

Battery Pack Applications



BODO MÖLLER CHEMIE

Engineer chemistry

- About Bodo Möller Chemie
- Our partners and customers
- Our branches
- Service beyond product
- Product range for emobility
- References
- Products





- More than 40 locations
- 150 direct technical sales staff
- More than 200 indirect sales channels
- Advising and supplying users in 60 countries
- Hubs around the globe



Strong product and service portfolio

Innovative products from leading brands

Bodo Möller Chemie stands for long-term partnerships and bundles the technologies of various brands under one roof.



Family owned
company with
almost **50**
years of history
in chemicals
distribution

Above
201 Mio. €
sales in 2023

Around **80%**
of our sales by our
top 5 brands

Around **29%**
sales in emerging
markets

Customers in
over **60**
countries

340
employees

Automotive – Rail – Aerospace – Electro & Electronics



Applied adhesive technology center

With our Adhesive Competence Center, we offer full service in all matters related to adhesive application technology – from product selection all the way to product validation, process simulation and engineering.

Adhesive Laboratory – Testing of adhesive joints

Engineering Data Management – Determination of construction data

Design Office – Calculation of adhesive bonds

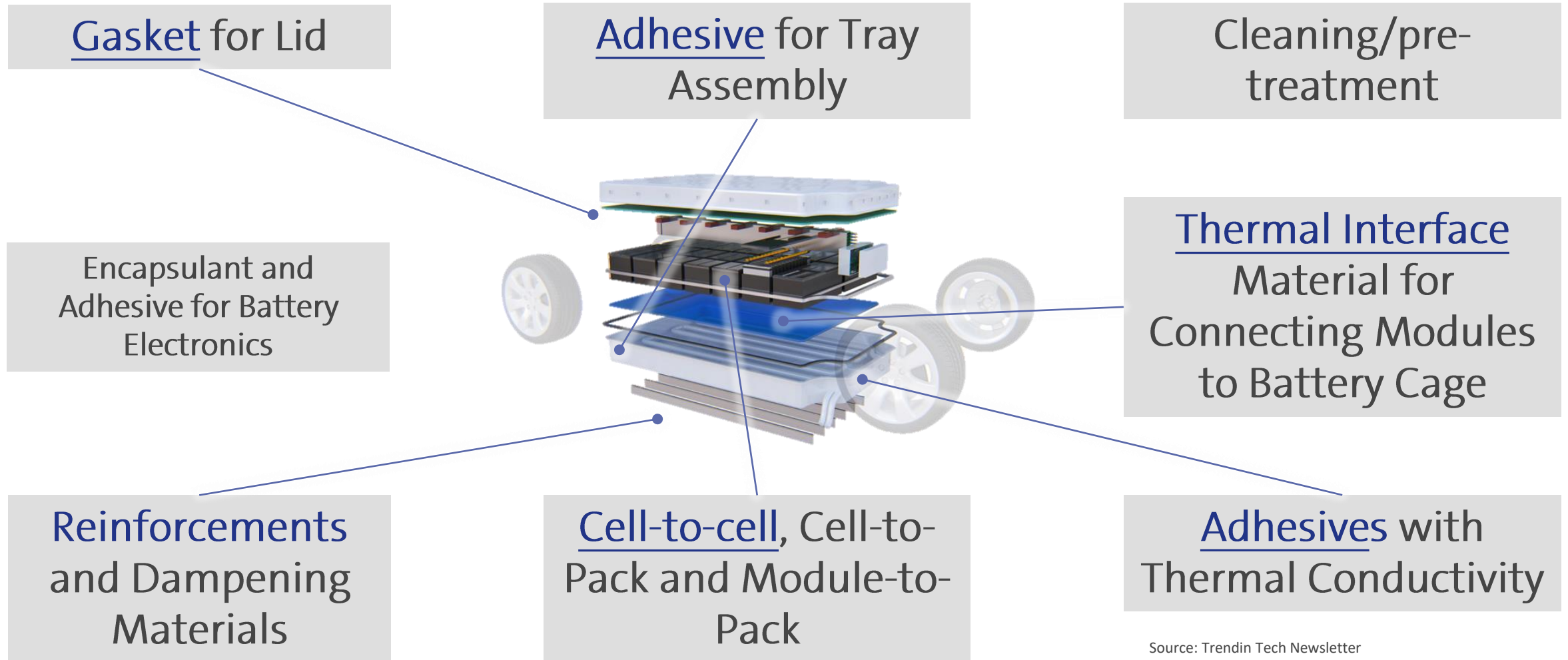
Audit Body – Preparation and implementation of pre-audits

Training Center – Transfer of product and application knowledge

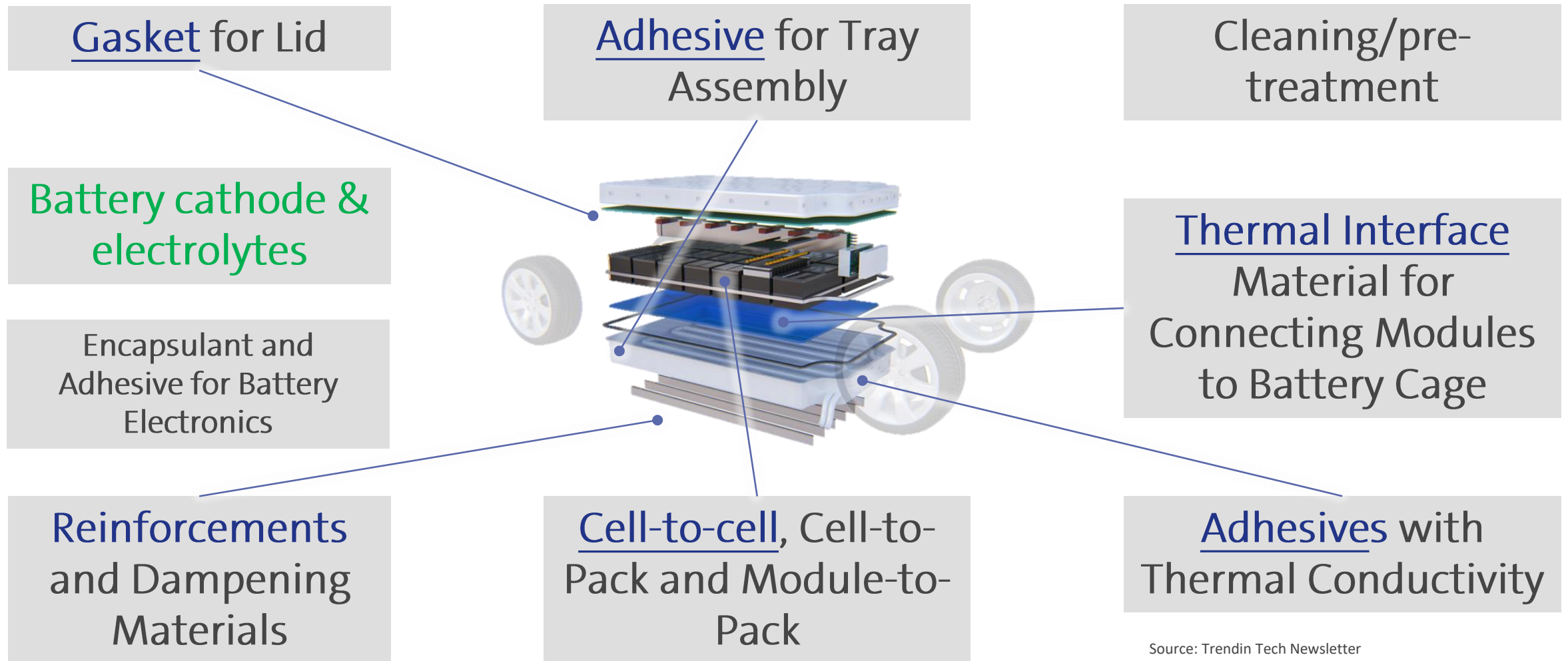


Certifications

DIN 6701-2 bonding railway vehicles and parts
DIN 2304-1 quality requirements on bonding processes
and further ISO, EN and DVS standards



Source: Trendin Tech Newsletter



Source: Trendin Tech Newsletter

Gasket for Lid

Gasket

1 k Polyurethane foam gasket

Butyl

SMP Polyurethane Adhesive/
Sealant

Adhesive

Adhesives for Cage

Structural

1 k Structural Epoxy Adhesives

2 k Structural Epoxy Adhesives

Methyl Methacrylate Adhesives

Polyurethane Adhesives

Sealer for post welding

Sealant

Gap Fillers

Polyurethane Gap Filler

Thermally Conductive Films

**Adhesives for Cell-to-
Pack bonding**

Thermally Conductive PU
Adhesives

**Insulating and
Dampening Materials**

Adhesives for Cell-to-cell, Cell-to-Pack and Module-to-Pack applications

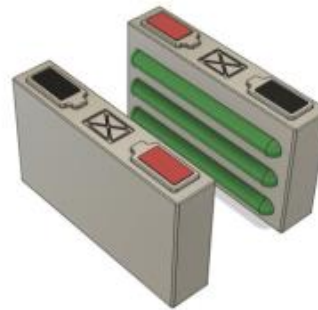
Flexible Structural

2k Thermally Conductive Epoxy
Adhesives under development

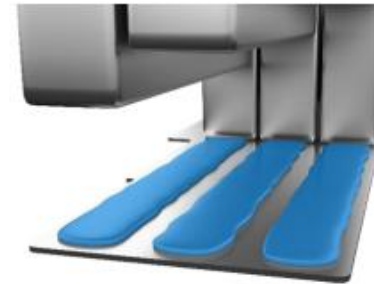
2k Thermally Conductive Polyurethane
Adhesives

Application examples

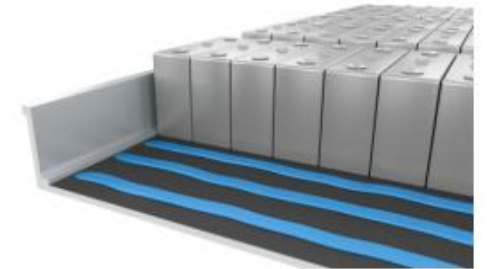
Cell-to-cell



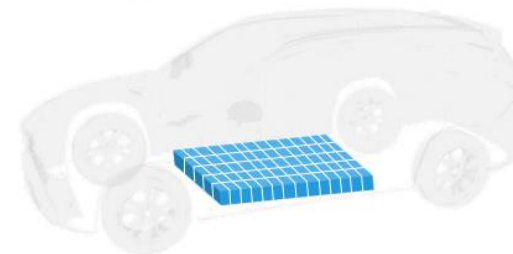
Cell-to-pack



Module-to-pack



Cell-to-Vehicle (CTV)



Repair of cells
planned?

