

An Instant Bond: Silicone Reactive Hot Melt for Plastics

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What We'll Discuss

1. 100% Silicone Reactive Hot Melt
 - Mechanical properties
 - Instant bonding
 - Energy dissipation
 - Low VOC
 - Stress strain
 - Elastic recovery
 - Features and benefits
 - Unprimed adhesion
 - Temperature resistance
 - Weather resistance / durability
2. Cost Savings
 - Manufacturing efficiency
 - Reduced material waste
 - Extended performance life
3. Expanding Applications
 - Plastic bonding applications
 - Replacement for mechanical fasteners

100% Silicone Reactive Hot Melt

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Comparison of Bonding Techniques

	Advantages	Disadvantages
Tape	<ul style="list-style-type: none">• Inexpensive• No equipment necessary	<ul style="list-style-type: none">• Labor intensive• No automated application• Application consistency (manual)• Primer often needed on low surface energy plastics
Traditional Sealants	<ul style="list-style-type: none">• Moderate-to-superior performance & reliability• Low cost application equipment	<ul style="list-style-type: none">• Poor green strength• Material squeeze-out• Surface contamination
Mechanical Fasteners	<ul style="list-style-type: none">• Long term bond	<ul style="list-style-type: none">• Drilled holes weaken material and can lead to stress points• Temperature variations induce high stress at screw points
Silicone Reactive Hot Melt	<ul style="list-style-type: none">• Instant bonding• Accelerated production process• Lowers labor costs• Design flexibility• Strong adhesion to plastics	<ul style="list-style-type: none">• Initial equipment investment• Higher material costs

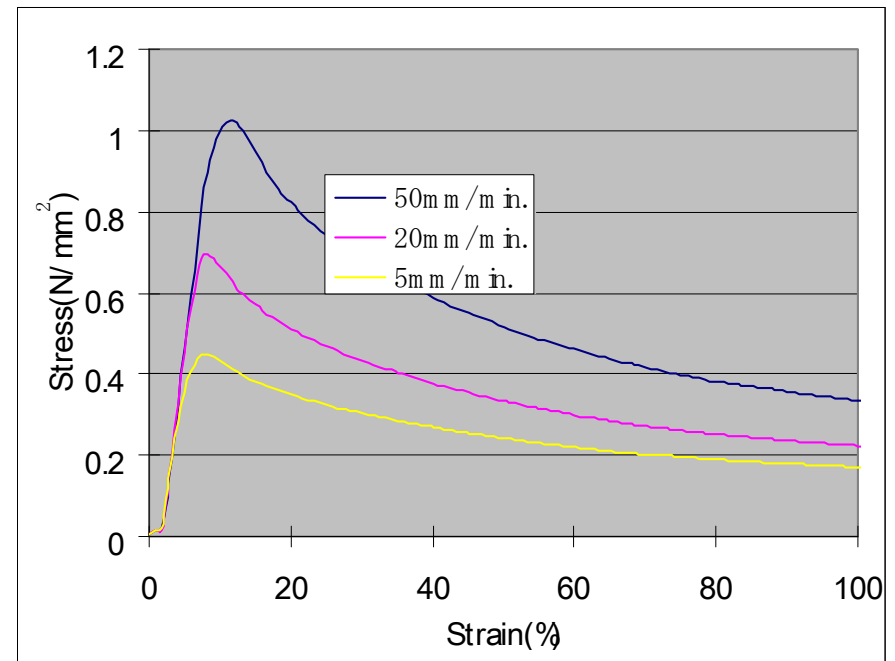
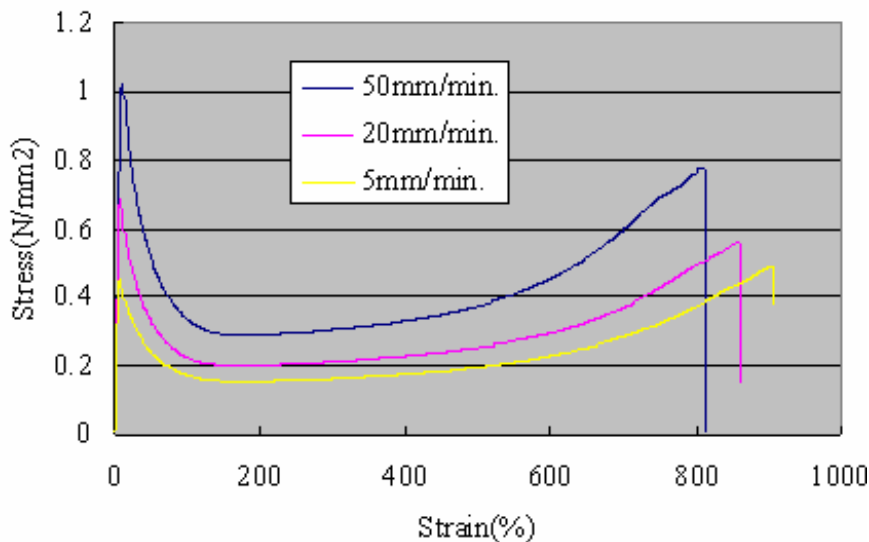


