

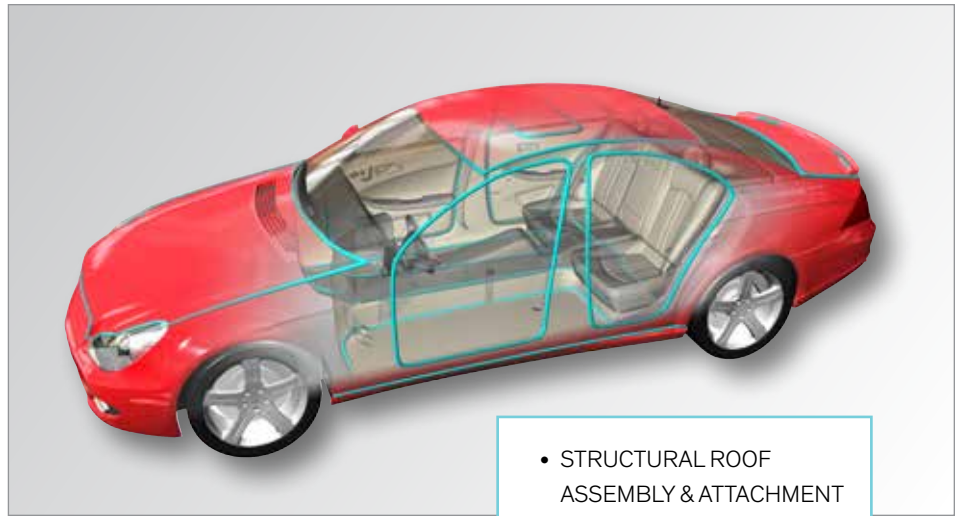


Solutions from Dow Automotive Systems

BETAFORCE™ Composite Bonding Adhesives for Lightweight Multi-material Vehicles



For high-performance bonding in lightweight multi-material vehicles, BETAFORCE™ composite bonding adhesive from Dow Automotive Systems enables significant weight reduction, acoustic performance and corrosion protection. Design flexibility is maintained while processing performance and sustainability goals are achieved.



- STRUCTURAL ROOF ASSEMBLY & ATTACHMENT
- TAILGATE/LIFTGATE
- TRUNK LIDS/HOODS
- SPOILER
- DOOR MODULES
- BODY CLOSURES
- PASSENGER CELLS

BETAFORCE is an ideal choice for joining carbon fiber and glass fiber composites and other dissimilar materials in a variety of lightweight designs, including modular assemblies. It can be used to bond coated metals like steel to aluminum, carbon fiber panels to steel or aluminum and sheet molding compound (SMC) to aluminum.

Composites are gaining traction in automotive production due to their weight-saving potential, yet they remain difficult to join. Adhesives offer a reliable alternative to traditional mechanical and thermal processes, which cannot be applied to these lightweight materials. Advanced bonding solutions such as BETAFORCE™ composite bonding adhesives from Dow Automotive enable a continuous bond line and cohesive joining of surfaces.

Recent formulations of BETAFORCE offer a cycle time of around one minute and are currently being used for mass series production. Open times can be adjusted to accommodate specific mounting requirements in the plant, such as a quicker curing time by infrared treatment and the initial adhesion requires no additional fixing tools.

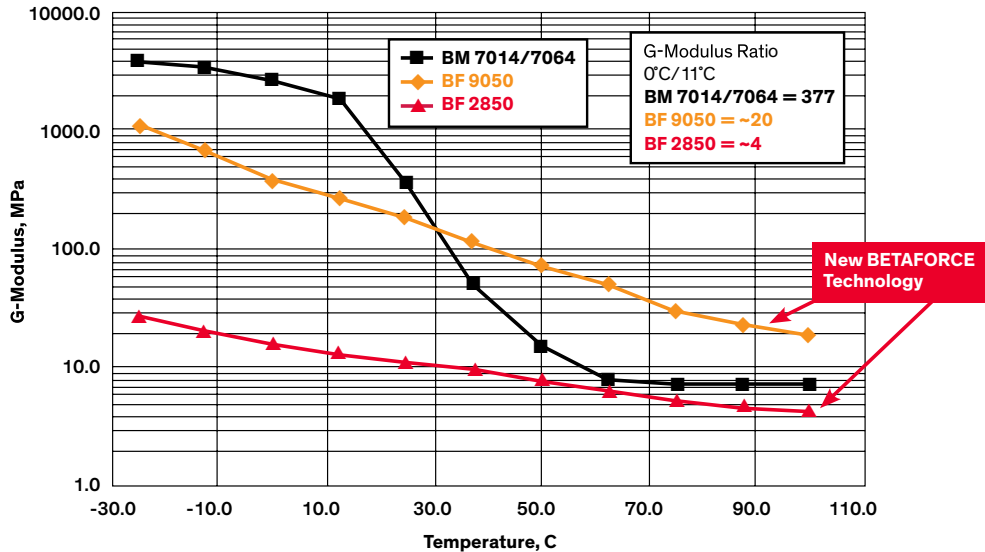
Additional processing and performance benefits include:

- Enables reduction in wall thicknesses due to structural mechanical properties of adhesive
- Allows for optimization of substrates and adhesive joint structure
- Excellent temperature resistance and retention of modulus across the working temperature range

- Enables process time reduction and significant investment savings due to very fast acceleration capabilities
- Reduces process complexity due to primerless adhesion performance
- Provides a corrosion barrier between dissimilar materials
- Reduces noise, vibration and harshness and improves crash performance
- Demonstrates variable cure rates

- Exhibits broad range of mechanical and product properties
- Has very good bead stability during application
- Allows bonding in general assembly, after e-coat and/or painting
- Demonstrates handling strength in a few minutes with accelerated heat curing enabled by tailored chemistry
- Combines high modulus, high strength and high elongation in one system for effective management of differential CLTE (for example, carbon fiber composite to aluminum) even on long bond lines
- Provides effective sealing from water intrusion
- Improves durability due to optimized load distribution
- Optimal mix ratios at 1:1 by volume
- Available in bulk or small packaging

BETAFORCE™ performance -- Shear modulus vs. temperature



Two-component, room-temperature curing BETAFORCE composite bonding adhesives enable light-weighting and dissimilar material bonding. The adhesives are optimized to retain strength and rigidity at elevated temperatures, providing industry leading temperature stability for customer applications.

ABOUT DOW AUTOMOTIVE SYSTEMS

Dow Automotive Systems, a business unit of The Dow Chemical Company, is a leading global provider of collaborative solutions and advanced materials for automotive and commercial transportation original equipment manufacturers, tier suppliers and aftermarket customers. Our materials focus includes structural, elastic and rubber-to-substrate adhesive solutions; polyurethane foams and acoustical management solutions; innovative composite solutions; and films and fluids, with an emphasis on achieving customer and corporate sustainability goals. Offices and application development centers are located around the world to ensure regionalized technical, engineering and commercial support for customers and industry groups. For additional information, visit dowautomotive.com.

