



Bringing safety,
sustainability and
performance to e-Mobility
**EXOLIT® FLAME
RETARDANTS**

CLARIANT 

Public

Business Unit Additives
Flame Retardants
16 Sept 2021

what is precious to you?

BU Additives is a global, diversified solution provider



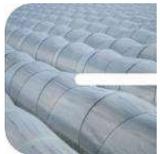
ADVANCED SURFACE SOLUTIONS

We offer advanced wax and polymer solutions that protect and enhance surfaces in plastics, coatings & inks, adhesives, agro and care applications.



FLAME RETARDANTS

Our patented halogen-free flame retardants provide environmentally compatible fire protection and pass demanding fire safety standards.



PERFORMANCE ADDITIVES

Our performance additives solutions prevent oxidation, dissipate electric charge accumulation and improve heat, light and weather resistance.



PLASTICS

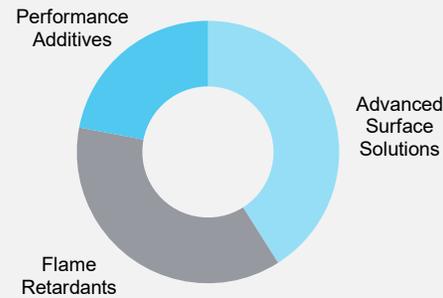


COATINGS & INKS

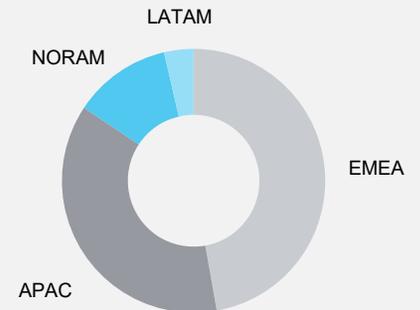


CONSUMER

SALES 2020 BY BUSINESS LINE



SALES 2020 BY REGION



~ 820

Employees

7

Production sites

3

Application Development Centers

3

Research Centers

You find us outside of the car, inside the car and under the hood

LICOCENE® HOT MELT ADHESIVE SOLUTIONS

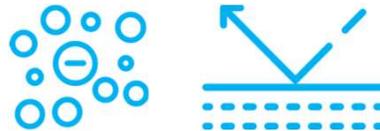
Carpet backing and headliners



- Low to no odor
- Effective bonding at a significantly lower net weight than alternatives.

ADDWORKS® ODOR CONTROL SOLUTIONS

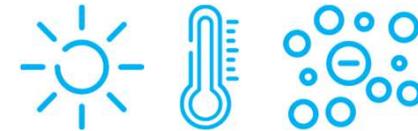
Interior polymers



- Reduce volatiles from forming during processing
- Capture them during use of the vehicle

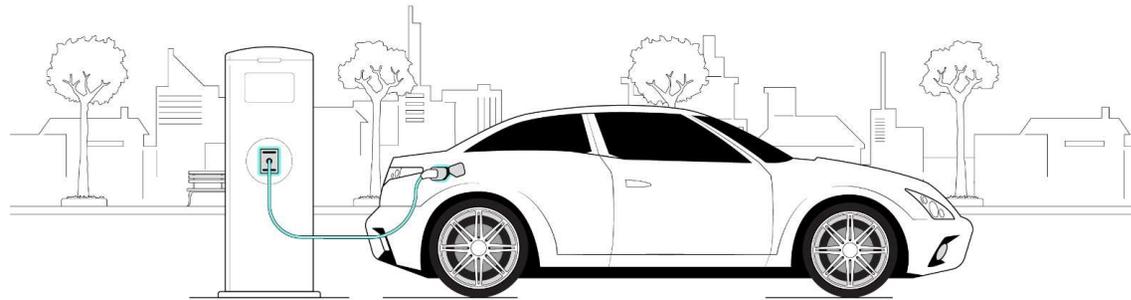
HOSTAVIN® LIGHT/HEAT STABILIZERS

Coatings



- Long term best in class performance for retaining color and properties in interior and exterior coatings
- Safer, no/low VOC profiles

