CHEMISTRY THAT MATTERS™

ADVANCED THERMOPLASTICS FOR MOBILITY SOLUTIONS

AN INTRODUCTION TO SABIC'S SPECIALTIES PORTFOLIO

2019

MATERIAL AND DESIGN FOR THE FUTURE OF MOBILITY

As we trend towards electrification, advanced driving assistance systems, and fully autonomous solutions, SABIC's Specialties business is prepared to work with you to address your future design and material needs.

Whether these needs are light weighting, structural stability, EMI shielding, radar absorption, wear & friction or superior heat and impact resistance, we have the product depth that can provide you with the solutions you need.

Aside from our extensive product portfolio, we have the design capabilities to assist you in addressing an ever-changing landscape. As technology advances, designs need to change. We can work with you in anticipating these changes and realizing trends that will allow you to prepare and address your material needs in a unique way.

Material selection collaboration with SABIC can help you move from "hands off" to "mind off"

AUTOMATED, CONNECTED, ELECTRIC AND SHARED MOBILITY

2019 – 2022

All major OEMs now produce hybrid and battery electric vehicles (BEVs) with many new BEV players arriving on the scene.

Range extension and reducing cost continues to be the primary focus. Limited charging infrastructure still causes range anxiety for many consumers. Exterior aesthetics and vehicle performance are very important for mass adoption.

Battery & powertrain (THERMOCOMP™ , KONDUIT™ & STAT-KON™ compound), battery protection (NORYL GTX™ resin), capacitor film (ULTEM™ resin)

Autonomous Vehicles are currently being tested in select cities across the globe.

Reliance on software will continue to drive development and selection process for sensing systems such as LiDAR. Consolidation will happen across the value chain to improve communication and connectivity.

Sensors/antennae, dielectric solutions (THERMOCOMP™ LDS compound), EMI shielding (FARADEX™ compound), lenses (ULTEM™ resin, LEXAN™ XHT resin), low moisture uptake (NORYL™ resin)

2023 & BEYOND

As ownership dynamics change, less emphasis will be placed on exterior aesthetics and engine performance. Primary focus will be placed on reimagining the interior for*:*

- Comfortability & cleanliness
- Customization & infotainment
- Durability

SABIC specialties unique offerings: Antimicrobial solutions, custom colors, visual effects, modular design, durable plastics

SPECIALTIES PRODUCT LINES

NORYL™ and NORYL GTX™ RESIN

KEY RESIN VALUE:

- ✓ Low specific gravity for weight out
- ✓ Very good chemical resistance to acids
- ✓ Non-brominated, non-chlorinated FR
- ✓ Excellent dimensional stability
- ✓ Excellent hydrolysis resistance
- ✓ Stiffness-to-strength ratio

APPLICATION SPACES:

- ✓ Exteriors: Wheel covers, tank flap, body panels, door handles & trim
- ✓ Electrical: EV charger & powertrain components
- ✓ U-t-H & Fuel Systems: Lead acid battery enclosures
- ✓ Crash & Chassis: B-Pillar, rail extensions, battery protection
- ✓ Sensing Systems: housing, circuit board (oligomers)

LNP™ COMPOUNDS and LEXAN™ COPOLYMERS

KEY RESIN VALUE & EFFECTS:

- ✓ High stiffness and impact
- ✓ Low wear & friction
- ✓ Thermal or electrical conductivity
- ✓ Non-brominated, non-chlorinated FR
- ✓ Chemical resistance
- ✓ CTI class 0 (600 v)
- ✓ IR transparency
- ✓ EMI shielding & radar absorbing

APPLICATION SPACES:

- ✓ Interiors: Buzz, squeak, & rattle, light diffusion aesthetics
- ✓ Exteriors: Grill, spoiler, sunroof beam, mirror assembly
- ✓ Lighting: Bezels, lenses, heat sinks,
- ✓ Electrical: EV charger & EV battery components
- ✓ U-t-H & Fuel Systems: Li-Ion Battery enclosures
- ✓ Sensing Systems: Radome, aperture plate, lens covers

ULTEM™ RESIN

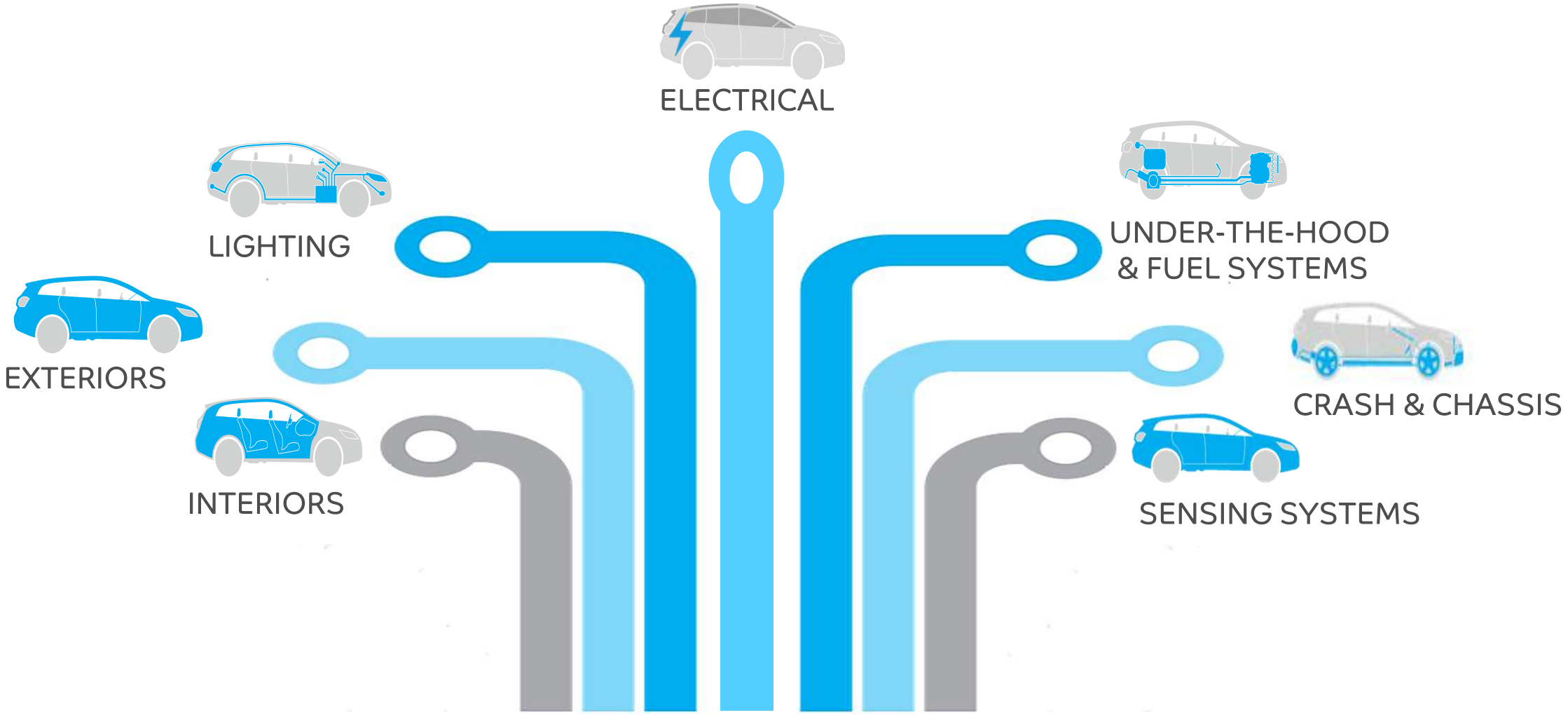
KEY RESIN VALUE:

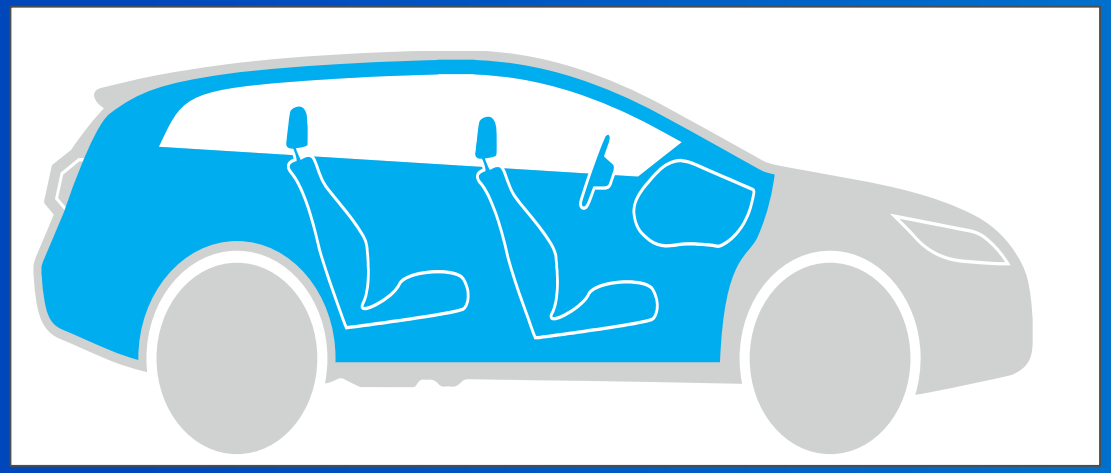
- ✓ Outstanding heat resistance
- ✓ IR transparent & high refractive index
- ✓ Chemical resistance
- ✓ Dielectric properties
- ✓ Excellent dimensional stability
- ✓ High strength and stiffness
- ✓ Inherent FR and low smoke

APPLICATION SPACES:

- ✓ Electrical: Capacitor film, electrical slot insulation
- ✓ U-t-H & Fuel Systems: Cylinder deactivation valves, cables
- ✓ Sensing Systems: Radome, lens cover
- ✓ Misc. Systems / Components: Requiring advanced heating needs or mechanical needs

SEGMENTS


ELECTRICAL
LIGHTING
UNDER-THE-HOOD
& FUEL SYSTEMS
EXTERIORS
CRASH & CHASSIS
INTERIORS
SENSING SYSTEMS



Interiors + Buzz, Squeak & Rattle (BSR)

Providing material solutions for today, while assisting the interior design of tomorrow, through an understanding of current and future automobile trends as shared and fleet markets expand.

SOLUTIONS FOR AUTOMOTIVE INTERIORS AND BSR

Infotainment Bezel, Trim, Gesture Control
LNP™ LUBRICOMP™ compound
(Low coefficient of friction (COF), dimensional accuracy
ULTEM™ / EXTEM™ resins
IR transparency, dimensional stability, reflow soldering

Heads-Up Display Component
LNP™ THERMOCOMP™ compound
High temperature, superior surface finish
ULTEM™ resin
Metallization, dimensional stability, heat management

Reading Lights
ULTEM™ resin
Metallization, heat resistance, dimensional stability

Aesthetic Interior Lighting Systems
LNP™ FXD compound
Visual diffusion effects; optical transparency

Radio Frame / Glovebox Guide Arms
LNP™ LUBRILOY™ compound
Superior wear, low COF, dimensional accuracy, paintable

Steering Lock Housing
LNP™ VERTON™ compound
Lightweight, high mechanical performance vs. Standard fiber

Center Console Slides & Rails
LNP™ LUBRICOMP™ compound
Superior wear, low COF, superior acid/base resistant vs. Pc

INTERIOR GEAR SYSTEMS

At the push of a button, windows move, doors lock, and HVAC comes to life. These electromotive actions require gears, bearings, bushings and other wear surfaces to provide smooth, reliable, actuation forces. LUBRICOMP™ and LUBRILOY™ compounds can help deliver the high quality performance required. Gears requiring high heat solutions can also be achieved through ULTEM™ and LNP™ resin product lines.

Power Sliding Door Unit
- ✓ Low moisture absorption
- ✓ High modulus & excellent chemical resistance

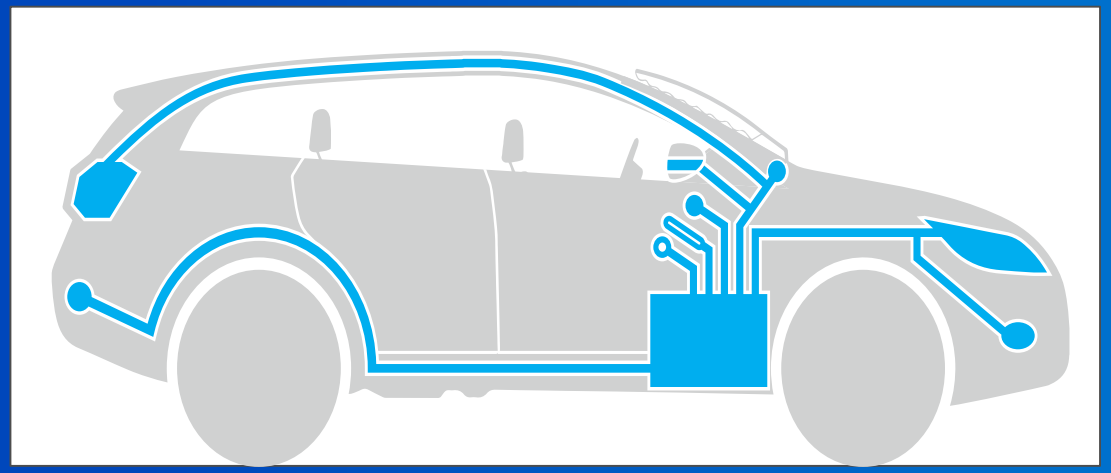
Door Lock Actuator Gears
- ✓ LNP™ LUBRICOMP™ compound (Low moisture absorption and dimensional stability, good wear)

HVAC Vent Lamellas & Slider
- ✓ LNP™ LUBRICOMP™ compound Superior friction and stiffness, low wear & COF

HVAC Actuator Gear
- ✓ LNP™ LUBRILOY™, LNP™ LUBRICOMP™ compound PTFE free, improved wear over POM

Handles Seat Adjustment
- ✓ LNP™ THERMOCOMP™ & LNP™ VERTON™ compound High strength, stiffness

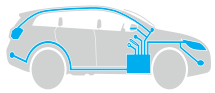
Seating Switch Slider
- ✓ LNP™ LUBRILOY™ & LNP™ LUBRICOMP™ compound PTFE free, anti –squeak



Lighting

Material solutions such as transparency and high heat resistance designed for complex vehicle lighting systems, where reflection, projection, heat management, and aesthetic appearance converge to enable the designs of tomorrow.

