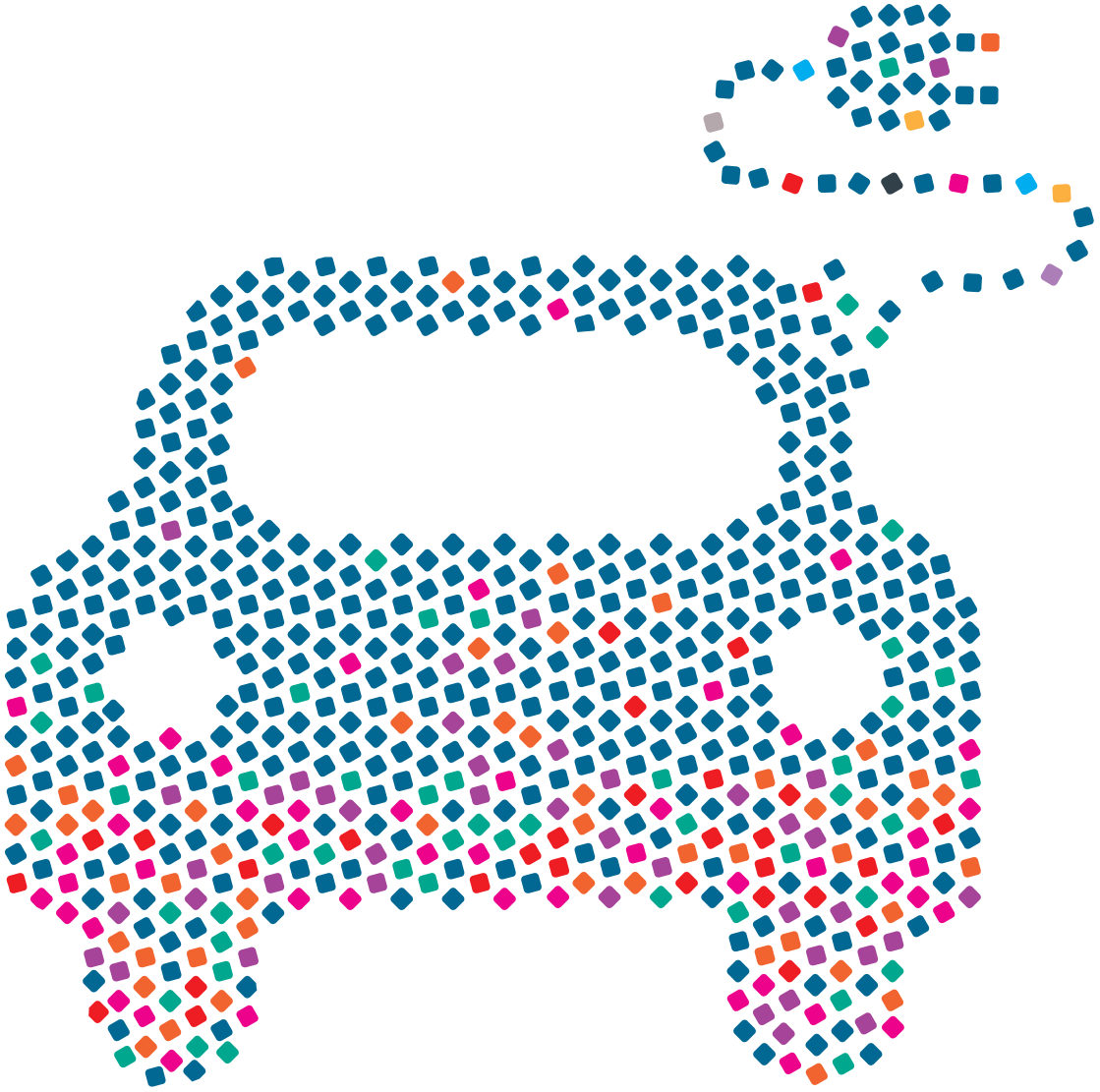
eurotec® engineering plastics



Intelligent Solutions for E-Mobility

Demand the Impossible

eurotec® is a leading compounder of engineering plastics that present innovative products based on intelligent solutions and tailor made services.

eurotec® through combining the latest technology and experienced, customer oriented and dynamic team, produces high quality products for sustainable success of industries that touch every aspect of life.

- **Tecomid®** PA6, PA6.6, PA6.6/6 and PA blends
- **Tecomid®** HT PPA
- **Tecodur®** PBT and PBT blends
- **Tecopet®** PET and PET blends
- **Tecotek®** PC, PPO, PESU, PPSU, PSU and blends
- **Tecolen®** PP and PE speciality
- **Tecoform®** POM
- **Tecopeek®** PEEK
- **Tecoket®** PK
- **Tecotron®** PPS
- **Tecoflex®** TPU

PRODUCT TYPES

- **Reinforced**
  - Glass fiber (up to 70%)
  - Carbon fiber
  - Aramide fiber
  - Glass bead
  - Glass bubble
  - Metal fibers and powders
  - Various minerals
  - Combinations
- **Impact Resistant**
  - From dry impact to supertough
  - Excellent low temperature impact types
- **Flame Retardant**
  - Halogen free / Halogenated
  - Red Phosphorus
  - Low smoke & toxic gas types
  - Ignition resistant
- **Surface Modified**
  - MoS_2, PTFE, Silicon, Graphite
- **Electrically Conductive**
  - From permanent anti-static, to highly conductive
  - EMI/RF Shielding
- **Thermally Conductive**
  - Electrically insulative – thermally conductive
  - Electrically & thermally conductive
- **Heat Stabilized**
  - High temperature applications
  - Hot water, hot oil, glycol resistance
- **UV-Light Stabilized**
  - For all climatic conditions
- **Colours**
  - Custom colours
  - Laser markable
  - Thermochromic
  - Fluorescence & Phosphorescence
  - Metallic effect

