

# BASF material solutions for the electric vehicle charging infrastructure

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# BASF offers a wide range of material solutions for the charging infrastructure

Mobile charging systems



Wallboxes



Public charging stations



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Mobile charging systems

Wallboxes

Public charging stations

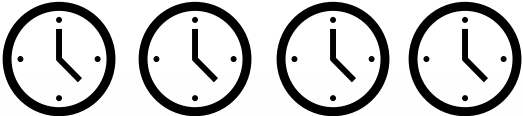
Power

AC

AC

AC/DC

Charging time



Installation costs



Complexity

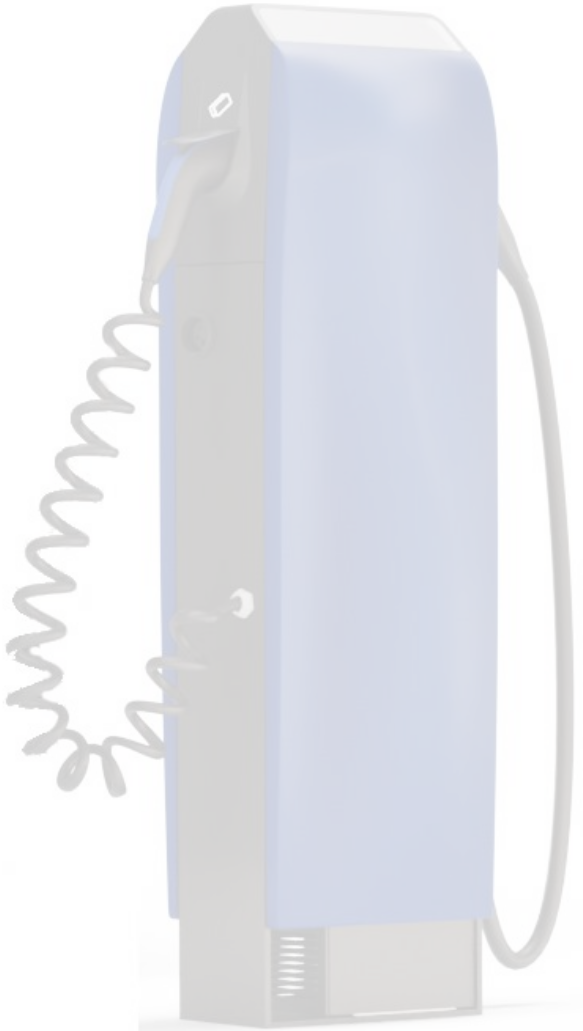


AC: Alternate Current  
DC: Direct Current

# Topics

1. Overview - powertrain landscape & charging systems
- 2. Charging components and requirements**
3. Does charging end at the car?

# Charging components and requirements



# Wallbox – Overview

Breakers, switches and safety components

Cover

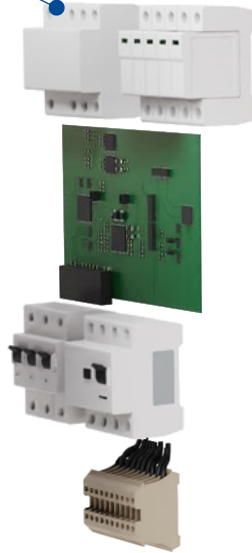
Display

Mounting Bracket

Loading Gun

Housing

Charging Cable





# Wallbox – Cover

## Ultramid® Deep Gloss

Cover



### Ultramid® Deep Gloss

- ▶ High-gloss inserts & design elements (different colors)
- ▶ Surface textures possible
- ▶ Excellent scratch resistance
- ▶ High chemical and good UV resistance



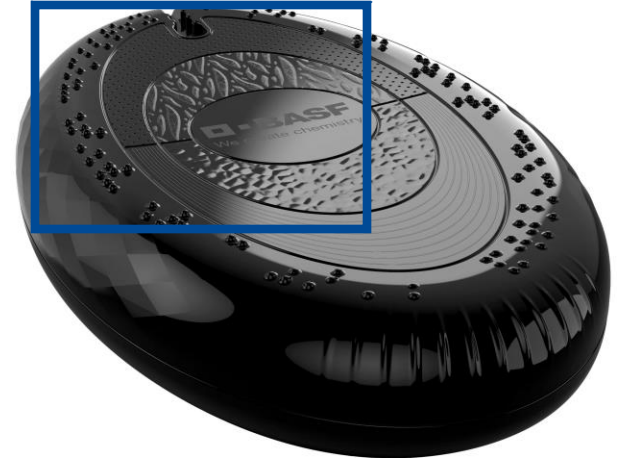
# Wallbox – Cover

## Ultramid® Deep Gloss

Cover

### Ultramid® Deep Gloss

- ▶ High-gloss (different colors)
- ▶ **Surface textures possible**
- ▶ Excellent scratch resistance
- ▶ High chemical and good UV resistance





