Highly Toughened Gap Filling Adhesives For Enhanced Body Structure Reinforcement

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Dow Automotive Systems

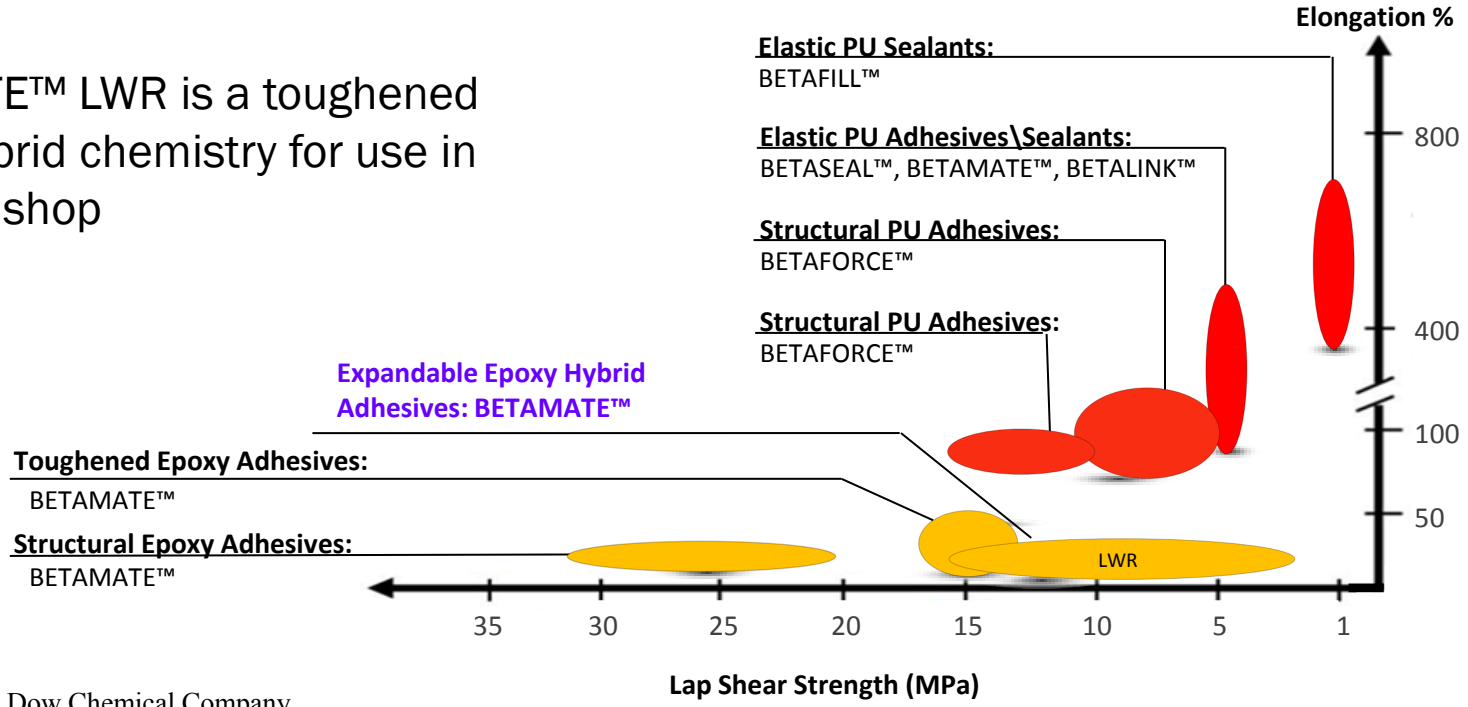
Content

- BETAMATE™ LWR Product Family
- Advantages of chemistry
- Advantages over manually applied tapes
- High modulus grade BETAMATE™ LWR
- Mid and low Modulus Grade BETAMATE™ LWR
- Performance Differences
- Recommended areas of use