You find us outside of the car, inside the car and under the hood



WAXES

CERIDUST®, **LICOCARE®**,
LICOWAX®, **LICOMONT®**

- Glove box
- Door panels
- High voltage connectors
- Instrument panels
- Charging infrastructure
- Cushioning materials
- Bumper liquid coatings
- Wheels powder coatings
- Interior decorative parts liquid coatings
- Functional accessory parts powder coatings

PROCESS IMPROVEMENT AND UV PROTECTION

NYLOSTAB®

- Air Intake manifold,
- Engine cover
- Rocker valve cover
- Door handles
- Exterior mirrors
- Front end grills
- Wheel covers
- Trims

HOT MELT ADHESIVES

LICOCENE®

- Carpet backing
- Headliners
- Sun visors
- Sound deadening
- PTFE free texturing powder coatings

FLAME RETARDANTS

EXOLIT®

- Charging infrastructure
- Battery module housing
- Structural parts
- High voltage connectors
- Busbars
- Car seat upholstery
- Padded doors
- Headliners
- Panels

UV PROTECTION

HOSTAVIN®

- Decorative trims
- Windshield
- Headlights
- Door handles
- Coating

STABILIZERS

ADDWORKS®

- Wheel covers
- Shock absorber
- Radiator grill
- Glove box
- Door panels

Flame retardants can have one or several modes of action

Gas phase: Br, Cl, P

React with, or remove by catalysis, the reactive OH^* and H^* radicals which are released by materials under heat and which feed fire.

Solid phase: P, N, B

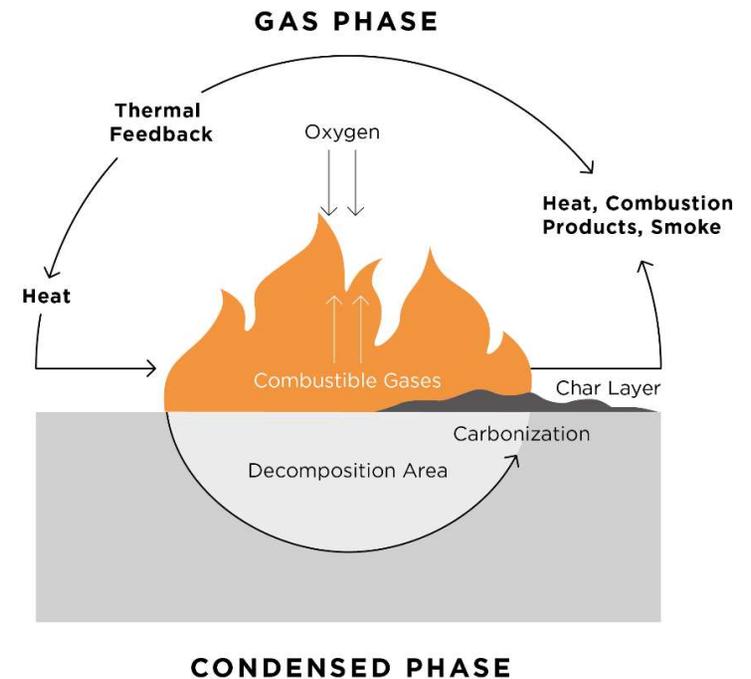
Generate a char layer on the material surface, which insulates from heat and prevents contact between oxygen and flammable gases.

Heat buffer: Al, Mg

Endothermic degradation reactions absorb heat energy.

Dilution: N

Release of non-combustible gases (e.g. water, nitrogen), which dilute fire gases and oxygen.



The Exolit® OP flame retardants portfolio consists of highly efficient solutions with excellent environmental and health profiles

HALOGEN-FREE TECHNOLOGY



Our flame retardants are based on phosphorus instead of halogens like bromine or chlorine and offer more eco-compatible, non-toxic solutions.

Excellent GreenScreen® benchmark 3 confirmed for Exolit OP line.