# Wallbox – Display Ultramid® Vision

## Ultramid® Vision

- ▶ First semi-transparent PA6 grade
- ▶ High scratch resistance
- ▶ Good chemical resistance
- ▶ UL94 V2 and UL 746C compliant

## Ultrason® E2010

- ▶ Transparent material
- ▶ UL94 V0
- ▶ Excellent temperature resistance

Display



# Wallbox – Display Ultramid® & Ultrason®

Display

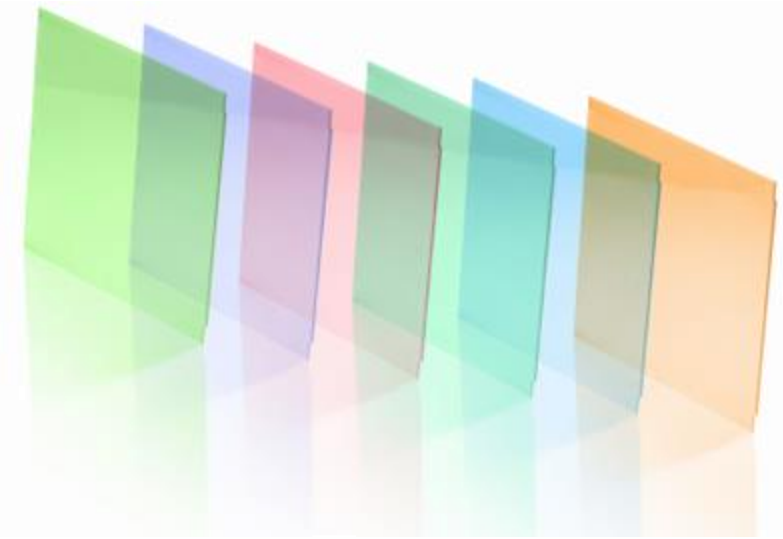


## Ultramid® Vision

- ▶ First semi-transparent PA6 grade
- ▶ High scratch resistance
- ▶ Chemical/stress cracking resistance
- ▶ UL94 V2 and UL 746C compliant

## Ultrason® E2010

- ▶ Transparent material
- ▶ UL94 V0
- ▶ Excellent temperature resistance



### Material

### Visual assessment

Ultramid® Vision

No scratch mark



Transparent PA12  
copolymer

No scratch mark



Polyether sulfone

Visible scratch mark  
(approx. 0.25 µm)

Polycarbonate

Highly visible scratch mark  
(approx. 1 µm)

Copolyester

Barely visible scratch mark  
(approx. 0.2 µm)

SAN

Highly visible scratch mark  
(approx. 0.3 µm)

Polypropylene with  
clarifier

Highly visible scratch mark  
(approx. 0.5 µm)

# Wallbox – Display Ultramid® & Ultrason®

Display



## Ultramid® Vision

- ▶ First semi-transparent PA6 grade
- ▶ High scratch resistance
- ▶ Good chemical resistance
- ▶ **UL94 V2 and UL 746C compliant**

## Ultrason® E2010

- ▶ Transparent material
- ▶ UL94 V0
- ▶ Excellent temperature resistance

Test	0.4 mm	0.75 mm	1.5 mm	3 mm
UL94	HB	V2	V2	V2
HWI	0	0	0	0
HAI	0	0	0	0
GWFI (°C)	960	960	960	960
GWIT (°C)	960	930	900	750
CTI (V)				550 (500)

**UL746C:** Materials with HB or V2 rating and HWI/HAI <2 can be used in applications requiring V0 rating!

Component - Plastics E41871  
 BASF SE  
 Performance Materials Europe, E-PIPE/NG - H201, Ludwigshafen 67056 DE