INTELLIGENT AND FUNCTIONAL SOLUTIONS

- **Energy saving**
- **Safety**
- **Aesthetics**
- **Insulation**
- **Design freedom**
- **Life span**
- **Health care**
- **Easy – life products**

eurotec® E-Mobility Concept

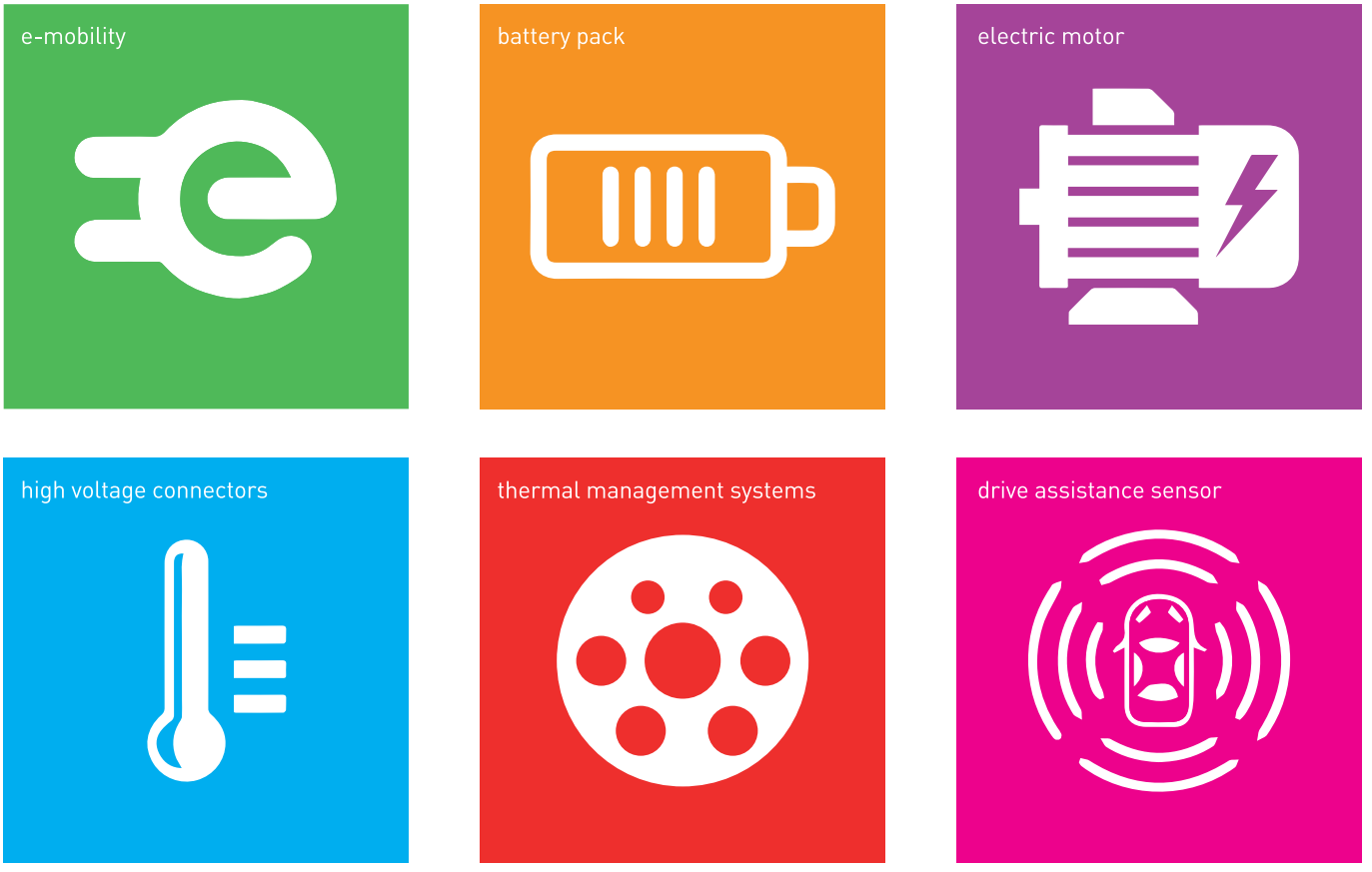
The automotive world is undergoing significant a change due to stringent climate targets and major technological innovations. New implementations are adopting by manufacturers to provide more sustainable, more eco-friendly, and more efficient solutions in the light of innovative state of the art technology and mobility services.

The future of the automotive industry is being shaped by E-mobility. Hybrid-powered and electric vehicle technology, advancing digitalization and autonomous driving are main developments and trends for E-mobility to help reduce carbon emissions and dependence on petroleum and to a have more safe and comfortable drive.