DESIGNING FOR THE LIGHTING SYSTEMS OF TOMORROW



Designing for superior reflection, projection, heat management and aesthetic appearance

Lenses/light guides

LEXAN™ XHT and LEXAN™ CXT resins

- Flexible styling
- Transparency
- High refractive index
- Flow heat balance
- Dimensional stability

Bezels/reflectors

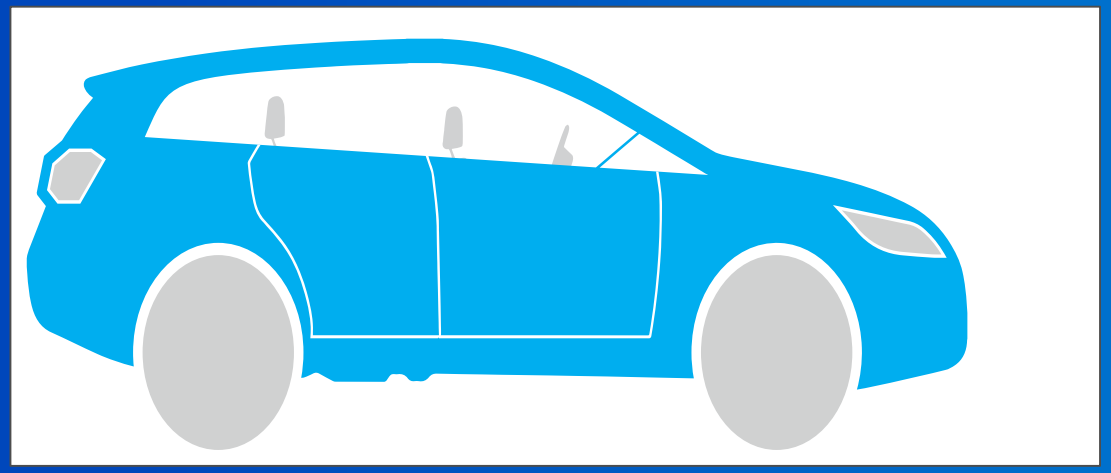
LEXAN™ XHT, LEXAN™ CXT resins, ULTEM™ resins

- High surface finish
- Dimensional stability
- Direct metallizable
- Haze onset temperatures (ranging from 145-230 °C)

Heat sinks

LNP™ KONDUIT™ compound

- Heat dissipation
- High modulus
- Injection moldable



Exteriors

Providing superior solutions to the automotive industry that allow for design freedom, improved aesthetics, impact, chemical resistance, and stiffness to enable future design needs.

EXTERIORS AESTHETICS TO MATCH THE INTERIOR TRENDS

Rear Spoiler
LEXAN™ EXL resin
Weatherability, impact & chemical resistance
NORYL™ resin
Large blow molded spoilers

Sunroof Beam & Mechanism
LNP™ VERTON™ resin
Superior sound dampening, stiffness and vibration control

Mirror Assembly
LEXAN™ SLX resin
Chemical & impact resistance
LNP™ THERMOCOMP™ compound
Stiffness, excellent surface finish
NORYL GTX™ resin
Painted mirror shells, high heat paint capable

Tank Flap
NORYL GTX™ resin
Low system cost, high surface finish, stiffness, dimensional stability, chemical resistance

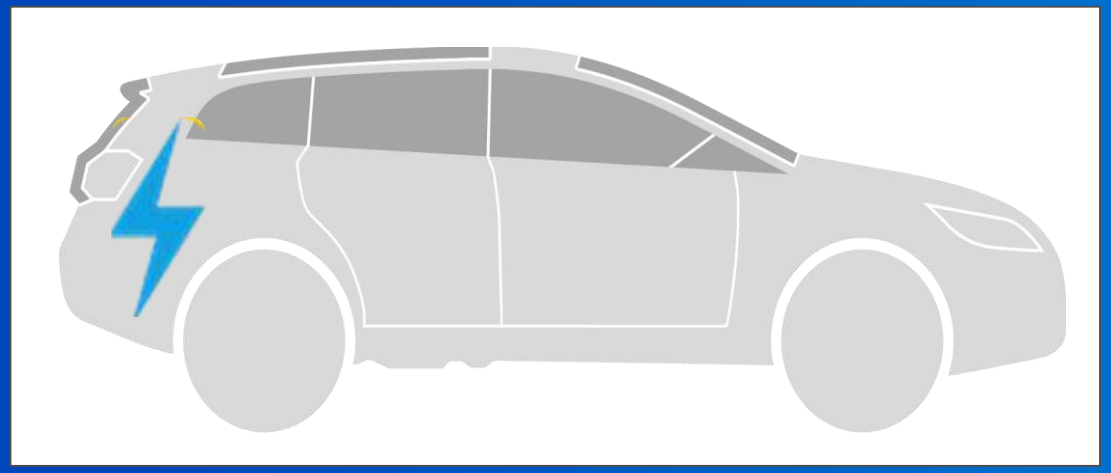
Door Handles
NORYL GTX™ resin
Superior finish, high surface gloss, high impact

TRIM
LEXAN™ SLX resin
Molded in color / paint free, weatherability

Body Panels
NORYL GTX™ resin
Lightweight, design freedom, pedestrian impact

Wheel covers:
NORYL GTX™ resin
Low system cost, high surface finish, stiffness, dimensional stability, chemical resistance

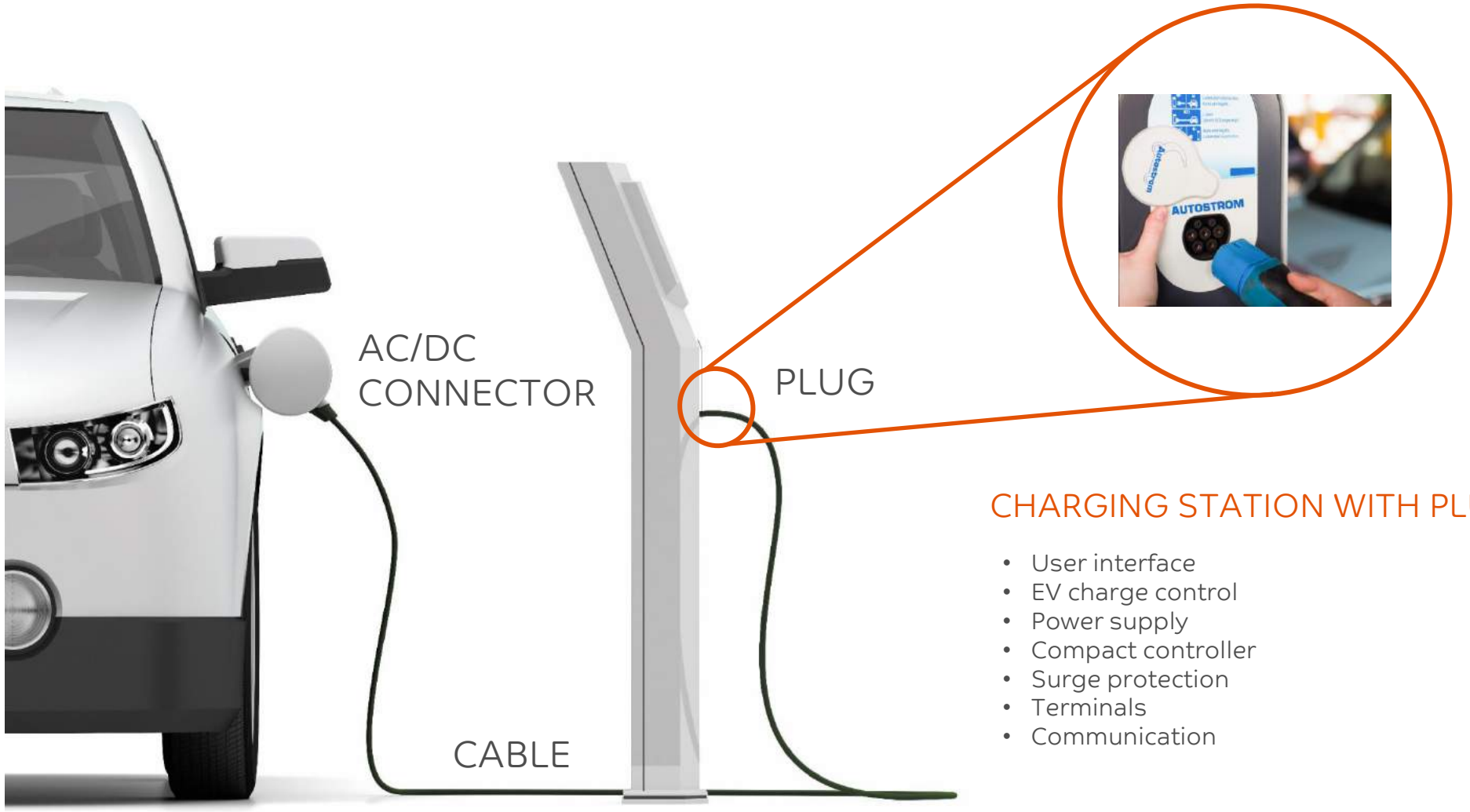
Grills
LEXAN™ SLX resin
Weatherability, impact & chemical resistance