Vision B3X  
 Polyamide 6 (PA6) "Ultramid", furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	0.4	HB	0	0	65	65	65
ALL	0.75	V-2	0	0	65	65	65
ALL	3.0	V-2	0	0	65	65	65

Report Date: 2019-11-28  
 Last Revised: 2020-01-09  
 © 2020 UL LLC

IEC and ISO Test Methods

Test Name	Test Methods	Units	Thickness Tested (mm)	Value
Flammability	IEC 60696-11-10 Class (color)		0.4	HB, HB40 (ALL)
			0.75	V-2 (ALL)
			3.0	V-2 (ALL)

© 2020 UL LLC

HWI: Hot Wire Ignition  
 HAI: Hot Arc Ignition



# Wallbox – Housing Ultradur® & Ultramid®

## Ultramid® B3UG4

- ▶ UL94 V2 and UL746C compliant
- ▶ High mechanical strength
- ▶ Good processability
- ▶ Based on non-halogenated flame retardant additives

## Ultradur® B4300 G6

- ▶ UL94 HB
- ▶ High mechanical strength
- ▶ Good processability



# Wallbox – Housing Ultradur® & Ultramid®



## Ultramid® B3UG4

- ▶ UL94 V2 and UL746C compliant
- ▶ High mechanical strength
- ▶ Good processability
- ▶ Based on non-halogenated flame retardant additives

## Ultradur® B4300 G6

- ▶ UL94 HB
- ▶ High mechanical strength
- ▶ Good processability

Flammability	Value	Testing method
Flammability class - UL		UL94
0.71 mm, BK	V2	IEC 60695-11-10, -20
1.5 mm, BK	V2	
3.0 mm, BK	V2	
Electrical properties	Value	Testing method
Hot-wire ignition (HWI)		UL746A
0.71 mm	PLC 3	
1.5 mm	PLC 2	
3.0 mm	PLC 1	
High amp arc ignition (HAI)		UL746A
0.71 mm	PLC 0	
1.5 mm	PLC 0	
3.0 mm	PLC 0	



# Wallbox – Mounting bracket Ultramid®

## Ultramid® B3GK24

- ▶ UL94 HB
- ▶ GWFI > 650°C
- ▶ Reduced warpage
- ▶ Good processability

## Ultramid® B3U50G6

- ▶ UL94 V0
- ▶ Based on non-halogenated flame retardant additives
- ▶ Suitable for unattended household appliances (IEC 60335)



GWFI:

Glow Wire Flammability Index

# Wallbox – Mounting bracket

## Ultramid®

### Ultramid® B3GK24 Cover

- ▶ UL94 HB
- ▶ GWFI > 650 °C
- ▶ Reduced warpage
- ▶ Good processability

### Ultramid® B3U50G6

- ▶ UL94 V0
- ▶ Based on non-halogenated flame retardant additives
- ▶ Suitable for unattended household appliances (IEC 60335)

Flammability	Value	Testing method
<b>Flammability class - UL</b>		
0.40 mm, ALL	HB	UL94
0.75 mm, ALL	V0	UL94 IEC 60695-11-10, -20
1.5 mm, ALL	V0, 5VA	UL94 IEC 60695-11-10, -20
3.0 mm, ALL	V0, 5VA	UL94 IEC 60695-11-10, -20
0.40 mm, ALL	HB75	IEC 60695-11-10, -20

Thermal properties	Value	Testing method
<b>RTI Elec</b>		
0.40 mm	140 °C	UL746B
0.75 mm	150 °C	
1.5 mm	150 °C	
3.0 mm	150 °C	
<b>RTI Imp</b>		
0.40 mm	105 °C	UL746B
0.75 mm	115 °C	
1.5 mm	115 °C	
3.0 mm	115 °C	