PU foams
accepted/desired?

Foam gasket CIPG
or elastomer FIPG?

How is the quality
of the sealing
measured?



System	Advantage	Disadvantage
Foam gasket	▪ Contract manufacturing possible ▪ Battery is serviceable	▪ Mechanical fixation of lid necessary
Butyl	▪ Proven system ▪ Cost effective solution ▪ Repairable adhesive system	▪ Some Butyl systems need mechanical fixation of lid ▪ Electrical connection between cage and lid needed
SMP Adhesive/Sealant and Polyurethane Adhesive/Sealant	▪ Elimination/reduction of bolts needed to fasten lid ▪ 1k and 2k versions available ▪ Fast curing	▪ Needs to be cut open in case of repair ▪ Electrical connection between cage and lid needed

2 c silicone foam gasket

Deliverable

Foam gasket to seal lid of battery cage, lid will be mechanically fixed

Key Product Features

2 component heat cure closed cell foam

Excellent adhesion on aluminum and steel

Chemically foamed, density and hardness can be adjusted

Temperature resistance up to 200 °C and flame retardant

Isocyanate-free, solvent-free

Process

Cleaning of substrates

Robotic application



Technical Info Pactan 9005 - TDS

2 c silicone foam gasket

Deliverable

Foam gasket to seal lid of battery cage, lid will be mechanically fixed

Key Product Features

2 component heat cure closed cell foam

Excellent adhesion on aluminum and steel

Chemically foamed, density and hardness can be adjusted

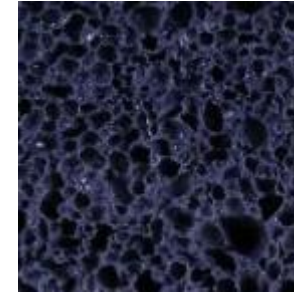
Temperature resistance up to 200 °C and flame retardant

Isocyanate-free, solvent-free

Process

Cleaning of substrates

Robotic application



TDS RT Foam 3244 EN.pdf

1 c Polyurethane foam gasket

Deliverable

Foam gasket to seal lid of battery cage, lid will be mechanically fixed

Key Product Features

One component heat cure closed cell foam

Excellent adhesion on aluminum and steel

Mechanically foamed, density and hardness can be adjusted

Process

Cleaning of substrates

Robotic application



1 k Butyl Elastomer Tape

Deliverable

Gasket to seal lid of battery cage, lid will be mechanically fixed

Key Product Features

Wide range of adhesion, excellent durability

Proven, cost effective product

Electrically insulating

Process

Can be used as tape or dispensed via pumps



Hybrid Adhesive/Sealant

Deliverable

Adhesive/Sealant to bond and seal lid of battery cage
Eliminate or reduce the number of bolts to fasten the lid

Key Product Features

Silane modified polyurethane adhesive/sealant,
wide range of adhesion
One component RT cure, cure can be accelerated

Process

Cleaning of substrates
Manual or robotic application
Cut and re-seal in case of repair



TDS A-J Adhesives

Hybrid Polyurethane Adhesive/Sealant

Deliverable

Adhesive to seal lid of battery cage

Reduce the number of bolts to fasten the lid

Key Product Features

Shore A 20, 600 % elongation

1K MS-hybrid polymer adhesive, approved by Mercedes-Benz

Process

Cleaning of substrates

Manual or robotic application

Cut and re-seal in case of repair

Technisches Datenblatt



BETALINK™ 32 Weiss

Kurzbeschreibung

1-komponentige, lufttrocknendhärtende MS Hybrid Versiegelung auf Polymer-Basis, mit dauerhafter Elastizität und guter Haftung auf verschiedenen Substraten ohne Anwendung von Primer. Das Material eignet sich für verschiedene Innen- / Aussendichtungsanwendungen, ist geruchsneutral und hat eine mittlere Festigkeit.

Eigenschaften

- Gute UV-Beständigkeit
- Lösungsmittel- und Isocyanat frei
- Geringe Volumenveränderung

Sollten nicht anders angegeben, werden die Produkte bei 23°C/50% relativer Luftfeuchtigkeit gemessen.

Allgemeine Informationen			
Bezeichnung	MS Hybrid Polymer		
Farbe	Weiss		
Andere Eigenschaften	Wert	Einheit	Norm
Dichte	1.34 ±0.02	g/cm³	
Verarbeitungs- und Materialtemperatur	+5 bis +40	°C	
Hautbildungszeit	25±5	Min.	
Durchhärtungsgeschwindigkeit nach 24 Std.	2.5±0.5	mm	
Volumenveränderung	<3	%	DIN 52451-1
Rheologische Eigenschaften	Wert	Einheit	Norm
Extrusions Viskosität bei 23°C / 2.9 mm Düse / 5.5 bar	250 - 400	g/15s	Ballan
Mechanische Eigenschaften	Wert	Einheit	Norm
Zugfestigkeit	1.1±0.2	MPa	DIN 53504
Bruchdehnung	Ca. 600	%	DIN 53504
Zugfestigkeit bei 100% Dehnung	<0.4	MPa	DIN 53504
Zugscherfestigkeit nach 7 Tagen	1.2	MPa	DIN EN 1465
Shore A Härte	21±2		DIN 53505
Temperaturbeständigkeit	Wert	Einheit	
Temperaturbeständigkeit	-40 bis +90	°C	

Subject to change; last revision: 2021-04-06

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TDS Betalink 32
Weiss

Structural bond
needed?

Material pairings?

Heat cure
possible?

Additional sealing
needed?



Summary Adhesives for Battery Box Assembly

System	Advantage	Disadvantage
1 k Structural Epoxy Adhesives	▪ Crash durable and OEM approved ▪ Tolerate oily surfaces ▪ Thin bond line ▪ No priming needed	▪ Low elongation at break ▪ For similar materials only ▪ Heat cure
2 k Structural Epoxy Adhesives	▪ Proven crash relevance ▪ Very high strength ▪ Room temperature cure ▪ Thin bond line ▪ No priming needed	▪ For similar materials only ▪ Low elongation at break
Methyl Methacrylate Adhesives	▪ No priming needed on most substrates ▪ High elongation products available ▪ Quick RT cure	▪ Slight odor
Polyurethane Adhesives	▪ Semi structural bond ▪ Excellent adhesion on laser treated aluminum ▪ Higher elongation than epoxies	▪ Limited crash relevance
Seam Sealer for post welding	▪ Seals battery cage after welding	

2 k Structural Epoxy Adhesives

Deliverable

Structural bond- crash durable, OEM approved, room temperature cure

Key Product Features

Improved mechanics, hybrid joining technologies possible

Crash energy dispersion

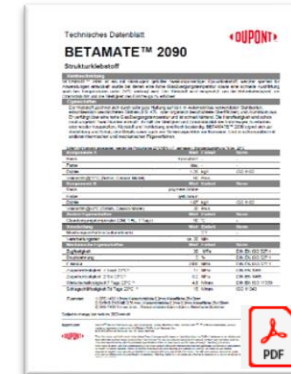
Robust, environmentally stable adhesion to many substrates

Process

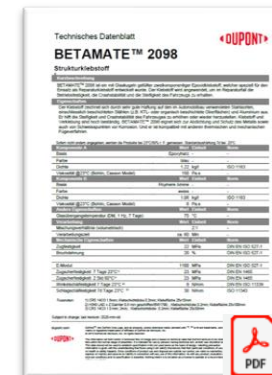
Cleaning of substrates

Manual or robotic application

RT cure, fast fixation capability due to long open time and fast ambient full cure. Heat acceleration possible



TDS Betamate
2096



Two Component Epoxy Paste Adhesive

Deliverable

Ideal for structural bonding GFRP, SMC and dissimilar substrates, RT cure

Key Product Features

Toughened paste

Gap filling, non-sagging up to 10 mm thickness

Good chemical resistances

Process

Cleaning of substrates

Robotic or manual application, room temperature cure

HUNTSMAN
Enriching lives through innovation

Advanced Materials

Araldite® 2015-1

Structural Adhesives

TECHNICAL DATASHEET

Araldite® 2015-1

Two component epoxy paste adhesive

Key properties

- Toughened paste
- Ideal for bonding GRP, SMC and dissimilar substrates
- Gap filling, non-sagging up to 10mm thickness
- Good resistance to weathering

Description

Araldite® 2015-1 is a two component, room temperature curing paste adhesive giving a resilient bond. It is thixotropic and non-sagging up to 10mm thickness. It is particularly suitable for SMC and GFRP bonding.

