

# TIMA<sup>®</sup> 5

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Thermal Interface Material Analyzer  
Model 5



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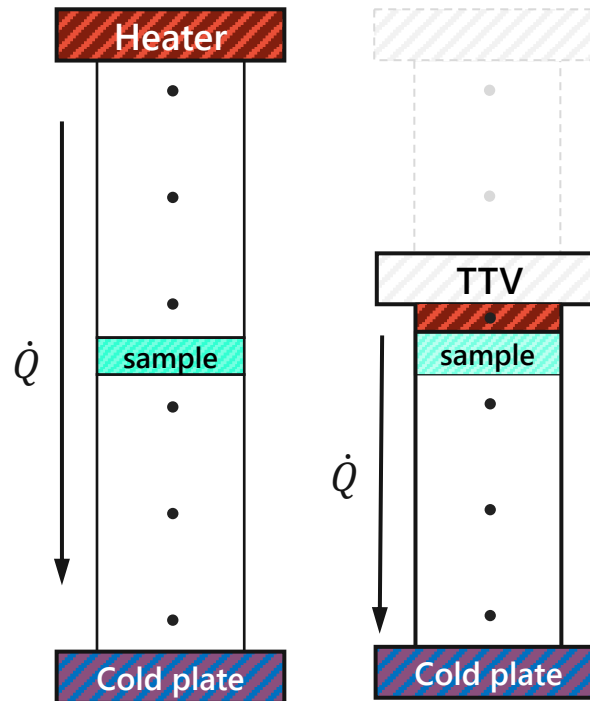
TIMA 5 | Thermal Interface Material Analyzer Model 5

## Beyond ASTM D5470

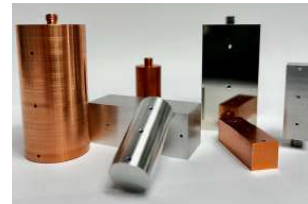
- » Effective and bulk thermal conductivity
- » Thermal effective and interface resistance
- » Temperature and pressure dependency
- » Aging and reliability testing
- » Compact all-in-one system

## Feasible samples

- » Thermal interface material
- » Die attach materials
- » Underfill materials
- » Molding compound
- » Substrates
- » Multilayer samples



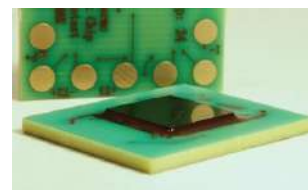
examples of feasible material samples



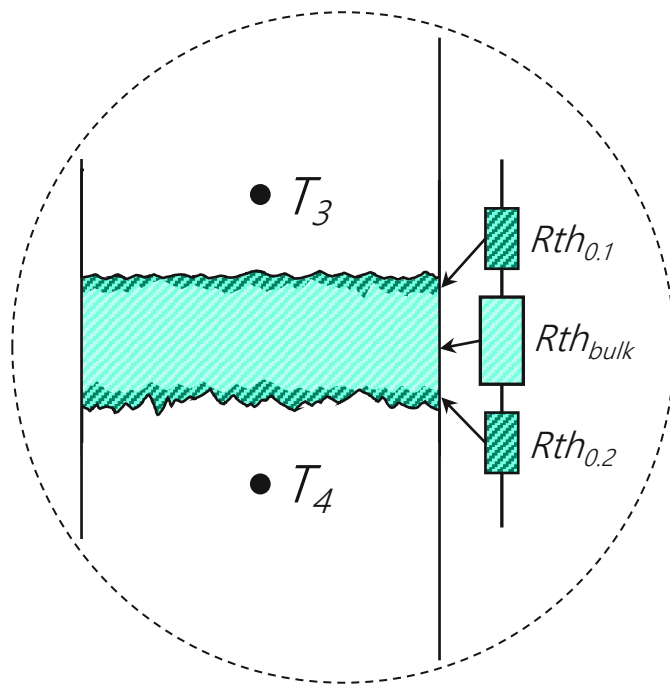
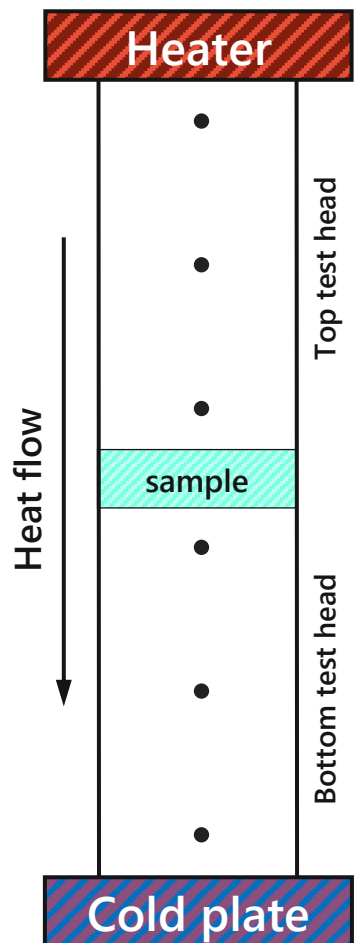
selection of available test heads



