## BR® 4535A

BR® 4535A is a single component, 100% solids, aluminum filled, 250 – 300 °F (120 – 150°C) curing epoxy paste adhesive. It has been developed for structural bonding and applications requiring increased adhesive flexibility and impact resistance with structural service performance to 300˚F (150˚C). Moderate temperature cure and good shelf stability give wide application to most manufacturing locations.

### Features and Benefits

- Increased adhesive flexibility and impact resistance
- Service temperatures up to 300˚F (150˚C)
- Moderate temperature cure, 250 – 300˚F (120 - 150˚C)
- Good shelf stability

## CHARACTERISTICS

**Table 1 | Physical Properties**

| Property | Value | Test Method |
|---|---|---|
| Tg, ˚F (˚C) | 298 (148) | ASTM D 7028 |
| Density, lb/in$^3$ (g/cm$^3$) | 0.046 (1.28) | ASTM D 792 |
| Consistency | Pumpable thixotropic paste | |
| Shelf Life | 6 months at or below 40˚F (4˚C) | |
| Shop Life | 30 days at or below 75˚F (24˚C) | |

**Table 2 | Product Availability**

| Property | Description |
|---|---|
| Solids | 100% |
| Base | Modified filled epoxy resin |
| Color | Grey |
| Size | 1 Liter |

## PROPERTIES

**Table 3 | BR® 4535A Mechanical Properties**

| Property | Cure Cycle | Test Temperature | Value | Test Method |
|---|---|---|---|---|
| Lap Shear Strength, psi (MPa) | 250˚F (120˚C) for 30 minutes | -40˚F (-40˚C)<br>77˚F (25˚C)<br>285˚F (140˚C) | 2700 (18.6)<br>3900 (26.9)<br>2700 (18.6) | ASTM D 1002 |
| | 275˚F (135˚C) for 30 minutes | -40˚F (-40˚C)<br>77˚F (25˚C)<br>285˚F (140˚C) | 3500 (24.1)<br>4500 (31.0)<br>3100 (21.4) | |
| | 300˚F (150˚C) for 30 minutes | -40˚F (-40˚C)<br>77˚F (25˚C)<br>285˚F (140˚C) | 4100 (28.3)<br>4500 (31.0)<br>3100 (21.4) | |
| | 250˚F (120˚C) for 60 minutes | -40˚F (-40˚C)<br>77˚F (25˚C)<br>285˚F (140˚C) | 4130 (28.5)<br>4820 (33.2)<br>3740 (25.8) | |
| Impact Strength, in-lb (J) | 275˚F (135˚C) for 30 minutes | -40˚F (-40˚C)<br>77˚F (25˚C)<br>285˚F (140˚C) | 40 (4.5)<br>48 (5.4)<br>60 (6.8) | ASTM D 950 |

Substrate: 0.064 inch 2024-T3 clad aluminum
Surface Preparation: FPL Etch

**Table 4 | BR® 4535A Mechanical Properties: Environmental Conditioning**

| Property | Condition | Value | Test Method |
|---|---|---|---|
| Lap Shear Strength, psi (MPa) | 14 days at 100˚F (38˚C), 100% R.H. | 4390 (30.3) | ASTM D 1002 |
| | 30 days salt spray | 5000 (34.5) | |
| | 30 days oven aging at 160˚F (71˚C) | 4390 (30.3) | |
| | 30 days water immersion at 77˚F (25˚C) | 5960 (41.1) | |
| Impact Strength, in-lb (J) | 14 days water immersion at 130˚F (54˚C) | 48 (5.4) | ASTM D 950 |
| | 30 days at 100˚F (38˚C), 100% R.H. | 50 (5.7) | |
| | 30 days salt spray | 46 (5.2) | |
| | 30 days oven aging at 160˚F (71˚C) | 56 (6.3) | |
| | 30 days water immersion at 77˚F (25˚C) | 52 (5.9) | |

Substrate: 0.064 inch 2024-T3 clad aluminum
Surface Preparation: FPL Etch
Cure Cycle: 30 minutes at 275˚F (135˚C)

**Table 5 | BR® 4535A Mechanical Properties: Long Term Salt Spray**

| Property | Salt Spray Duration | Value | Test Method |
|---|---|---|---|
| Lap Shear Strength, psi (MPa) | Initial | 4760 (32.8) | ASTM D 1002 |
| | 4 months | 5000 (34.5) | |
| | 8 months | 4990 (34.4) | |
| | 12 months | 3800 (26.2) | |
| | 18 months | 4500 (31.0) | |

Substrate: 0.064 inch 2024-T3 clad aluminum
Surface Preparation: FPL Etch
Cure Cycle: 30 minutes at 275˚F (135˚C)

## Stress Strain Evaluation

**Table 6 | BR® 4535A Stress Strain Evaulation**

| Property | Cure Cycle | Value | Test Method |
|---|---|---|---|
| Linear Limit Stress, ksi (MPa) | 250˚F (120˚C) for 30 minutes | 5.0 (34.5) | ASTM D 1002 |
| | 300˚F (150˚C) for 30 minutes | 5.0 (34.5) | |
| Linear Limit Strain | 250˚F (120˚C) for 30 minutes | 0.033 | ASTM D 1002 |
| | 300˚F (150˚C) for 30 minutes | 0.025 | |
| Ultimate Stress, ksi (MPa) | 250˚F (120˚C) for 30 minutes | 8.7 (60.0) | ASTM D 1002 |
| | 300˚F (150˚C) for 30 minutes | 10 (69.0) | |
| Ultimate Strain | 250˚F (120˚C) for 30 minutes | 0.353 | ASTM D 1002 |
| | 300˚F (150˚C) for 30 minutes | 0.635 | |
| Shear modulus, ksi (GPa) | 250˚F (120˚C) for 30 minutes | 151 (1.04) | ASTM D 1002 |
| | 300˚F (150˚C) for 30 minutes | 197 (1.36) | |
| Bulk (Young's Modulus), ksi (GPa) | 300˚F (150˚C) for 30 minutes | 525 (3.62) | ASTM D 1002 |

