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inventing possibilities

## TIA350R – 1Part Thermal Conductive Adhesive (3.5 W/mK – Low Temperature, Fast Cure Adhesive)



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May 2016

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# Index

<b>Introduction</b>	<b>page 3</b>
<b>Material Properties</b>	<b>page 4</b>
<b>Potential Use</b>	<b>page 5</b>
<b>Rheological behavior</b>	<b>page 6</b>
<b>Curing behavior</b>	<b>page 9</b>
<b>Reliability Data</b>	<b>page 11</b>
<b>Mechanical Properties at different Cure Temp.</b>	<b>page 15</b>
<b>Adhesion Test</b>	<b>page 16</b>
<b>Flowability Test</b>	<b>page 17</b>
<b>BLT / Thermal Resistance</b>	<b>page 19</b>
<b>Conclusion</b>	<b>page 20</b>
<b>Packaging / Storage Condition / Shelf-Life</b>	<b>page 21</b>

# Introduction

## Description

TIA350R is a one-component, heat curable silicone adhesive designed for thermally conductive applications. TIA350R cures quickly upon exposure to heat, and adheres well to a wide variety of substrates.

## KEY FEATURES

- **Good thermal conductivity**
- **Low temperature, fast cure**
- Easy to use one component formulation
- Electrically insulative.
- Primerless adhesion to many substrates
- Non-corrosive to metals

## APPLICATIONS

- Thermal Interface Material between dies and heat spreaders.
- Adhesive for use between various heat sources and heat dissipation devices.

# Material Properties

## TYPICAL PROPERTIES

Uncured Properties		
Appearance		Gray paste
Viscosity (23°C)	Pa·s	67
Cured Properties (30min @ 120°C)		
Density (23°C)	g/cm <sup>3</sup>	3.1
Thermal Conductivity <sup>1</sup>	W/m·K	3.5
Thermal Resistance <sup>2</sup> (BLT:60 μ m)	mm <sup>2</sup> ·K/W	24
Hardness (Type A)		72
Tensile Strength	MPa	2.2
Elongation	%	30
Adhesion Strength <sup>3</sup>	MPa	1.0
Volume Resistivity	MΩ ·m	4.8x10 <sup>6</sup>
Dielectric Strength	kV/mm	20
1: Hot Wire Method 2: Laser flash method 3: Al/Al (lap shear) Typical property data values should not be used as specifications.		

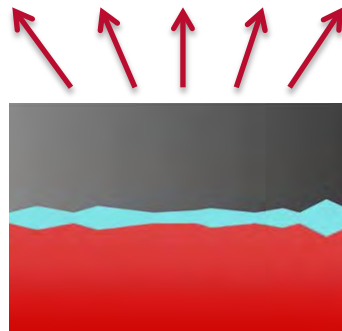
→ Low temperature, fast cure adhesive with high thermal conductivity

# Potential Use



## “Inside the Package”

- Thermal path between Si & heat spreader
- Requires structural adhesion
- Ability to withstand thermal stress



## “Outside the Package”

- Thermal path between heat spreader/ Sink
- Reparability commonly required

TIM materials provide a heat path from a heat source to a heat dissipation device

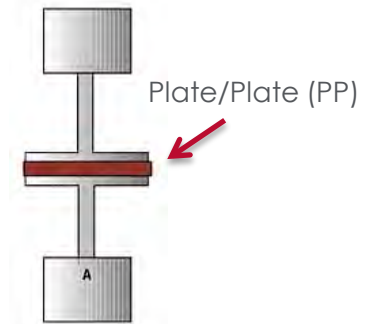
Thermal Interface Materials are used in almost all Electronic Products to remove heat, maintain device processing speed / functionality, and extend the lifetime of electronic products.

# Viscosity Testing

	TIA350R – 15MJPA007
Viscosity @ 10°C [Pas – 10 1/s]	156
Viscosity @ 20°C [Pas – 10 1/s]	121 (Spec: 50-180)
Viscosity @ 30°C [Pas – 10 1/s]	84
Viscosity @ 10°C [Pas – 1 1/s]	132
Viscosity @ 20°C [Pas – 1 1/s]	99
Viscosity @ 30°C [Pas 1 1/s]	76
Thixo Index (1 1/s / 10 1/s) @ 20°C	0,81