The impact of electrification in automotive industries brought new parts to vehicles such as batteries, charging stations, high voltage components, inverters and many more... euro**tec**® is always oriented innovation which offers a wide range of high-performance plastics for E-mobility with the combination its deep material knowledge and experience in automotive and E&E industries.

euro**tec**® provides grades to electrical vehicles in accordance with related certificates and safety standards in the terms of fire rating, electrically conductivity, thermally conductivity and mechanical properties with high quality experience and knowledge.

euro**tec**® E-mobility concept is divided to five sections; battery pack, electric motor, high voltage connectors, thermal management systems and drive assistance sensors.



eurotec® engineering plastics

Battery Pack

- **Tecomid NA40 GR30 NL HS**
  PA6,6, 30% glass fiber reinforced, heat stabilized
- **Tecomid NA40 GR25 NL XA60**
  PA6,6, 25% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NA30 NL FA50 QL**
  PA6,6, unfilled, flame retardant - halogen free, UL registered
- **Tecomid NA30 GR25 BK048 XA43 QL**
  PA6,6, 25% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, UL registered
- **Tecomid HT NT40 GR30 NL XA60**
  PPA, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid HT NT40 GR30 NL HS**
  PPA, 30% glass fiber reinforced, heat stabilized
- **Tecomid HT NT40 GD40 BK009 XA61**
  PPA, 40% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, low warpage and good surface finish grade
- **Tecodur PB70 GR30 NL XA74**
  PBT/ASA, 30% glass fiber reinforced, flame retardant halogen (RoHS compliant), heat stabilized
- **Tecodur PB70 GR25 NL XA60**
  PBT, 25% glass fiber reinforced, flame retardant - halogen free, heat stabilized
- **Tecomid NA40 GR30 NL KZ 07**
  PA6,6/PA6,10, 30% glass fiber reinforced, salt resistance, heat stabilized
- **Tecomid NA40 GR30 NL XA60**
  PA6,6, 30% glass fiber reinforced, flame retardant halogen & red phosphorus free, heat stabilized
- **Tecomid NB30 GR45 NL XA60**
  PA6, 45% glass fiber reinforced, flame retardant halogen & red phosphorus free, heat stabilized
- **Tecomid NB30 NL FA50 QL**
  PA6, unfilled, flame retardant - halogen free, UL registered
- **Tecomid NB40 GR30 NL XA60**
  PA6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, EN 4354:b compliant
- **Tecomid NB40 K030 BK005 HV**
  PA6, 30% glass fiber/glass bead reinforced, hydrolysis and glycol stabilized
- **Tecomid NG40 GR30 NL XA60**
  High performance PA, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NG40 GR30 BK005 HS**
  High performance PA, 30% glass fiber reinforced, heat stabilized
- **Tecotek PC40 BK013 XA80**
  PC, unfilled, flame retardant - Br, Cl free, heat stabilized
- **Tecotron XS20 GR40 BK009**
  PPS, 40% glass fiber reinforced
- **Tecodur PB70 GR30 NL HS**
  PBT, 30% glass fiber reinforced, heat stabilized

Electric Motor

- **Tecodur PB70 BK001 HS**
  PBT, unfilled, heat stabilized
- **Tecodur PB70 GR30 NL MB04**
  PBT/ASA, 30% glass fiber reinforced, heat & UV stabilized
- **Tecodur PB70 GR30 NL100**
  PBT, 30% glass fiber reinforced
- **Tecodur PB70 GR30 NL100 XA70**
  PBT, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized
- **Tecodur PB70 GR50 NL100**
  PBT, 50% glass fiber reinforced

Electric Motor

- **Tecaform PO30 AR15 NL HS**
  POM copolymer, 15% aramide fiber reinforced, heat stabilized
- **Tecomid NA40 CR30 BK111 HS**
  PA6,6, 30% carbon fiber reinforced, heat stabilized
- **Tecomid NA40 GB30 NL007 HS**
  PA6,6, 30% glass bead reinforced, heat stabilized
- **Tecomid NA40 GR30 BK005 HS**
  PA6,6, 30% glass fiber reinforced, heat stabilized
- **Tecomid NA40 GR30 NL HS**
  PA6,6, 30% glass fiber reinforced, heat stabilized
- **Tecomid NA40 GR30 NL HT**
  PA6,6, 30% glass fiber reinforced, high heat stabilized
- **Tecomid NA40 GR33 BK005 MB**
  PA6,6, 33% glass fiber reinforced, impact modified
- **Tecomid NA40 GR50 NL HS**
  PA6,6, 50% glass fiber reinforced, heat stabilized
- **Tecomid NA40 K030 NL HS**
  PA6,6, 30% glass fiber / glass bead reinforced, heat stabilized
- **Tecomid NA40 KK30 NL HS**
  PA6,6, 30% glass fiber / mineral reinforced, heat stabilized
- **Tecomid NA43 GR30 BK005 HS**
  PA6,6, 30% glass fiber reinforced, heat stabilized
- **Tecomid NA40 MR40 NL HS**
  PA6,6, 40% mineral reinforced, heat stabilized
- **Tecomid NB30 MF30 BK001 HS**
  PA6, 30% mineral filled, heat stabilized
- **Tecomid NB40 GR30 NL HS**
  PA6, 30% glass fiber reinforced, heat stabilized
- **Tecomid NG40 GR30 NL HS**
  High performance PA, 30% glass fiber reinforced, heat stabilized, low warpage and good surface finish

High Voltage Connector

- **Tecopet PT70 KK45 NL XA20 0B**
  PET, 45% glass fiber/mineral reinforced, flame retardant halogen (RoHS compliant), heat stabilized
- **Tecopet PT70 GR30 NL XA60**
  PET, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecopet PT70 GR30 NL100 PS20**
  PET, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, fast crystallization grade
- **Tecopet PT70 GR15 NL100 PS20**
  PET, 15% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, fast crystallization grade
- **Tecomid NG40 GR25 NL XA60**
  High performance PA, 25% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NG40 GD50 NL XA60**
  High performance PA, 50% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NB40 GR30 NL XA4X**
  PA6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, EN 4354:b compliant
- **Tecomid NB40 GR30 NL XA60**
  PA6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, EN 4354:b compliant
- **Tecomid NB40 GR20 NL XA60**
  PA6, 20% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NB30 NL FA50 QL**
  PA6, unfilled, flame retardant - halogen free, UL registered