Product data

Property	Araldite® 2015-1 Resin	Araldite® 2015-1 Hardener	Mixed Adhesive
Colour - visual (A1 I2)*	beige paste	beige paste	beige paste
Specific gravity	1.4	1.4	1.4
Viscosity at 25°C (Pa.s)	thixotropic	thixotropic	thixotropic
Lap shear strength at 25°C (AS01)*	-	-	> 15 MPa
Pot Life (100 g at 25°C)	-	-	45 - 55 minutes

* Specified data are on a regular basis analysed. Data which is described in this document as 'typical' is not analysed on a regular basis and is given for information purposes only. Data values are not guaranteed or warranted unless it specifically mentioned.

Processing

Pre-treatment

The strength and durability of a bonded joint are dependent on proper treatment of the surfaces to be bonded. At the very least, joint surfaces should be cleaned with a good degreasing agent such as acetone, iso-propanol (for plastics) or other proprietary degreasing agents in order to remove all traces of oil, grease and dirt. Low grade alcohol, gasoline (petrol) or paint thinners should never be used. The strongest and most durable joints are obtained by either mechanically abrading or chemically etching ('pickling') the degreased surfaces. Abrading should be followed by a second degreasing treatment.

Mix ratio	Parts by weight	Parts by volume
Araldite® 2015-1 Resin	100	100
Araldite® 2015-1 Hardener	100	100

Araldite® 2015-1 is available in cartridges incorporating mixers and can be applied as ready to use adhesive with the aid of the tool recommended by Huntsman Advanced Materials.

July 2018

Araldite® 2015-1

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 PDF

TDS Araldite
2015-1

Low Odor Methyl Methacrylate Adhesives

Deliverable

Structural Adhesive, room temperature cure

Key Product Features

Medium or fast curing at room temperature

High green strength

Multimaterial bonding possible

Superior gap filling, high elongation

Process

2 component RT cure

Manual or robotic application

L&L Bond		PROVISIONAL Technical Data Sheet
A-K321		
Two-component, fast curing, low odour and toughened structural adhesive with high elongation		
Based on methyl methacrylate and provides primer-less adhesion to most metals, thermoplastics, composites and other substrates common to the commercial vehicle industry*.		
It is dedicated for bonding applications where high peel strength is desired. The ratio between working time and fixture time is optimized versus other methyl methacrylate systems to minimize cycle times.		
A-K321 does not boil at higher bonding gaps and therefore is an ideal solution for repair or backfill of large composite structures. Due to its low odour, this product can be accepted in metal working workshops and other places where the typical distinctive MMA odour is restricted.		
Available in 50 ml 6490 ml cartridges, 20 L [5 GAL.] pails and 200 L [50 GAL.] drums.		
Technical Data		
TYPICAL PROPERTIES		
	A-K321	Test Method
Physical Properties	Appearance	A-K321 Adhesive: off White A-K322 Activator: off white / Black Mixed product: Tan / Black
	Mix Ratio	10:1 (by vol)
	Open Time ²	4-6min
	Fixture Time ³	8-11min
	Viscosity - A-K321 Adhesive - Brookfield - 23°C-spindle 7-20rpm (cps)	100 000 - 200 000
	Viscosity - A-K322 Activator - Brookfield - 23°C-spindle 7-10rpm (cps)	To be defined
	Density - A-K321 Adhesive (g/cc)	0.97 - 1.01
	Density - A-K322 Activator (g/cc)	1.3 - 1.4

TDS A-K 321

L&L Bond		PROVISIONAL Technical Data Sheet
A-K322		
Two-component, low odour, toughened structural adhesive		
Based on methyl methacrylate and provides primer-less adhesion to most metals, thermoplastics, composites and other substrates common to the commercial vehicle industry*.		
This product is dedicated for bonding applications where high peel strength is desired. The ratio between working time and fixture time is optimized versus other methyl methacrylate systems to minimize cycle times.		
Due to its low odour, this product can be accepted in metal working workshops and other places where the typical distinctive MMA odour is restricted.		
Available in 490 ml cartridges, 20 L [5 GAL.] pails and 200 L [50 GAL.] drums.		
Technical Data		
TYPICAL PROPERTIES		
	XP-A-K322	Test Method
Physical Properties	Appearance	Part A: off White Part B: off White Mixed product: Brown
	Mix Ratio	10:1 (by vol (wt.))
	Open Time ²	14 - 17min
	Fixture Time ³	25-30min
	Viscosity part A-Brookfield - 25°C-spindle 7-20rpm (cps)	100 000 - 200 000
	Viscosity part B-Brookfield - 25°C-spindle 7-10rpm (cps)	To be defined
	Density part A (g/cc)	0.99-1
	Density part B (g/cc)	1.3-1.4

TDS A-K 322

Deliverable

Key Product Features

8 MPa tensile strength, 120 % elongation

RT latent technology

Robust adhesion after ageing

Process

Cleaning of substrates

Robotic or manual application

35 minutes handling time

Technisches Datenblatt

BETAFORM™ 2817BM

Kurzbeschreibung

2-Komponenten Polyurethanbleibstoff mit mittlerem Modul, speziell entwickelt für die Verklebung auf blankem Aluminium, entsprechend vorhanden.

Eigenschaften

- Gute Haftung auf Kunststoffen, Verbundwerkstoffen und lackierten Oberflächen
- Gute Haftung auf Aluminium nach geeigneter Oberflächenbehandlung in Abhängigkeit der Legierungsbeschichteten Oberflächen
- Optimiert für beschleunigten Haftaufbau durch Erwärmung mit IR Strahlung
- Hohe mechanische Festigkeiten und hohe Bruchdehnung
- Glasübergangstemperatur ausserhalb Anwendungsbereichs

Sofort nicht anders angeben, werden die Produkte bei 23°C±50% relativer Luftfeuchtigkeit gemessen

Komponente A	Wert	Einheit	Norm
Basis	Isocyanat (Härter)		BETAFORM™ 281ES ISOQ
Farbe	Schwarz	-	-
Dichte	1.16±0.03	g/cm³	-
Extrusion Viskosität / 2mm Düse / 4 bar	22 - 37	g/min	Ballen

Komponente B	Wert	Einheit	Norm
Basis	Polyol (Harz)		BETAFORM™ 2817BM POLC
Farbe	Schwarz	-	-
Dichte	1.39±0.03	g/cm³	-
Extrusion Viskosität / 2mm Düse / 4 bar	20 - 35	g/min	Ballen

Anderes Eigenschaften	Wert	Einheit	Norm
Glasübergangstemperatur	-41	°C	-
Mischverhältnis (Volumetrisch A+B)	1:1 +/- 0.05	-	-
Verarbeitungstemperatur	18 - 28	°C	-
Max. Verarbeitungszeit, Fügetext ¹)	15 - 20	min	²)

Mechanische Eigenschaften	Wert	Einheit	Norm
Zugfestigkeit	7.5	MPa	DIN EN ISO 527-2
Bruchdehnung	120	%	DIN EN ISO 527-2
E-Modul	13	MPa	DIN EN 527-2
Zugscherfestigkeit nach 7 Tagen ³)	7	MPa	DIN EN 1465

Anmerkung:

- 1) Es gilt zu beachten, dass die Temperatur einen entscheidenden Einfluss auf die Reaktivität / Verarbeitungszeit des Bleibstoffs hat. Die Verarbeitungsdauer muss je nach Prozess und Bedingungen evaluiert werden.
- 2) Geprüft bei 23°C an einem ca. 30 – 50 mm langen Bleibstoffspraye, 10 mm breit ca. 0,5 g/mm.
- 3) Probehöhe: 1,5 mm; Klobefähigkeit: 15kN/25mm; auf RTL, bei handelsüblichen Stahl 1,3 mm.

Subject to change, last revision: 2020-07-14

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**TDS Betaforce
2817BM**

Semi Structural Adhesive

Deliverable

Alternative to welding, medium modulus, short to long open time
Excellent adhesion to plastics, composites and coated and metals

Key Product Features

18 MPa tensile strength, 80 % elongation
Robust adhesion after ageing

Process

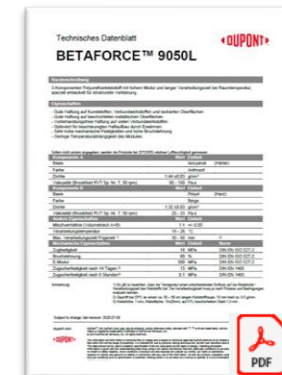
Cleaning of substrates
Manual or robotic application (can be accelerated by heat)
5 to 30 minutes working time (depending on version)



TDS Betaforce
9050 S



TDS Betaforce
9050 M



TDS Betaforce
9050 L

Structural Adhesive

Deliverable

Alternative to welding, high modulus, short open time

Excellent adhesion to laser treated aluminum, Ti-/Zr passivated aluminum

Key Product Features

18 MPa tensile strength, 50 % elongation

RT latent technology

Robust adhesion after ageing

Process

Cleaning of substrates

Robotic or manual application

30 minutes handling time: > 1 MPa

provisorische Technisches Datenblatt



BETAFORCE™ 9060S

Kurzbeschreibung
2-Komponenten Polyurethanklebstoff mit hohem Modul und schneller Aushärtung bei Raumtemperatur welcher speziell für strukturelle Verklebungen und verbesserter Haftung auf laserbehandeltem Aluminium entwickelt wurde.