Electrical

As today's mobility grows to be ever-more electrified, our world demands materials offering the utmost in safety, functionality and performance. SABIC's range of specialty solutions for electrical applications may assist with fire safety, weight reduction, design freedom and enhanced processing. Our diverse product range is already enabling electric vehicle charging, battery systems, and other high voltage electrical assemblies.

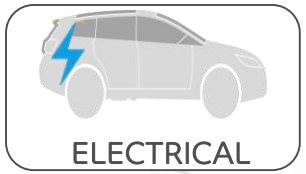
MATERIALS FOR ELECTRIC VEHICLE SERVICE EQUIPMENT (EVSE)

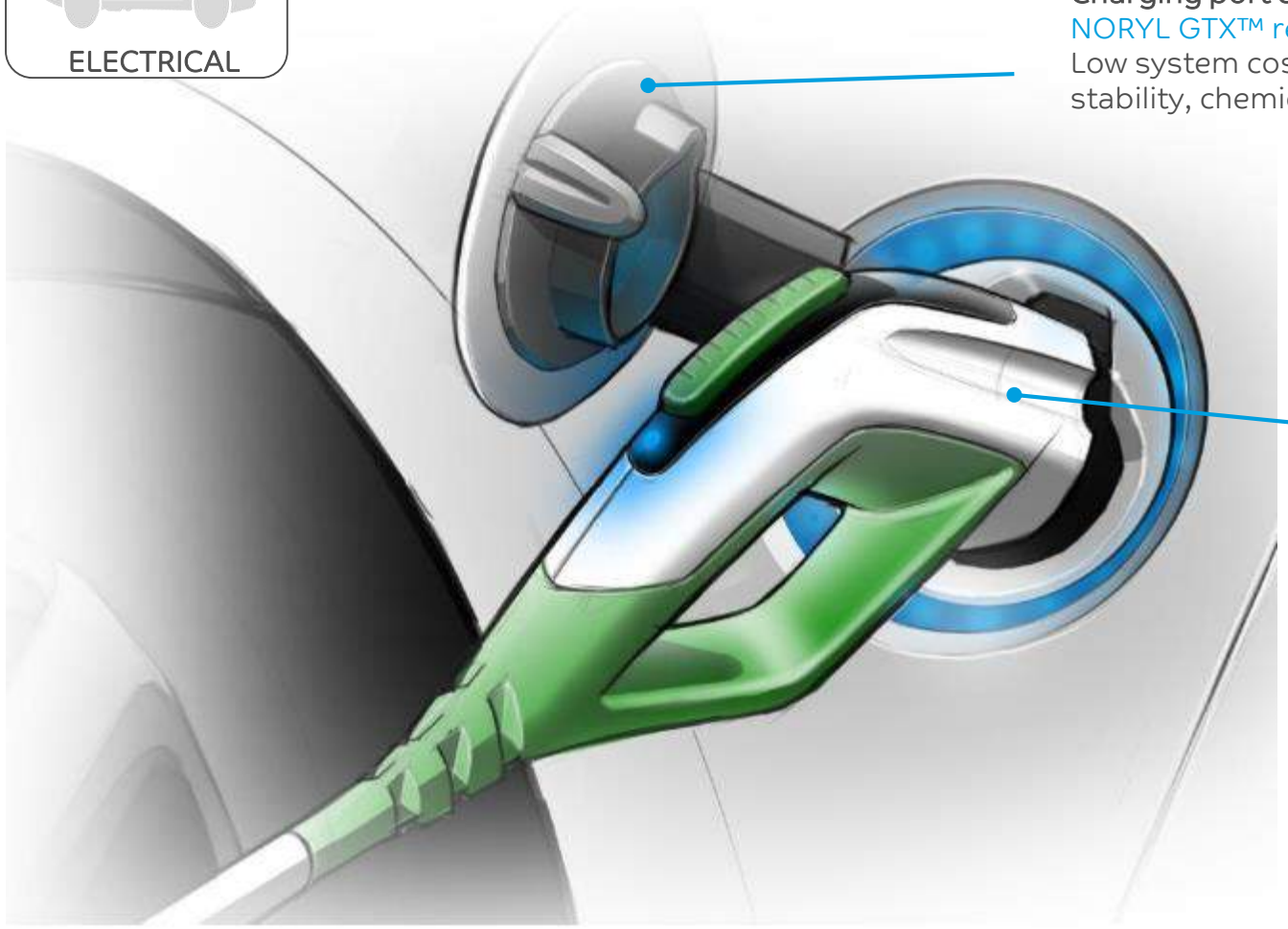


CHARGING STATION WITH PLUG

- User interface
- EV charge control
- Power supply
- Compact controller
- Surge protection
- Terminals
- Communication

EVSE CHARGING CABLES AND CONNECTORS





Charging port cover
NORYL GTX™ resin
Low system cost, class A surface finish, stiffness, dimensional stability, chemical resistance

Charger connector
LEXAN™ EXL resin
Weatherability, impact & chemical resistance

LNP™ THERMOCOMP™ compound
Low moisture absorption, high modulus, superior hydrolytic stability, chemical resistance