100% GREEN ELECTRICITY



We use 100% green electricity – sourced from wind and water – to produce our Exolit flame retardants at our site in Knapsack, Germany.

RECYCLABLE



The Fraunhofer Institute LBF confirms, that products from the Exolit OP line let PA6 and PA66 GF keep their UL 94 V-0 rating even after being recycled multiple times.

RENEWABLE CARBON SOURCE



The new Exolit OP Terra line based on renewable carbon feedstock provides like-for-like drop-in's that performs precisely as the fossil-based grade, without further testing or approvals. It has an approx. 20% lower carbon footprint than the fossil-based standard grade (before 2020).

Exolit® OP phosphinate flame retardants have a proven environmental and health profile – they achieve the EcoTain® label

Clariant awards its EcoTain sustainable excellence label to products in its portfolio that provide sustainable benefits above market standard and therefore represent best-in-class solutions. These phosphinate based flame retardants have achieved the EcoTain label:



EXOLIT OP 925
EXOLIT OP 930 / 930 TERRA
EXOLIT OP 935 / 935 TERRA
EXOLIT OP 1230 1230 TERRA
EXOLIT OP 1240 / 1240 TERRA
EXOLIT OP 1260 / 1260 TERRA
EXOLIT OP 1311 / 1311 TERRA
EXOLIT OP 1400 / 1400 TERRA
EXOLIT OP 1466 (TP) / 1466 (TP) TERRA

Third party assessments have confirmed Exolit OP's environmental and health profile:



German Environment Protection Agency (UBA)
[more](#)



US Environment Protection Agency Design for Environment projects
[more](#)



ENFIRO research project funded by the European Commission
[more](#)



GreenScreen Assessment (benchmark 3, revision 2016-10). [DEPAL](#)



Marzi T., Beard A. (2006): The ecological footprint of flame retardants: A case study. Specialty Chemicals Magazine, pp. 28–30

Beard A, Hoerold S (2013): Are halogens really necessary? Kunststoffe Int. pp. 25-26, available [online](#)

Exolit OP is not subject to eco-design restrictions, for example the upcoming EcoDesign Regulation for electronic displays based on the EcoDesign Directive (2009/125/EC).

Clariant's flagship label for sustainability excellence



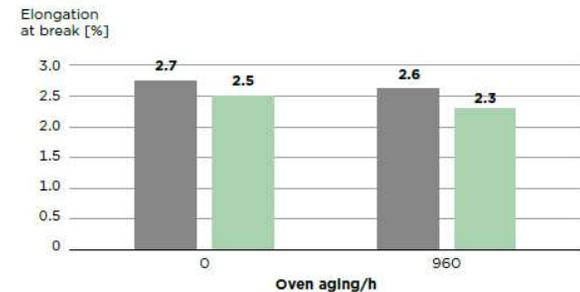
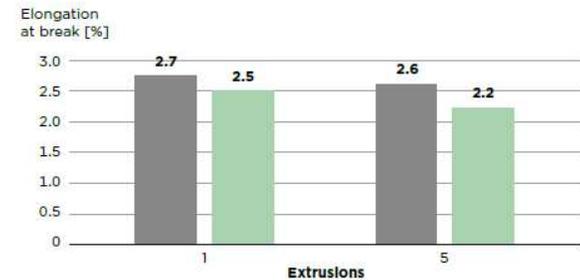
- Each product we label as EcoTain® undergoes a systematic, in-depth screening process.
- We use 36 criteria as part of our Portfolio Value Program (PVP) to evaluate the impact of products and solutions over their entire life cycle across three dimensions of sustainability: People, Planet and Performance.
- This system was developed by internal experts in collaboration with an independent non-profit organization and is subject to independent third-party verification.