High Voltage Connector

- **Tecomid NB30 NL FY50**
  PA6, unfilled, flame retardant - halogen & red phosphorus free
- **Tecomid NB30 GP20 NL XZ50**
  PA6, 20% glass fiber reinforced, flame retardant - halogen free, heat stabilized
- **Tecomid NA40 GR30 NL XA4X**
  PA6,6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, EN 4354:b compliant
- **Tecomid NA40 GR25 NL XA60**
  PA6,6, 25% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NA40 GD30 NL XA60**
  PA6,6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid HT NT40 GR30 NL XA60**
  PPA, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid HT NT40 GD40 NL XA61**
  PPA, 40% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecodur PB70 GR30 GR006 MB**
  PBT, 30% glass fiber reinforced, impact modified, heat stabilized
- **Tecodur PB70 GR30 NL XA70**
  PBT, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized
- **Tecodur PB70 GR30 NL XA60**
  PBT, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecodur PB70 GR30 NL MS**
  PBT, 30% glass fiber reinforced, hydrolysis stabilized, impact modified
- **Tecomid NA40 GR30 BK005 HY QH**
  PA6,6, 30% glass fiber reinforced, hydrolysis stabilized
- **Tecomid NA40 GR30 NL HW**
  PA6,6, 30% glass fiber reinforced, hydrolysis stabilized
- **Tecomid NA40 GR30 NL KD**
  PA6,6, 30% glass fiber reinforced, hydrolysis stabilized
- **Tecomid NA40 GR30 NL KZ 07**
  PA6,6/PA6,10, 30% glass fiber reinforced, salt resistance, heat stabilized
- **Tecomid NB60 KG30 BK005 HV 0B**
  PA6, 30% glass fiber / glass bead reinforced, heat stabilized
- **Tecomid NG60 KG30 BK005 HV 0B**
  High performance PA, 30% glass fiber / glass bead reinforced, heat stabilized

Thermal Management

- **Tecotron XS20 GR30 BK009**
  PPS, 30% glass fiber reinforced
- **Tecotron XS20 GR40 BK009**
  PPS, 40% glass fiber reinforced
- **Tecotron XS20 KK30 BK009 IL 0B**
  PPS, 30% glass fiber / mineral reinforced, impact modified
- **Tecomid NA30 NL TC 5D**
  PA6,6, unfilled, thermally conductive
- **Tecomid NA30 NL TC 4A**
  PA6,6, unfilled, thermally conductive
- **Tecotron XS20 NL TC 5A**
  PPS, unfilled, thermally conductive
- **Tecomid NB30 NL CZ60 5B**
  PA6, unfilled, thermally conductive, flame retardant - halogen free
- **Tecomid NB30 NL TC 5B**
  PA6, unfilled, thermally conductive

Thermal Management

- **Tecomid NA30 NL TC 5C**
  PA6,6, unfilled, thermally conductive
- **Tecomid NB30 NL CZ70 2C**
  PA6, unfilled, thermally conductive, flame retardant - halogen (RoHS compliant)
- **Tecomid HT NT40 NL CZ60 2A**
  PPA, unfilled, thermally conductive, flame retardant - halogen (RoHS compliant), heat stabilized
- **Tecomid NB30 NL CZ70 5A**
  PA6, unfilled, thermally conductive, flame retardant - halogen (RoHS compliant), heat stabilized
- **Tecomid HT NT40 NL TC 2B**
  PPA, unfilled, thermally conductive

Drive Assistance Sensors

- **Tecomid NA30 GR15 BK111 TC 1C**
  PA6,6, 15% glass fiber reinforced, electrically and thermally conductive
- **Tecomid NA40 CN20 BK012 HS**
  PA6,6, 20% carbon fiber reinforced, heat stabilized
- **Tecomid NA40 CR15 BK111 HW**
  PA6,6, 15% carbon fiber reinforced, hydrolysis stabilized
- **Tecomid NA40 CR20 BK111 XA60**
  PA6,6, 20% carbon fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid NA40 GR15 BK111 EF 0C**
  PA6,6, 15% glass fiber reinforced, electrically conductive
- **Tecomid NB30 BK ET70**
  PA6, unfilled, impact modified, flame retardant - halogen (RoHS compliant), electrically conductive
- **Tecomid NB30 BK111 EC 0C**
  PA6, unfilled, electrically conductive
- **Tecomid NB30 BK111 TC 1C**
  PA6, unfilled, electrically and thermally conductive
- **Tecomid NB30 BK111 TC 1G**
  PA6, unfilled, electrically and thermally conductive
- **Tecomid NB30 BK111 TC 6G**
  PA6, unfilled, electrically and thermally conductive
- **Tecomid NB30 GR20 BK EF**
  PA6, 20% glass fiber reinforced, suitable for electrostatic powder coating
- **Tecomid NB30 GR25 NL AS**
  PA6, 25% glass fiber reinforced, antistatic
- **Tecomid NB40 CR25 BK111**
  PA6, 25% carbon fiber reinforced
- **Tecomid NB40 SR15 NL AS**
  PA6, 15% steel fiber reinforced, permanent antistatic
- **Tecomid NG40 KC55 BK111 HS 0A**
  High performance PA, 55% glass fiber / carbon fiber reinforced, heat stabilized
- **Tecomid HT NT40 CR30 BK111 XA60**
  PPA, 30% carbon fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized
- **Tecomid HT NT40 BK111 CZ60 1A**
  PPA, unfilled, thermally conductive, flame retardant - halogen free
- **Tecotek AB40 SR10 GR003 FA70**
  ABS, 10% steel fiber reinforced, flame retardant - halogen (RoHS compliant)
- **Tecotek PC60 BK111 TC 1D**
  PC, unfilled, thermally and electrically conductive
- **Tecotron XS20 BK111 TC 1D**
  PPS, unfilled, electrically and thermally conductive