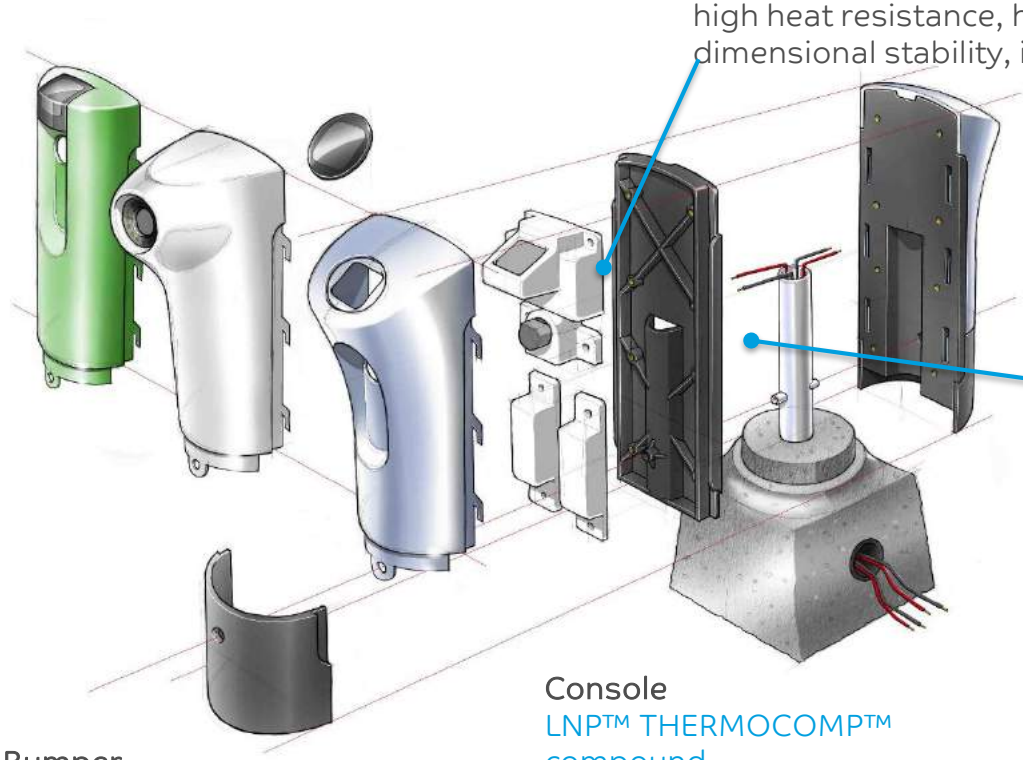
ULTEM™ resin
High heat resistance, inherent FR, low temperature ductility & weatherability

EMPOWERING ELECTRIC VEHICLE SERVICE EQUIPMENT

Display
LEXAN™ SLX resin
Weatherability, impact & chemical resistance

Connector & socket
NORYL GTX™ resin
Low system cost, high surface finish, dimensional stability, chemical resistance
ULTEM™ resin
high heat resistance, high mechanical performance, dimensional stability, inherent FR

Fascia
LEXAN™ SLX and LEXAN™ EXL resin
Weatherability, impact & chemical resistance
NORYL GTX™ resin
(Low system cost, high surface finish, dimensional stability, chemical resistance)



Frame
LEXAN™ EXL resin
Weatherability, impact & chemical resistance
LNP™ VERTON™ compounds
High mechanical performance

Bumper
LEXAN™ EXL resin
(Impact & chemical resistance)

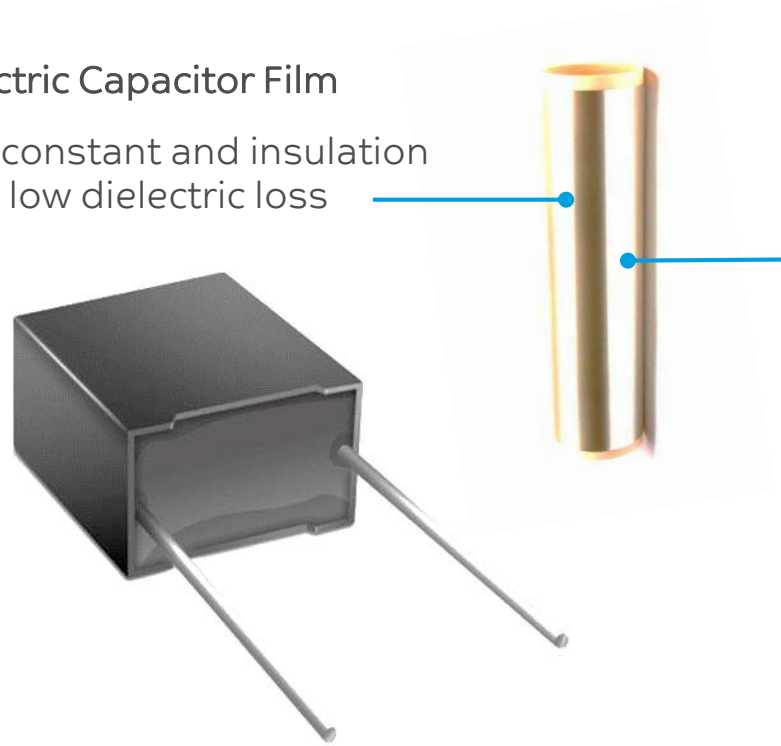
Console
LNP™ THERMOCOMP™ compound
Low moisture absorption, high modulus, superior hydrolytic stability, chemical resistance

HIGH TEMPERATURE ULTEM™ DIELECTRIC CAPACITOR FILM

ULTEM™ Dielectric Capacitor Film is a high heat and high energy density dielectric film that meets the most stringent technical demands for use in professional-grade dielectric film capacitors. Available in gauges of 4, 5, 7 and 10 µm.

ULTEM™ Dielectric Capacitor Film

High dielectric constant and insulation resistance and low dielectric loss



Stable at temperatures **up to 150 °C** and at high frequencies

Minimize the need for active cooling loops

Capable of withstanding industry-standard 260 °C reflow soldering processes

- INVERTERS
- DC-DC CONVERTERS
- HIGH INTENSITY LIGHTING (HIL)
- E-COMPRESSORS

ENABLING THE 48 V MHEV BATTERY WITH ALL THERMOPLASTIC DESIGNS

To reduce tailpipe emissions, increase fuel efficiency and power an ever-growing number of electric devices, 48 V mild hybrid electric vehicles (MHEVs) are poised to grow significantly in the coming years.

Depending on individual crush requirements, all plastic enclosures can help to save weight and increase productivity.

SABIC's Specialties business offers a range tailorable high strength, chemically resistant, UL94 flame retardant materials from our LNP™ compound and NORYL™ resin product lines for 48 V battery enclosures.

SABIC can offer a number of functional 48 V battery elements including cell spacers (NORYL™), retainers, brackets and connectors

To aid cooling of the 48 V battery, thermally conductive LNP™ KONDUIT™ compound can be used that can be glass filled for added stiffness.