Mounting Bracket

# Wallbox – Loading gun Ultramid® & Elastollan®



# Wallbox – Loading gun Ultramid® & Elastollan®

## Contact carrier – Ultramid® B3U42G6

- ▶ UL94 V0
- ▶ Based on non-halogenated flame retardant additives
- ▶ CTI 600

## Housing – Ultramid® B3SR03

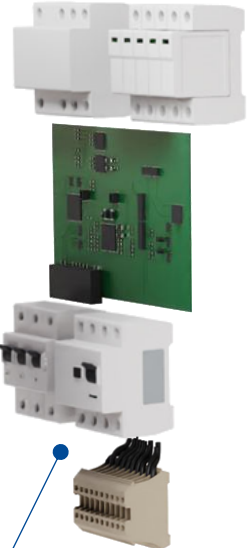
- ▶ High chemical resistance
- ▶ UL94 V2 UL f1 approved
- ▶ High toughness

## Haptic element – Elastollan® 1185

- ▶ Good adhesion to PA Housing
- ▶ Good chemical resistance
- ▶ UV resistance

Loading Gun

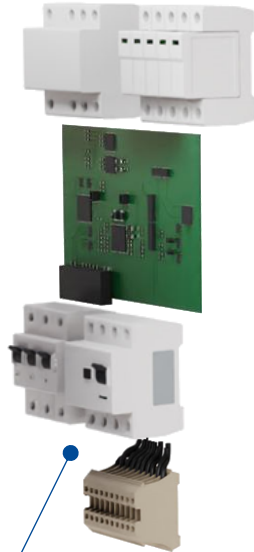
# Wallbox – Loading gun Ultramid® & Elastollan®



Breakers, switches and safety components



# Wallbox – Breakers, switches and safety components



## Breakers, switches and safety components

### Materials with UL, IEC, CCC, CSA approvals

Ultramid® B3UG4	UL94 V2 (0.71 mm)
Ultramid® B3U42G6	UL94 V0 (0.8 mm)
Ultramid® C3U	UL94 V0 (0.4 mm)
Ultramid® A3UG5	UL94 V0 (0.75 mm)
Ultramid® B3U30G6	UL94 V2 (0.75 mm)

Breakers, switches and safety components

Charging Cable

# Charging components and requirements



# Public charging station - Overview

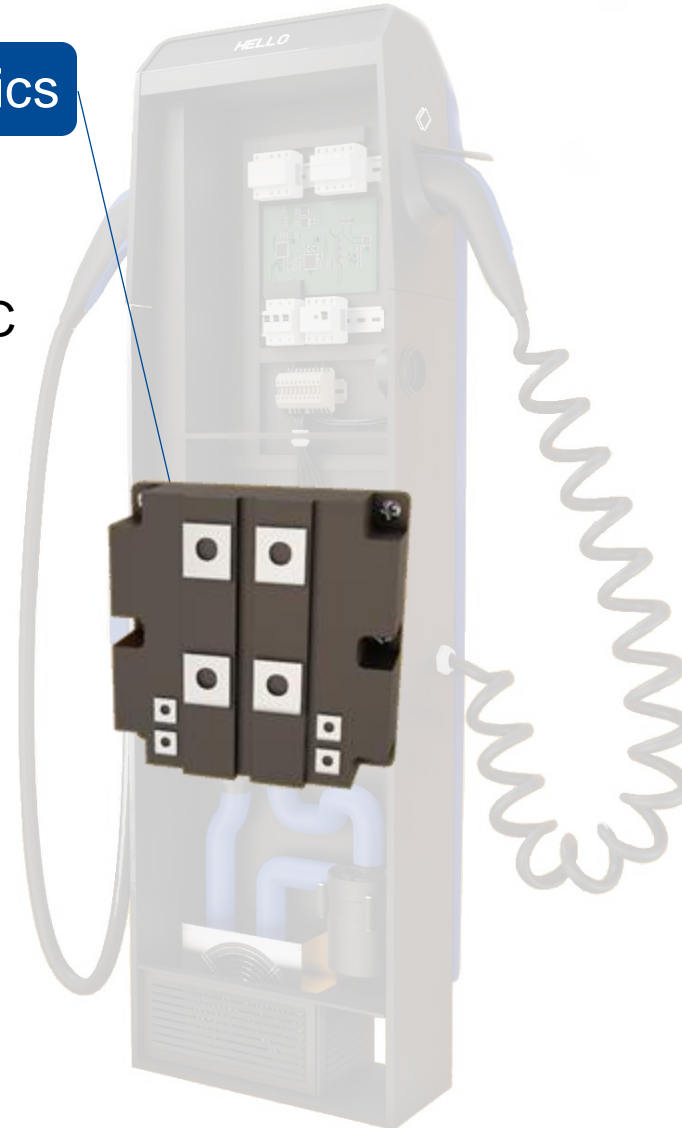


# Public charging station - Power electronics

## Power Electronics

### Key requirements

- ▶ **Electric insulation** of high AC and DC voltages
- ▶ Excellent **insulation** performance for tight contact arrays
- ▶ High **CTI and RTI**
- ▶ Constant **dielectric strength**