1. Battery Pack
2. Electric Motor
3. High Voltage Connectors and Cables
4. Thermal Management Systems
5. Drive Assistance Sensors

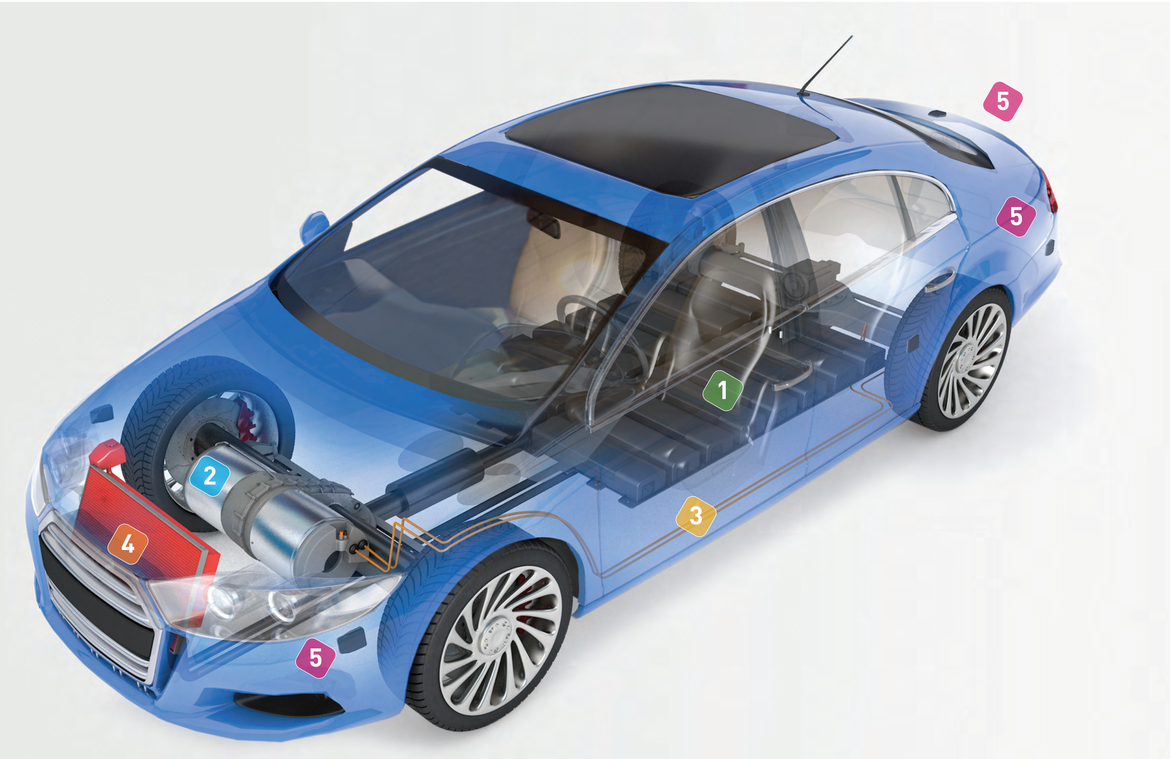
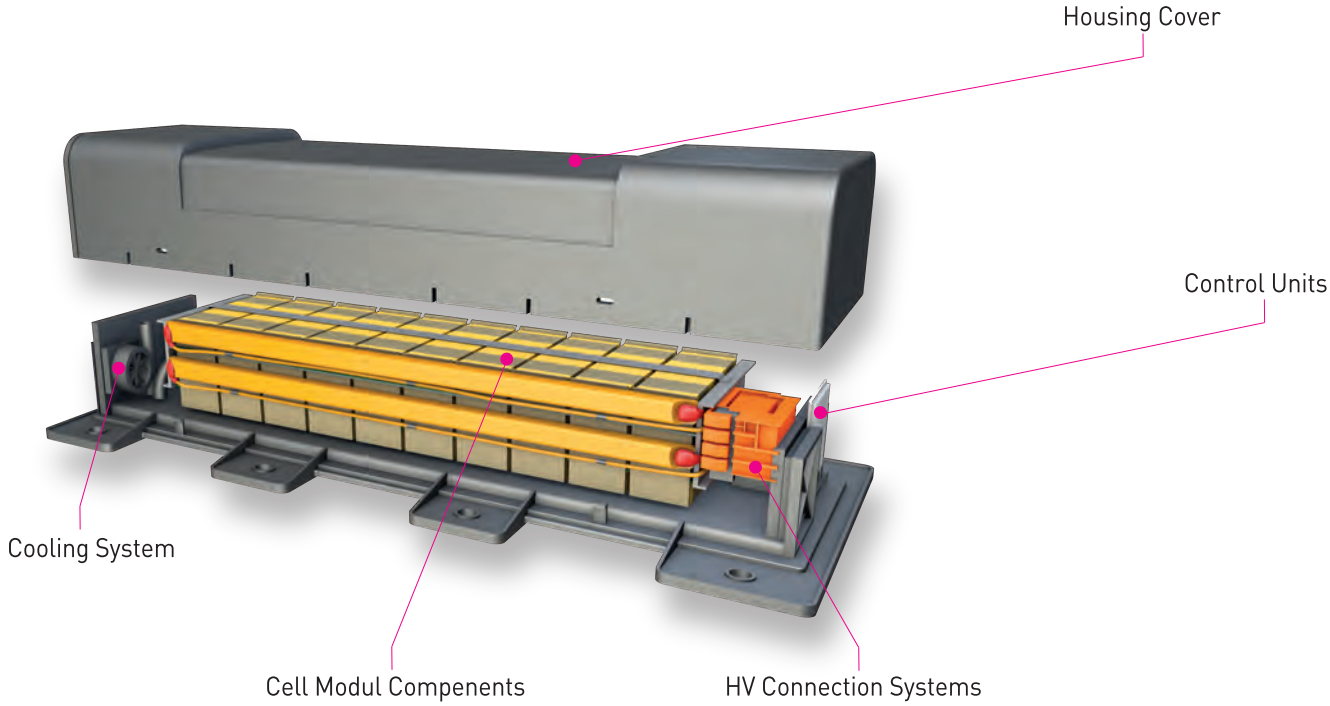