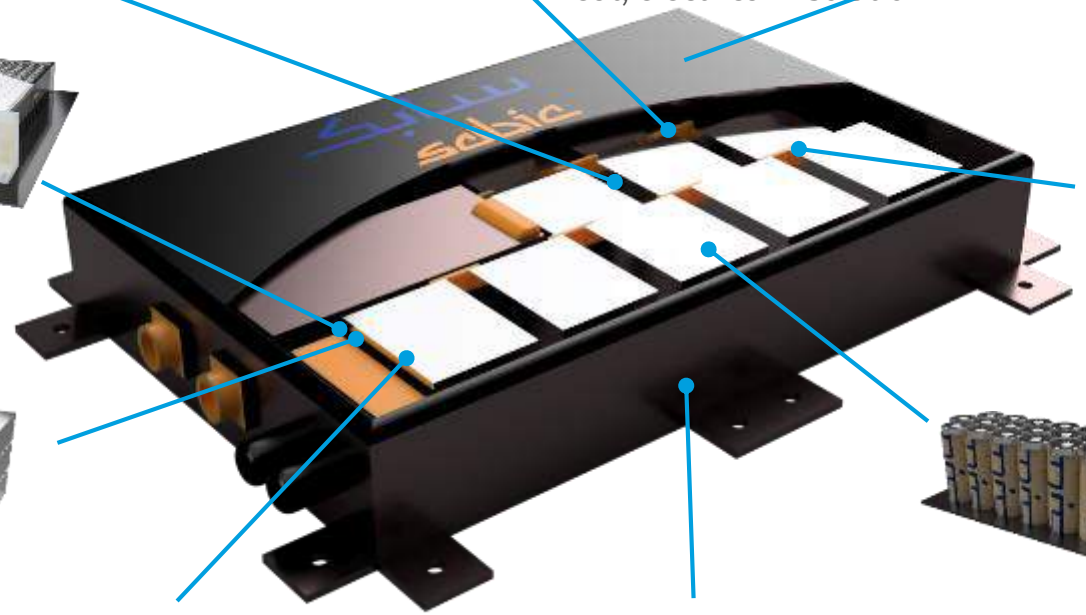
SAFETY AND FUNCTIONALITY: INNOVATIVE MATERIALS FOR EV BATTERY PACKS

CELL SPACERS
NORYL™ resin
LNP™ KONDUIT™ compound
Flame retardant, dimensional stability, thin wall processing

LAMINATED BUS BARS
ULTEM™ resin
NORYL™
LNP™ resin
Flame retardant, high heat, electrical insulation

PACK ENCLOSURES
LNP™ VERTON™ compound
NORYL™ resin
Flame retardant, stiffness & impact strength.

END PLATES/BRACKETS
LNP™ VERTON™ compound
LNP™ THERMOTUF™ compound
Flame retardant, high stiffness.



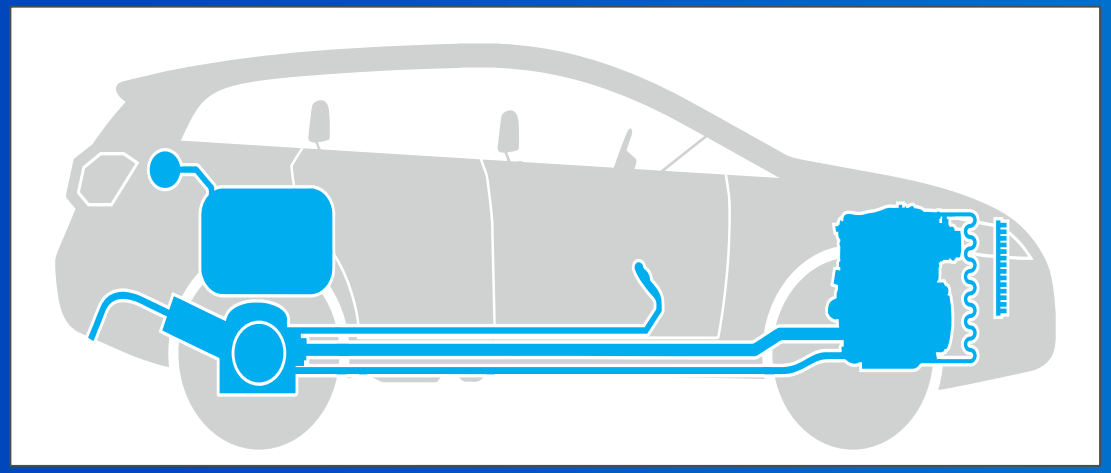
MODULE ENCLOSURES AND BUS BAR PROTECTION
NORYL™ resin
Flame retardant, chemical resistance, dimensional stability

TERMINAL COVERS/CAPS
NORYL™ resin
ULTEM™ resin
Flame retardant, dimensional stability, thin wall processing

CYLINDRICAL CELL RETAINERS
PC-ABS CX resin
NORYL™ resin
Flame retardant, UV transparent, dimensional stability, thin wall processing

POUCH CELL FRAMES
NORYL™ resin
Flame retardant, dimensional stability, thin wall processing

SIDE IMPACT – ROCKER PROTECTION
NORYL GTX™ resin
High energy absorption, weight out vs. metal.



Under-the-Hood & Fuel Systems

It’s an aggressive world under the hood. Performance plastics need to withstand vibration, high temperatures and a host of chemicals, dirt and debris. Our portfolio is there to help our customers save weight and cost. Where fuel is concerned, SABIC brings you a range of high strength, chemically resistant materials that are designed to help prevent hazardous electrostatic ignition.

UNIQUE OFFERINGS FOR 12 V LEAD ACID/LITHIUM-ION BATTERIES

SABIC Specialties and its majority-owned affiliate **Black Diamond Structures** offer a number of unique solutions for 12 V lead acid and Lithium-ion starting lighting and ignition (SLI) batteries.

With excellent hydro- and dimensional stability, together with chemical resistance to H_2SO_4, select NORYL™ resin grades are ideal for 12 V lead acid battery enclosures and covers.

Select NORYL™ resin and LNP™ compounds are also suited to enclosures and internal elements of 12 V Li-ion SLI batteries.

Enabling batteries to store more energy, charge faster, and last significantly longer.

Discrete, multi-walled carbon nanotubes (MWCNTs) from Black Diamond Structures may help to boost the performance of all types of 12 V lead acid batteries:

- Improved consistency in performance
- Extended cycle life
- Increased charge acceptance
- Extended plate durability

ACTIVE FUEL MANAGEMENT SOLUTIONS

Fuel Line Clips
LNP™ STAT-KON™ Compound
Electrostatic discharge protection, superior chemical resistance, high ductility and toughness

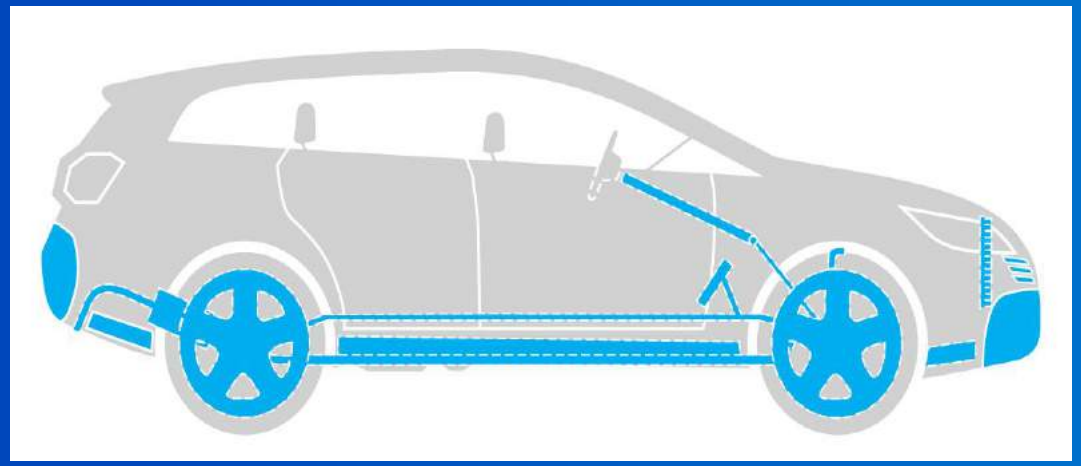
In-Line Fuel Filter Housing
LNP™ STAT-KON™ Compound
Electrostatic discharge protection, superior chemical resistance, high ductility and toughness