Assembly and curing tool adhesive

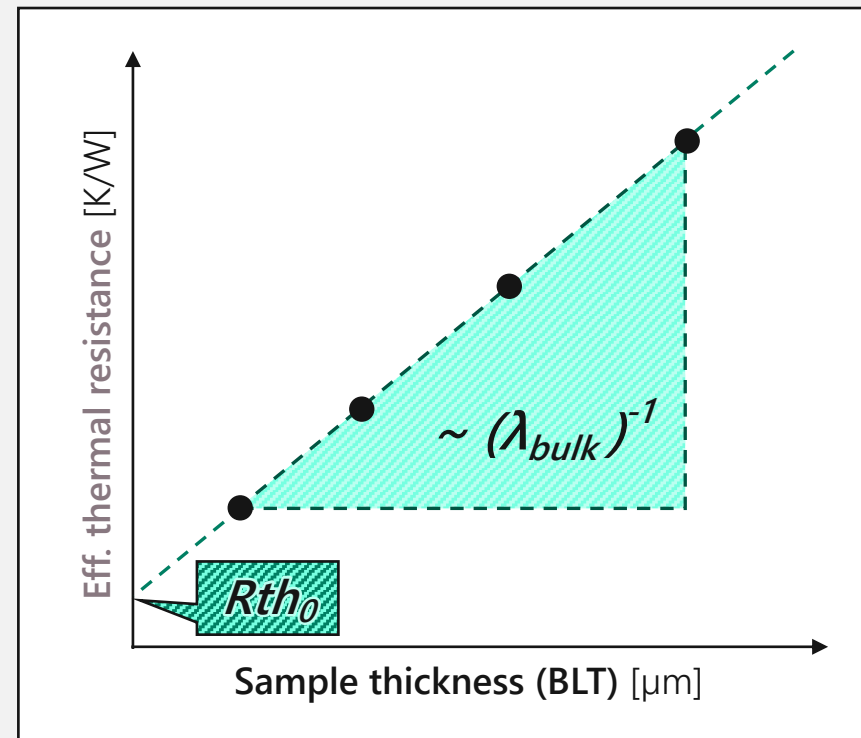


Thermal test chip



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

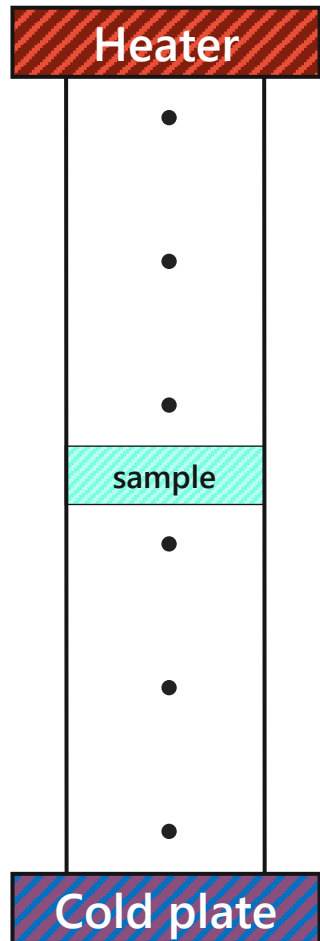
$$Rth_{eff} = \frac{\Delta T}{\dot{Q}}$$



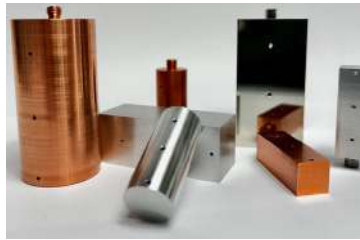
$$Rth_{eff} = \frac{1}{\lambda_{bulk} \cdot A} \cdot BLT + Rth_0$$

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

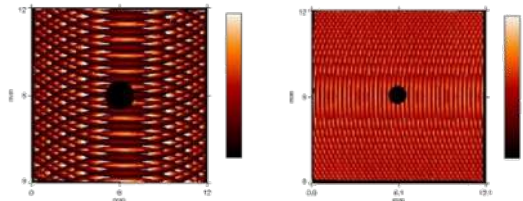
## » Testing under application-related or customer-specific conditions



### Test heads



Various **test heads materials** allow to mimic contacting surfaces from real application cases

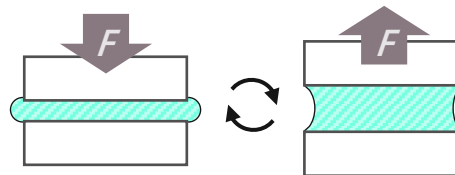


Manipulation of **surface coating** and **roughness** brings the test setup even closer to real application

### Beyond the scope

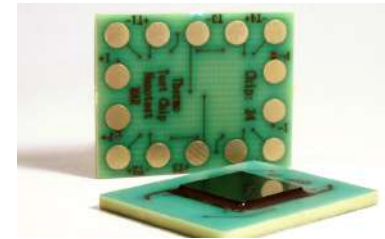


Specialized **curing tools** for external sample curing under any sample-specific condition



In-situ testing of **aging behavior**, lifetime expectancy and reliability of TIM under recurring loads

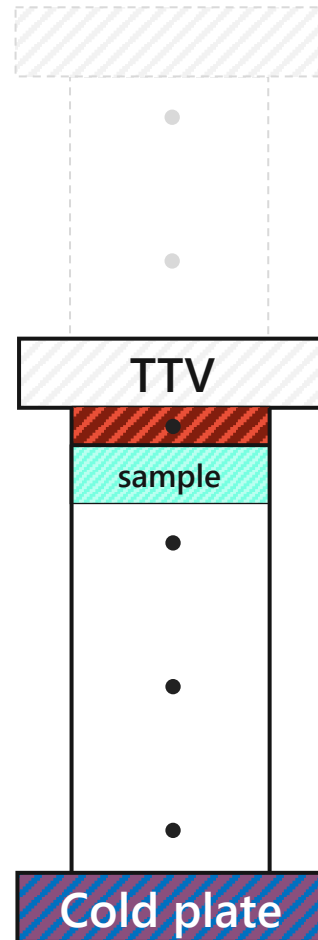
### TIM1 testing



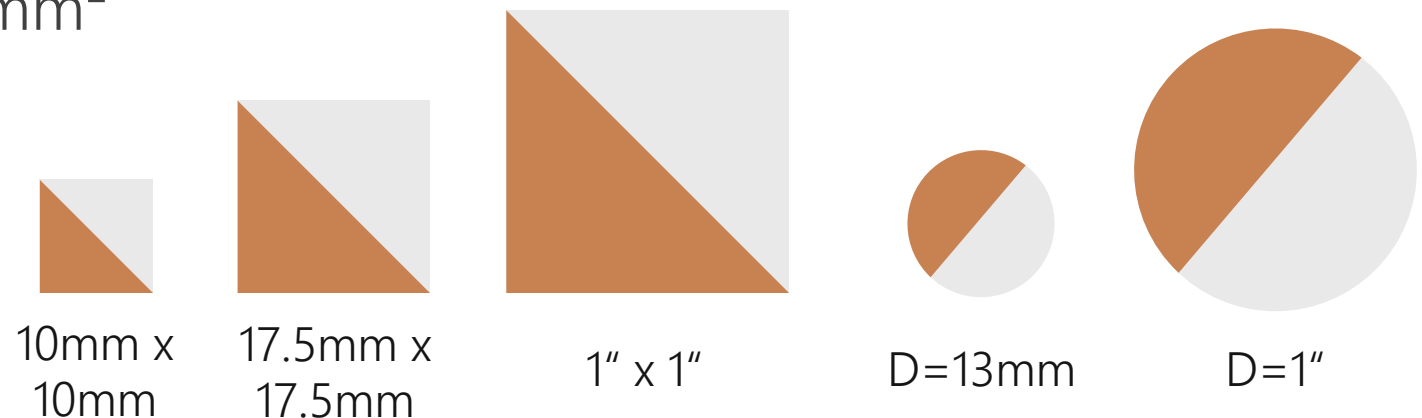
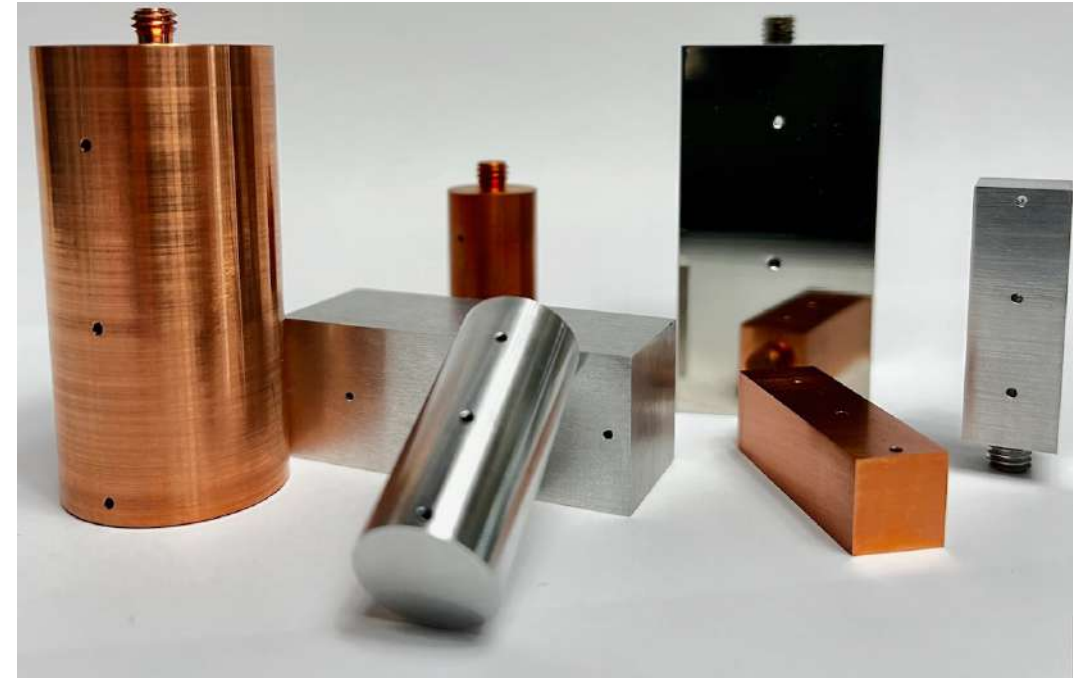
The **use of a TTV** instead of a metal top test head creates a typical TIM1 scenario

