Clariant Exolit® Flame Retardants help ensure Fire Safety in E-Mobility
Addressing global megatrends

E-Mobility

- In 2040, more than two billion automobiles will be on the roads
- New energy cars will be part of the global transport growth
- The transition towards safer, emission-free mobility can only take place with improved material properties
- Clariant has a broad portfolio of additive solutions that help to make plastics safer, look better, last longer and be more sustainable

Source: Business Insider (2016)
The total number of E-Vehicles has reached 3.2 mio units in 2017, forecasted at sales of 40 mio units by 2030 ~ 40% market share?

Number of electric cars (BEV + PHEV) [million units]

Sales of electric cars 2015 vs. 2017 [thousand units]

BEV = battery electric vehicle,
PHEV = plug in hybrid electric vehicle

Source: International Energy Agency 6/18
Exolit® OP flame retardants are recognised for their safe and sustainable chemistry

These phosphinate based flame retardants have achieved the highest sustainability standard within Clariant, the EcoTain® label:

EXOLIT® OP 1230
EXOLIT® OP 1240
EXOLIT® OP 1400
EXOLIT® OP 930
EXOLIT® OP 935

Third party assessments have confirmed as well Exolit® OP’s outstanding environmental profile:

German Environment Protection Agency (UBA)

US Environment Protection Agency Design for Environment projects

ENFIRO research project funded by the European Commission

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

Exolit OP Value Proposition for Engineering Thermoplastics
Demanding requirements for High voltage connectors

- Resins for electric connectors require:
  - Impact strength and creep resistance
  - Reliability at temperature cycles of -40°C to 150°C
  - UL 94 V0 classification
  - High Comparative Tracking Index of 600V
  - No metal contact corrosion under hot and humid condition
  - Medium weather-fastness
  - Orange color stability at elevated temperature
  - RoHS / WEEE
  - Halogen free not regulated, but strongly preferred due to excellent performance

- Materials
  - PBT, PA, PPA, PPS – FR grades

- Coloration
  - Trend to RAL 2003
Value Proposition for Engineering Thermoplasstics

To Compounders for high voltage connectors applications

Who want
- consistent and high quality FRs
- to use an environmental friendly chemistry that meets sustainability criteria.
- the option for recyclable compounds to follow ecological and economic megatrend
- To work with a solution that meets the demanding technical requirements of the industry

EXOLIT OP FRs are the products that...
- are supplied by Clariant, a leading HFFR supplier for Engineering Thermoplastics
- use green and sustainable, halogen free chemistry with high thermal stability up to 350 °C, suitable for application even in HPPAs, fulfilling RoHS, WEEE regulations
- can be used as well in recycled post-industrial materials
- are already today widely used for high voltage connectors, offering high CTI to meet high voltage resistance and demanding electrical performance requirements from OEMs
- are state of the art solution (Exolit® OP 1400) to resolve blooming and mold deposit issue.
- compatible with various anti-oxidants to achieve good long-term thermal stabilized materials

Reasons To Believe
- V0 rating at all thicknesses
- High CTI value data (600 V CTI)
- No blooming and mold deposit solution
- Mechanical performance data
- Recipe cost comparison
- Density data
- Pinfa recycling data
- Heat aging data with Exolit OP
- CLN EcoTain label and GreenScreen benchmark 3
Exolit® OP based compounds are cost-competitive to BrPS based formulations, especially in Polyamides.

The price of FR pro part for brominated or Exolit® based UL94 V0 PA GF compound is similar.
Exolit® OP can be used for all colors compounds

PV FAST BLUE BG
PV FAST VIOLET RL
PV FAST PINK E
PV FAST RED B
YELLOW NR
VIRGIN

DDR BLUE CONNECTORS – PA 66 GF WITH EXOLIT® OP 1400
CONNECTOR STATION – PA 66 GF WITH EXOLIT® OP 1314
AddWorks Value Proposition for polyolefin based materials
Sustainable fire protection for polyolefin based materials
AddWorks® LXR 920

There is a move from PVC towards TPO skin for leather/synthetic leather finish in car interiors. Unlike PVC, PP can propagate fire. PP is lighter than PVC, fulfilling lightweight requirements for e-mobility. E-car batteries will intensify flame retardancy requirements.

CUSTOMER NEEDS

− PP performing at least as good as PVC, including good protection against possible fire caused by batteries overheating
− Sustainable environment in car interiors
− Aesthetics

ADDWORKS LXR 920

− Halogen-free flame retardant for polyolefin based materials
− Efficient flame retardancy at low concentration
− Maintains mechanical and optical properties of final articles
− High compatibility, low migration in polyolefin films
− Fulfils stringent fire safety standards
Exolit Value Proposition for Thermosets and Polyurethanes
A preferable flame retardant for flexible polyurethane foams
Exolit® OP 560

Non-halogenated Exolit® OP 560 is an excellent choice for upholstering anything from car seats to padded doors, headliners and panels. It has been confirmed as a preferable flame retardant for polyurethane foams by the US Environmental Protection Agency (EPA).

Benefits
- Lower fogging and VOC values
- Meeting stringent emission standards in the automotive industry
- High efficiency
- High polymer compatibility
- Reduced risk to health and environment
Ideal solution for advanced epoxy based composites for transportation

Exolit® EP 360 & Exolit® EP 390

Exolit® EP 360 & Exolit® EP 390 are liquid non-halogenated flame retardants based on phosphorus. They can be used for advanced composite application for transportation addressing lightweight requirements for e-mobility.

Benefits
- Broad epoxy resin compatibility
- Lower viscosity compared to alternative solutions
- Non halogenated flame retardant with epoxy functionality (Exolit EP 360)
- Enabling to fulfil the required flame retardant performance at a low dosage
The values that guide us to success

**WE DISCOVER** – driven by a deep curiosity for innovative solutions.

**WE MAKE IT HAPPEN** – delivering excellent quality in time.

**WE PLAY TO WIN** – in the markets we are active in.

**WE COLLABORATE** – knowing the value of real team play and partnership.
Thank you!
GOODBYE