Exolit® OP 1400 for glass fiber reinforced polyamides maintains flame retardant functionality after recycling

BENEFITS

- PA6 and PA66 GF containing Exolit OP 1400 maintain their UL 94 V-0 rating when recycled back into production streams multiple times as confirmed by Fraunhofer LBF
- Flame-retarding properties maintained throughout the entire aging time of 1,000 hours at 120 °C
- E-modulus and tensile strength decreased after the fifth processing cycle due to a reduced length of the glass fibers (from 210 µm to 136 µm), while elongation at break was largely preserved
- Carries the Clariant EcoTain® label and available now with renewable carbon source (Exolit OP 1400 Terra)

INFLUENCE OF RECYCLING ON ELONGATION AT BREAK



■ PA66 GF 30
■ PA66 GF 30 Exolit* OP 1400

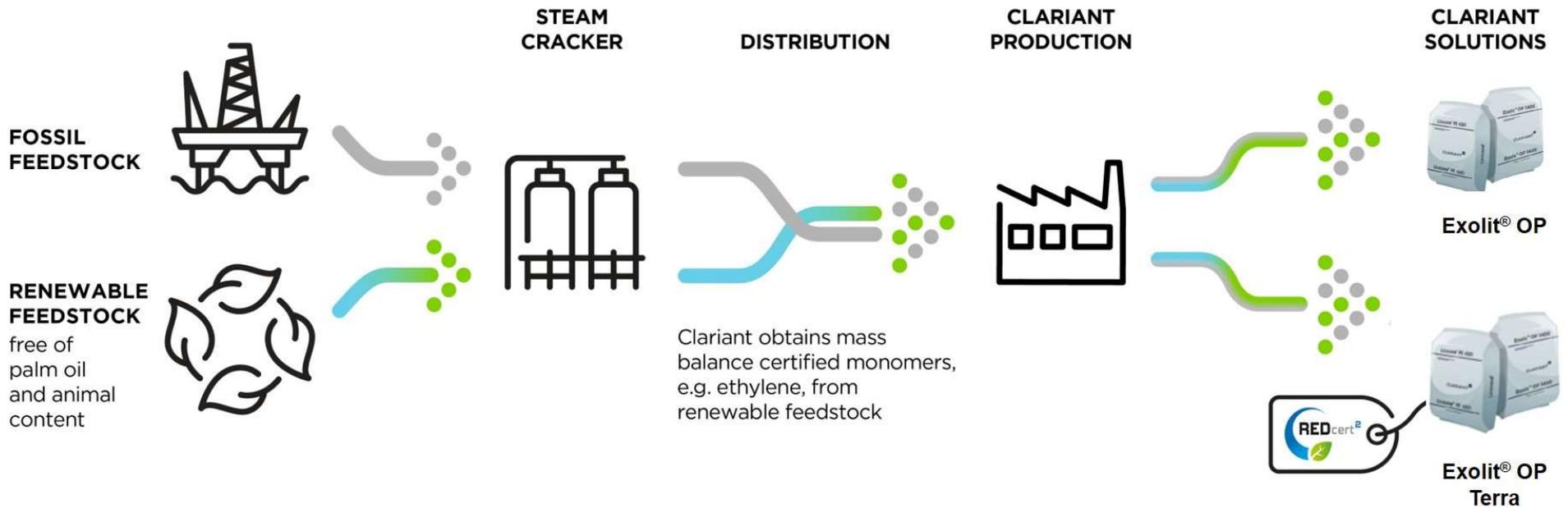
The new Exolit® OP Terra line is based on renewable carbon feedstock

BENEFITS

- Raw materials, C2/C3 monomers, derived from 100% renewable feedstock such as fat residues and discarded cooking oil
- Mass balance certification for usage of renewable ethylene
- Drop-in additive solutions without compromising on quality and performance, no additional technical testing or approvals needed
- Reducing carbon emissions and crude oil dependency
- Several solutions carry Clariant's EcoTain® label



Traditional fossil infrastructure is used to produce Clariant's new mass balance certified Terra solutions