Illustration © eurotec®

Battery Pack

Battery cells are one of the most critical parts of electric vehicle since it functions as unit that stores energy. The housing cover, cooling systems and connectors of the battery cell must be light weight to provide energy efficiency to compensate the limited range and heavy weight of battery. Hence thermoplastic materials will continue to play an important role due to their lightness weight in electric cars. Plastic materials could be exposed to high currents or sparks in the battery so they need to have high thermal and ignition resistance with good tracking behaviours to avoid any safety failure. In addition, if the plastic materials directly contact with battery, they need to show good resistance against to chemicals which comes from battery leakage. It is crucial that thermoplastic materials must deliver an outstanding performance against flammability requirements, resistance to high temperature and chemicals, dimensional stability, EMI RF shielding and crash resistance according to their position and function in a battery pack.

euro**tec**® offers intelligent solutions that meets these stricts requirement in a battery pack.



Thermal Management Systems

New trends in the automotive industry promotes more powerful and compact electronic technologies. Hence, one of the biggest challenges is to design an effective cooling system. Coolant systems in a battery are essential parts to provide efficient battery cooling and maintain battery temperature stabilized for energy efficiency and power availability. Cooling system can be controlled by active cooling like air cooling, liquid cooling and refrigerant cooling or by passive cooling with thermally conductive thermoplastic materials. For active cooling systems, thermoplastic materials need to display high chemical resistance depending on the type of coolant. Additionally, they need to have good dimensional stability to provide many design flexibility options to OEMs because each OEM designs its own special cooling system for electric vehicles.

Thermally conductive plastic materials increase the performance of electric vehicles due to their lightness in weight compared to metals. In E-mobility applications, components become smaller, require more power and need to have an aesthetic aspect but a new challenge arise at this point, high thermal load. Thus it is important to dissipate heat to enhance life time and reliable power for battery.

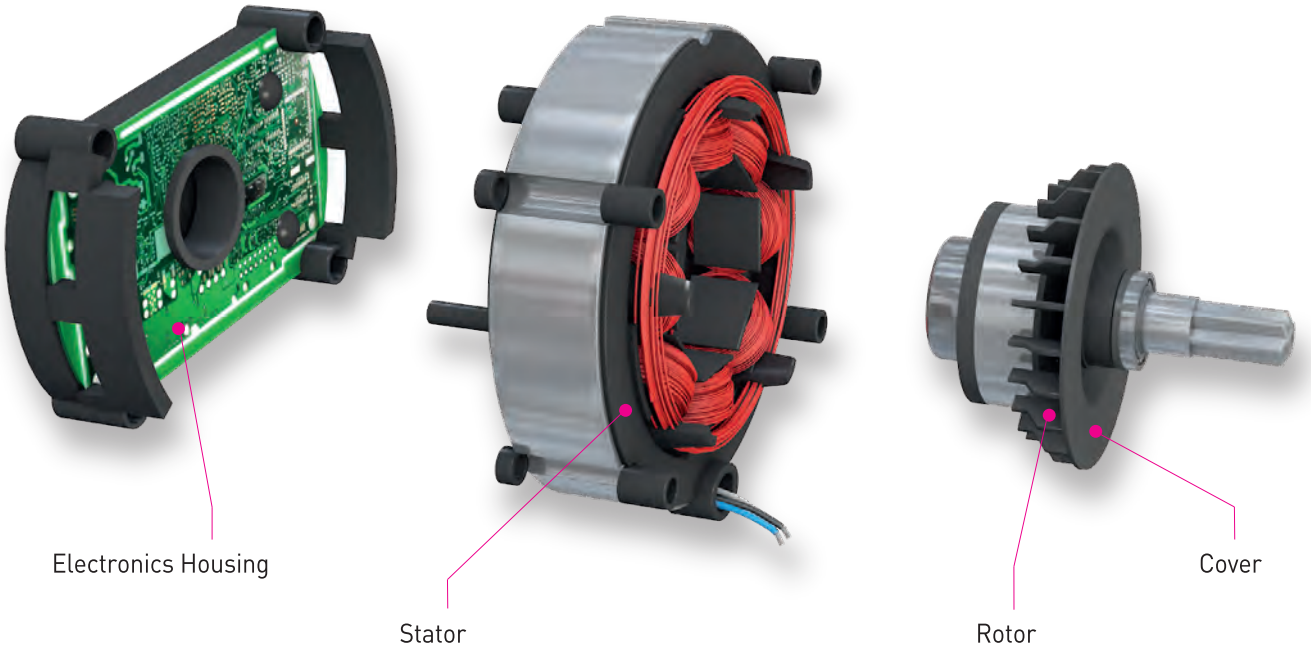
euro**tec**® offers unique solutions with high hydrolysis resistance grades which are comply with many OEM specifications such as Renault (AS 27), VW (TL 52682) and PSA (B71-6000) and additionally thermally conductive grades for thermal management requirement for electric vehicles.