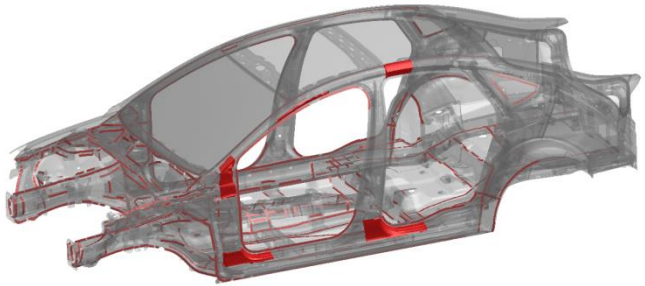
Dow Automotive Product Line

Body | 180° C, 30' | Paint | 80-160° C, 30' | Trim | 25° C | Repair

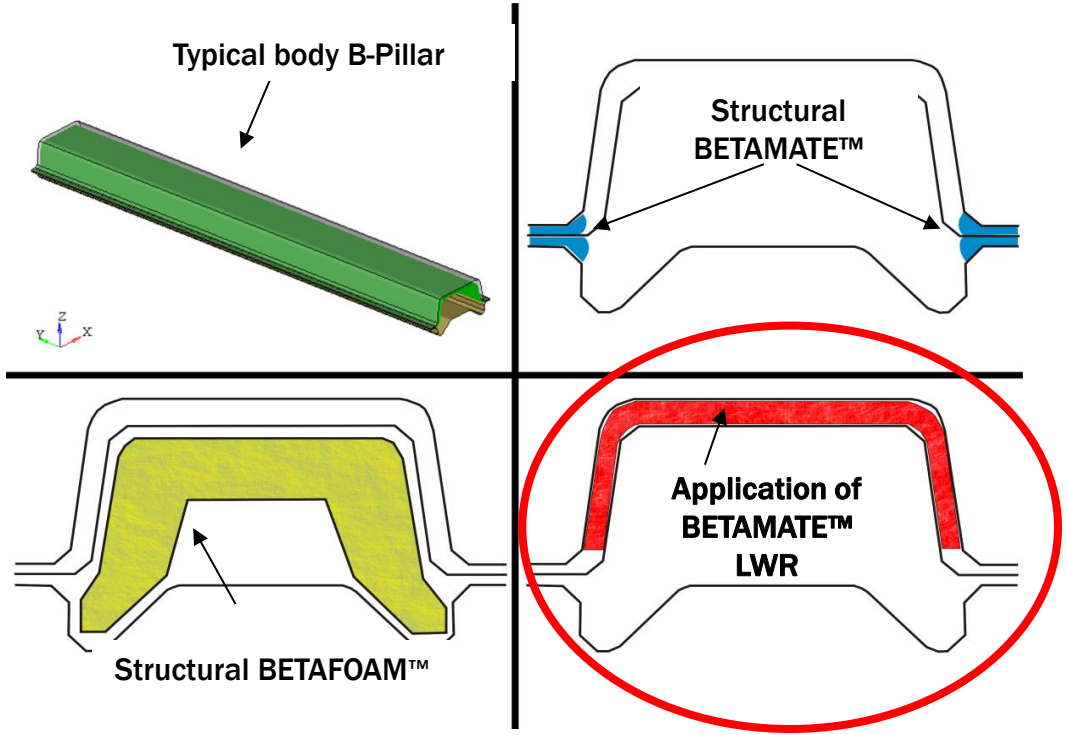
BETAMATE™ LWR is a toughened epoxy hybrid chemistry for use in the body shop



BETAMATE™ LWR Expandable Adhesives

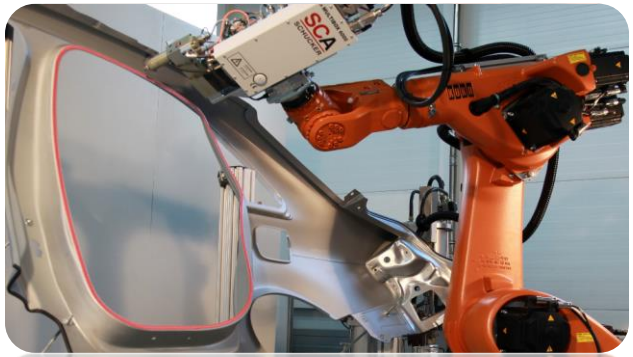


- Designed for BIW substrates
- Mass efficient solution
- Toughness and body stiffness
- Applied in bulk



BETAMATE™ LWR Products

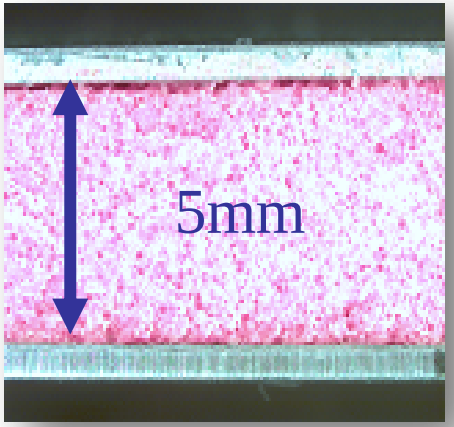
- One Part Epoxy Hybrids → **Body Shop Bake** bonds through oily substrates
- Toughened → **Absorbs energy** and does not become brittle at **cold temperatures**
- Expandable → **Fills gaps** and compensates for **metal separation** and movement during thermal loads