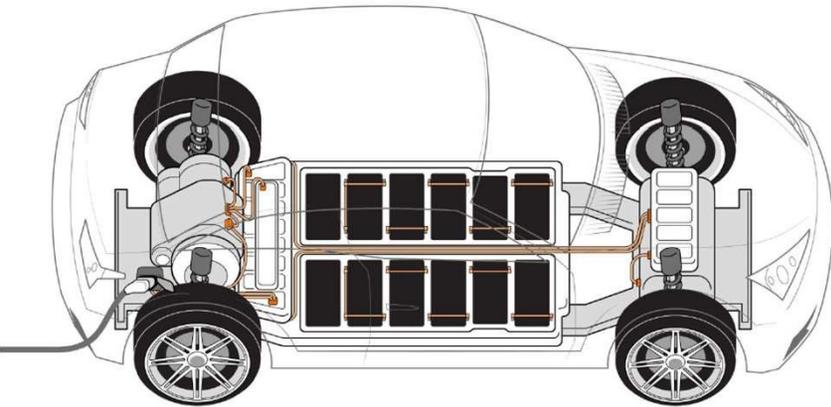


With the mass balance approach renewable based feedstock is allocated to specific end products using a third party verified certification method to ensure that input and output quantities along the value chain match. Clariant uses the REDcert² mass balance certification scheme.

pinfa.org – Clariant is a founding member of the industry association for halogen-free phosphorus, inorganic and nitrogen flame retardants



Sustainable fire protection for electric vehicles



- Electric Vehicles have **different fire risks** compared to combustion engines because of high voltages and currents during charging and the battery with a large amount of electro-chemical energy
- The battery as well as peripherals need to be protected against fire risk by using appropriate, flammability rated material
- If lithium-ion batteries short-circuit, cells can enter a state known as "thermal runaway," in which they continue heating up to a point where they can eventually ignite
- Batteries can catch fire long after the initial damage has occurred
- Orange color in the presence of high voltages and after aging must remain visible

Technical challenges related to e-Mobility

- CTI 600V and above
- V-0 down to 0.4 mm and after aging
- Laser marking and laser welding
- Avoid blooming and mold deposits
- Low density parts leading to weight reduction

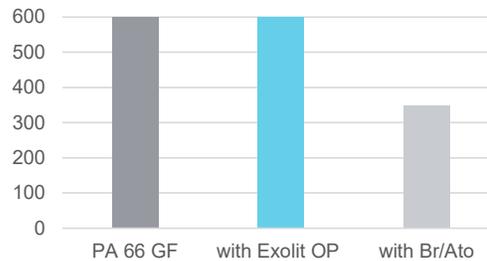


Exolit® OP compared to brominated flame retardants in PA and PBT

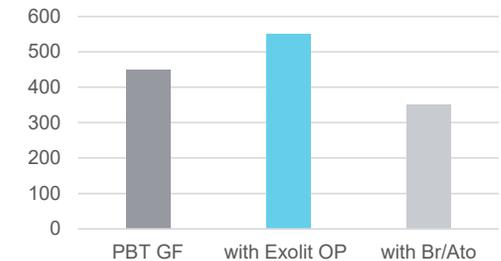
ADVANTAGES OF EXOLIT® OP

- CTI of 600 V (and above)
- Higher laser transparency
- 10 – 15% lower compound density
- Lower optical smoke density
- No corrosive smoke gases

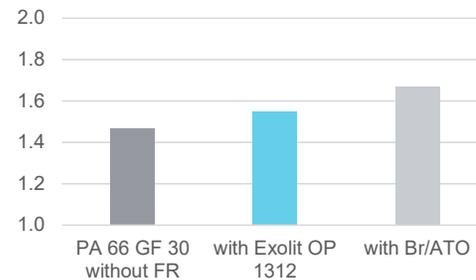
CTI /V



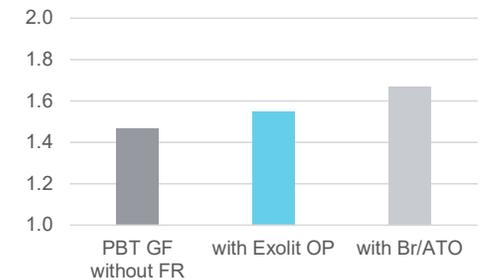
CTI /V



DENSITY
[g/cm³]