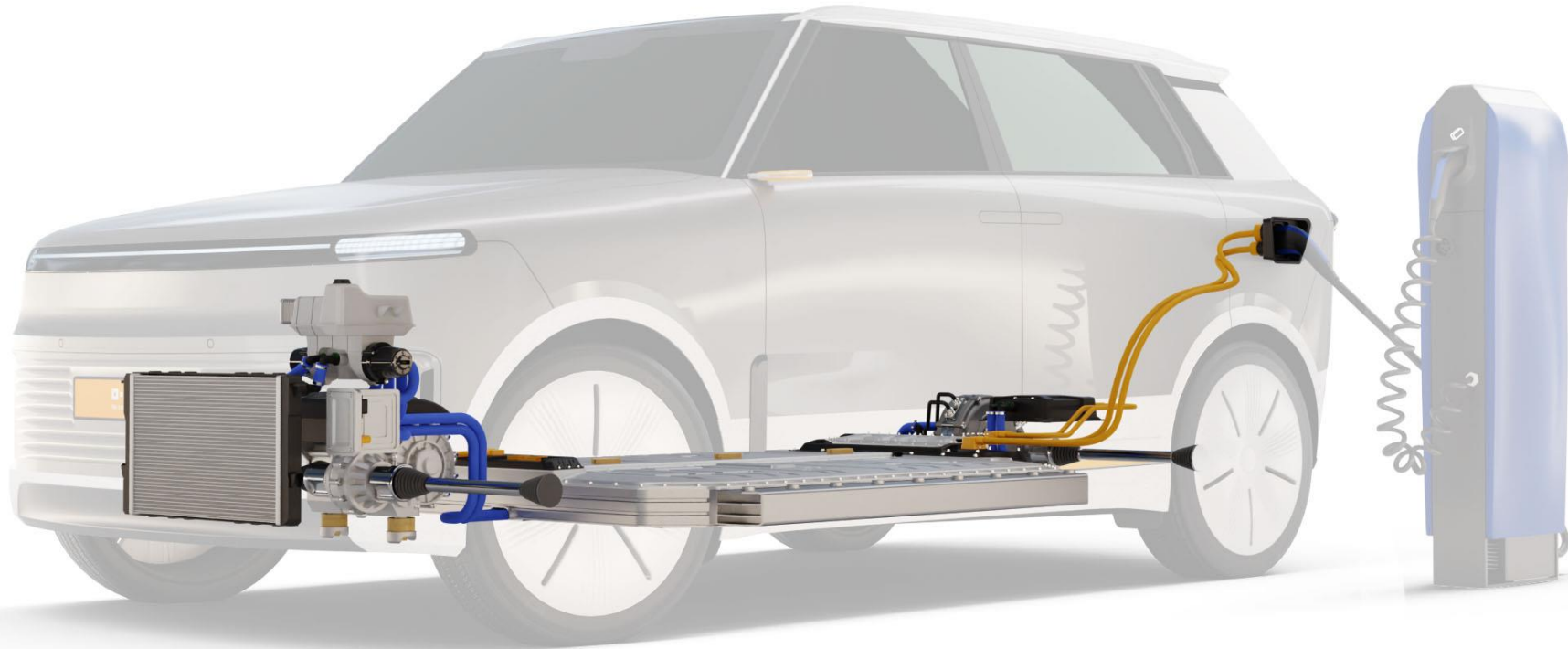
- ▶ Very **few free ions**, to avoid electrical corrosion under DC currents
- ▶ Long term **thermal resistance**
- ▶ **Thermal conductivity** if risk of hot spots exists

# Topics

1. Overview - powertrain landscape & charging systems
2. Charging components and requirements
- 3. Does charging end at the car?**



# Charging inlet



# Charging inlet

## Key requirements

- ▶ High mechanical strength
- ▶ UV resistance
- ▶ High CTI
- ▶ Dielectric strength