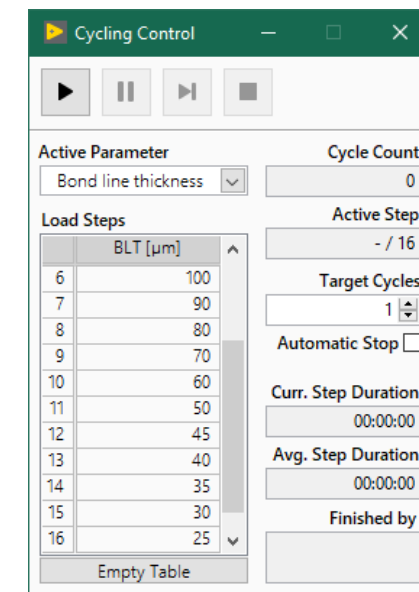
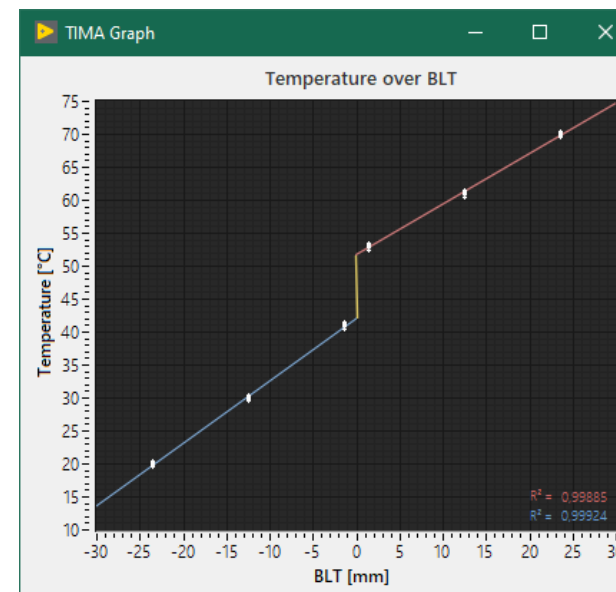
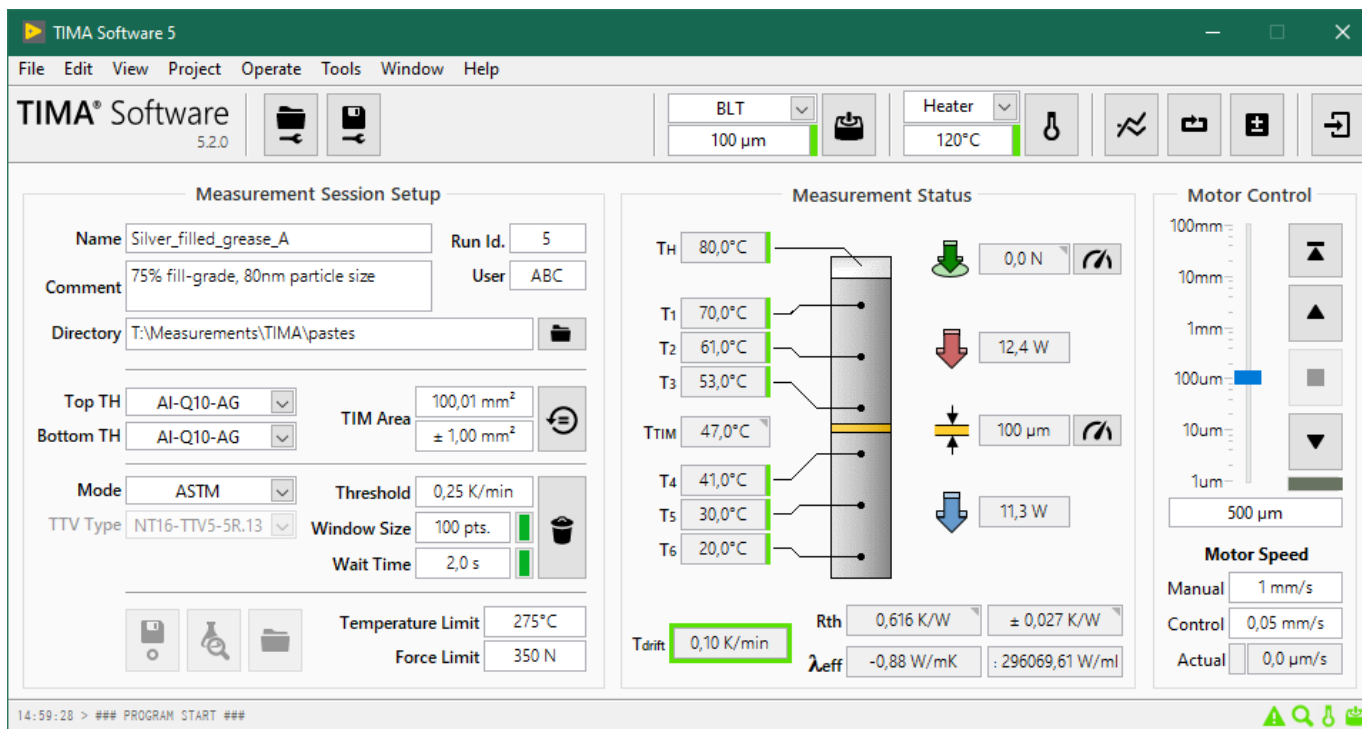


Interior of TIMA 5 is at any time **easily accessible** to always visually observe what is happening