Eigenschaften
- Gute Haftung auf beschichteten und lackierten Metalloberflächen
- Gute Haftung auf Aluminium mit Titan/Zirkon- oder Laseroberflächenbehandlung in Abhängigkeit der Legierung
- Schneller Festigkeitsaufbau bei Raumtemperatur
- Beschleunigter Festigkeitsaufbau bei erhöhten Temperaturen
- Sehr hohe mechanische Festigkeit und hohe Bruchdehnung
- Geringe Temperaturabhängigkeit des Moduls
- Glasübergangstemperatur ausserhalb Anwendungsbereich

Siehe nicht anders ansetzen, werden die Produkte bei 23°C/50% relativer Luftfeuchtigkeit gemessen.

Komponente A	Wert	Einheit	Norm
Basis	Isocyanat (Härter)		BETAFORCE™ 9060S ISO
Farbe	Schwarz		-
Dichte	1.31	g/cm³	
Viskosität Bolin 23°C	10	Pa.s	Casson
Komponente B	Wert	Einheit	Norm
Basis	Polyol (Harz)		BETAFORCE™ 9060S POLYC
Farbe	Beige		-
Dichte	1.30	g/cm³	
Viskosität Bolin 23°C	6	Pa.s	Casson
Andere Eigenschaften	Wert	Einheit	Norm
Mischverhältnis (Volumetrisch A+B)	1:1	+/- 0.05	-
Verarbeitungstemperatur	18 - 28	°C	
Offenzeit, Rundraupe 6-8mm	5-8	min	-
Mechanische Eigenschaften	Wert	Einheit	Norm
Zugfestigkeit	> 18	MPa	DIN EN ISO 527-2
Bruchdehnung	> 50	%	DIN EN ISO 527-2
E-Modul	> 400	MPa	DIN EN ISO 527-2
Zugscherfestigkeit* nach 7 Tagen	> 15	MPa	DIN EN 1465
Zugscherfestigkeit* nach 30 Min	> 1.0	MPa	DIN EN 1465
Glasübergangstemperatur	Wert	Einheit	Norm
Glasübergangstemperatur	> 70	°C	ISO 011357-1/2

Anmerkung: Es gilt zu beachten, dass die Temperatur einen entscheidenden Einfluss auf die Offenzeit hat.
Klebstoffhöhe: 1 mm; Klebefläche: 15x25mm; 1.3 mm Stahl KTL beschichtet.

Subject to change, last revision: 2021-11-16

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BETAFORCE
9060S

Semi Structural Adhesive?

Deliverable

Multi material bonding, medium modulus, short open time, quick cure

Key Product Features

7 MPa tensile strength, 250 % elongation

excellent sag and bead stability

Process

Cleaning, surface treatment depending on substrate (primerless on paint)

Robotic application

About 20 minutes working time (depending on mixing ratio)

Cut and re-seal in case of repair

Technical Datasheet				
BETAMATE™ 7170-1F + ACCEL 2				
Short Description				
One component, environmental moisture curing, solvent adhesive with excellent sag and bead stability based on polyurethane chemistry. Skin formation and curing is dependent on humidity, temperature and application dimensions. BETAMATE™ ACCEL 2 is a water-based accelerator paste.				
Characteristic				
High viscosity, high modulus, low conductive glass bonding adhesive can be used primerless on paint and glass. It should be combined with a clear activator developed for Uniswape Adhesives (BETAWIPE™ 6600T or BETAWIPE™ Hydro 2) on ceramic coated glass.				
Unless specified otherwise test are conducted at 23°C/50% relative humidity.				
Component A	Value	Unit	Standard	
Base	Polyurethane prepolymers			
Colour	Black			
Density	1.25	g/cm³		
Processing temperature	50 - 60	°C		
Extrusion Viscosity at 55°C / 2mm nozzle / 4bar	12 - 18	g/min	Ballan	
Component B	Value	Unit	Standard	
Base	Polyol compound			
Colour	White			
Density	1.60	g/cm³		
Processing temperature	23.0	°C		
Extrusion Viscosity at 23°C / 2mm nozzle / 4bar	5 - 12	g/min	Ballan	
Other Properties	Value	Unit	Standard	
Mixing Ratio	BM 7170-1F: 97 - 99	%		
	SM ACCEL 2: 1 - 3	%		
Solid contents	>98	%		
Working time with 3% BM™ACCEL 2	Max 20	min		
Sagging on vertical wall tilting	Max 30	°		
Mechanical Properties	Value	Unit	Standard	
Tensile Strength at break	7	MPa	DIN 53504	
Tensile Elongation at break	>250	%	DIN 53504	
Lab shear strength after 2 hours	Min 2.0	MPa	DIN EN 1465	
G-Modulus	2.0 - 2.6	MPa	DIN EN 14869-2	
Hardness Shore A	60 - 70		DIN 53505	
Subject to change; last revision: 2020-11-10				Page 1 of 2
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TDS Betamate
7170-1F + Accel 2

Hybrid Polyurethane Adhesive/Sealant

Deliverable

Adhesive to seal lid of battery cage

Reduce the number of bolts to fasten the lid

Key Product Features

Shore A 20, 600 % elongation

1K MS-hybrid polymer adhesive, approved by Mercedes-Benz

Process

Cleaning of substrates

Manual or robotic application

Cut and re-seal in case of repair

Technisches Datenblatt



BETALINK™ 32 Weiss

Kurzbeschreibung

1-komponentige, luftfeuchtigkeitshärtende MS Hybrid Versiegelung auf Polymer-Basis, mit dauerhafter Elastizität und guter Haftung auf verschiedenen Substraten ohne Anwendung von Primer. Das Material eignet sich für verschiedene Innen- / Aussendichtungsanwendungen, ist geruchsneutral und hat eine mittlere Festigkeit.

Eigenschaften

- Gute UV-Beständigkeit
- Lösungsmittel- und Isocyanat frei
- Geringe Volumenveränderung

Soweit nicht anders angegeben, werden die Produkte bei 23°C/50% relativer Luftfeuchtigkeit gemessen.

Allgemeine Informationen			
Basis	MS Hybrid Polymer		
Farbe	Weiss		
Andere Eigenschaften	Wert	Einheit	Norm
Dichte	1.34 ±0.02	g/cm³	
Verarbeitungs- und Materialtemperatur	+5 bis +40	°C	
Hautbildungszeit	25±5	Min	
Durchhärtegeschwindigkeit nach 24 Std.	2.5±0.5	mm	
Volumenveränderung	<3	%	DIN 52451-1
Rheologische Eigenschaften	Wert	Einheit	Norm
Extrusions Viskosität bei 23°C / 2.9 mm Düse / 5.5 bar	250 - 400	gr/15s	Ballan
Mechanische Eigenschaften	Wert	Einheit	Norm
Zugfestigkeit	1.1±0.2	MPa	DIN 53504
Bruchdehnung	Ca. 600	%	DIN 53504
Zugfestigkeit bei 100% Dehnung	<0.4	MPa	DIN 53504
Zugscherfestigkeit nach 7 Tagen	1.2	MPa	DIN EN 1465
Shore A Härte	21±2		DIN 53505
Temperaturbeständigkeit	Wert	Einheit	
Temperaturbeständigkeit	-40 bis +90	°C	

*Subject to change, last revision: 2021-04-08

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TDS Betalink 32
Weiss

Hybrid Polyurethane Adhesive/Sealant

Deliverable

Adhesive to seal lid of battery cage, short open time, quick cure
Eliminate or reduce the number of bolts to fasten the lid

Key Product Features

Shore A 50, 150 % elongation
2K MS-hybrid polymer adhesive

Process

Cleaning, surface treatment depending on substrate
Manual or robotic application
Cut and re-seal in case of repair

Technical Datasheet



BETALINK™ 36

Provisional

Short Description

2-component, permanently elastic STP based adhesive with a very fast strength build-up and very good adhesion properties on a large variety of substrates. Thanks to fast cross-linking it is possible to bond parts in a continuous working process.

Characteristic

- Fast strength build-up, handling strength achieved after 30 minutes
- Compatible with paints
- Corrosion protecting
- Solvents, isocyanates and silicones free
- Odorless
- Non-corrosive on surfaces
- Impact and vibration resistant (shock absorbing)
- Very good sealing properties

Unless specified otherwise test are conducted at 23°C/50% relative humidity.

General Properties

Basic	2-component Silane modified Polymers			
Colour	Light Grey			
Other Properties				
Mixing Ratio (volumetric)	Value	Unit	Standard	
	1:1			
Density Component A	1.35 ±0.05	g/cm³		
Density Component B	1.40 ±0.05	g/cm³		
Processing temperature	+5 - +40	°C		
Working time	Max. 4	min		
Volume change	± 8	%	DIN 52451-1	
Rheological Properties				
Viscosity	Value	Unit	Standard	
at 23°C / 10 1/s	Comp. A: 100 Comp. B: 60	Pa.s		
Mechanical Properties				
Tensile strength	Approx. 3.0	MPa	DIN 53504	
Elongation at break	Approx. 150	%	DIN 53504	
Modulus elongation at 100%	Approx. 2.0	MPa	DIN 53504	
Lap shear strength after 7 days	Approx. 2.0	MPa	DIN EN 14665	
Hardness Shore A	50±5		DIN 53505	
Thermal Properties				
Temperature stability	-40 to +90	°C		

• Subject to change, last revision: 2021-04-22

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TDS Betalink 36

What heat
conductivity
needed?

