiller
- Substrates and interposer

The principle of ASTM D 5470



Samples are measured between two metal test heads that are known in geometry and physical properties. Measuring both temperature gradient ΔT over and heat flow Q through the sample returns its effective thermal resistance Rth_{eff}.

Repeating such measurement for multiple sample thicknesses allows to calculate the following linear fit to receive the sample's bulk thermal conductivity.



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

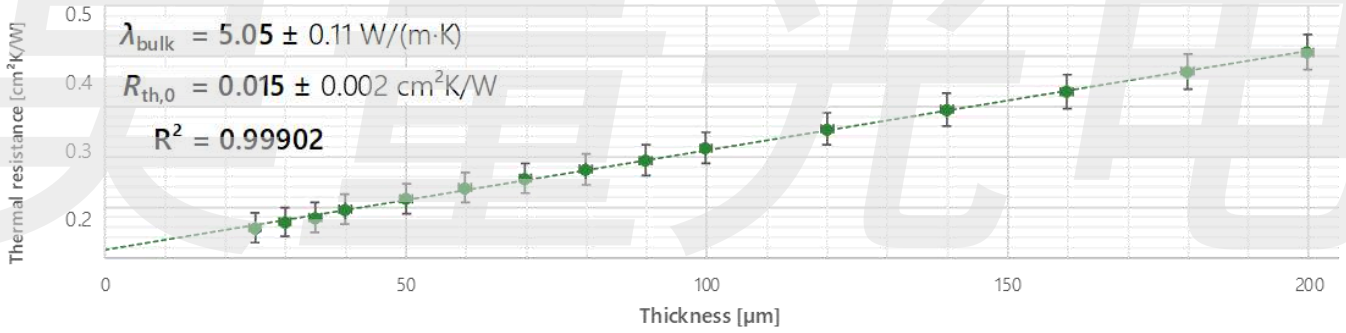
$$Rth_{eff} = \frac{\Delta T}{Q}$$

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

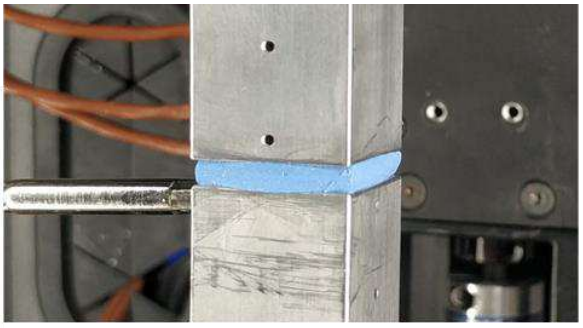
The linear fit over the thickness bears information about ***bulk thermal conductivity*** *and* ***thermal interface resistance****.*

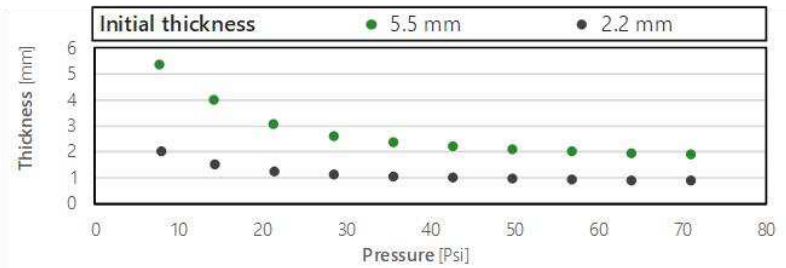
Determination of bulk thermal conductivity

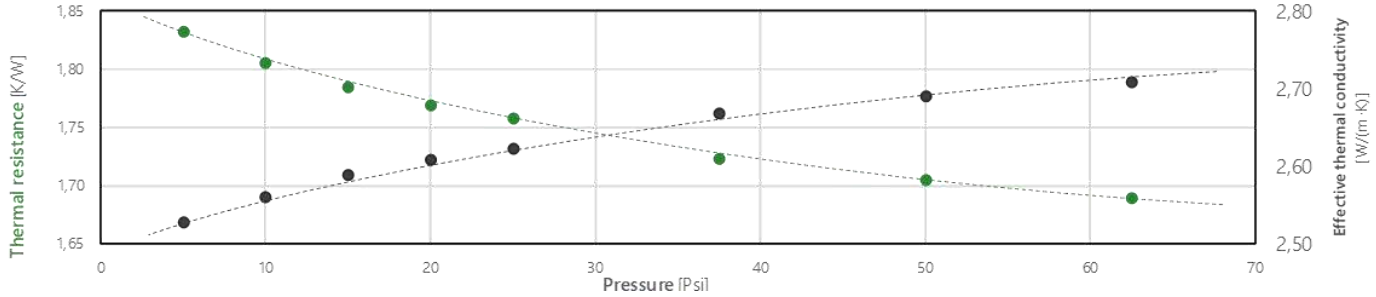
- Eff. thermal resistance over bond line thickness
  → Bulk thermal conductivity and contact resistance
- Thickness range 25 to 200 µm
- 60°C sample temperature



Thermal characterization of soft material







Measurement deviation

Rth = ΔT / Q		Q [W]	5	10	15	20	25	30	40	50
		dQ	5.0%	3.9%	3.6%	3.5%	3.4%	3.3%	3.3%	3.3%
ΔT [K]	dΔT	dRth								
1	10.5%		15.5%	14.4%	14.1%	14.0%	13.9%	13.8%	13.8%	13.8%
2	5.5%		10.5%	9.4%	9.1%	9.0%	8.9%	8.8%	8.8%	8.8%
5	2.5%		7.5%	6.4%	6.1%	6.0%	5.9%	5.8%	5.8%	5.8%
10	1.5%		6.5%	5.4%	5.1%	5.0%	4.9%	4.8%	4.8%	4.8%
15	1.2%		6.2%	5.1%	4.8%	4.7%	4.6%	4.5%	4.5%	4.5%
20	1.0%		6.0%	4.9%	4.6%	4.5%	4.4%	4.3%	4.3%	4.3%
25	0.9%		5.9%	4.8%	4.5%	4.4%	4.3%	4.2%	4.2%	4.2%
30	0.8%		5.8%	4.7%	4.4%	4.3%	4.2%	4.1%	4.1%	4.1%
40	0.8%		5.8%	4.7%	4.4%	4.3%	4.2%	4.1%	4.1%	4.1%
50	0.7%		5.7%	4.6%	4.3%	4.2%	4.1%	4.0%	4.0%	4.0%
60	0.7%		5.7%	4.6%	4.3%	4.2%	4.1%	4.0%	4.0%	4.0%
70	0.7%		5.7%	4.6%	4.3%	4.2%	4.1%	4.0%	4.0%	4.0%
90	0.6%		5.6%	4.5%	4.2%	4.1%	4.0%	3.9%	3.9%	3.9%
100	0.6%		5.6%	4.5%	4.2%	4.1%	4.0%	3.9%	3.9%	3.9%