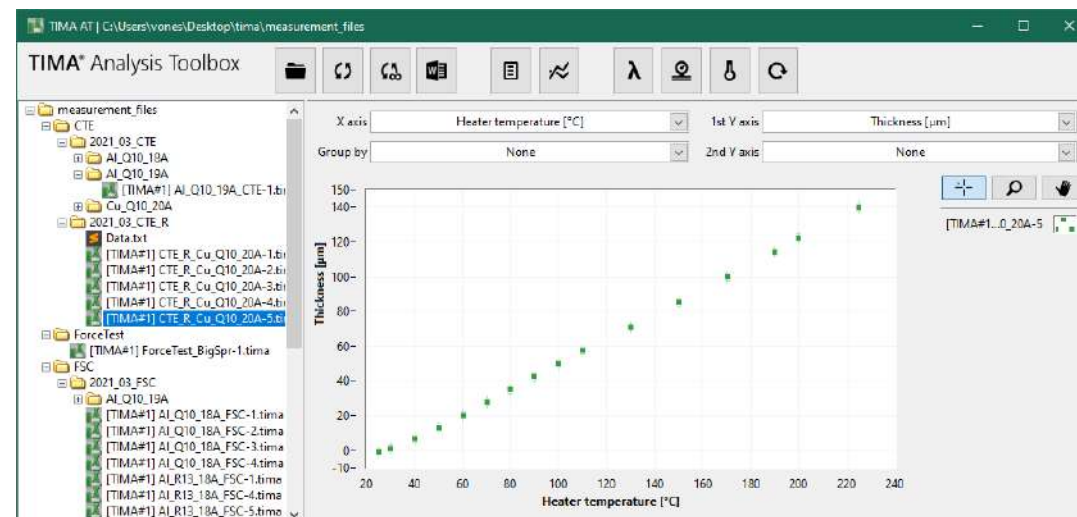


- » High flexibility in choice of test heads
- » Materials: Aluminum | Copper
- » Metalization for copper test heads available: Ni | CrN | TiN
- » Shapes: round | square
- » Surface areas: from 100mm<sup>2</sup> to 654mm<sup>2</sup>
- » Lengths: from 30mm to 50mm
- » Surface roughness @ Rz ~ 2µm





- » Live measurement monitoring
- » Full measurement setup control
- » Measurement setup save and restore
- » Quick measurement results review
- » Lean and intuitive design



# Measurement examples

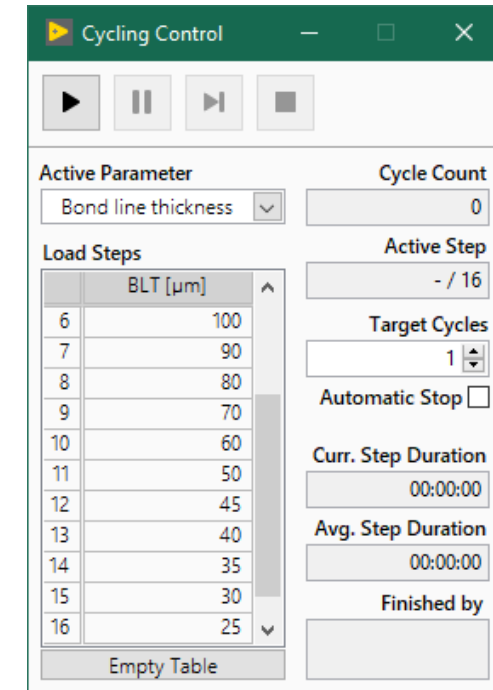
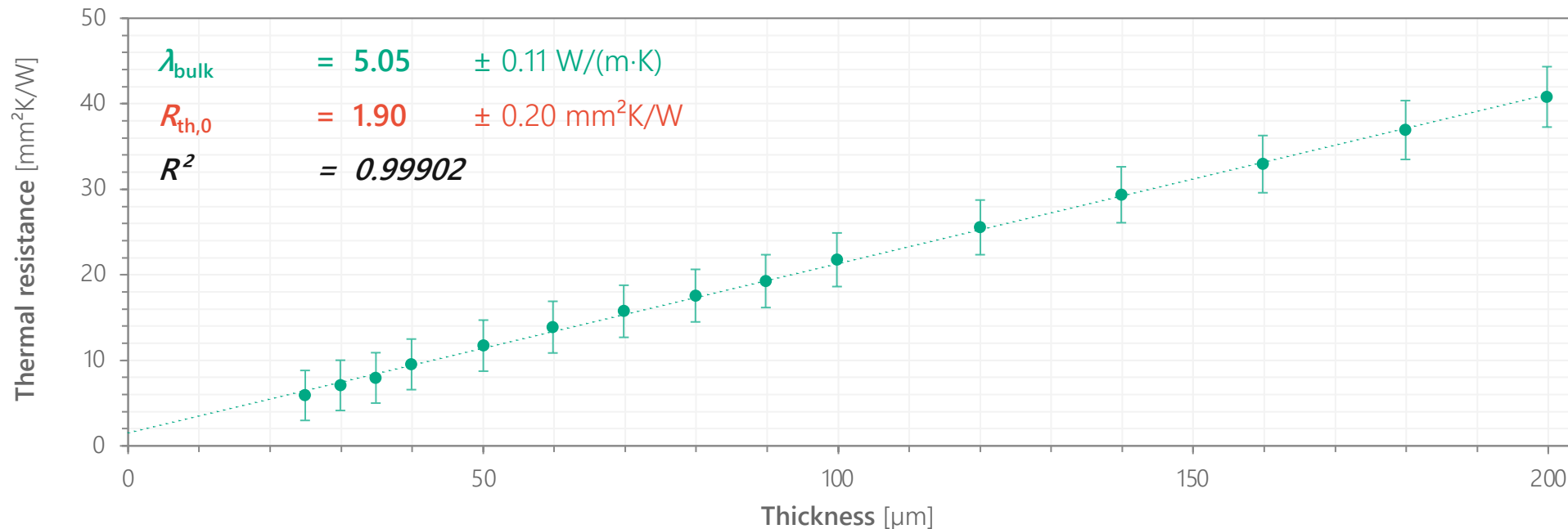
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TIMA<sup>®</sup> 5 in action