Tolerances of
battery cage
bottom?

Liquid 1k or 2 k,
Pads?

Desired processing
speed?



Semi structural
bond needed?

Material pairings?

Heat cure
possible?

What heat
conductivity
needed?



System	Advantage	Disadvantage
Polyurethane Gap Filler	▪ Low abrasion of filler system ▪ Silicone free ▪ Low press in force ▪ Modules can be removed	▪ Not economic for low volumes
Thermally Conductive Films	▪ Proven in electrical/electronics ▪ Modules can be easily removed ▪ Customized die cut parts	▪ High volume automated assembly difficult
Thermally Conductive PU Adhesives	▪ Adhesive system ▪ Low abrasion of filler system ▪ Silicone free	▪ No removal of modules possible

Polyurethane Gap Filler

Deliverable

Provide thermally conductive system between module and heat sink.

Modules removable

Key Product Features

Thermal conductivity 2.0 W/mK

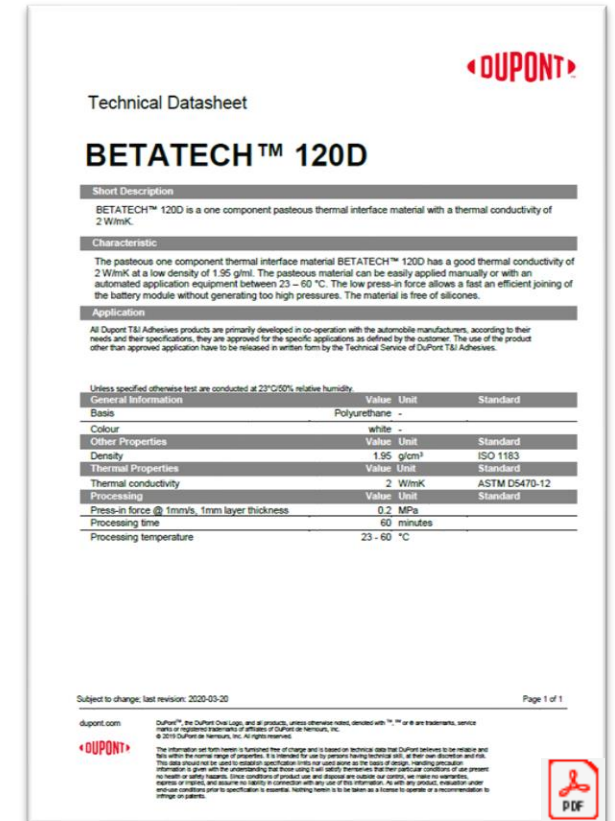
1 Component polyurethane system, non sag, low press-in force, UL94V0

Low abrasion fillers, > 10 kV dielectric strength according to ASTM 149, 1×10^{12} Ohmcm

Process

1 component system

Manual or robotic application



TDS Betatech
120D

Polyurethane Gap Filler

Deliverable

Provide thermally conductive system between module and heat sink.

Modules removable

Key Product Features

Thermal conductivity 2.0 W/mK

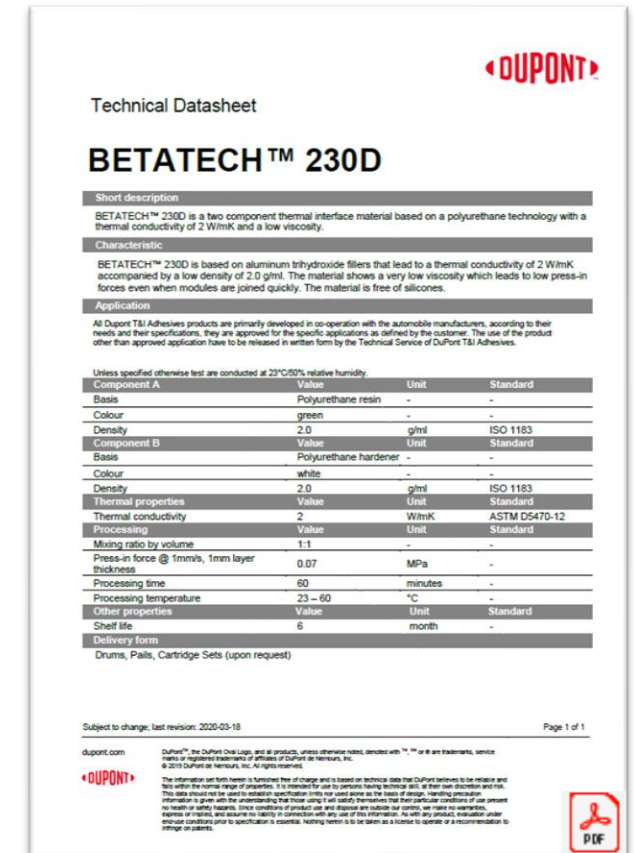
2 Component polyurethane system, non sag, low press-in force, UL94V0

Low abrasion fillers, > 10 kV dielectric strength according to ASTM 149, 1×10^{12} Ohmcm

Process

2 component system

Robotic application



TDS Betatech
230D

Deliverable

Modules removable

Key Product Features

Thermal conductivity 3 W/mK

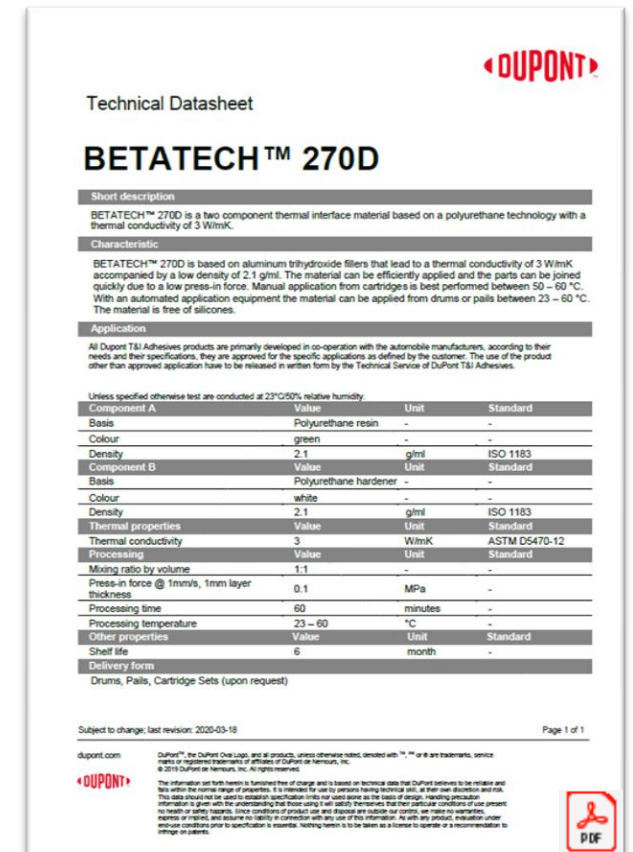
2 Component polyurethane system, non sag, low press-in force, UL94V0

Low abrasion fillers, > 10 kV dielectric strength according to ASTM 149, 1×10^{12} Ohmcm

Process

2 component system

Robotic application



TDS Betatech
270D

Gap Pads

Deliverable

Provide thermally conductive material between module and heat sink when modules need to be removed

Key Product Features

Thermal conductivity up to 7 W/mK

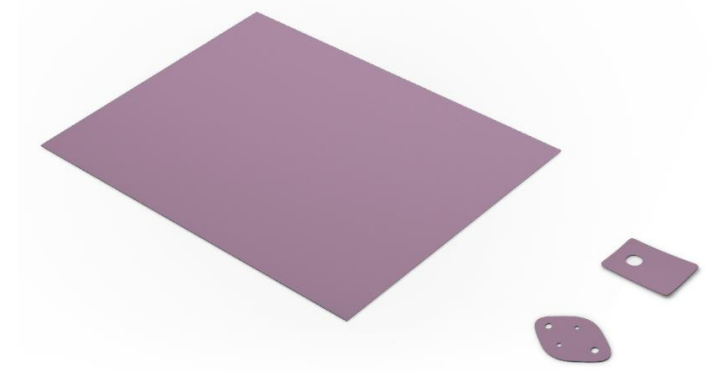
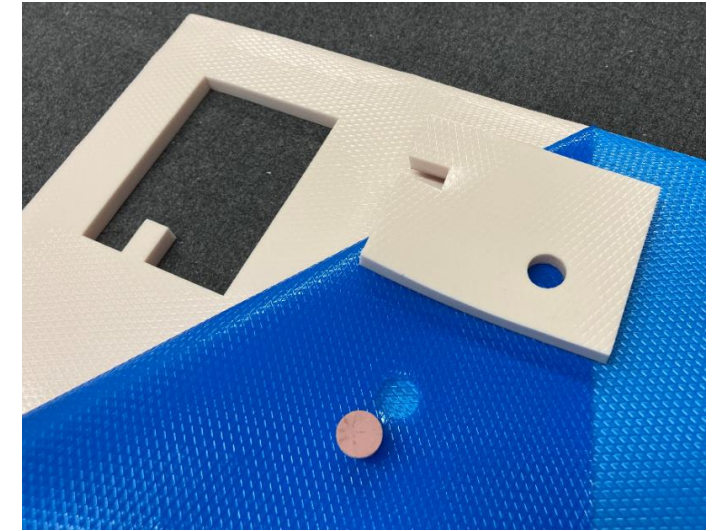
Silicone and non-silicone, phase change materials

