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)	42.3 × 48.3	cm^2
Height	75.2	cm
Weight	50	kg
Power supply	100 … 230	VAC
	50 … 60	Hz
	600	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	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

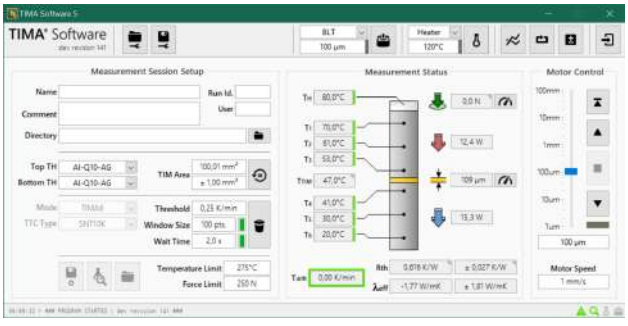
Measurement conditions

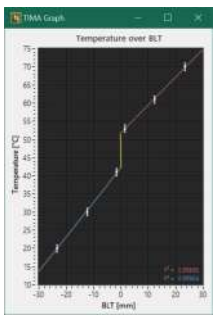
Force (continuous)	-300 … 300		N
Force (short-term)	-450 … 450		
Pressure (short-term)	☐ 10 mm	4.5	MPa
		652	Psi
	Ø 25.4 mm	0.9	MPa
		130	Psi
Sample Temperature	20 … 150		°C

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

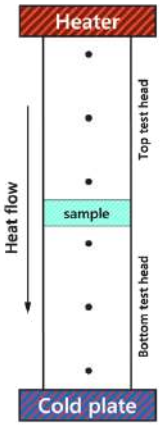
Key testing schemes

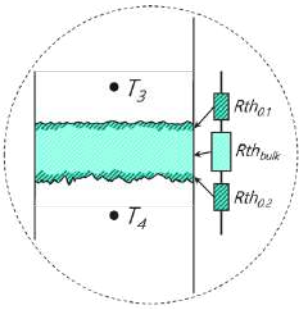
- Temperature dependency
- Pressure dependency
- Thermal performance
- Interface quality
- Thermo-mechanical stability
- Aging behavior / life expectation

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 D5470

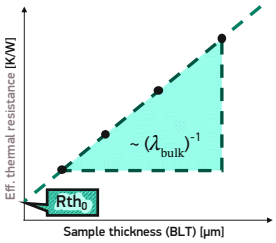




Samples are measured between two metal test heads that are known in geometry and physical properties. Measuring both temperature gradient ΔT over and heat flow Q through the sample returns its effective thermal resistance Rth_{eff}.

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

Linar fit of Rth over BLT



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

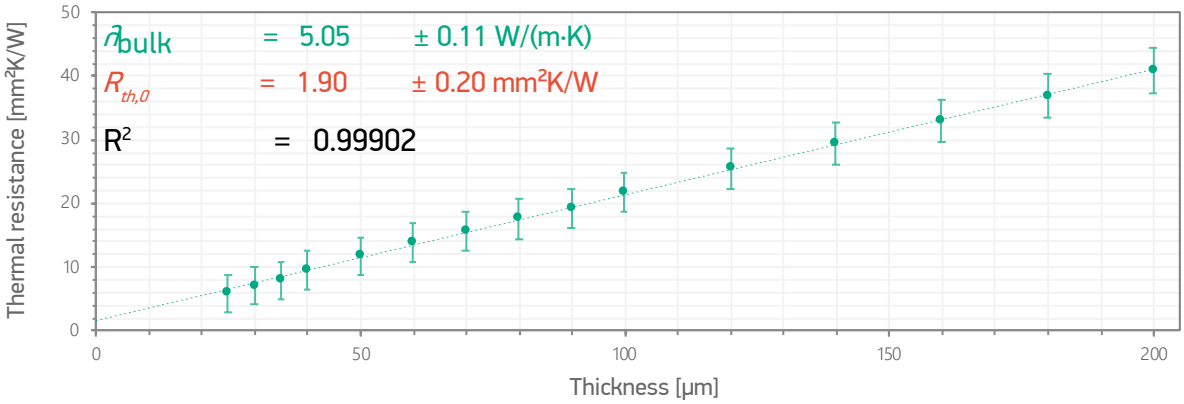
$$Rth_{eff} = \frac{\Delta T}{\dot{Q}}$$

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

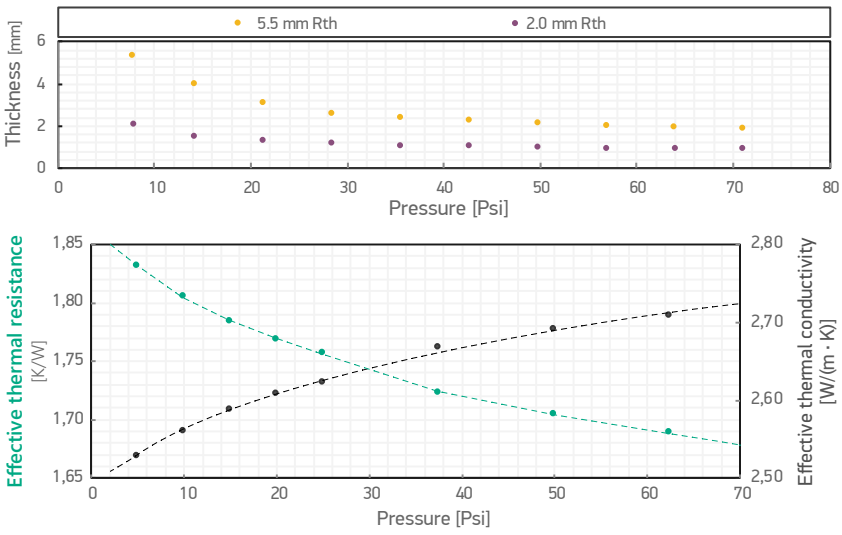
The linear fit of thermal resistance over the thickness bears information about bulk thermal conductivity and interface resistance.

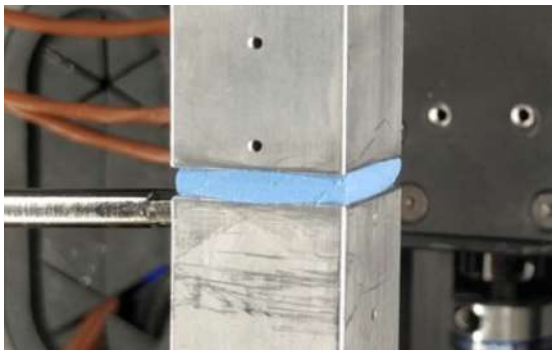
Determination of bulk thermal conductivity

- Eff. thermal resistance over bond line thickness
  - → Bulk thermal conductivity and contact resistance
- Thickess 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%