Mechanical Properties

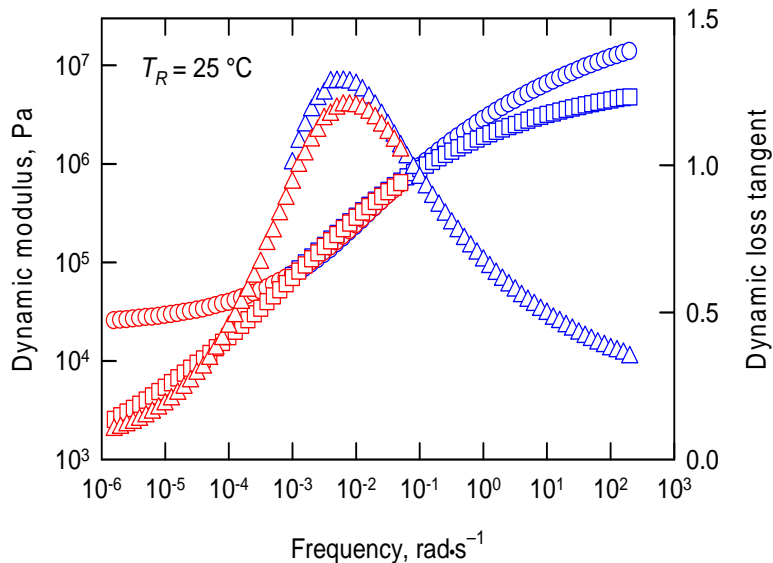
Stress Strain

- Behaves like a high modulus elastomer at low temperature or high strain rate
- Behaves like a low modulus elastomer at high temperature or under constant load

Stress-Strain Curve



Mechanical Properties



High temperature behavior
Long-term (slow rate) properties

Low temperature behavior
Short-term (high rate) properties

- ◆ The elastic component G' is a measure of the ability to store energy and to recover when deformation ceases
- ◆ The viscous component G'' is a measure of the ability to dissipate the energy being applied
- ◆ The dynamic loss tangent, $\tan \delta$, is the ratio of G'' to G' . The breadth and magnitude of $\tan \delta$ is responsible for the adhesive performance over a wide range of frequencies and temperatures; balancing energy dissipation (adhesive) and energy storing (strength) capabilities.

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Viscoelastic function

- ○ Storage modulus G' ; elastic component
- □ Loss modulus G'' ; loss/viscous component
- △ △ Loss tangent, $\tan \delta$ (G''/G')

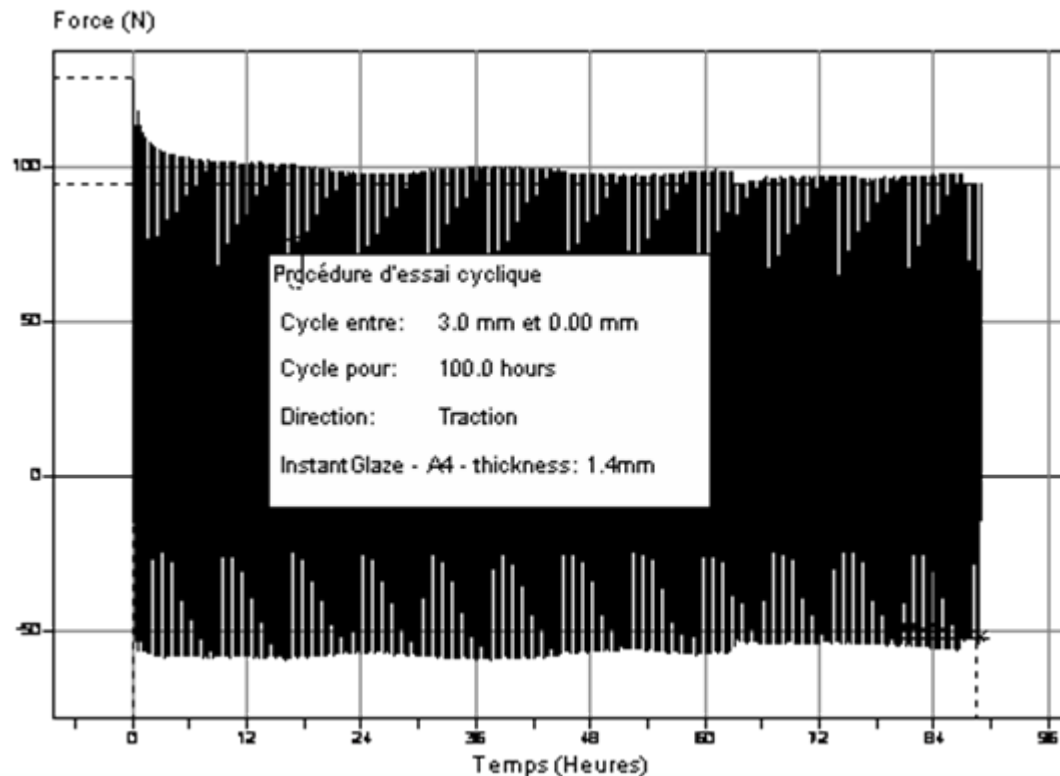
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Mechanical Properties