- Robotically applied in bulk
- Designed to endure wash and e-coat cycles

Robotically Applied Expandable Structural Adhesive

- Expands 150% by volume → fills gaps
- Robotic Application
  - Removes risk of human error
  - Faster cycle times
  - Removes added labor and piece costs
- Tailored Application → bead dimensions
- Useful for areas that are difficult to weld
- Robust adhesion to a variety of metals
- Useful for areas with variable design gaps – up to 15 mm
- Can bond substrates with different CLTE

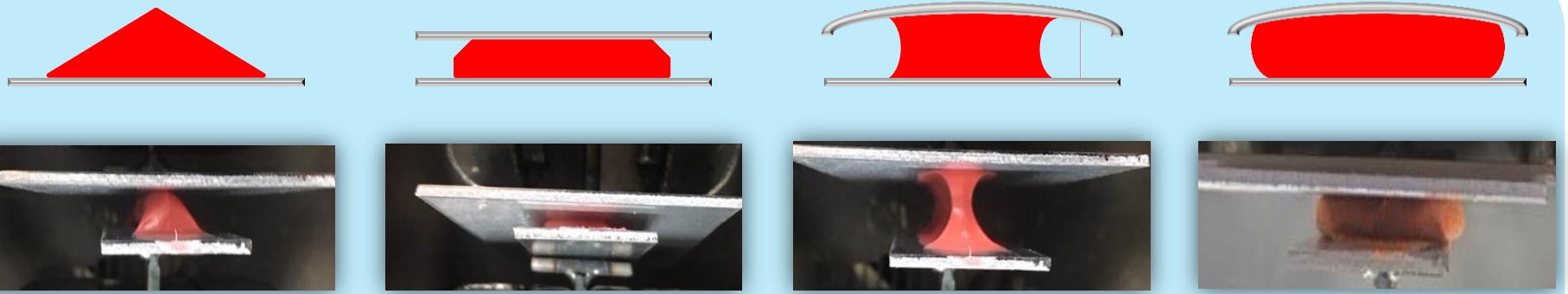


Uniform Expansion

Tape vs. Paste Application

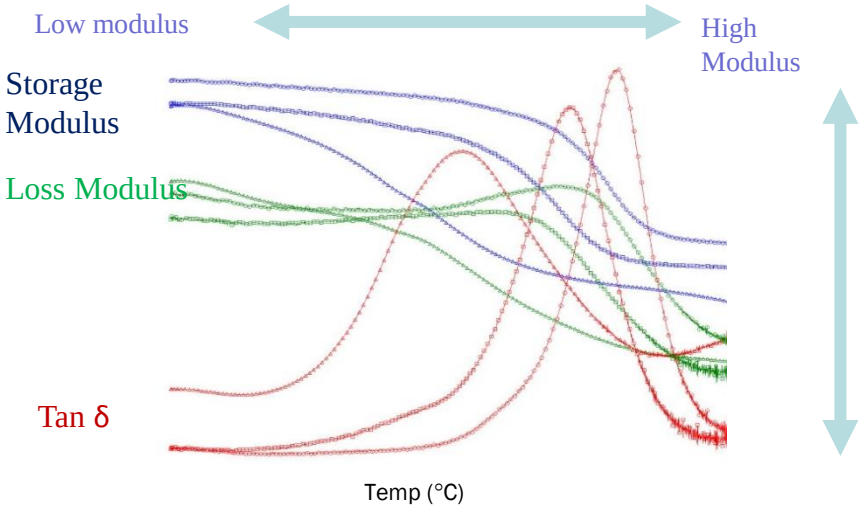
Tape Adhesive

Material Applied | Parts Mated | Thermal Load | Expansion & Cure



Paste Adhesive

BETAMATE™ LWR Product Family



High Modulus (Crash Worthiness Stiffness Torsional rigidity)

Fills gaps to improve structural integrity

Weld accessibility

Thermal expansion

Galvanic corrosion

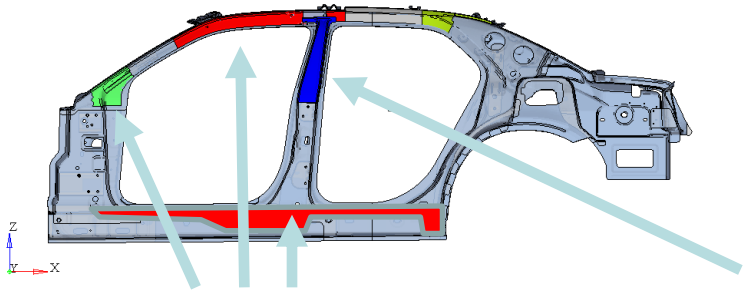
Low Modulus

(NVH Performance moderate structural bond, class A surfaces)