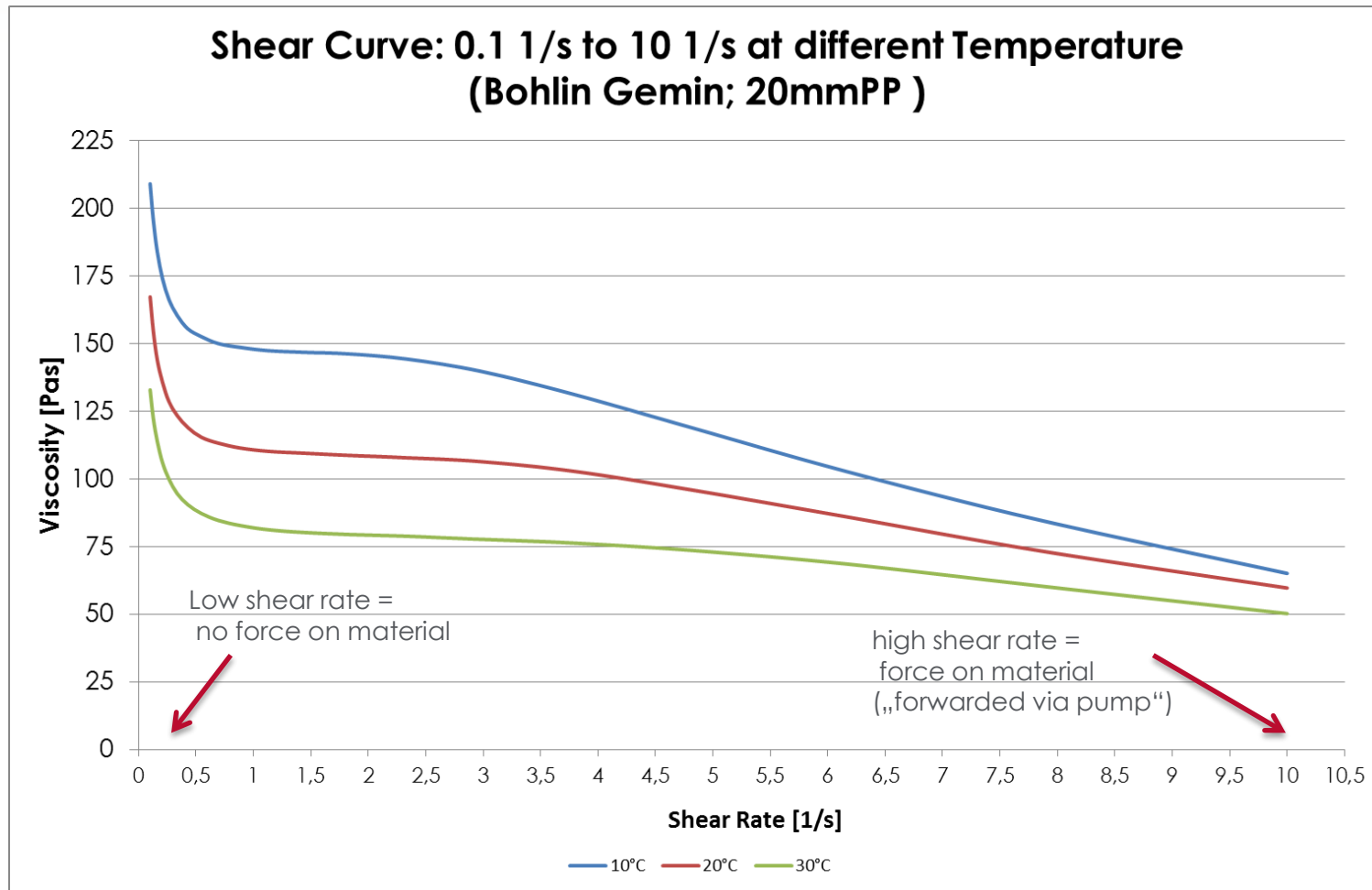
Test Condition: Bohlin Gemini Rheometer, 20mmPP

→ TIA350R is a self-leveling material





# Viscosity Testing – Shear Rate



→ TIA350R shows a shear thinning effect when pumped

# Storage Test

	TIA350R – 15MJPA007		
	0d	7d	14d
Viscosity @ 23°C stored [10 1/s - 20°C - 20PP] [Pas]	121	135	148
Viscosity @ 40°C stored [10 1/s - 20°C - 20PP] [Pas]	121	cured	cured
Hardness @ 23°C stored (30min @ 120°C)	81	81	81
Hardness @ 40°C stored (30min @ 120°C)	81	cured	cured