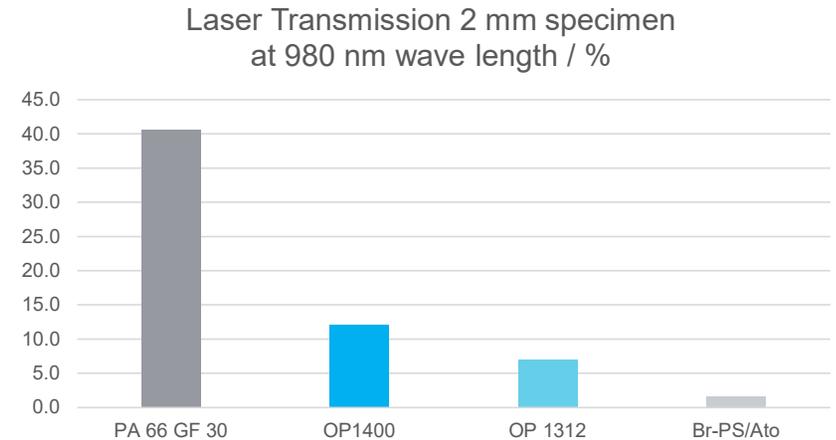


DENSITY
[g/cm³]



Laser welding – Laser transparency

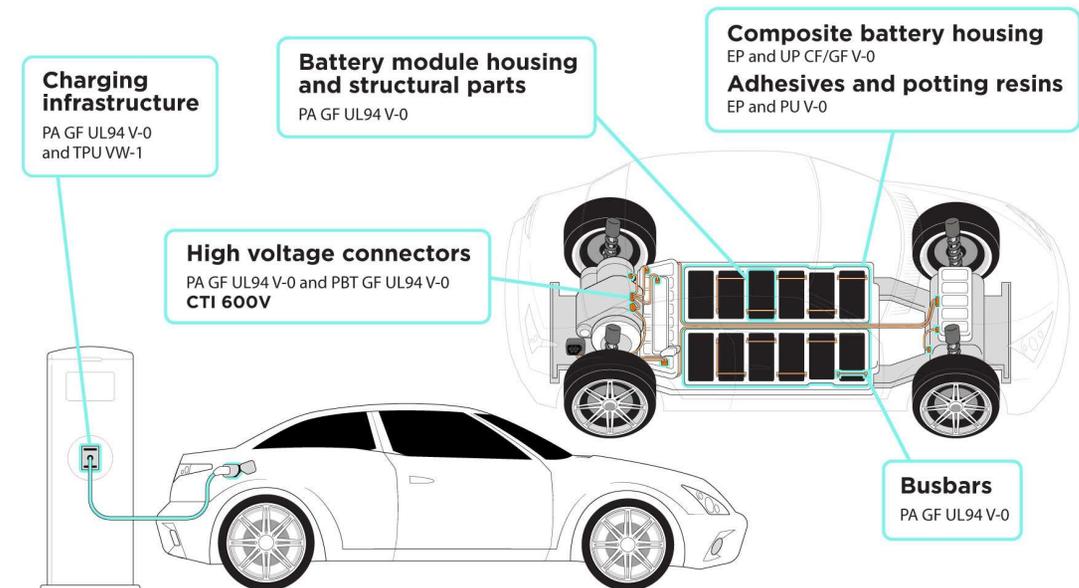
- Laser welding needs a transparent plastic part and an absorbing joining part
- Absorbing is achieved by special additives
- Transparency is affected by flame retardants (and other fillers)
- Laser welding is not possible with Br-PS/ATO due to strong hiding effect of ATO