BETAMATE™ LWR Product Family

Product	Status	Modulus	Applications
BETAMATE™ LWR High Modulus	Implemented	350 - 750MPa	Stiffness, crash worthiness
BETAMATE™ LWR Medium Modulus	Commercially available 4th Quarter 2018	150 - 250 MPa	Tape replacement, NVH
BETAMATE™ LWR Low Modulus	Commercially available 2nd quarter 2018	35 - 150 MPa	NVH, Low distortion to class A surfaces

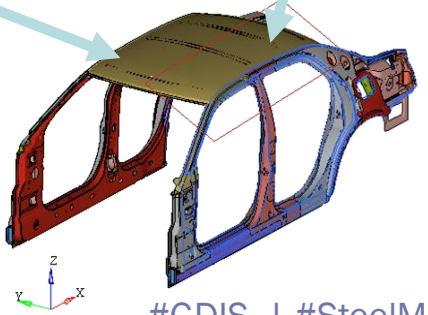
Key Areas Targeted For BETAMATE™LWR



High modulus for crash and torsional stiffness

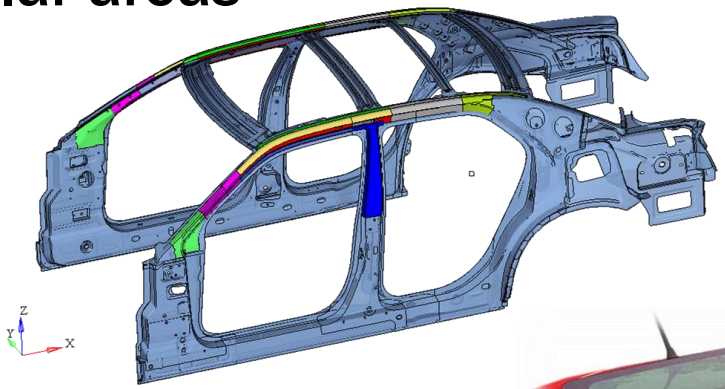
Mid modulus for areas that need high stiffness and have mild distortion issues

Low modulus for areas that have surfaces more sensitive to defects in the class A surface