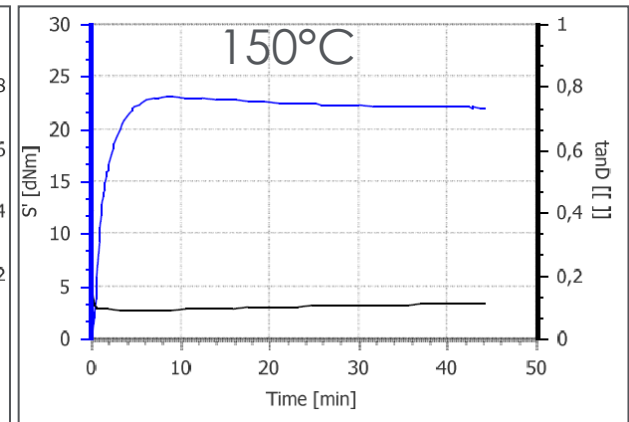
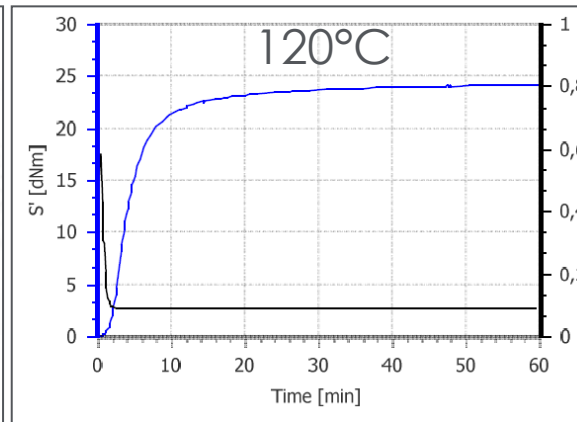
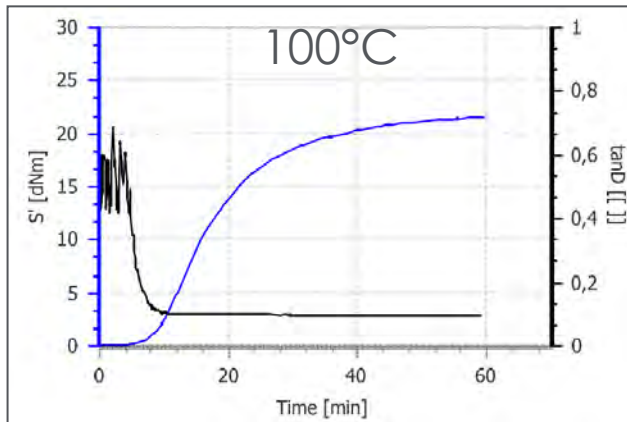
- Material shows a slight increase in viscosity after 14d @ RT
- Material can not be stored at 40°C
- Storage at RT does not show a significant impact on hardness



# Cure Speed

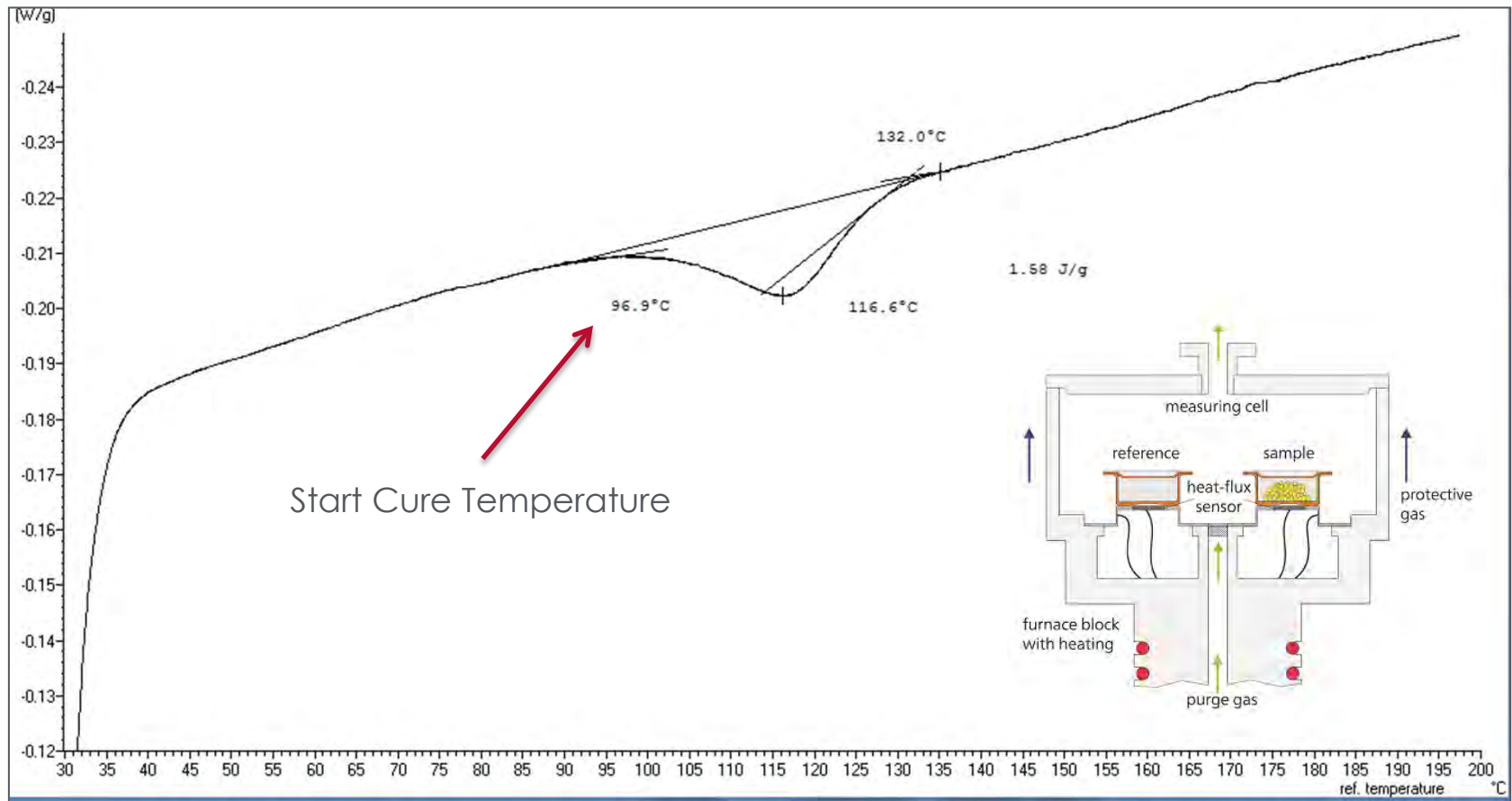
	TIA350R – 15MJPA007		
	100°C	120°C	150°C
T10 @ X°C [min]	9,88	2,11	0,44
T60 @ X°C [min]	18,87	4,74	1,44
T90 @ X°C [min]	34,16	24,12	3,73