Substrate: 0.064 inch 2024-T3 clad aluminum
Surface Preparation: FPL Etch
Bond Line: 0.004 inches

The shear stress-strain curves from which shear modulus, shear strain, and shear stress may be obtained are determined from bond deflection plots of thick adherent specimens equipped with sensitive deflection extensometers.

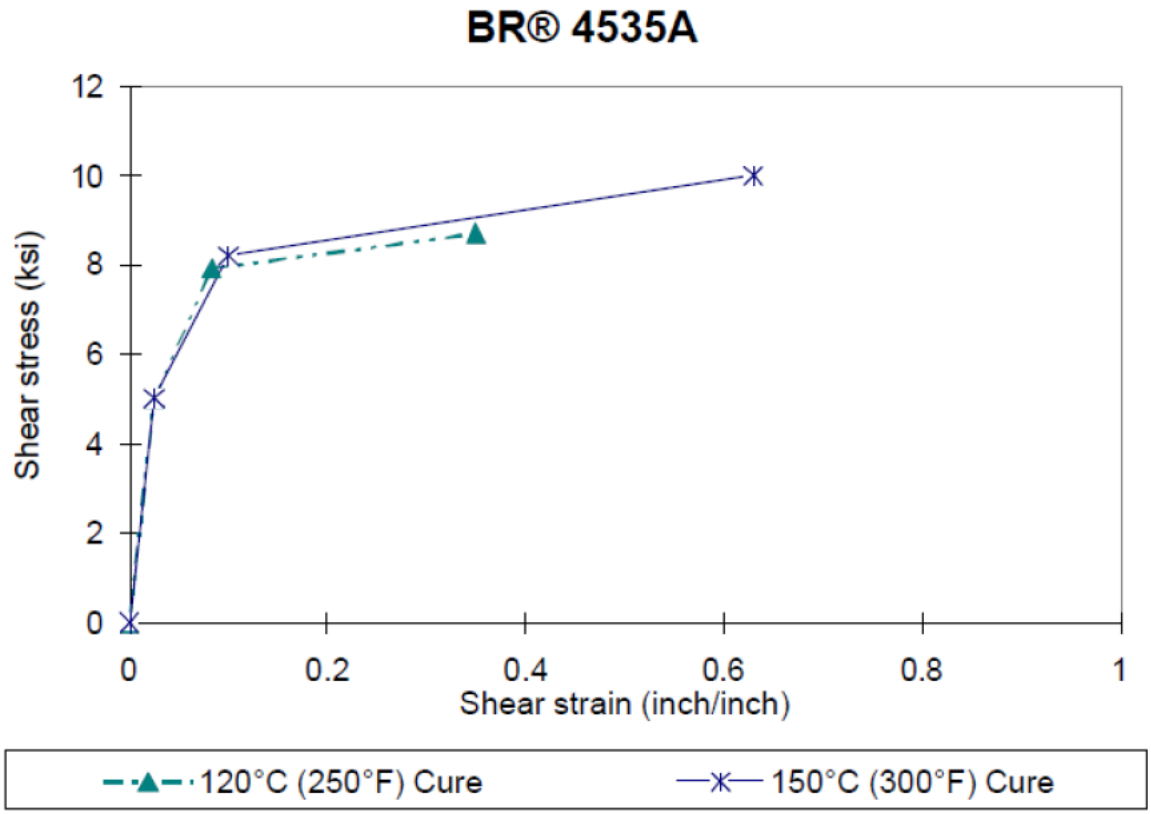


**Figure 1 | Stress-Strain Curve for BR® 4535A Paste Adhesive**

## PROCESSING

### Recommended Cure Cycle

| | |
|---|---|
| Cure Cycle | Apply full vacuum, 24 in Hg (0.081 MPa) minimum.<br>Apply 40 psi (0.28 MPa) pressure, vent vacuum at 20 psi (0.14 MPa).<br>Heat from 75°F (24°C) to 275°F ± 25˚F (135°C ± 14˚C) at 1 – 5°F (0.5 – 3°C)/minute.<br>Hold at 275°F ± 25˚F (135°C ± 14˚C) for 30 – 60 minutes.<br>Cool down under pressure below 140°F (60°C) at 1 – 5°F (0.5 – 3°C)/minute. |

**Note:** There is an exotherm risk from thick glue sections and/or faster heat-up rates.

## Recommended Consumables

The table below provides a list of Solvay's consumable processing materials recommended for use with BR® 4535A.

**Table 7 | Solvay's Processing Materials**

| | |
|---|---|
| Sealant Tape | SM5142BY, SM 5127, SM5126 |
| Release Film* | A6200, A5000 |
| Release Fabric | 200 TFP, 200 TFNP |
| Breather/Bleeder Fabric | RC3000-10, A3000-4 |
| Peel Ply | 60001, 60002, 51789 |
| Bagging Film | HS 8171, SV 3000 |
| Adhesive Tape | Flashtape 1, Flashtape 2 |