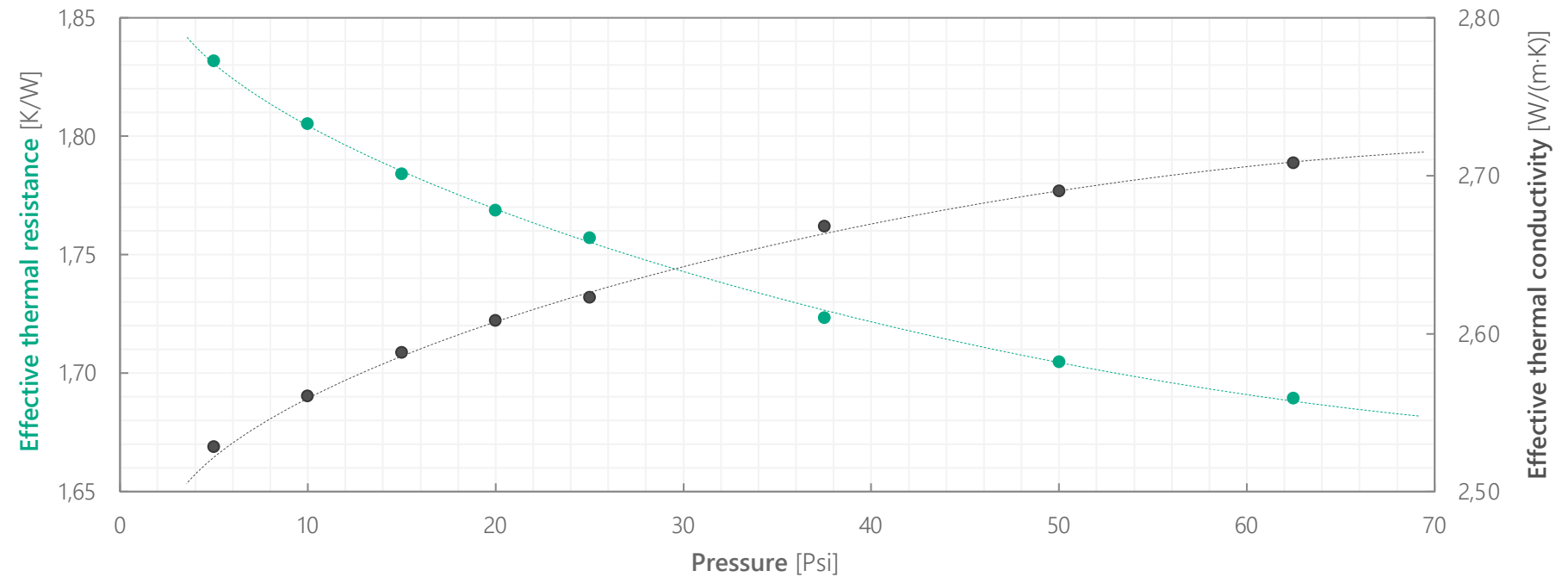
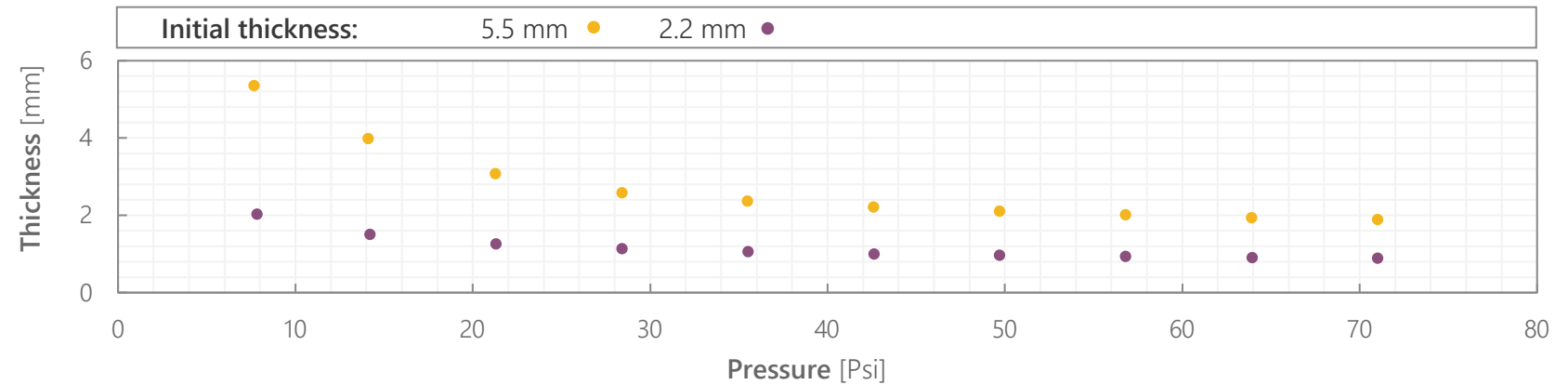
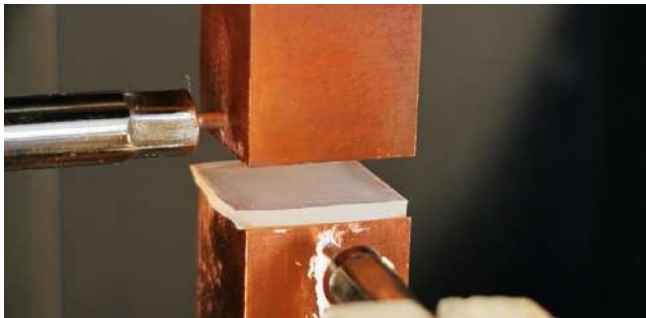
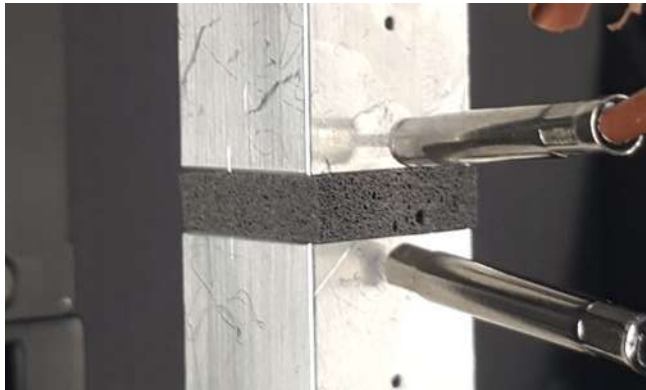
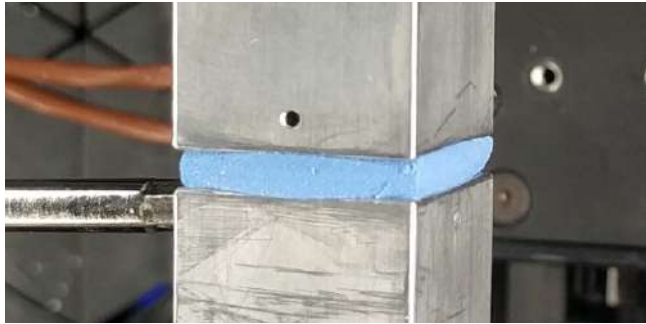


## Silver-filled polymer

- › R-value vs. thickness
  - Bulk thermal conductivity and contact resistance
- › Thickness range 25 to 200  $\mu\text{m}$ 
  - Automatic scheduled measurement

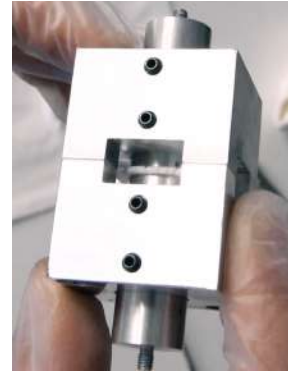




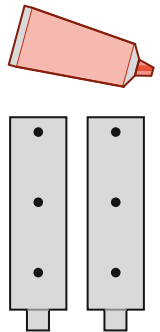


## External curing of samples for measurement in TIMA

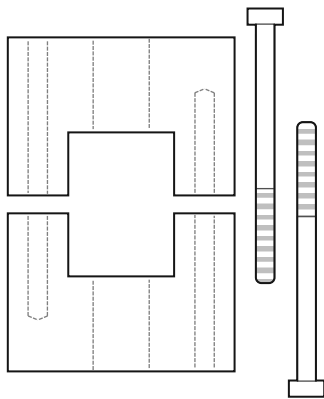
- » Low-stress bond lines
- » Defines bond line thicknesses
- » Easy assembling and disassembling