Test Condition: RPA2000LV



→ Material can also be cured at lower temperatures (extended cure time might be required)

# DSC Measurement (30°C – 200°C / 10K/min)



DSC: Differential Scanning Calorimeter: Mettler Toledo

- Cure Start Temperature (T-Onset) at 97°C
- Heat Flow (exothermic – cure) of 1.58J/g

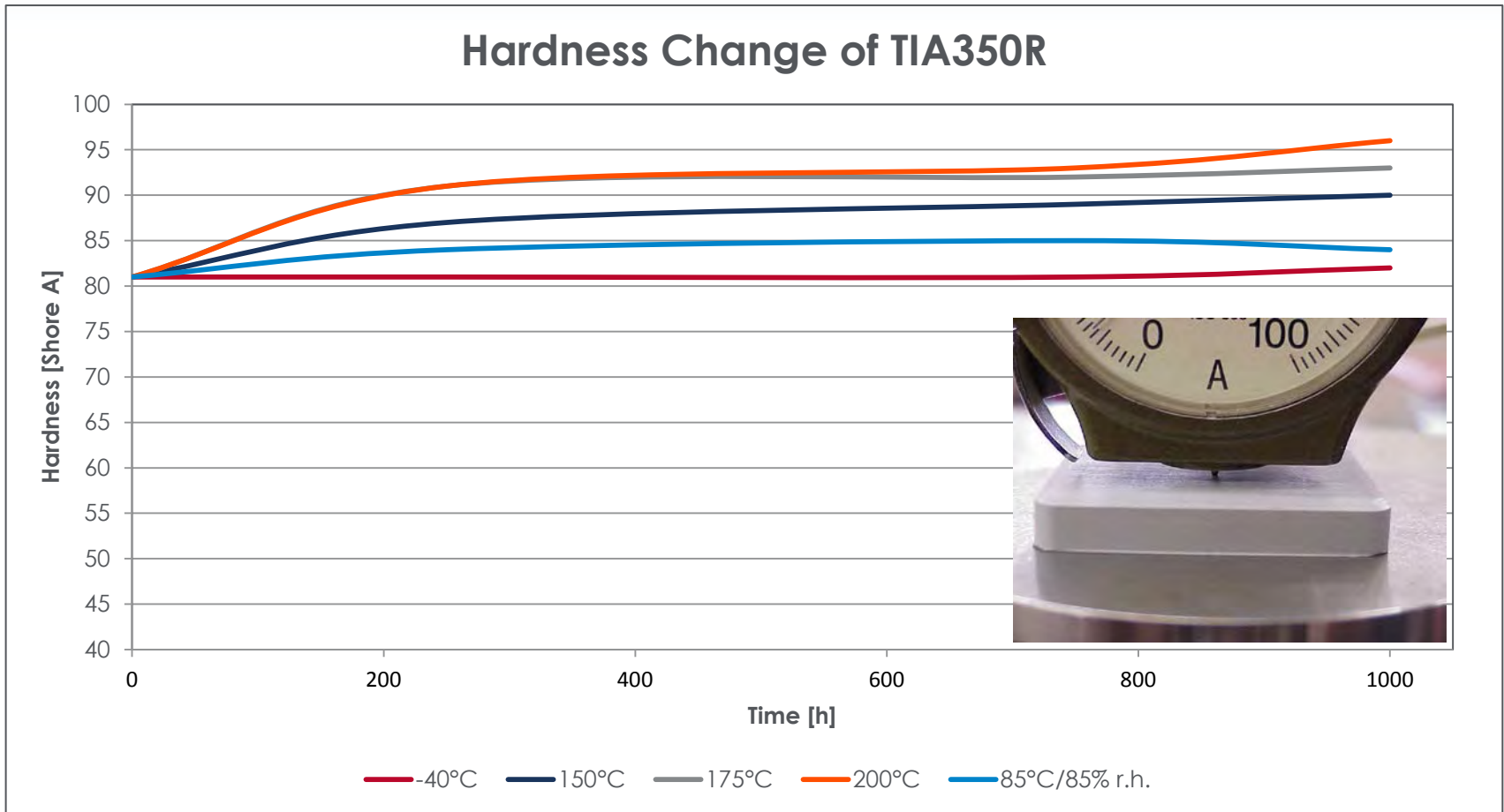
## Reliability Data - Summary

Mechanical Properties	Δ 1000h @ 150°C	Δ 1000h @ 175°C	Δ 1000h @ 200°C	Δ 1000h @ -40°C	Δ 1000h @ 85°C/85%r.h.
Tensile Strength [%]	129	187	306	5	31
Elongation [%]	81	61	38	18	62
Hardness [%]	11	15	19	1	4

2mm cured silicone sheet cured in a press for 30min @ 120°C; measured on Tensometer in Leverkusen;  
Hardness measured on 3x2mm thick silicone sheets

- **Material shows some changes in mechanical properties after aging**
- **Tensile Strength increased at higher temperatures (more force is needed to break the silicone), while the elongation is only slightly impacted (material still flexible)**
- **Almost no change in hardness at higher temperatures**
- **Useful Temperature Range: -40°C to 200°C**