Various thickness and hardness

Process

Custom parts

Manual application



Thermally Conductive PU Adhesive

Deliverable

Semi-structural bond with thermal conductivity

Key Product Features

High mechanical strength: 8 MPa, elongation 30 %

Thermal conductivity > 1.0 W/mK

2 Component polyurethane system

Process

Cleaning and priming of substrates (no priming if e-coated)

RT cure, can be accelerated by temperature - quick curing by induction heating

Manual or robotic application, open time 10-15 min

BETAFORCE™ 2800 TC for the Audi e-tron® battery
DuPont Transportation & Industrial
Audi



Technisches Datenblatt



BETAFORCE™ 2800 TC

Kurzbeschreibung

Wärmeleitfähiger, flammhemmender 2-Komponenten Polyurethanalbstrich, speziell entwickelt für die Batterieverklebung

Eigenschaften

- Gute Wärmeleitfähigkeit
- Gute Haftung auf beschichteten und lackierten Metall Oberflächen
- Gute Haftung auf Aluminium nach geeigneter Oberflächenbehandlung in Abhängigkeit der Legierung
- Beschleunigter Festigkeitsaufbau bei erhöhter Temperatur
- Silikonfrei
- Frei von abrasiven Füllstoffen
- Geringe Temperaturabhängigkeit des Moduls
- Flammhemmende Eigenschaften: UL94V0

Sollten nicht anders angegeben, werden die Produkte bei 23°C/50% relativer Luftfeuchtigkeit gemessen.

Komponente A		Wert	Einheit	Norm
Basis		Isocyanat (Härter)		BETAFORCE™ 2800 TC ISO
Farbe		Schwarz		
Dichte		1.62±0.05	g/cm³	-
Extrusion Viskosität / 2mm Düse / 4 bar		>4	g/min	Ballan
Komponente B		Wert	Einheit	Norm
Basis		Polyol (Harz)		BETAFORCE™ 2800 TC POLC
Farbe		Schwarz		
Dichte		1.56±0.05	g/cm³	-
Extrusion Viskosität / 2mm Düse / 4 bar		>4	g/min	Ballan
Andere Eigenschaften		Wert	Einheit	
Mischverhältnis (Volumetrisch A+B)		1:1	±0.05	
Verarbeitungstemperatur		18 - 28	°C	
Max. Verarbeitungszeit, Fügezeit ¹⁾		10 - 15	min	²⁾
Mechanische Eigenschaften		Wert	Einheit	Norm
Zugfestigkeit		> 8	MPa	DIN EN ISO 527-2
Bruchdehnung		Ca. 30	%	DIN EN ISO 527-2
E-Modul		Ca. 90	MPa	DIN EN ISO 527-2
Zugscherfestigkeit nach 7 Tagen ³⁾		> 5	MPa	DIN EN 1465
Zugscherfestigkeit nach 4 Stunden ³⁾		> 0.5	MPa	DIN EN 1465
Wärmeleitfähigkeit		> 1	W/mK	ASTM D5470-12
Spezifischer elektrischer Durchgangswiderstand (100V)		10 ¹¹	Ω cm	DIN IEC 93/VE
Durchschlagsfestigkeit		1.4	KV/mm	IEC 60243

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TDS BF 2800 TC

Case Study BETAFORCE™ 2800 TC

Project

DuPont's Transportation & Industrial team collaborated with Audi engineers to develop a bonding material that supports super-fast charging for the Audi e-tron, Audi's first all-electric SUV launched in Spring 2019. In addition to thermal management capabilities, the thermal-conductive adhesive also had to be optimized to help attain best-in-class driving range, lengthen module lifecycle, and improve performance.

Challenges

Thermal management

One of the biggest challenges in designing batteries for plug-in hybrid (PH) and electrical vehicles (EV) is thermal management of the battery pack. Battery components must operate in the optimum temperature window of 25°C during operations and below 60°C while charging.

Maximize vehicle performance Some drivers resist adopting EVs because of limited driving range, performance, and battery life. Audi's goal was to ensure sufficient day-to-day capability without sacrificing performance.

Minimize charging time

Drivers don't want delays because their EV takes too long to charge. Audi's e-tron SUV needed to be capable of super-fast charging without generating excessive heat

Solution

BETAFORCE™ 2800 TC thermal-conductive adhesives for battery pack assembly were optimized and specified for use on the Audi e-tron.

Thermal and vibration management

The thermal management properties of BETAFORCE™ 2800 TC help the 95 kWh Audi e-tron battery operate in the optimum window of 25°C during its operations and below 60°C while charging. The excellent combination of higher modulus and elongation helps ensure that the battery and the bonded substrates that support the battery assembly can last over the vehicle lifetime.

Longer range

The new Audi e-tron battery – optimized with BETAFORCE™ 2800 TC that conducts temperature both during charging and driving – delivers a range of more than 400 kilometers and supports super-fast 150 kW charging, freeing drivers from “range anxiety.”

Optimized handling

Placement of the bonded battery in the floor of the passenger compartment creates a low center of gravity for dynamic handling and helps achieve the Audi e-tron's long-range capacity.

Manufacturing performance

Good shear thinning behavior of BETAFORCE™ 2800 TC allows for the fast dispensing needed to support high-volume production.

Testing confirmed that the material properties meet or exceed heat-cure performance, mixer dwell times, pump pressures, and press-in forces.

Key BETAFORCE™ properties

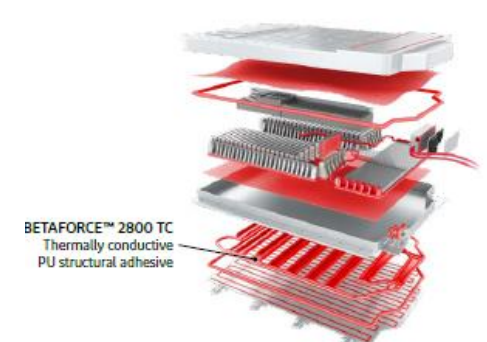
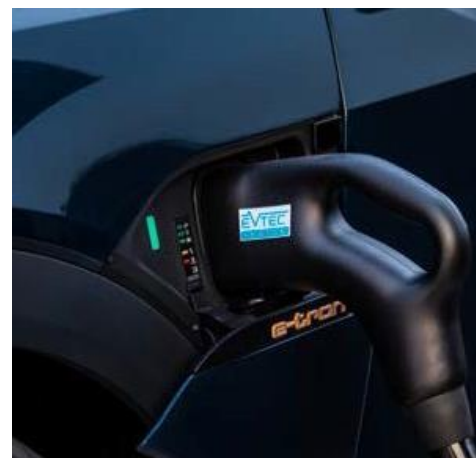
Thermal conductance (ASTM 5470-12, ZFW)	1.2 W/mK
E-Modulus [MPa]	90
Elongation at Break [%]	30
Tensile Strength [MPa]	6
Lap Shear Strength [MPa]	ca 5 MPa
Open Time at RT [min]	10-15
Handling Strength at RT	ca 1h
Curing time at RT	ca 24h
Curing time at 80°C	ca 2 min

BETAFORCE™ Enables Multi-material Mix

BETAFORCE™ 2800 TC is the bonding material that made it possible to develop the first organic thermal-conductive bonding for plug-in hybrid and electric vehicles.

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.

BETAFORCE™ polyurethane adhesives are two-component composite bonding adhesives. Formulations vary based on the vehicle production process and reflect variables such as viscosity, application temperature, conductivity, cure time, E-modulus, strength, and temperature. Both components can be dispensed from bulk containers into standard meter mix equipment for application. Products are also sold in single-use kits.



BETAFORCE™ 2800 TC exhibits appropriate elongation to manage the potential temperature difference between the cooling unit and the cooling plate.
Note - not an illustration of e-tron battery system.