## Ultramid® B3EG6 black

- ▶ UL94 HB

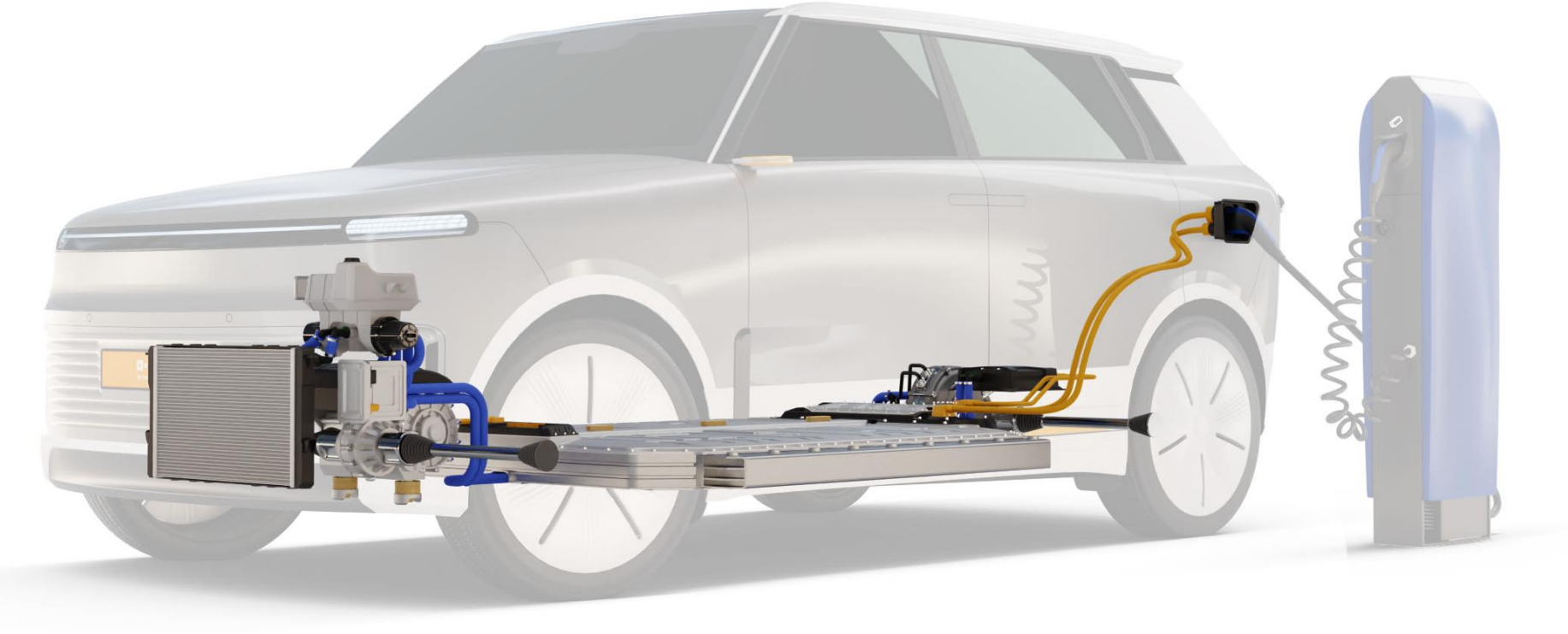
## Ultramid® B3U30G6 black

- ▶ UL94 V2

## Ultradur® B4450G5 black

- ▶ UL94 V0

# High voltage connections for power distribution



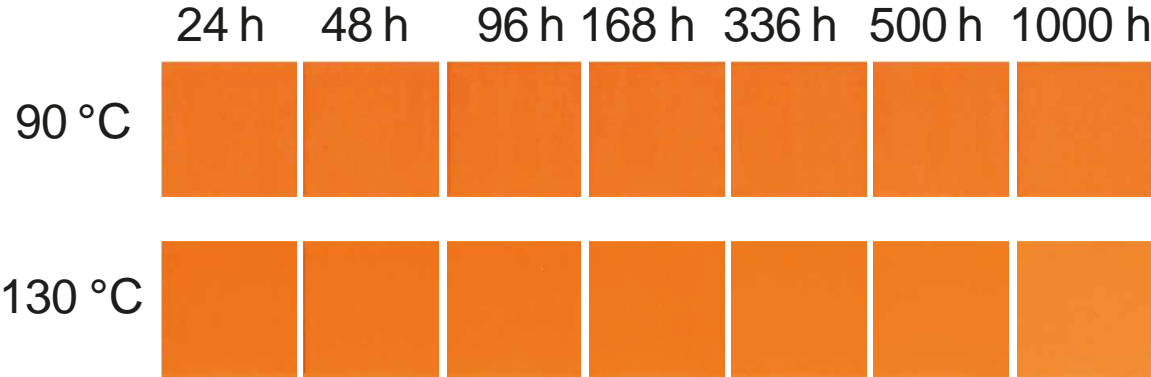