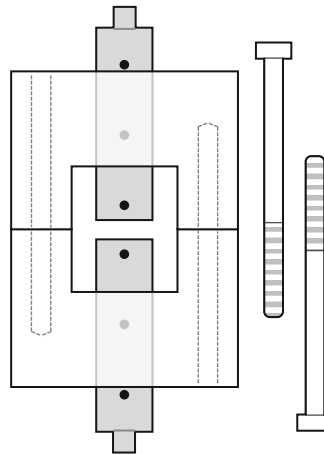
Test heads  
& sample



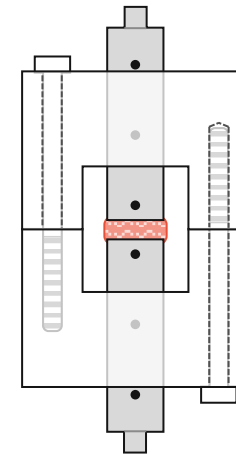
Curing tool



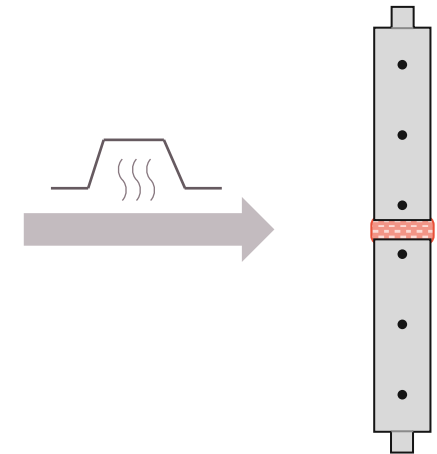
Setting defined BLT



Assembly & curing



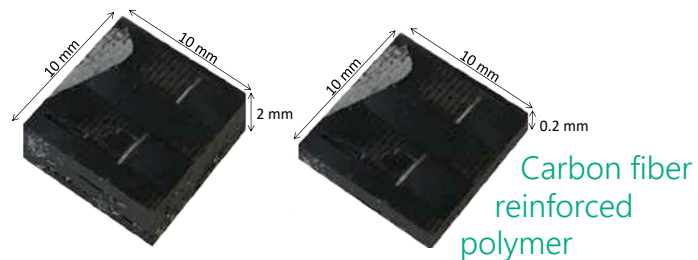
completed sample



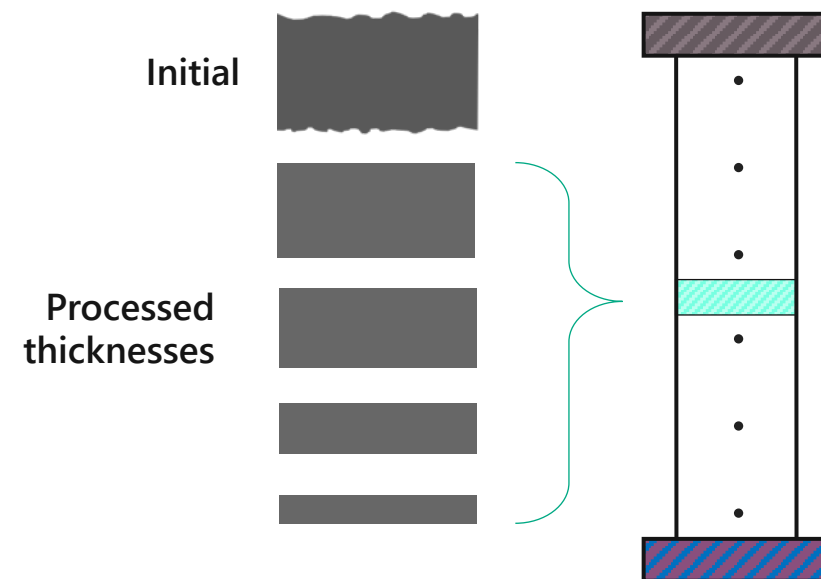
- » Bulk thermal conductivity determined by measurements at different thicknesses
- » ASTM D5470 conformant
- » **Iterative thinning** and measurement of same sample
- » Characterization of **pre-cured samples**