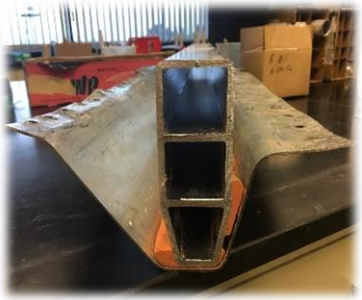


Typical Uses for BETAMATE™ LWR High Modulus

Key areas for crash performance in pillar areas

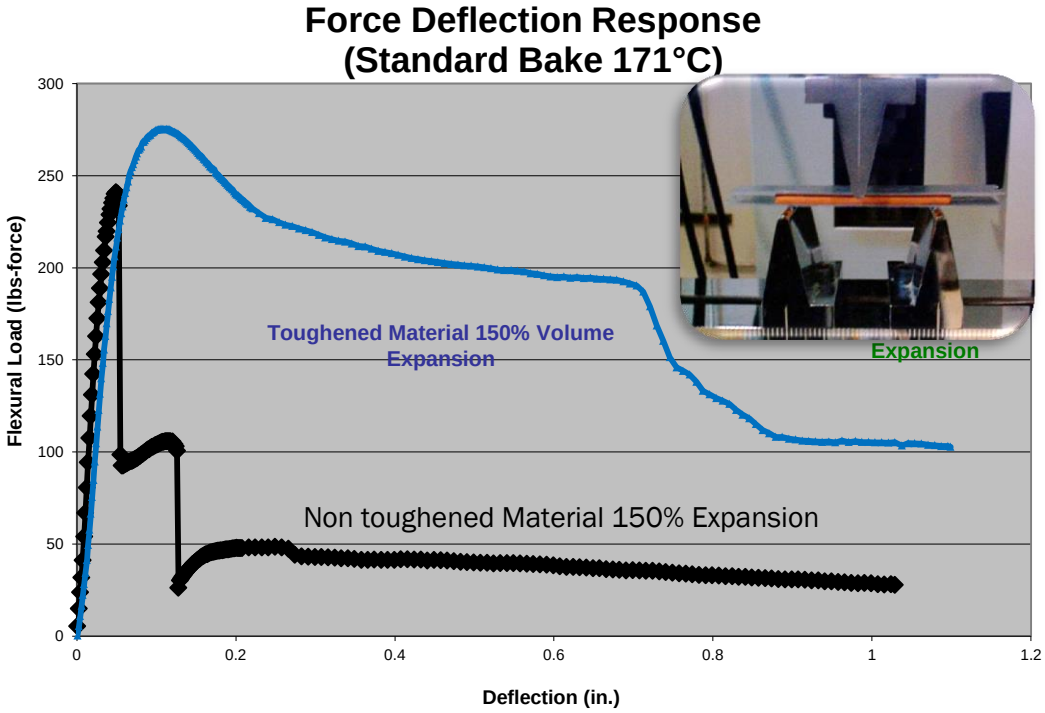


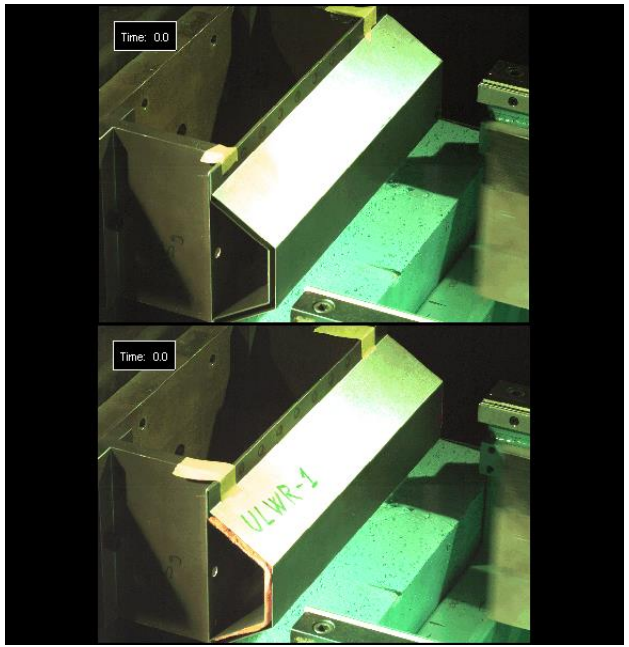
Rocker panels for stiffness and torsional rigidity



Sun roof support rings (non class A surface)

BETAMATE™ LWR High Modulus





Special Case: Bonding Class A Surfaces

Class A Surfaces present special challenges

- "Read-through"
- Outer panel distortion
- Rigidity loss by light weighting
- Each application is unique

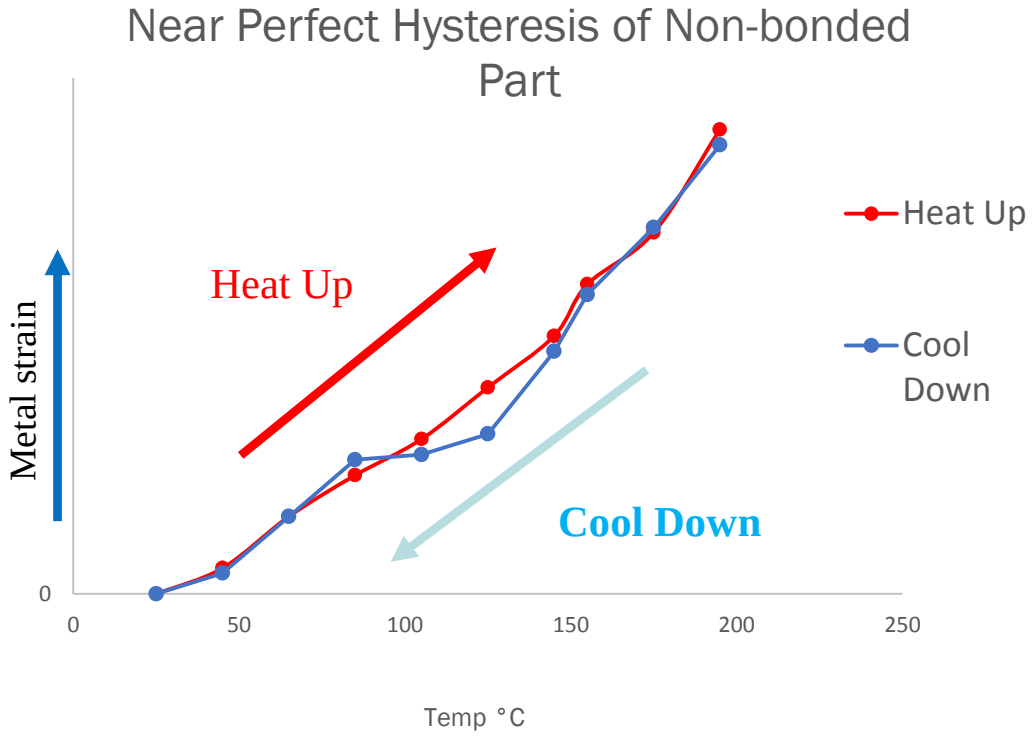
Reflected light showing surface distortion