Elastic Recovery

- The cycling under a constant deformation shows that an elastic recovery greater than 90% is retained over more than 3 days thereby providing this hot melt with excellent movement capability resulting in less stress buildup



Features and Benefits

Unprimed Adhesion

- Very low surface tension → excellent wetting characteristics even on non polar substrates such as polyethylene or polypropylene
- Low elastic modulus → a material of choice for sealing plastics to materials with different CTEs such as glass, plastics and metals

Temperature Resistance

- Chemical bond unaffected by typical high and low temperature conditions
- Service temperatures of -50°F (-45°C) to 300°F (150°C)

Weather Resistance / Durability

- Unaffected by long term direct and indirect UV exposure
- The silicone reactive hot melt is resistance to water

Cost Savings

Manufacturing Efficiency

- Fast bonding
 - Rapid rise in viscosity
 - Pressure sensitive adhesive (PSA) character of the material
- No need for priming or surface activation; including plastics, glass, PVC, wood, paints and aluminum
- Easy to process using automatic equipment
- Increases production rates in assembly manufacturing

Shear Strength vs. Cure Time

Adhesive	15min $\times 10^3 \text{Pa}$	1 day $\times 10^3 \text{Pa}$	7 days $\times 10^3 \text{Pa}$	7 days + 24hrs water $\times 10^3 \text{Pa}$
Silicone reactive hot melt	85	130	280	300
Silicone sealant	0.1	40	110	100
Bonding tape #1	14	26	29	<10
Bonding tape #2	38	40	40	<10

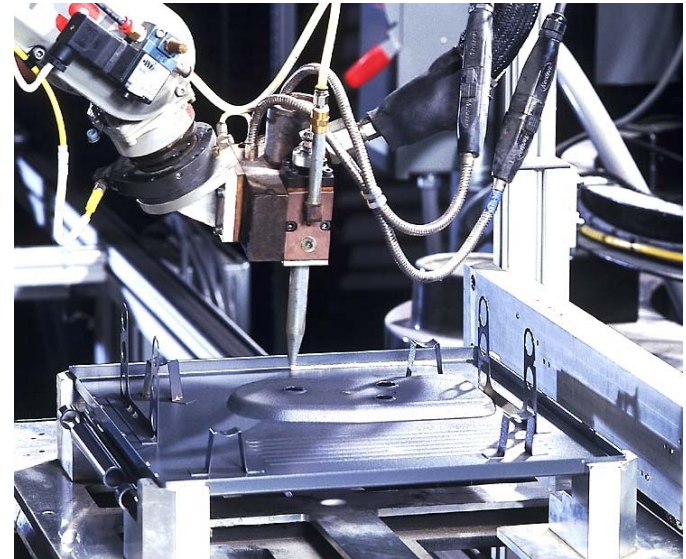
Cost Savings

Reduced Material Waste

- 24-hour pot life
- Reduces squeeze out
- Improves beading consistency
- 15-minute open time to adjust materials being set

Extended Performance Life

- Reduces sealant failure → reduced part replacement
- Reduces total cost of ownership



Expanding Applications

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Expanding Applications

Plastic Bonding

- Silicone hot melts bond readily to plastics
 - Polyethylene, polycarbonate, polypropylene, acrylic
- Provides a flexible seal that withstands differing thermal expansion coefficients
- Reduces stress on bond line with low elastic modulus

Replacement for Mechanical Fasteners

- Bonds more completely than mechanical fasteners
- More durable over time
- Low stress point cracking
- Absorbs stress from thermal expansion

Assembly Trends

Industrial Applications



Sports & Leisure



Home Appliances

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Expanding Applications

Home & Industrial Appliances



Oven, steam iron, coffee pot, stovetop, kitchen equipment, refrigerator, washing machine, dishwasher, steam cleaner



Automotive Headlamps

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Expanding Applications

Solar cells

Bonding of polypropylene junction box to solar modules



PC Boards

Silicone adhesive lead to a good bond between the PC board and the polypropylene housing in the absence of primer or pre-treatment

Summary

• **Takeaway #1:**

Silicone reactive hot melts have the mechanical properties, adhesion performance and temperature resistant characteristics required to support an expanding range of applications, including plastic bonding and replacement of mechanical fasteners.

• **Takeaway #2:**

Silicone reactive hot melt supports higher-speed assembly to increase manufacture output while reducing maintenance costs.

THANK YOU !!!

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