Fuel Filter Bracket & Pockets
LNP™ STAT-KON™ Compound
Electrostatic discharge protection, superior chemical resistance, high ductility and toughness

Ignition Coils, Junction Boxes, Connectors
NORYL™ and NORYL GTX™ resin
superior chemical resistance, dimensional stability, heat resistance, impact resistance, good foam adhesion and property retention

Inlet Control Valve Bodies and Poppets
LNP™ STAT-KON™ Compound
Electrostatic discharge protection, superior chemical resistance, high ductility and toughness

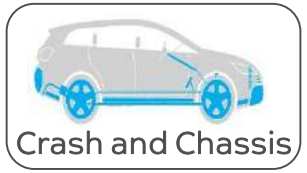
Cylinder Deactivation Valve
ULTEM™ resin
dimensional stability, chemical resistance, high heat resistance, mechanical property retention



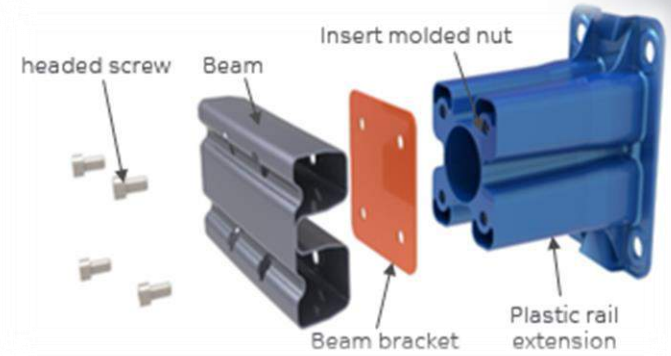
Crash and Chassis

Chassis and body account for over 60% of the vehicle mass and represents a prime focus area for weight reduction opportunities. Use of plastic-metal hybrids for body-in-white (BIW) components is the first step towards eventual multi-material construction of next generation vehicles.

SOLUTIONS FOR BODY IN WHITE REINFORCEMENTS



B-PILLAR REINFORCEMENT
NORYL GTX™ resin (weight & mass reduction, ease of assembly)



PLASTIC RAIL EXTENSION
NORYL GTX™ resin
50% weight reduction, reduced system cost, comparable impact & crash performance

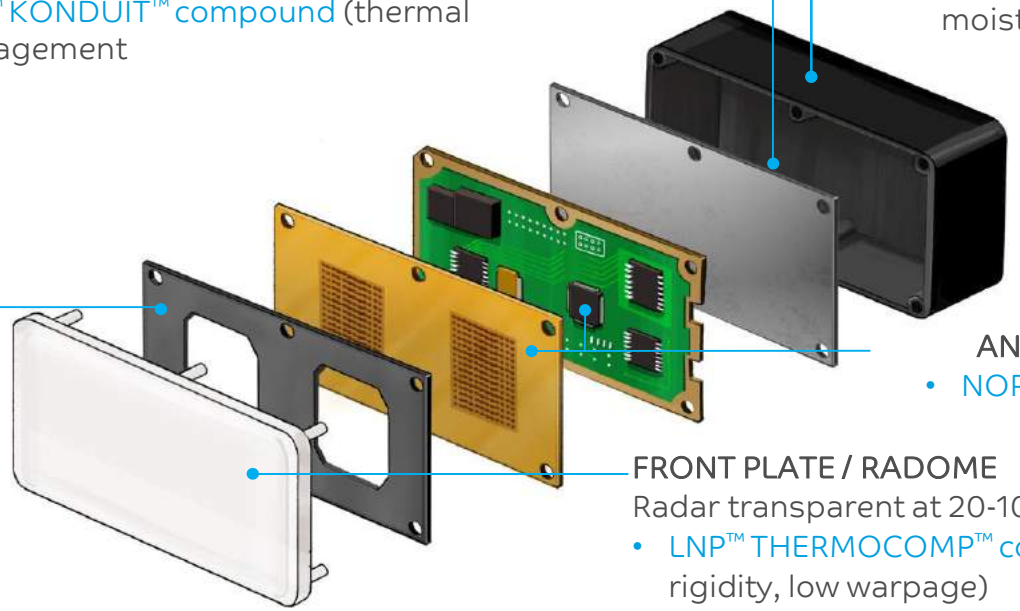
Sensing Systems

The importance of passenger, occupant and pedestrian safety is driving automakers and their suppliers to upgrade their ADAS offerings to further advance the performance and reliability of assisted driving. As adoption rates rise, the number of safety features and onboard electronic systems per vehicle increases each year, requiring engineers to seek out material solutions for light weighting and increased design flexibility.

ADVANCED DRIVING ASSISTANCE SYSTEMS: RADAR

MIDDLE PLATES
Radar absorbing / shielding at 20-100 GHz
- LNP™ STAT-KON™ compound (radar absorbing)
- LNP™ FARADEX™ compound (EMI Shielding)
- LNP™ KONDUIT™ compound (thermal management

BACK COVER
EMI Shielding / Mechanical Strength
- LNP™ FARADEX™ compound (EMI shielding)
- LNP™ THERMOCOMP™ compound (chemical resistance, rigidity, low warpage)
  - NORYL™ resin (chemical resistance, low moisture and warpage, laser weld capable)



ANTENNA / CONTROL CHIP PCB BOARD
- NORYL™ resin (low dielectric loss)

FRONT PLATE / RADOME
Radar transparent at 20-100 GHz
- LNP™ THERMOCOMP™ compound (chemical resistance, rigidity, low warpage)
- ULTEM™ resin (high temperature resistance, radar transparent, weatherability, dimensional stability)
- NORYL™ resin (superior dimensional stability, low warpage, UV property retention, stability of Dk/Df

ADVANCED DRIVING ASSISTANCE SYSTEMS: AUTOMOTIVE CAMERA

TOP COVER
- **LNP™ THERMOCOMP™ compound** (chemical resistance, rigidity, low warpage, UV stability)
- **NORYL™ resin** (UV property stability, low warpage, dimensional stability, low moisture uptake, laser welding)
- **LNP™ KONDUIT™ compound** (thermal management)

IR LENS
- **ULTEM™ / EXTEM™ resin** (IR transparent, high heat & chemical resistance, UV resistant, reflow soldering capable, dimensional stability)