Electrical Motors

The electric motors for electric vehicles continues to develop and manufacturers rely on in-house developments to try and build them according to their own expertise. Gasoline engine is replaced by an electric motor in electric vehicles. E- Motor derives its power from controllers which supply energy from battery. A gasoline engine is equipped with fuel lines, exhaust pipes, coolant hoses and intake manifolds where an electric motor is equipped with wires. Compared with combustion engine cars, electric cars are quieter and generate very low emission. Engineering thermoplastic materials continue to provide significant savings in electric motors for their advantage over metals and thermoset materials.

Thermoplastic materials offer low assembly costs, miniaturization options, design flexibility, longer mold life time, reduction in noise and vibration and better part integration. It is important to choose the right material for E-motor applications like gears, bearings, covers, coils, brushes due to the high temperature requirement, dimensional stability and friction resistance.

euro**tec**® team can easily identify the right material for electric vehicle technology based on the knowledge in automotive and E/E industries with the wide speciality product range.



High Voltage Connectors

Electric vehicles need high-voltage systems to provide enough power to drive motor and charge to battery. Due to safety requirement or to avoid any failure, it is important that materials should have a high dielectric strength, creep and tracking resistance for high voltage applications. These material should have halogen free or red phosphorous options to meet high CTI demand for these applications.

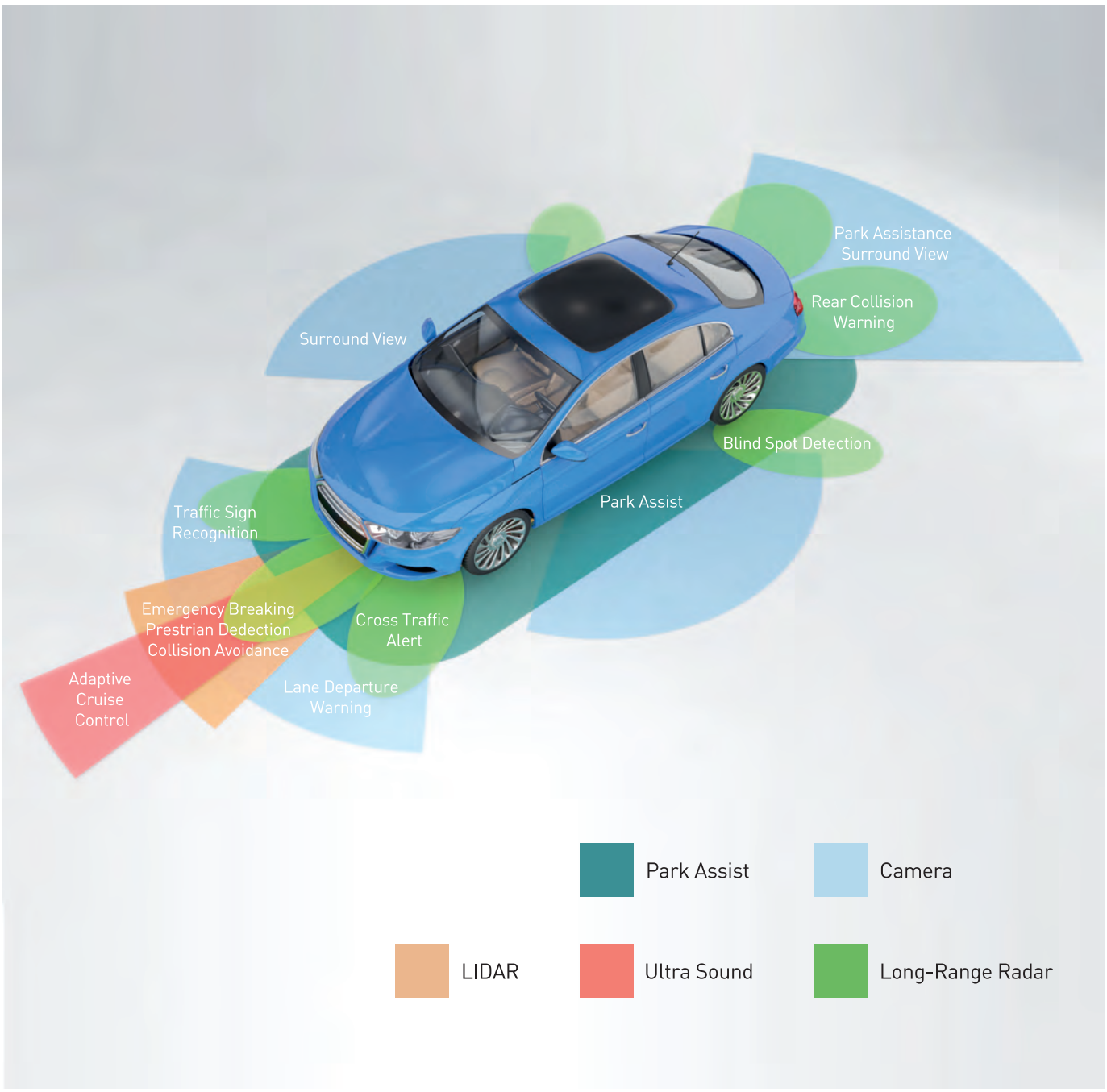
euro**tec**® offers a variety of orange colours for high voltage connectors to meet the required colour standards. The materials should also have a good thermal stability to maintain colour stabilized when it is exposed to heat. euro**tec**® is expanding its product range of orange-coloured compounds with focus on specific application requirements by offering halogen-free and high tracking resistance solutions through the provision of highly resistant own masterbatch solutions for orange-coloured compounds.