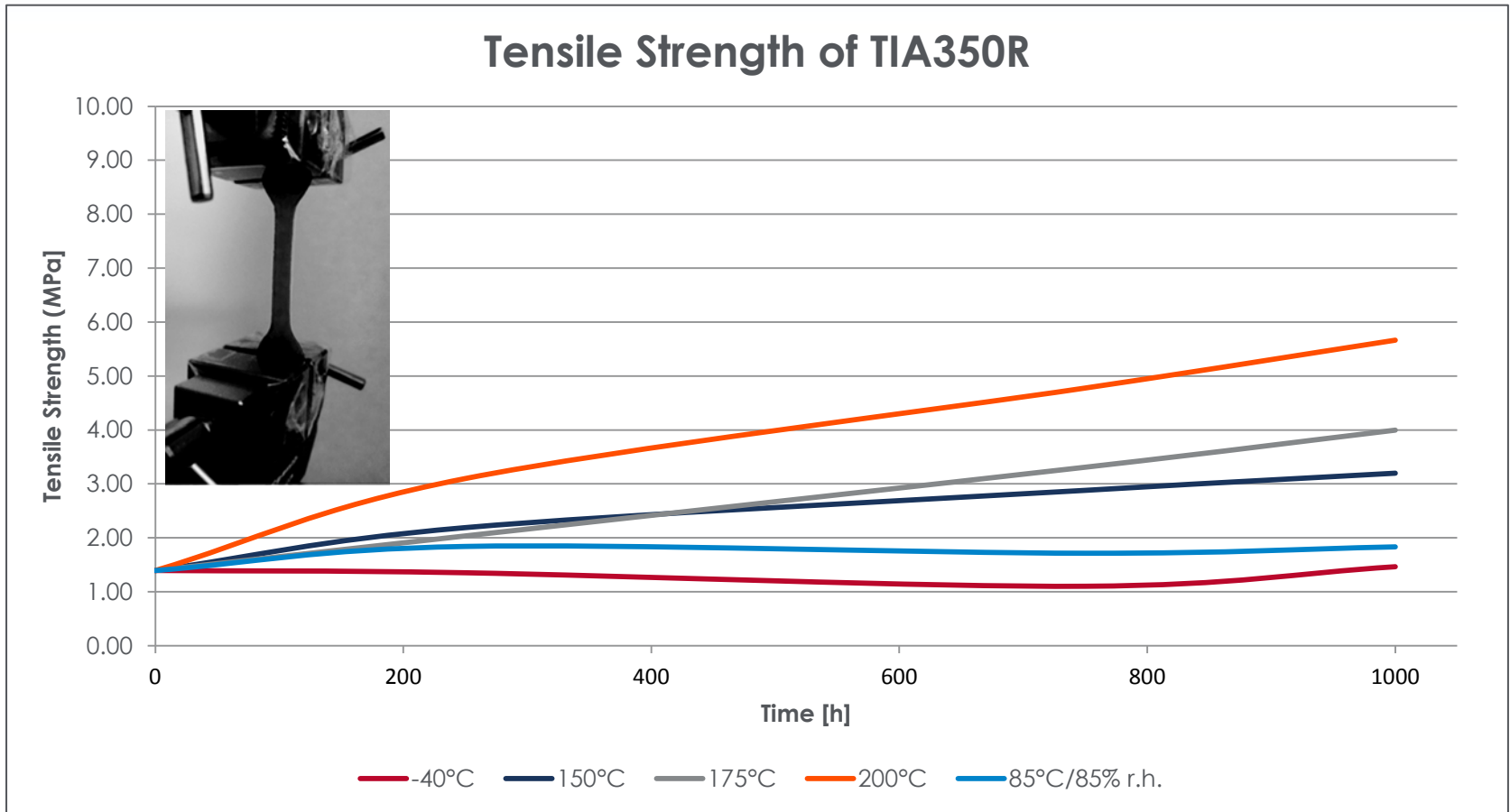
# Reliability Data – Hardness Change



ASTM:D2240

→ **Very stable Hardness at elevated temperatures**

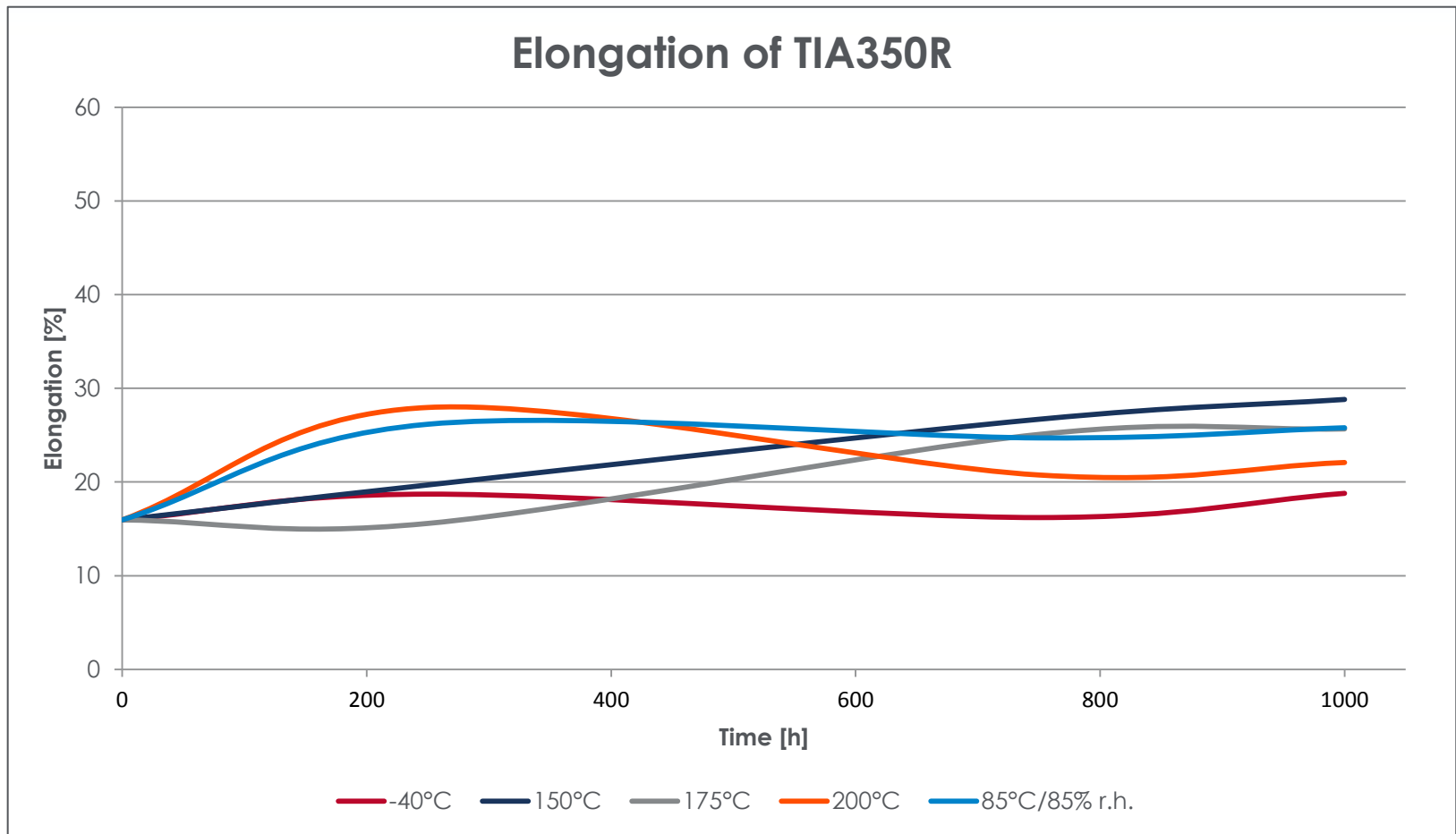
# Reliability Data – Tensile Strength Change



ASTM D412

→ Tensile Strength increases at higher temperatures (more force is needed to break the silicone)