LWR performance tailored to alleviate distortion Issues

Thermal Load and Induced Strain

Thermal loads cause:

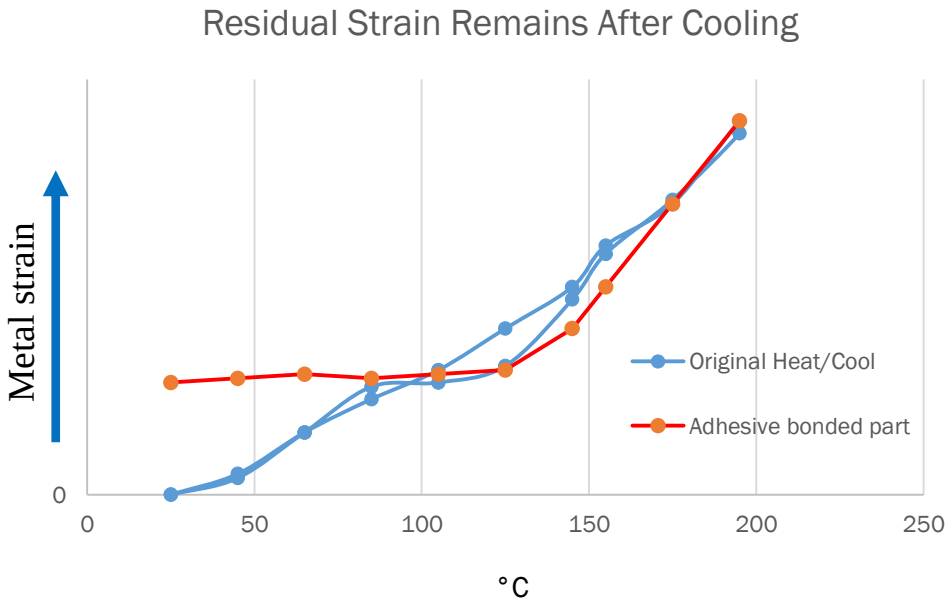
- **Metal expansion**
- **Induced strain**
- **Returns to original state upon cooling**



Adhesives and Residual Strain

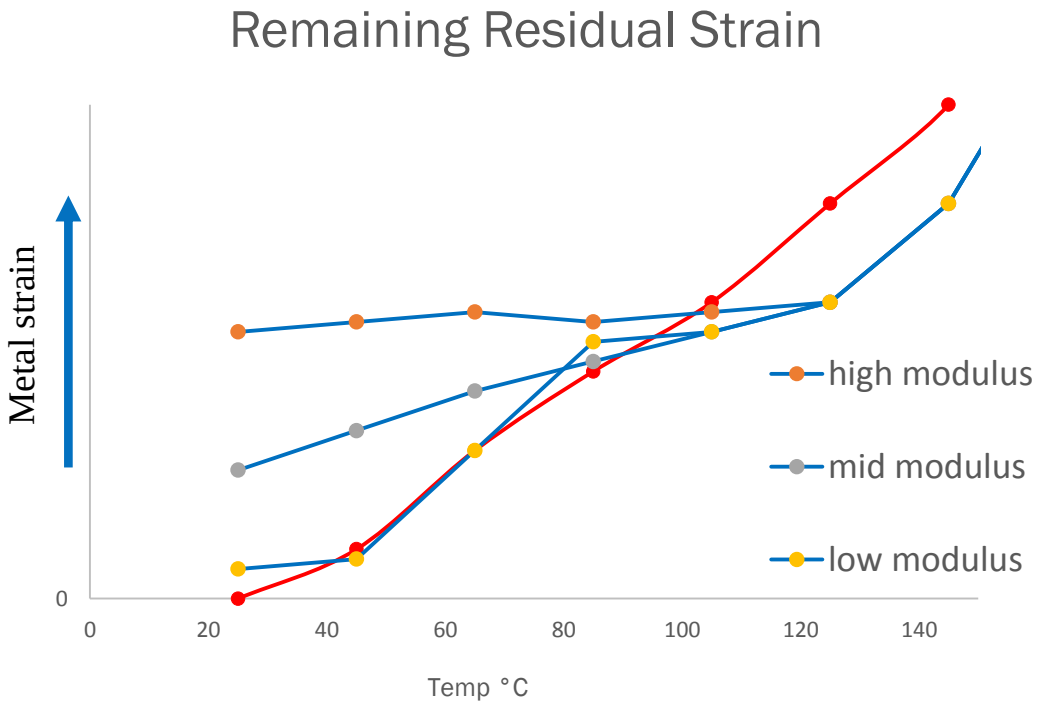
When bonding two parts together the adhesive hardens and can prevent perfect hysteresis