# High voltage connectors

## Ultradur® and Ultramid®

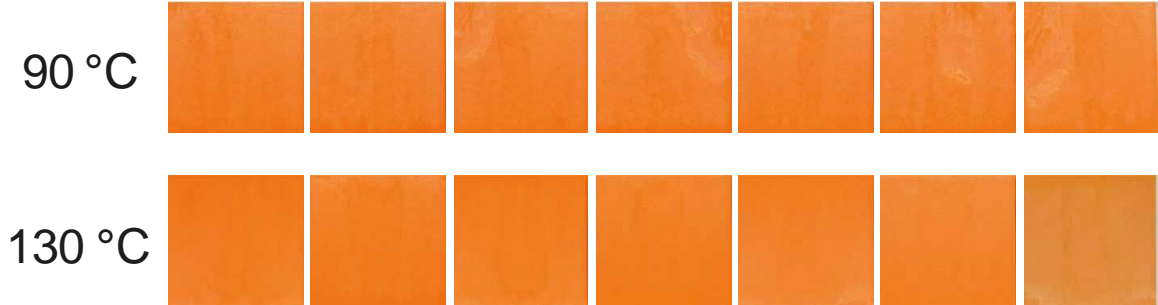
- ▶ UL94 HB and V0
- ▶ High mechanical strength
- ▶ High CTI
- ▶ Hydrolysis resistance
- ▶ Good processability
- ▶ Durable orange color