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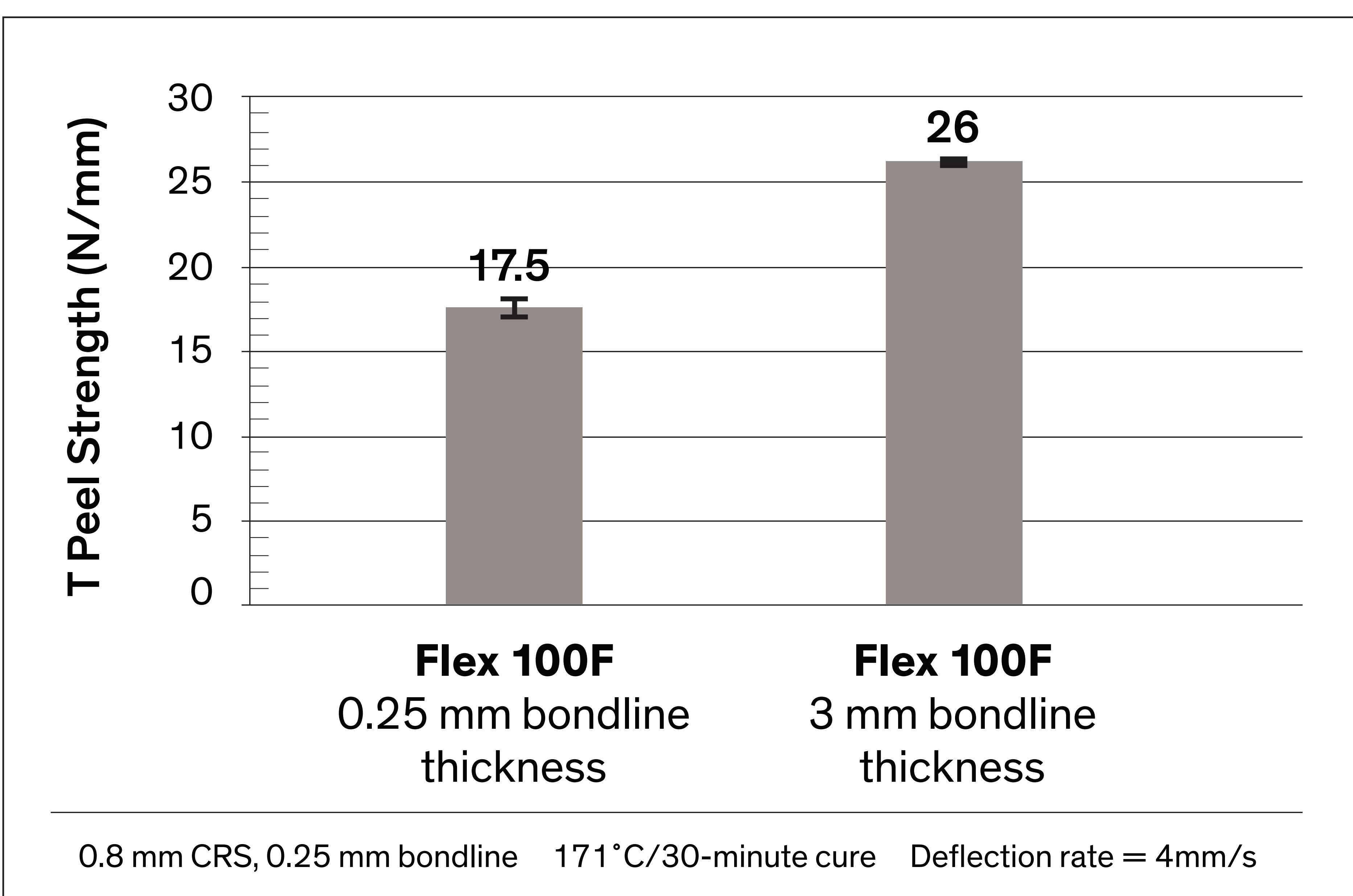
NEW BETAMATE™ FLEX100F STRUCTURAL ADHESIVES JOIN MIXED MATERIALS IN THE BODY SHOP

BETAMATE Flex 100F is a one-component polyurethane adhesive stiffened with epoxy to deliver 200 percent elongation and superior resistance to dynamic and peel forces. Competitive body shop adhesives offer less than 20 percent elongation.