This can result in visual defects in class A surfaces



Balancing Performance

Residual strain levels can be minimized through the optimization of LWR cured performance properties

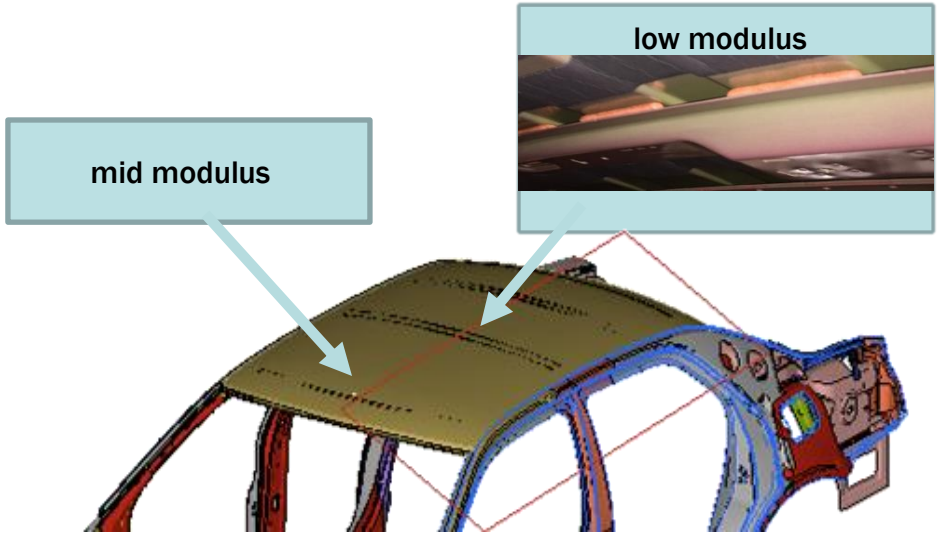


BETAMATE™ LWR Low Modulus

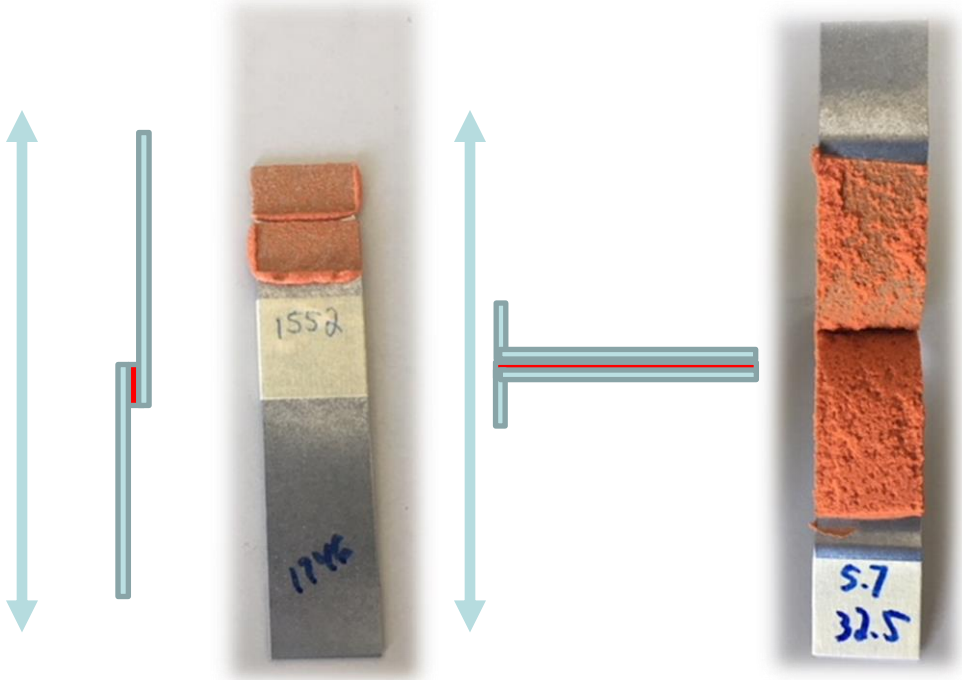
Possible applications on:
lift gates doors roofs pillars and other class A areas in need of stiffness and improved NVH response