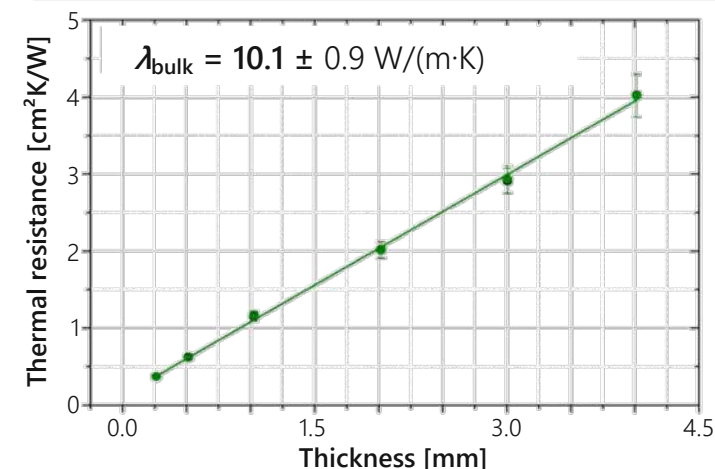
Underfill material

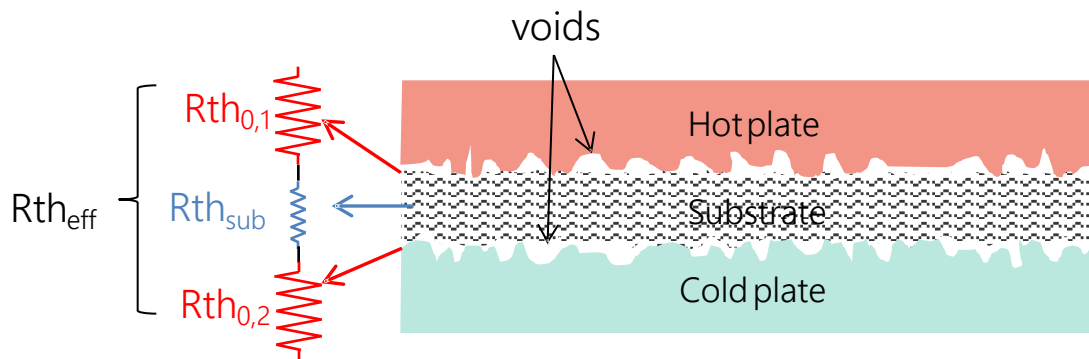


Sample preparation tool

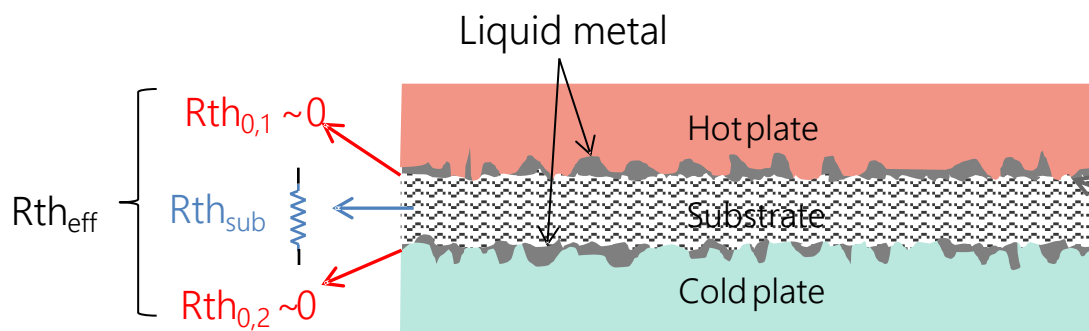


Bulk thermal conductivity of highly conductive polymer

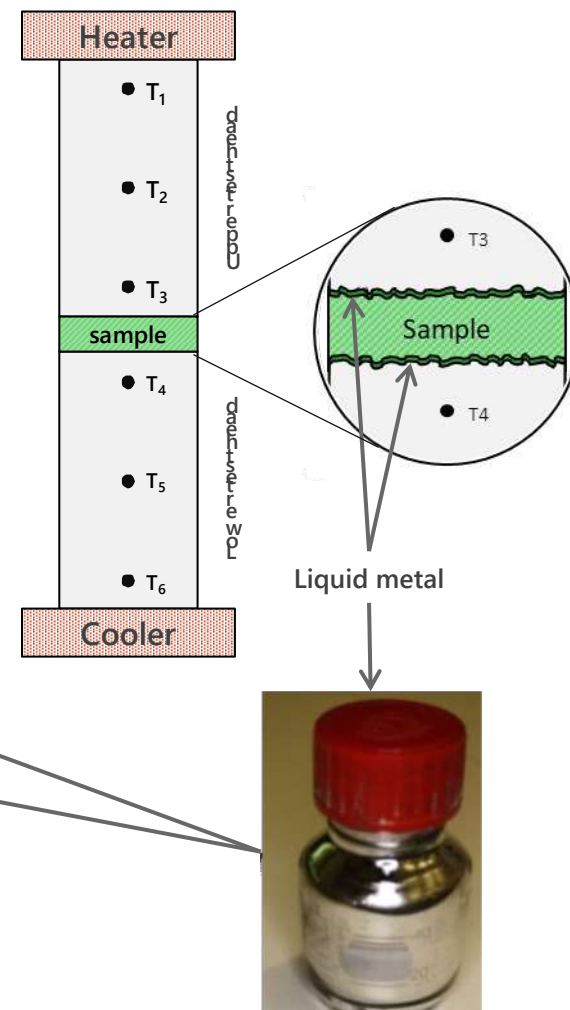




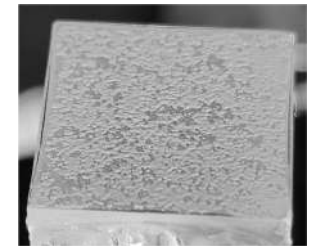
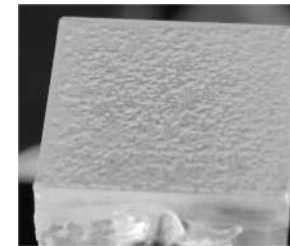
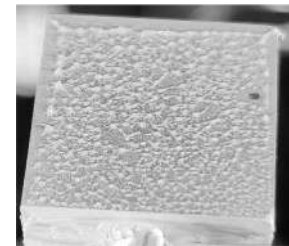
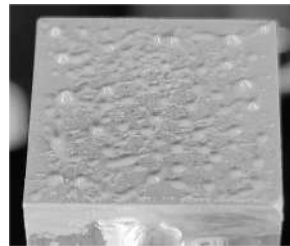
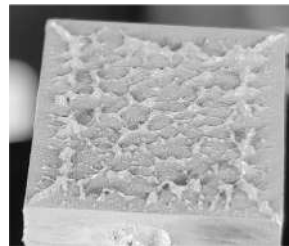
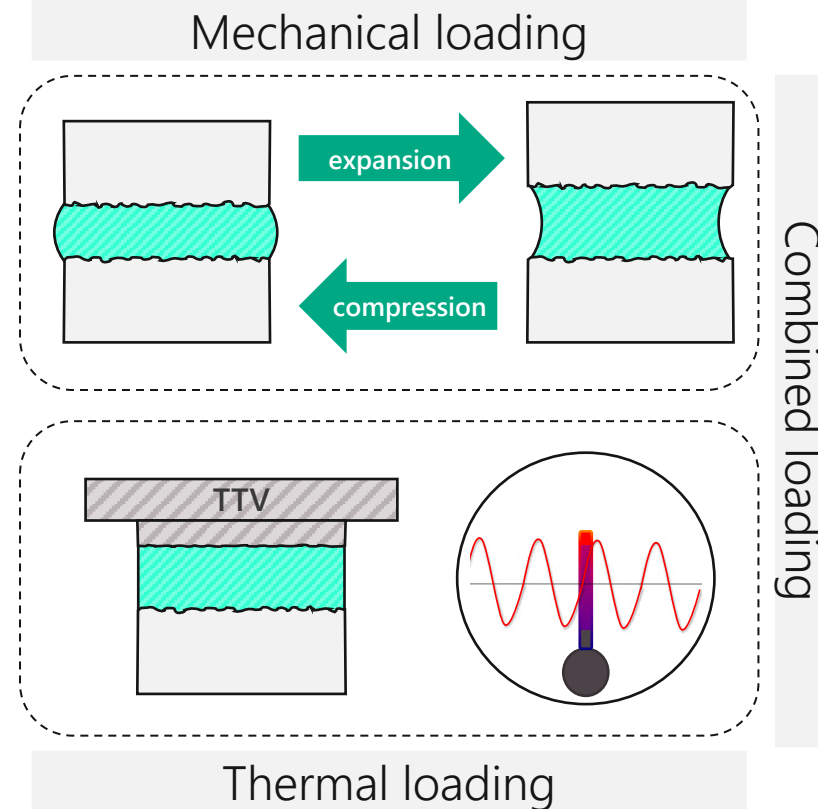
High surface roughness  $\rightarrow$  high interface resistance  
 $\rightarrow$  interface resistance dominates



Use of liquid metal in contact areas  
 $\rightarrow$  elimination of the interface resistance



Liquid metal  
(61.0Ga/25.0In/13.0Sn/1.0Zn)