# Reliability Data – Elongation Change



→ Slight elongation change at higher temperatures (TIA350R is still flexible)

# Mechanical Properties @ different Temperatures

	TIA350R – 15MJPA007		
	60min @ 100°C	30min @ 120°C (TDS)	10min @ 150°C
Tensile Strength [N/mm <sup>2</sup> ]	1,29	1,39	1,38
Elongation [%]	16	16	16
Hardness [Shore A]	80	81	80

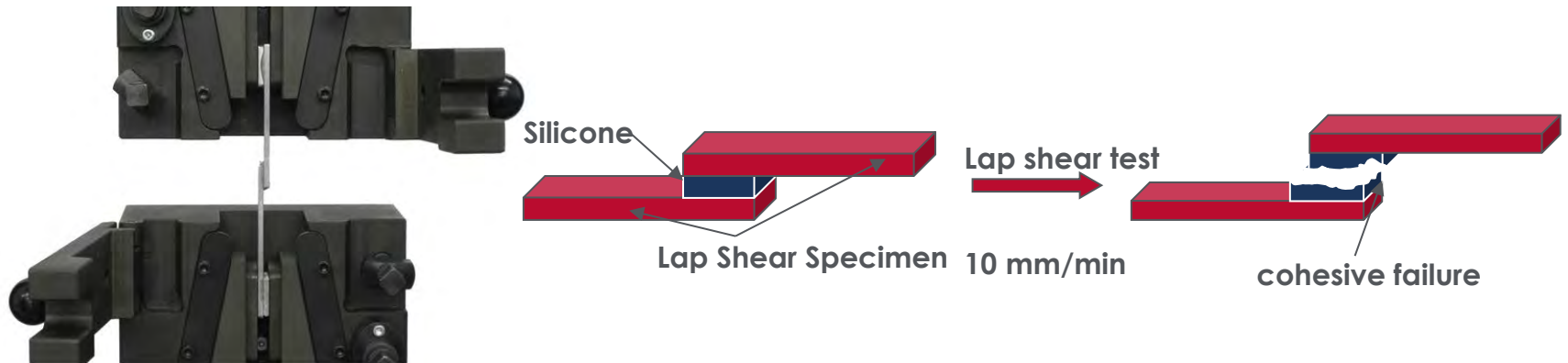
→ TIA350R can be cured at different temperatures, longer cure time might be required



# Adhesion Test – Lap Shear

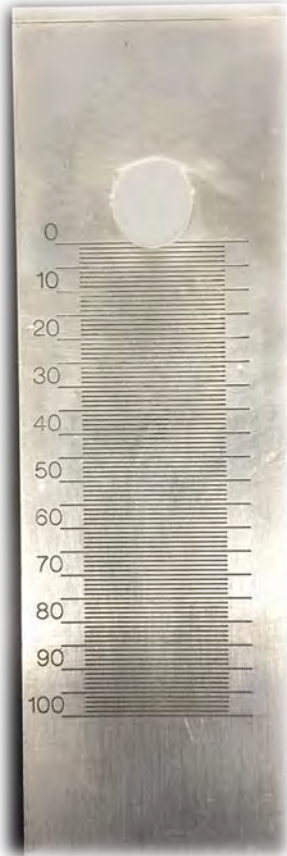
	TIA350R – 15MJPA007			
	60min @ 100°C	30min @ 120°C (TDS)	10min @ 150°C	60min @ 150°C
Aluminum 5754	1,2 MPa	1,1 MPa	1,1 MPa	1,2 Mpa
Cohesive Failure	>90% cohesive failure			

Dimension: 25mmx10mmx0,25mm  
Traction Speed: 10mm/min



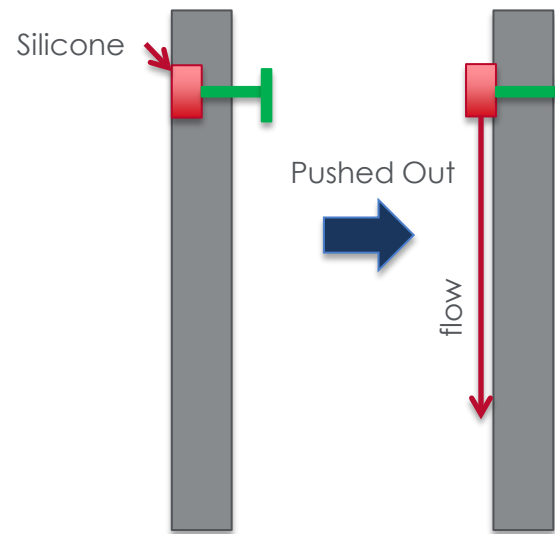
→ TIA350R can be cured at lower temperatures and achieve good adhesion properties