Thermally conductive PU adhesive- OEM specified

Deliverable

Semi-structural bond with thermal conductivity

Key Product Features

High mechanical strength: > 8 MPa, elongation 15 %

Thermal conductivity > 1 W/mK

2 Component polyurethane system, working time < 180 sec

Process

Cleaning substrates (surface treatment depending on substrate)

RT cure 18-28 °C

Manual or robotic application

Technical Datasheet			
BETAFORCE™ 2900 TC			
Preliminary			
Short Description			
Thermal conductive 2-component polyurethane adhesive, specially developed for battery assembly.			
Characteristic			
- Good thermal conductivity - Good adhesion to coated and painted metal surfaces - Good adhesion to aluminum after appropriate treatment of the surface, depending on alloy-type - Silicon free - Free of abrasive fillers - Shear-thinning material			
Unless specified otherwise test are conducted at 23°C/50% relative humidity.			
Component A	Value	Unit	Standard
Basis	Isocyanate (Hardener)		BETAFORCE™ 2900 TC ISO-C
Colour	Black		-
Density	1.59±0.05	g/cm³	-
Extrusion Viscosity / 2mm nozzle / 4bar	>4	g/min	Ballan
Component B	Value	Unit	Standard
Basis	Polyol (Resin)		BETAFORCE™ 2900 TC POL-C
Colour	Black		-
Density	1.59±0.05	g/cm³	-
Extrusion Viscosity / 2mm nozzle / 4bar	>4	g/min	Ballan
Other Properties	Value	Unit	
Mixing Ratio (volumetric A+B)	1:1	±0.05	
Processing temperature	18 to 28	°C	
Maximum Working time 1)	180	sec	2)
Mechanical Properties	Value	Unit	Standard
Tensile Strength	> 8	MPa	DIN EN ISO 527-2
Elongation at break	>15	%	DIN EN ISO 527-2
E-Modulus	>100	MPa	DIN EN ISO 527-2
Lab shear strength 7 days ³⁾	>5	MPa	DIN EN 1465
Lab shear strength 1 h ³⁾	>0.5	MPa	DIN EN 1465
Thermal conductivity	Value	Unit	Standard
Thermal conductivity	> 1	W/mK	ASTM D5470-12
Footnotes:			
1) It should be noted that temperature has high influence on reactivity/working time of the adhesive assembly time must be separately evaluated depending on processing and conditions.			
2) Tested at 35°C on Rheometer: 10Hz, Gap 1mm			
3) Bonding height: 1 mm; Bonding area: 15x25mm; on e-coated Steel 1.3mm. Material application temperature 35°C			
Subject to change; last revision: 2020-11-02			
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			Page 1 of 2

Thermally conductive PU adhesive

Deliverable

Semi-structural bond with thermal conductivity

Key Product Features

High mechanical strength: 8 MPa, elongation >11 %

Thermal conductivity >1 W/mK

2 Component polyurethane system

Process

Cleaning substrates (surface treatment depending on substrate)

RT cure

Manual or Robotic application, working time 4-7 min

Technical Datasheet				
BETAFORCE™ 2915 TC				
Preliminary				
Short Description				
Thermal conductive flame retardant 2-component polyurethane adhesive, specially developed for battery assembly.				
Characteristic				
- Good thermal conductivity - Good adhesion to coated and painted metal surfaces - Good adhesion to aluminum after appropriate treatment of the surface, depending on alloy-type - Accelerated adhesion at elevated temperatures - Silicon free - Free of abrasive fillers - Shear-thinning material - Flame retardant properties: UL94V0				
Unless specified otherwise test are conducted at 23°C/50% relative humidity; and 7days curing				
Component A	Value	Unit	Standard	
Basis	Isocyanate (Hardener)		BETAFORCE™ 2915 TC ISOC	
Colour	Black		-	
Density	1.62±0.06	g/cm³	-	
Extrusion Viscosity / 2mm nozzle / 4bar	>4	g/min	Ballan	
Component B	Value	Unit	Standard	
Basis	Polyol (Resin)		BETAFORCE™ 2915 TC POLC	
Colour	Black		-	
Density	1.55±0.06	g/cm³	-	
Extrusion Viscosity / 2mm nozzle / 4bar	>4	g/min	Ballan	
Other Properties				
Mixing Ratio (volumetric A+B)	1:1	±0.05		
Processing temperature	18 - 28	°C		
Maximum Working time / tack free time ¹⁾	4 - 7	min	2)	
Mechanical Properties				
Tensile Strength	> 8	MPa	DIN EN ISO 527-2	
Elongation at break	>11	%	DIN EN ISO 527-2	
E-Modulus	>100	MPa	DIN EN ISO 527-2	
Lab shear strength 7 days ²⁾	>5	MPa	DIN EN 1465	
Lab shear strength 4 hours ²⁾	>0.5	MPa	DIN EN 1465	
Thermal conductivity	> 1	W/mK	ASTM D5470-12	
Specific electrical volume resistivity (at 100V)	10 ¹²	Ω.cm	DIN IEC 93/VE 0303/HD429 S1	
Dielectric strength	0.6	KV/mm	IEC 60243	
Subject to change; last revision: 2021-04-27				Page 1 of 2
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TDS Betaforce
2915 TC

Material pairings?

Heat conductivity
needed?

What elasticity
needed?

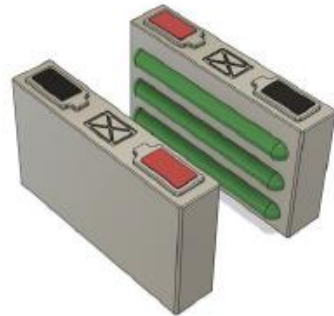
1k or 2k systems
desired?



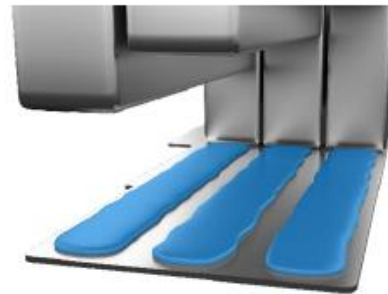
Summary Cell-to-Cell, Cell-to-Pack, Module-to-Pack

System	Advantage	Disadvantage
Thermally Conductive PU Adhesives	▪ Adhesive system ▪ Long and short open times available ▪ Low abrasion of filler system ▪ Silicone free	▪ No removal of modules possible

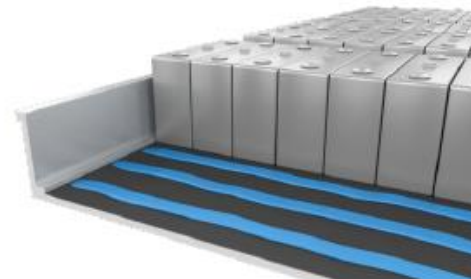
Cell-to-cell



Cell-to-pack



Module-to-pack



Primary function?

What heat
conductivity
needed?

Pre-fabricated
parts desired?

What assembly
method planned?



Voratron™ Structural PU foam increases Battery Pack Stiffness and Drive Comfort

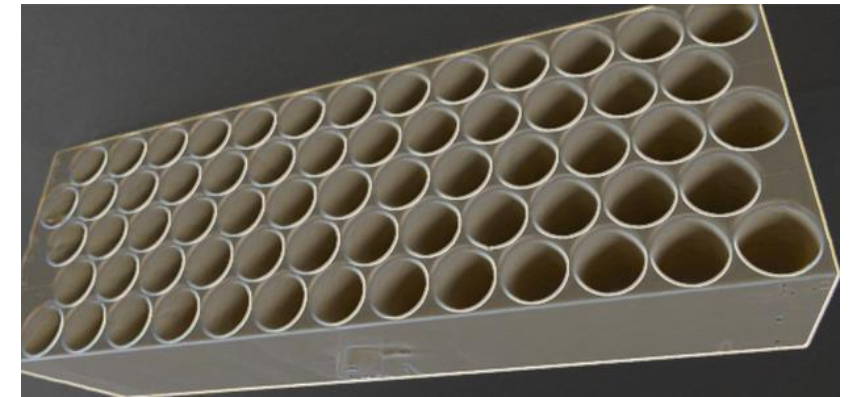
Allows for multi-material designs of battery tray, underbody protection and structural battery

Lightweight sandwich construction delivers improved stiffness, handling of vehicle, and drive comfort.

- Structural reinforcement
- Vibration damping
- Thermal insulation
- High elongation, High strength
- Clean spray application / injection
- Excellent adhesion on e-coat and paints, certain types of plastics
- Various processing speeds