## Long-term testing

- » High-temperature duration test
- » In-situ curing characterization

## Mechanical loading

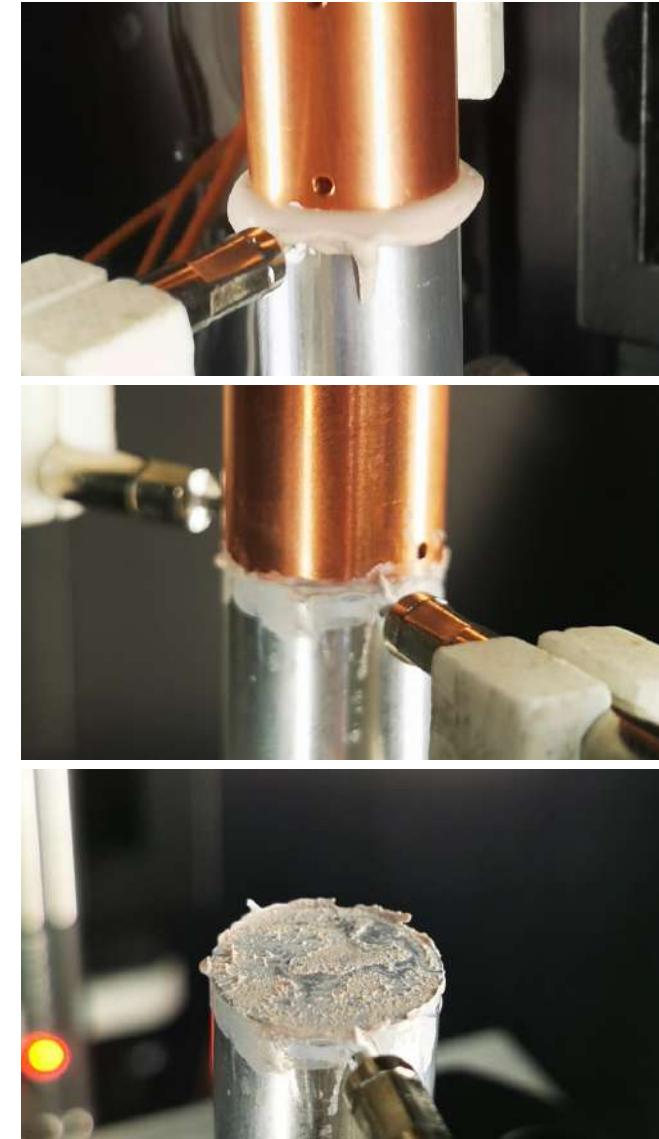
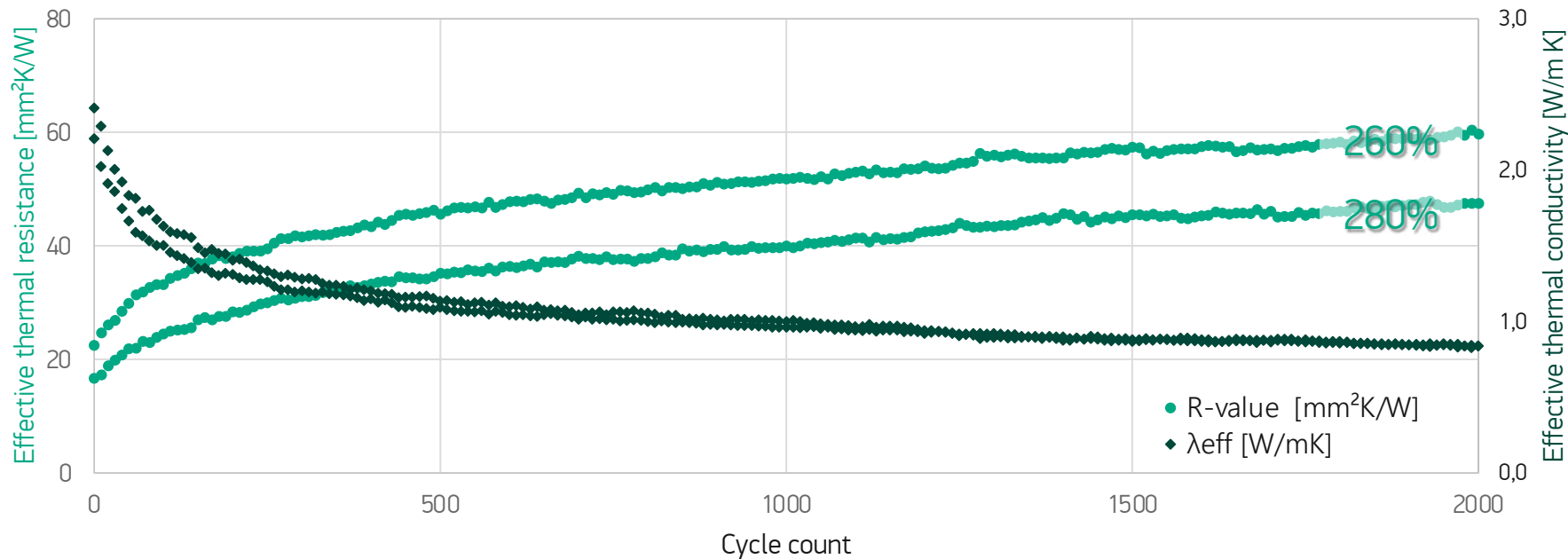
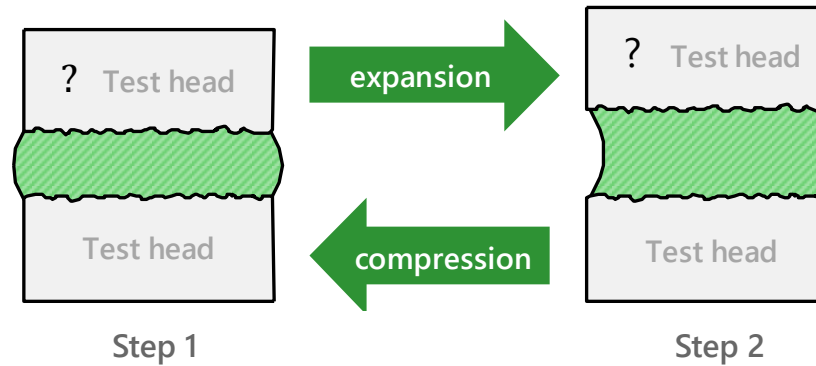
- » Cyclic thickness variation
- » Compression & decompression
- » Repeated tension and release
- » Long-term compression

## Thermal loading

- » Temperature cycling
- » TIM1 power profile cycling



- » Initial thickness of 300  $\mu\text{m}$
- » 80°C sample temperature
- » +10% gap width variation
- » 90%  $R_{\text{th}}$  increase
- » Pump-out and dry-out effect



## **The System** Key Characteristics

- » Highly compact
- » Robust and user-friendly
- » Comprehensive
  - › Bulk & eff. thermal conductivity
  - › Effective and interface resistance
  - › Pressure dependence
  - › Temperature dependence
  - › Process dependence
- » Full ASTM D5470 coverage
- » Up to 150°C sample temp.
- » 300 N clamping or tensile force

## **The Edge** Unique Selling Points

- » Automated testing
- » Custom contacting surfaces
- » Cured material characterization
  - › Adhesives
  - › Resins
  - › Gap fillers
- » Phase change material testing
- » In-situ aging investigations
- » Burn-in testing





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*simply measured*

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