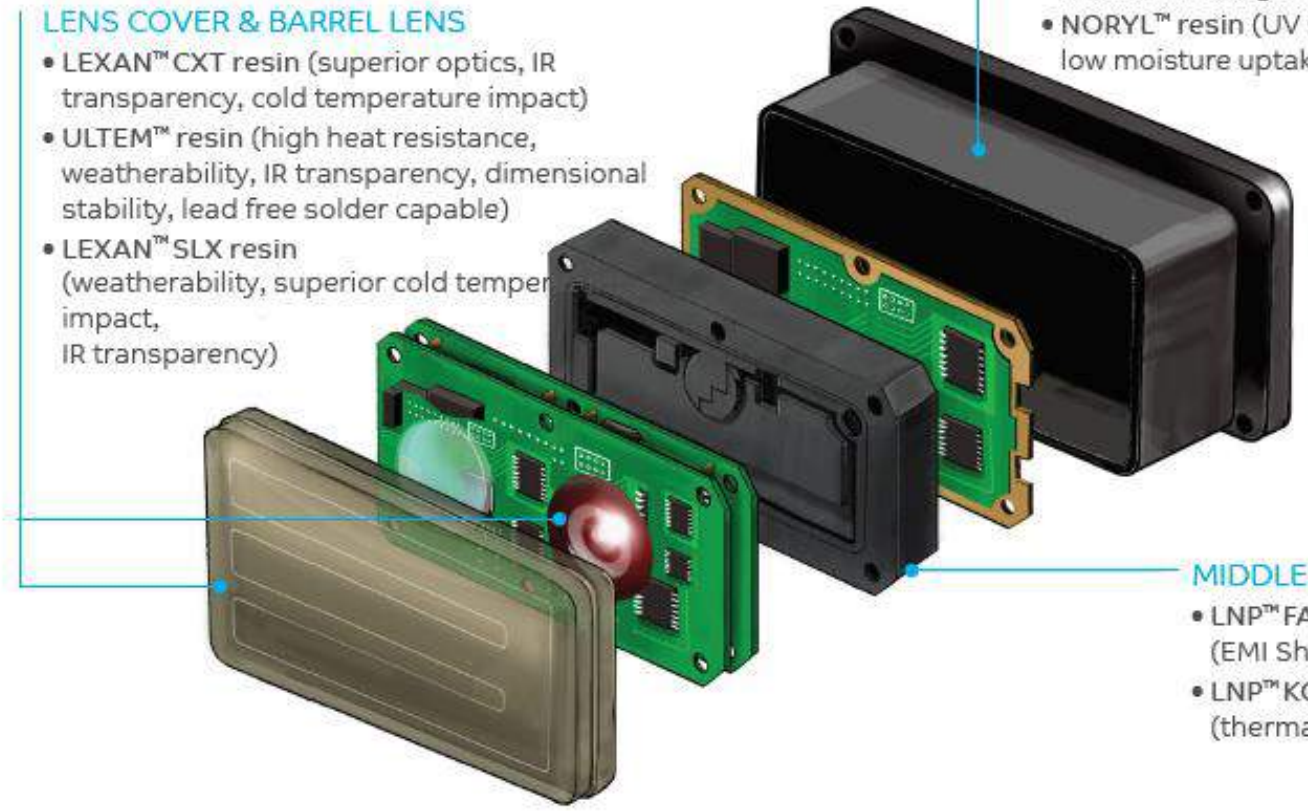
LENS BARREL
- **ULTEM™ resin** (low outgassing, dimensional stability, opaque or IR transparent, chemical resistance, high heat resistance)

MODULE HOUSING
- **LNP™ THERMOCOMP™ compound** (dimensional stability)
- **NORYL™ resin** (dimensional stability)
- **ULTEM™ resin** (dimensional stability, high heat resistance)

LENS SPACER
- **ULTEM™ resin** (dimensional stability, high heat and chemical resistance, low CTE)

BOTTOM COVER
- **LNP™ THERMOCOMP™ compound** (chemical resistance, rigidity, low warpage)
- **LNP™ KONDUIT™ compound** (thermal management)
- **LNP™ FARADEX™ compound** (EMI Shielding)
- **NORYL™ resin** (dimensional stability, low warpage, low moisture uptake, laser welding)

ADVANCED DRIVING ASSISTANCE SYSTEMS: LIDAR



BACK COVER / SIDE HOUSING
- LNP™ THERMOCOMP™ compound (chemical resistance, rigidity, low warpage, UV stability)
- LNP™ KONDUIT™ compound (thermal management)
- NORYL™ resin (UV stability, low warpage, low moisture uptake, laser welding)

LENS COVER & BARREL LENS
- LEXAN™ CXT resin (superior optics, IR transparency, cold temperature impact)
- ULTEM™ resin (high heat resistance, weatherability, IR transparency, dimensional stability, lead free solder capable)
- LEXAN™ SLX resin (weatherability, superior cold temper impact, IR transparency)

MIDDLE PLATE
- LNP™ FARADEX™ compound (EMI Shielding)
- LNP™ KONDUIT™ compound (thermal management)

PRODUCT LINE CARD

PRODUCT LINE CARD

NORYL™ - Modified PPE/HIPS Resin
- Amorphous, reinforced & un-reinforced, additives
- Good room temp. & Low temp. Impact strength
- Excellent hydrolytic stability
- Low specific gravity
- Heat resistance to 149 °C
- Strong electrical and flame resistance properties

NORYL GTX™ - PPE/Polyamide Resin
- Amorphous/crystalline blend, reinforced & un-reinforced
- Good chemical resistance
- Dimensional stability
- Heat resistance to 240 °C
- Excellent impact
- Electrostatic painting & powder coating

ULTEM™ - PEI Resin
- Amorphous, reinforced & un-reinforced, additives
- Heat resistance to 221 °C
- Excellent hydrolytic & chemical stability
- Transparent (amber) & colors
- Good electrical properties
- Inherent flame retardancy/ low smoke generation

EXTEM™ – High Heat Resin
- Amorphous TPI and PEI resins
- Heat resistance to 255 °C
- Infrared transparency
- Lead free solder capable

SILTEM™ – Siloxane polyetherimide block copolymer
- Wire and cable applications
- Halogen free
- Good electrical properties
- Heat resistance to 164 °C

LEXAN™ EXL Resin – High Impact PC/Siloxane Copolymer
- Excellent low temperatures impact
- Weatherability
- Improved chemical resistance
- Excellent processability
- Impact retention upon long term heat and humidity aging
- Eco-FR grades for ECO compliant applications
- Wide range of colors including Visualfx™

LEXAN™ SLX Resin – Weatherable PC Copolymer
- Extreme weatherability—prolonged UV exposure (>10yr)
- Cost reduction through paint-free, MIC
- Clarity: low haze, high light transmission
- Lower gloss loss and color shift
- High heat and impact performance
- Higher flow SLX to enable thinner wall designs and benefits for cost savings

LEXAN™ XHT Resin, CXT resin, and PPC resin - High Heat PC Copolymer
- Heat resistance in range of 140-180 °C
- Outstanding surface finish and primer-less metallization
- High flow XHT to enable thinner wall designs
- CXT resin: highest heat resistance (up to 190 °C) with higher clarity vs. XHT resin
- PPC resin: heat resistance (up to 165 °C) and impact performance

LNP™ LUBRICOMP™/LUBRILOY™ compound
- Lubrication
- Durability
- Noise abatement
- Low maintenance

LNP™ STAT-KON™/STAT-LOY™ compound
- Anti-static
- Electro-static dissipation

LNP™ THERMOCOMP™ /THERMOTUF™ compound
- Dimensional accuracy
- High modulus & ductile
- Super structural
- Metal replacement
- NMT (nano molding)
- Tunable dielectric solution (dk / df)
- Sustainable solutions

LNP™ FARADEX™ compound
- EMI/RFI shielding

LNP™ KONDUIT™ compound
- Thermal dissipation

LNP™ VERTON™ compound
- High modulus
- Excellent impact at all temperatures

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