### Ultradur® B4331G6 HR OR55092 – PBT-I-GF30

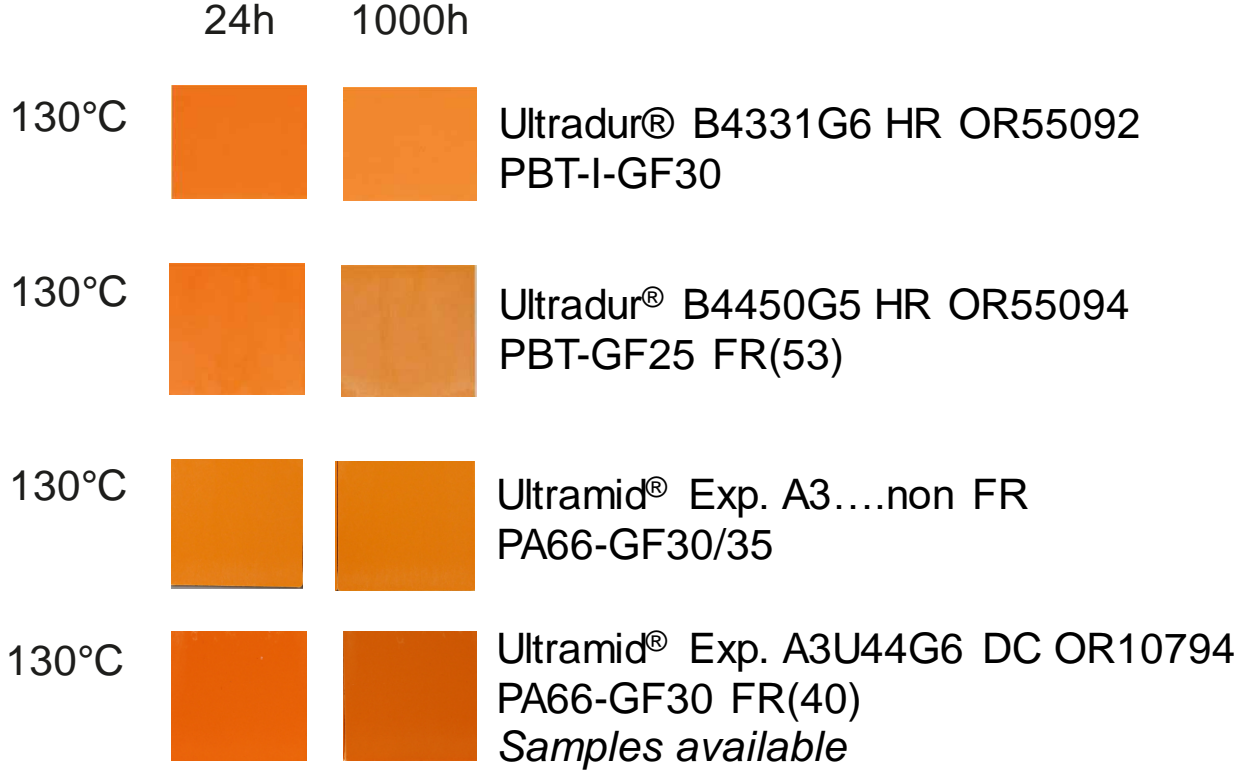
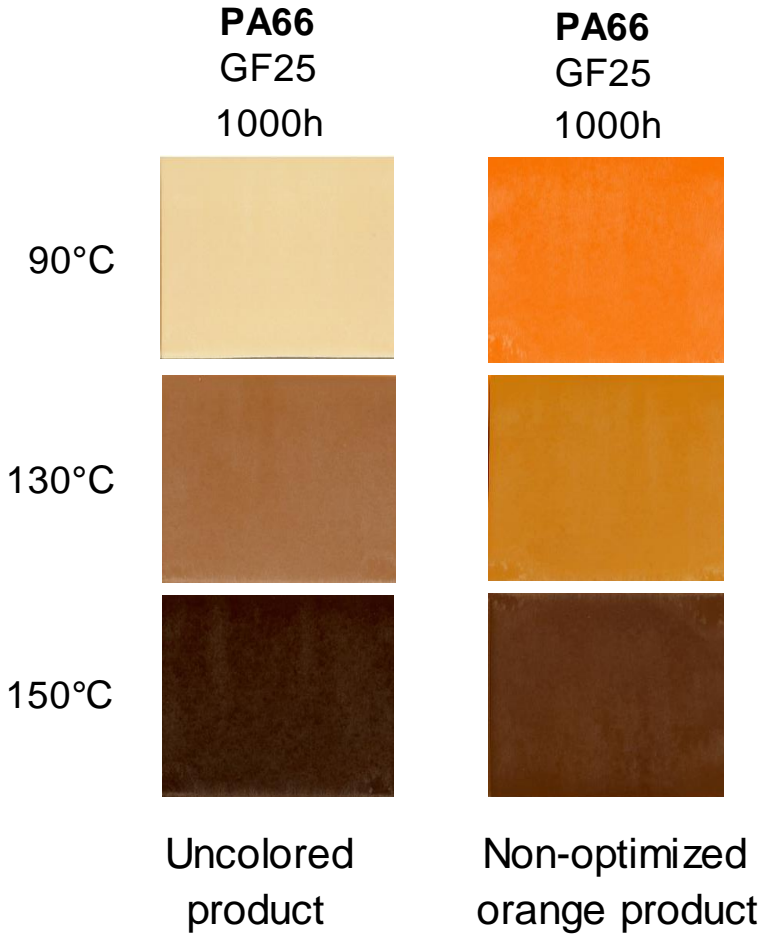


### Ultradur® B4450G5 HR OR55094 – PBT-GF25 FR(53)



# Durable orange-colored products

## Existing materials and new developments





# Summary and outlook

- ▶ **Electrification** will influence the whole market
- ▶ Charging infrastructure is key to support the **transformation** in eMobility
- ▶ BASF offers the right material to fulfill **design aspects** and **chemical resistance** Click to add text
- ▶ A broad non-flame retardant and **flame retardant portfolio** is available (UL-Listing for relevant products)
- ▶ DC fast charging systems build **new challenges** regarding electrical corrosion and deposits
- ▶ To distribute the power in the car, products in **long-lasting orange** are needed and **different polymer types** will be available



# Contacts



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