# Flowability – Test 1



## Modified Boeing Vertical Flow Test:

Volume: 1,2mL  
Amount: 3,7g  
Time to reach 100mm: 45s



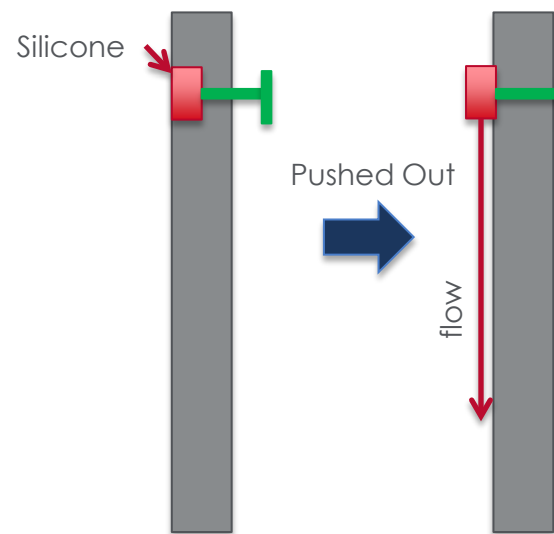
→ TIA350R is a semi-flowable material

# Flowability – Test 2



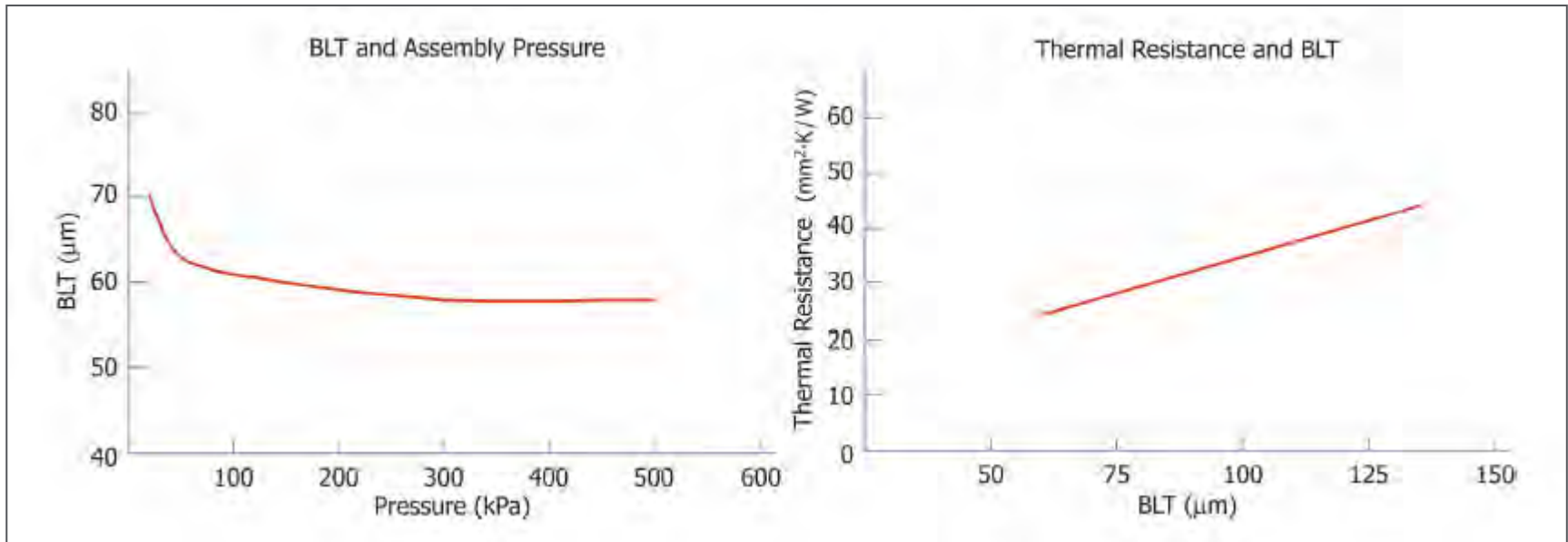
## Boeing Vertical Flow Test:

Volume: 10,2mL  
Amount: 32g  
Time to reach 100mm: 9s



→ TIA350R is a semi-flowable material

# BLT / Thermal Resistance



→ Low thermal resistance values (TR) of 24mm<sup>2</sup>K/W with BLT (Bond Line Thickness) of ~60μm can be achieved with this material

# Conclusion

- TIA350R is semi-flowable, easy to dispense, medium viscosity one part material
- with 3.5 W/mK Thermal Conductivity
- Material shows good adhesion on tested AL5754
- Can be cured at low temperature 100°C
- Useful Temperature: -40°C to 200°C

# Packaging / Storage Condition / Shelf-Life

## Packaging

333mL Cartridge (1.04KG-2.29LB) – SAP Material No.: 108073

30cc Syringe (0.176LB-0.08KG) – SAP Material No.: 127385

## Shelf Life:

270 days

## Minimum Remaining Shelf Life:

90 days

## Storage condition:

2-10°C

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