Areas with more contour and/or stiffness utilize mid modulus such as *front and rear header* areas and roof *perimeter*

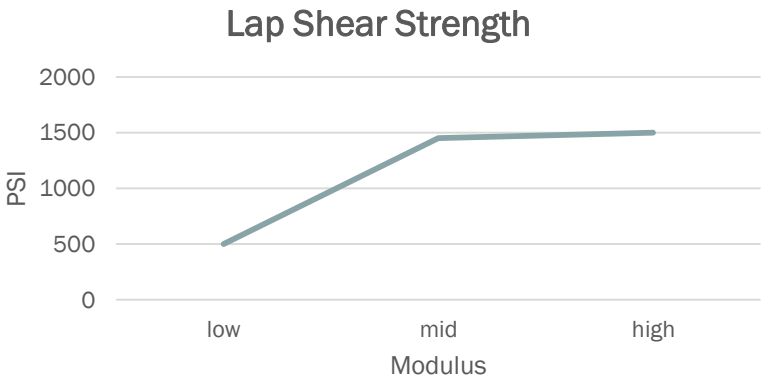
- **Lower Modulus** (compared to most structural adhesives)
- **Lower Tg** (compared to most structural adhesives)
- **Better NVH response** (compared to most anti-flutters)
- **More structure than anti-flutter material**

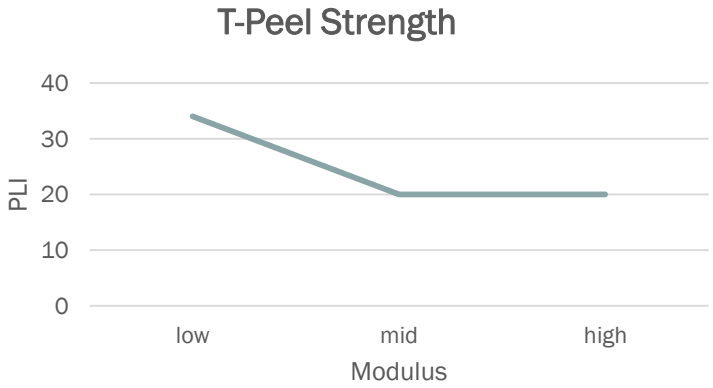


Strength Differences



Lap Shear and T-peel geometry

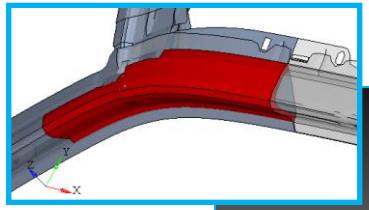


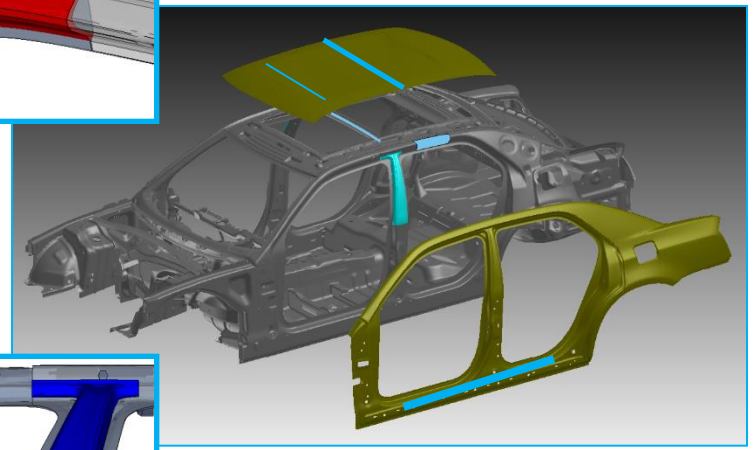


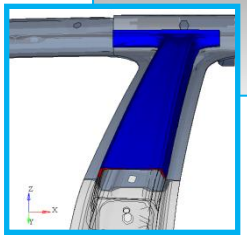
Conclusion

BETAMATE™ LWR is a new tool for engineers that offers:

- Expansion
- Robotic application
- Tailored performance
- Potential cost savings







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Thank You !!