Drive Assistance Sensor

Vehicles are showing significant changes, getting smarter and autonomous. This will result in new challenges and opportunities in terms of design and functionality. There will be more complex and various sensor systems for infotainment and safety systems like cruise control, radar system, park assistance, traffic control, etc. All these additional sensors, cables and screens will also increase the weight of the vehicle. At the same time, future vehicles will enable people to live and relax in the passenger cabin instead of driving the vehicle. Therefore, aesthetics of the cabin interior will be more important than ever in future vehicles!

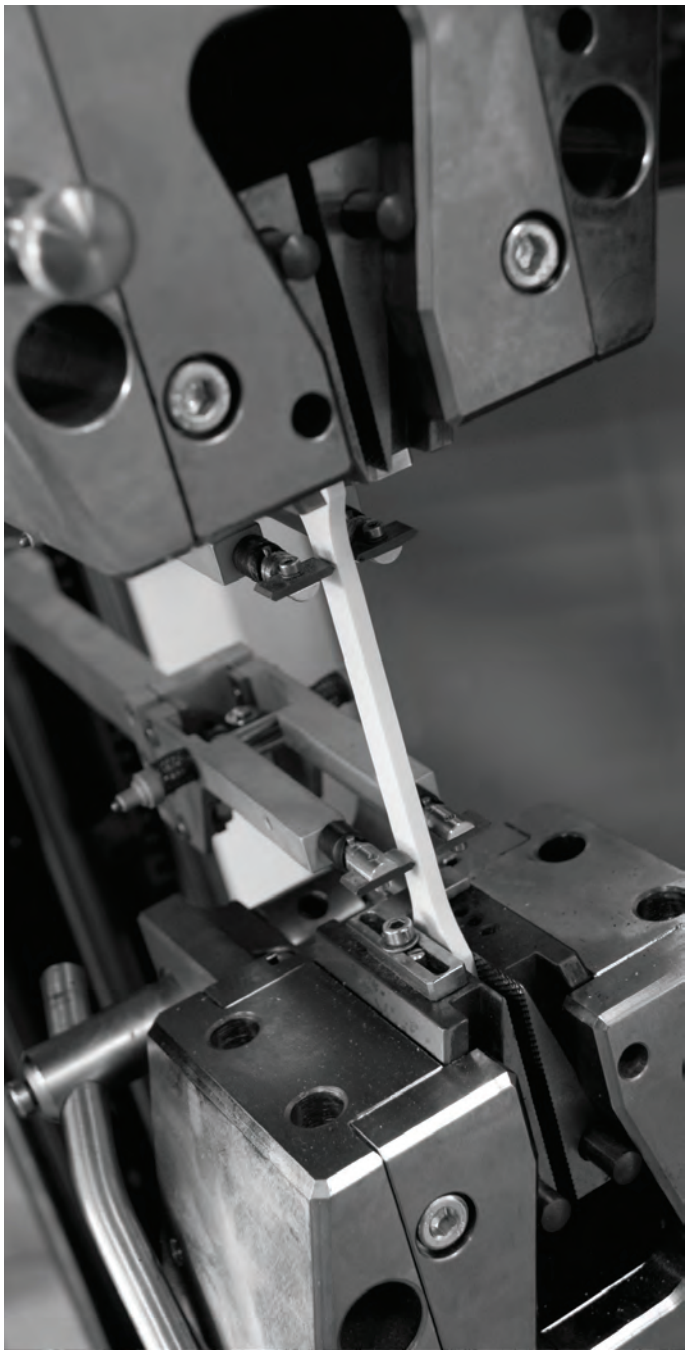
Another important parameter is to establish good communication system between vehicle and environment by advanced control systems to identify information comes from sensors. It is important that sensor housing materials should have a good mechanical stiffness, creep and fatigue resistance, dimensional stability and EMI/RF shielding properties to avoid any safety issue. Electrically conductive thermoplastic materials will play an important role on autonomous vehicles.

With its vast knowledge in electrically conductive plastics, euro**tec**® provides electrically conductive and structural materials that are especially suited to sensor components.



INNOVATIVE PRODUCTS AND TAILOR MADE SERVICES

- Wide range of product for demanding requirements
- Technical support by enthusiastic engineers
- Consistent quality through advanced technology
- Fast new product development based on industry trends
- Quick response for urgent orders
- Alternative logistics solutions
- Small lot sizes
- Custom colours



TESTING CAPABILITIES

- Flammability and electrical tests according to UL, IEC, DIN, EN, BS, ASTM, NF, FAR, FMVSS etc.
- Smoke and gas analysis
- Mechanical properties at specified temperatures
  Accelerated aging and weathering
- Chemical exposure at defined conditions
- Thermal analysis
- Failure analysis
- Dimensional stability and shrinkage
- Colour and gloss measurements
- Customer specific test simulations

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