Summary

Exolit® OP brings safety, sustainability and performance to e-Mobility

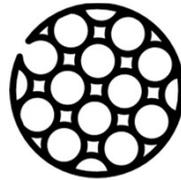
- Based on phosphorus instead of halogens
- High efficiency (V-0 down to 0.4 mm)
- CTI of 600 V
- Good laser transparency and laser welding
- Low density
- For all colors
- Several grades carry our sustainability label EcoTain® and are available as »Terra« versions based on renewable carbon



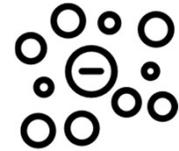
Our offering brings safety, sustainability and performance to e-Mobility



Using sustainable
chemistry



Making
vehicles lighter



Keeping volatile
emissions low



Offering highest
level of fire safety



Enabling fast
charging



Maintaining the
aesthetics

Collaboration is key

We collaborate with partners across the entire plastics value chain

- Clariant shares a good working relationship with all the major global suppliers of polymer applications that Exolit® plays in.
- We have the internal expertise to provide onsite or remote technical service at the compounder, or the processor (injection molder, extrusion etc.)
- Our relationships with OEMs and tiers allow us to innovate faster, understand the trajectory of market needs, and ensure the optimum solution to meet regulatory and physical property requirements, as well as processing requirements



Thank you for your attention!

We can support you globally on a technical and commercial basis with local coverage in all regions.



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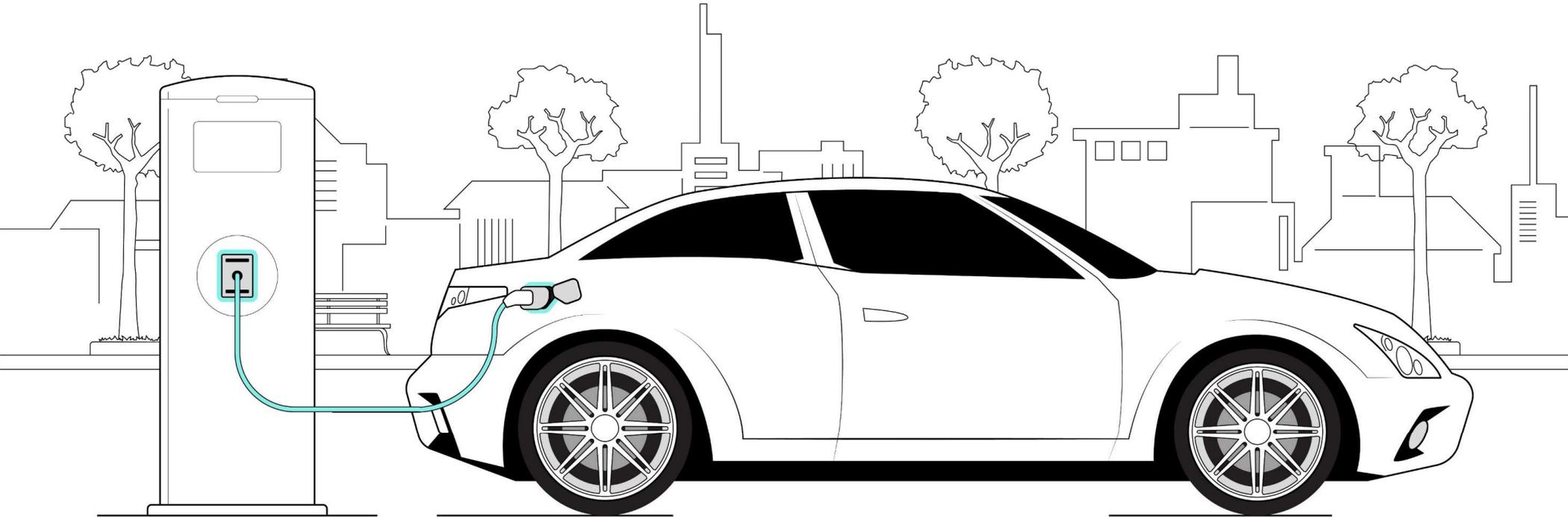
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Thank you!

WE ARE HAPPY TO TAKE YOUR QUESTIONS



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