Benefits include:

- High elastic properties after cure
- Robust adhesion to aluminum and steel
- Superb crash durability
- Excellent sealing ability
- Resistance to galvanic corrosion
- Enhances damping performance of bonded components
- Cold applied processing
- No infrastructure changes are required for application

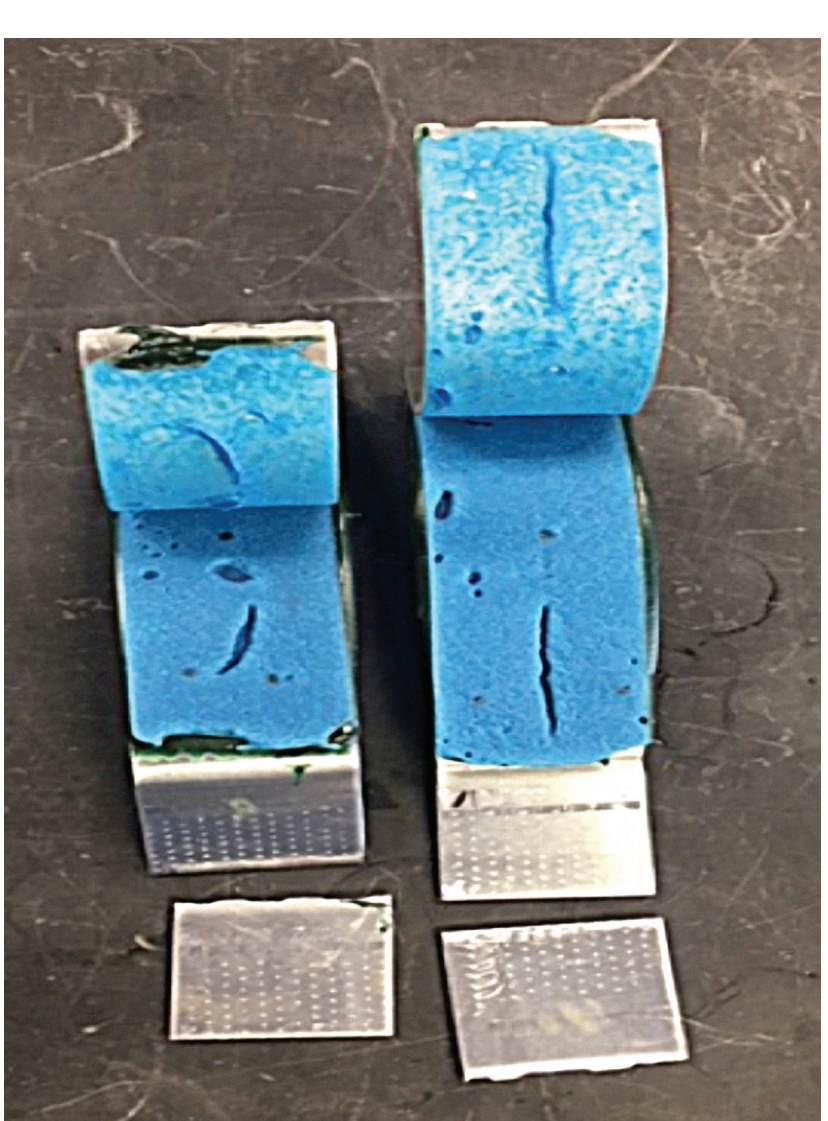
Peel resistance increases with bondline thickness