Lightweight closed cell structure with 0,55-0,6 kg/L density



Structural battery – symbolic picture

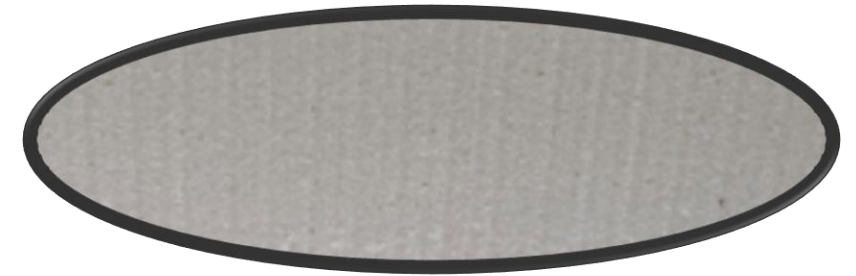
source: dow.com



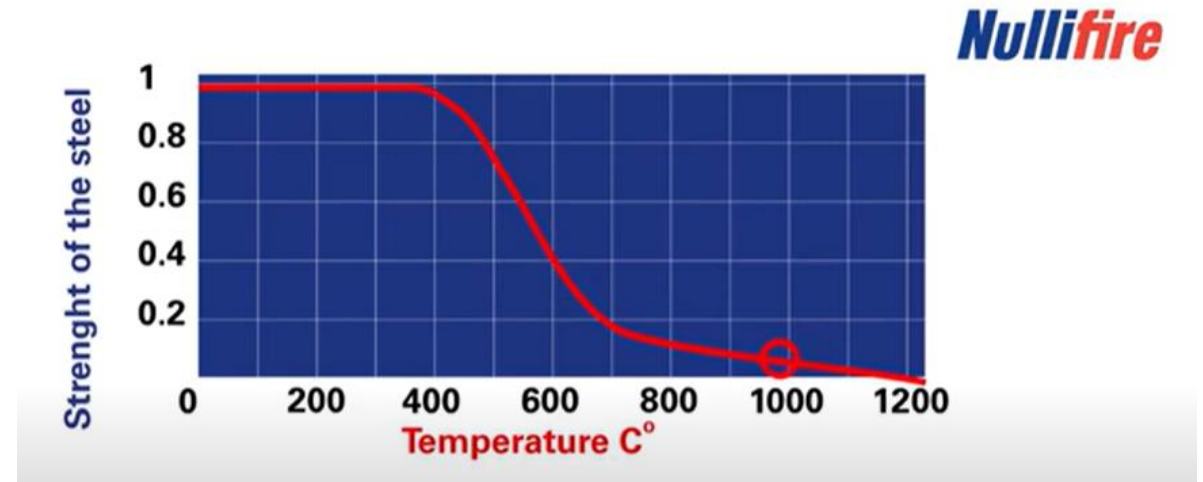
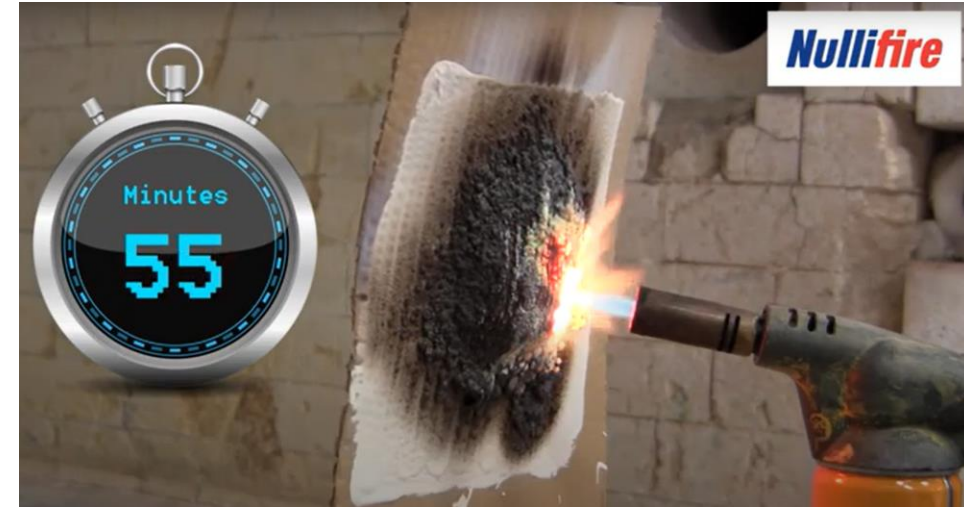
VORATRON EXP EP 520-S15M polyol & VORATRON EY 708 isocyanate - Provisional TDS_2023-07_EN.pdf

VORATRON™ PUR-Foams

- Structural reinforcement
- Thermal insulation
- **Vibration damping**
- Clean spray application / injection
- Excellent adhesion on e-coat and paints, certain types of plastics
- High elongation
- High strength



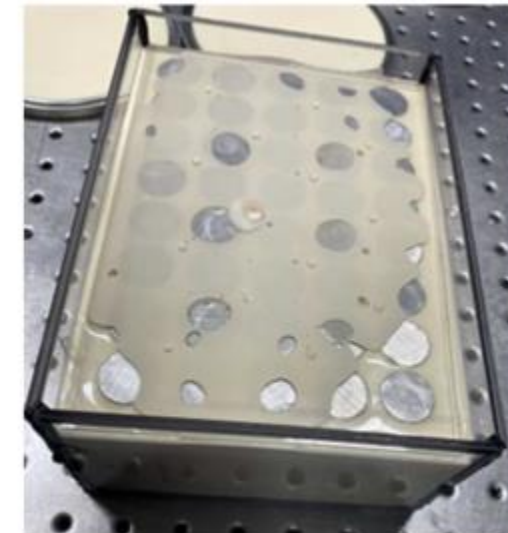
Thermal propagation protection – Nullifire SC xx



Voratron™ Series – Ultra High Strength Encapsulant

- VORATRON™ series of 2K non-foaming system
- **UL-94 V0** performance at 5 mm (pottant alone)
- Low viscosity for ease of encapsulation/potting
- Develops > 500 MPa modulus at room temperature
- Complete fill in mock-packs shown with GRACO EVR unit

Key Performance Requirements	VORATRON™ EN 2114
UL-94 vertical burn @ 5 mm	V0
Elastic Modulus at RT (MPa)*	1000+
Ultimate tensile strength (MPa)	35+
Open time (min)	> 10 min in pack
Density (g/cc)	0.85 – 0.9
Viscosity (cP) at dispense†	< 2000



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Non-Foaming System (UL-94 V0 @ 2 mm)



- Total – 20 sec flame exposure
- 2 X 10 sec timeslot
- ~1 sec break in between

Pottant thickness	Side plates	Plate thickness
2 mm	Aluminum	~1 mm

Although rating cannot be assigned (non-standard test) – **performance of assembly could be deemed similar to V0 material**

- Burn length minimal
- Pottant did not drip
- No after burn observed



Pottant

Before test

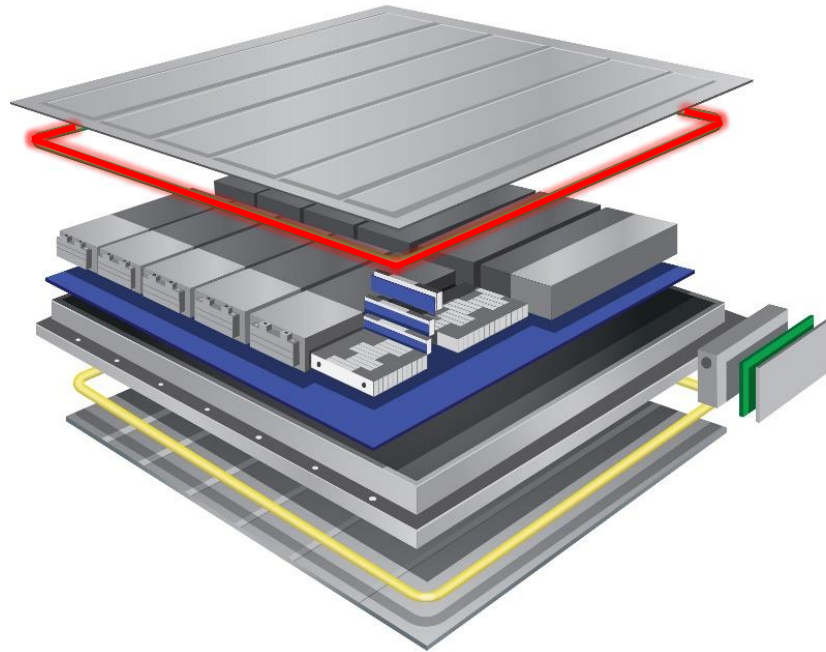


Negligible damage

After test

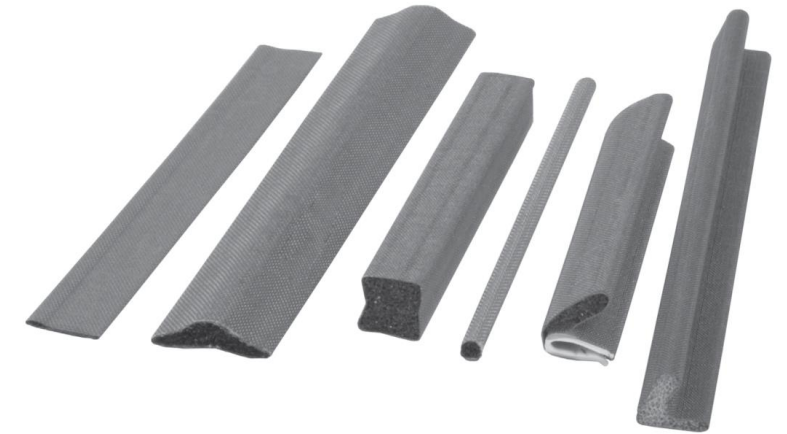


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Fabric-over-Foam (FOF) gasket

- Highly conductive fabric over a foam core
- Applied as electrical grounding or EMI shielding
- Shielding effectiveness >100 dB across wide frequency spectrum
- Various grades and shapes available



Die wichtigsten Anwendungen

- Neutrale Entfettung mit temporärem Korrosionsschutz als Zwischen- oder Endbehandlung,
- Korrosionsschutz auf Wasser- und Ölbasis
- hochwirksame Entfettung vor der Oberflächenbehandlung und Lackierung, Entlackung, Lackkoagulierung, Entkalkung und Beizen

Neue Beschichtungsgeneration

BONDERITE C-AK 1563 – alkalischer Reiniger für Stahl und Aluminium

BONDERITE M-NT 2040 – chromfreie Beizpassivierung für Aluminium, Anwendung bei Batteriekästen für E-Automobile

BONDERITE M-NT 40043 – Cleaner-Coater, Reiniger + Beschichtung in Einem, ersetzt Eisenphosphatierung

BONDERITE M-NT 30002 – Konversionsbehandlung für Zink-, Stahl-, und Aluminiumoberflächen



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Application overview

- Neutral degreasing with temporary corrosion protection as an intermediate or final treatment
- Water and oil-based corrosion protection
- Highly effective degreasing before surface treatment and painting, paint stripping, paint coagulation, descaling and pickling

Next generation coating

BONDERITE C-AK 1563 – alkaline cleaner for steel and aluminium

BONDERITE M-NT 2040 – chrome-free pickling passivation for aluminum, used in battery boxes for electric vehicles

BONDERITE M-NT 40043 – Cleaner-Coater, cleaner + coating in one, replaces iron phosphating

BONDERITE M-NT 30002 – conversion treatment for zinc, steel and aluminum surfaces



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