Typical application areas include:

- Roofs
- Door panels
- Closures
- Body structures
- Components
- Liftgates

Thick bondlines are ideal for improving structural integrity, especially in areas with wide/variable design gaps.



When thick bondlines (greater than 1.25mm) of BETAMATE Flex 100F are used, it is common to observe metal failure prior to complete rupture of the adhesive bond.

2mm aluminum alloy 6111, bake-hardened at 205°C

BETAMATE Flex 100F: Low modulus and high elongation

Tensile strength (MPa)	9±1
Elongation	228%
Storage modulus @ 25°C (MPa)	55
T _g (°C)	30.5



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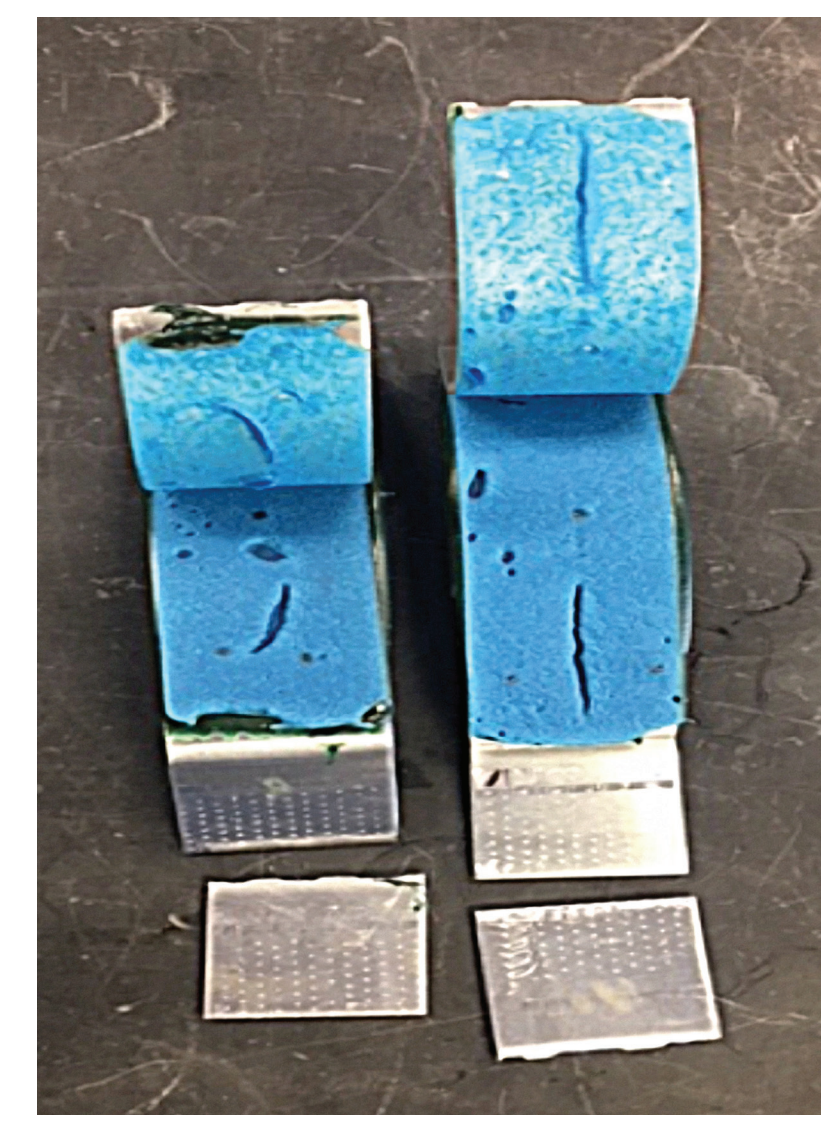
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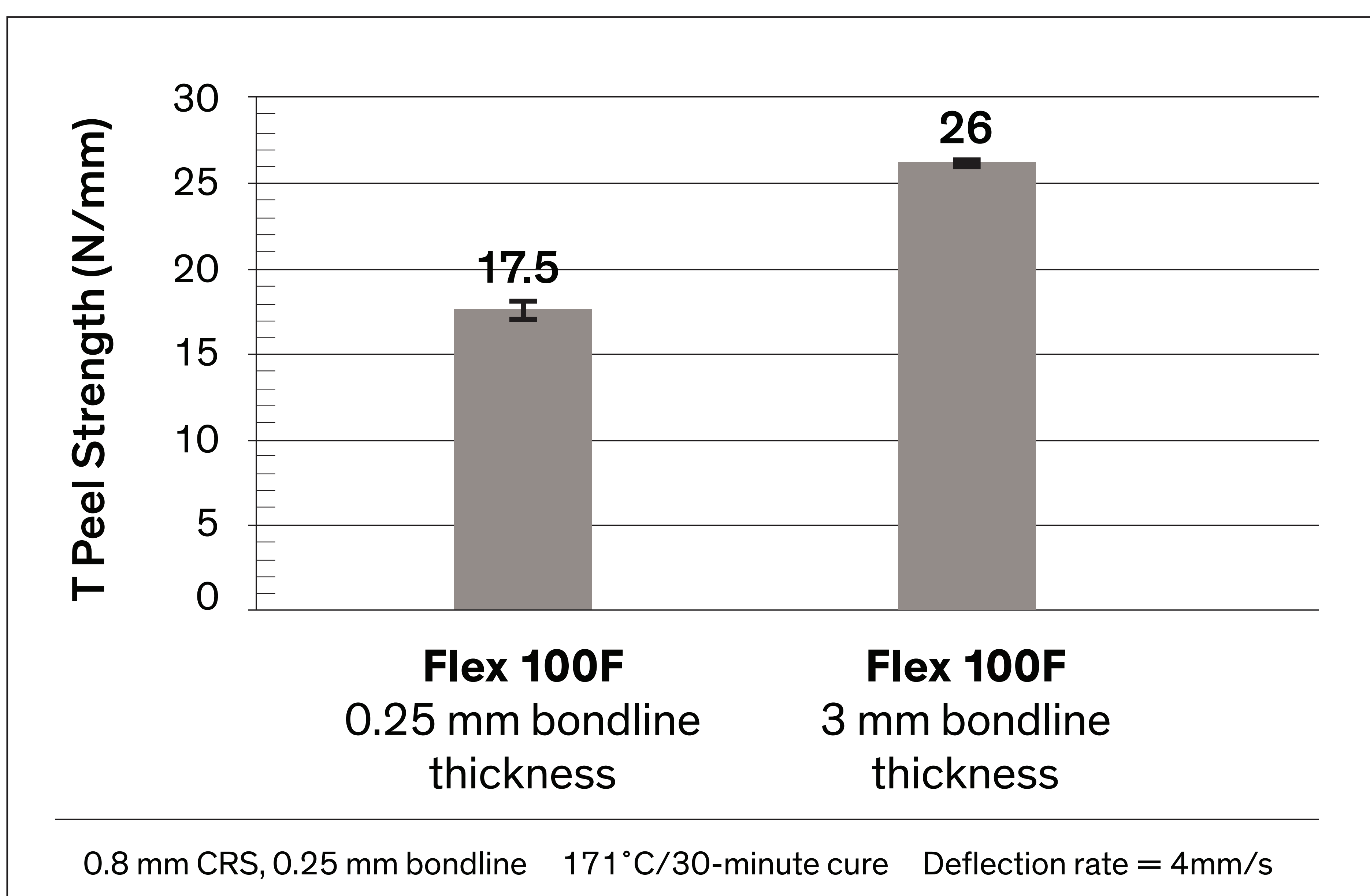
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