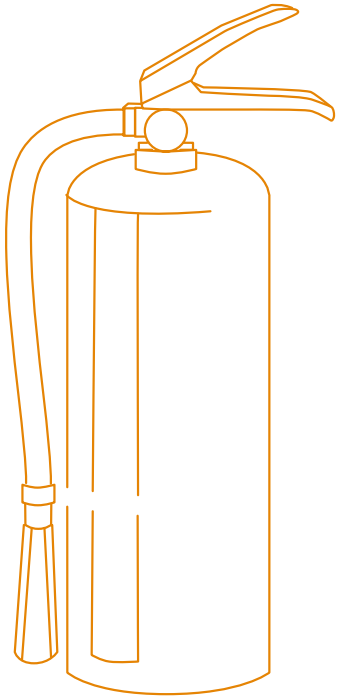
CLARIANT

BUILT-IN PROTECTION AGAINST IGNITION

Exolit™ flame retardants for thermoplastics

Greater chemistry



Quick performance matters – and without a doubt, especially in areas where the protection of life and property is key. In that context, modern flame retardants have to fulfill demanding material requirements in addition to their most prominent role as an additive to slow down or even fully prevent starting fires.

Production site in Knapsack, Germany

Production site in Daya Bay, Huizhou, China

Plastics generally exhibit excellent insulation properties combined with low weight and high mechanical strength – an important feature for electric and electronic (E&E), transportation and appliances industries. In these application areas, glass fiber reinforced polyamides are increasingly used due to their well-balanced properties. However, they can catch fire when exposed to an ignition source. In order to ensure fire safety, flame retardants are added to meet the requirements of various flammability standards.

Influence on compound properties

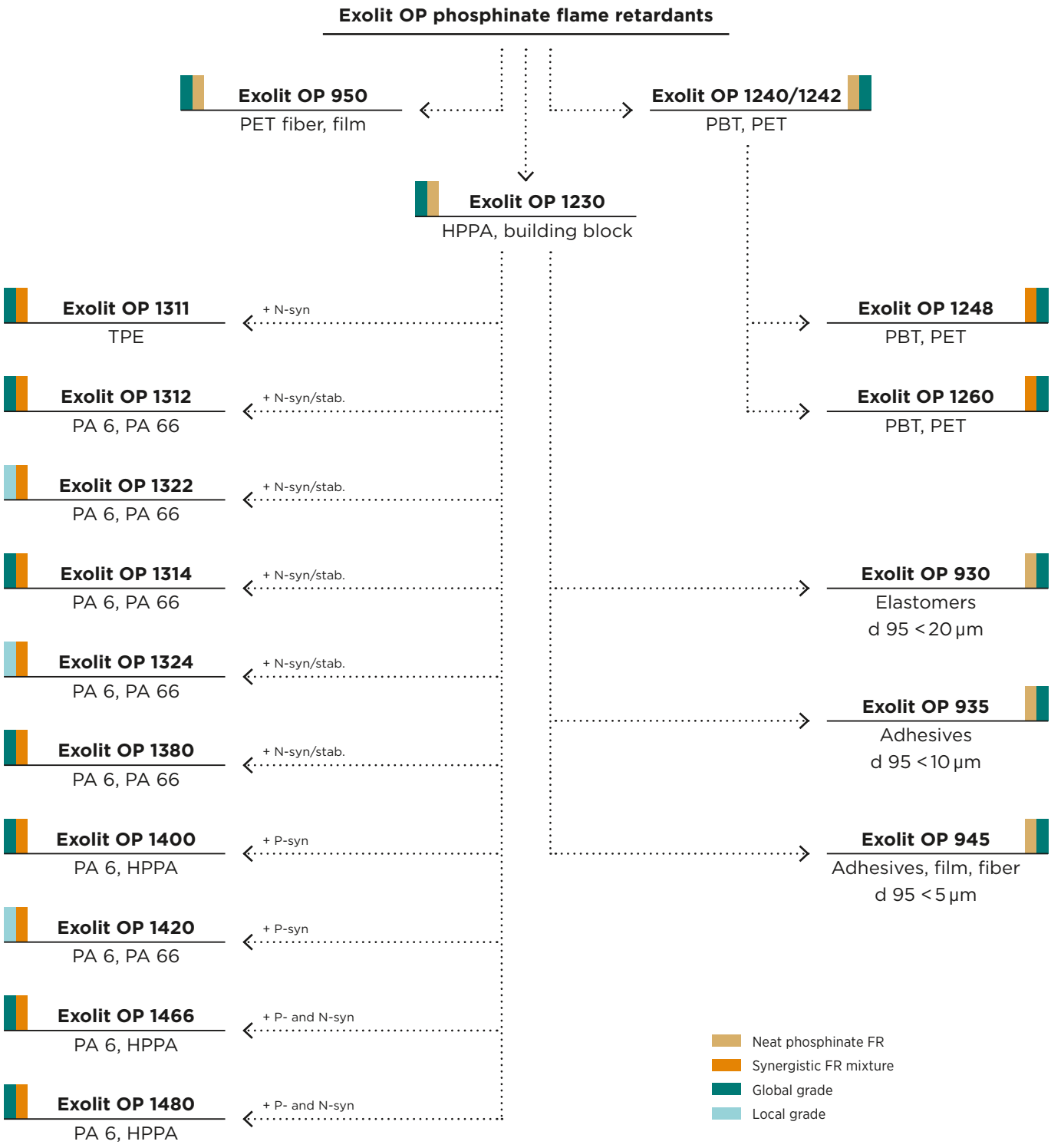
Mechanical and electrical properties, a good melt flow behavior and a robust processing window are critical points, especially in the electronics industry, where miniaturization plays a vital role. For electrical properties like comparative tracking index (CTI), Exolit grades are amongst the best solutions available. Compared to other flame retardants, Exolit products often have a smaller impact on mechanical properties due to their relatively low dosage. An additional feature is the low density, which can be a convincing reason for their use e. g. in the transport industry, where weight reduction is becoming more and more important.

Influence on the surroundings in case of a fire

Already a small, starting fire develops smoke, and it is the toxic smoke that kills by far most fire victims. In addition, dense smoke can make visual orientation impossible and hinder the escape from e. g. a building, ship or train. If the smoke contains corrosive substances (e. g. from halogen-containing polymers or flame retardants), equipment not affected by the fire itself can also be damaged. Exolit flame retardants show less toxic smoke development compared to halogenated solutions.

The Exolit™ OP product range

Exolit OP flame retardants offer tailor-made fire protection for thermoplastics in ignition-prone environments. They are available both as neat phosphinates and synergistic mixtures. Several grades are available as renewable carbon-based types (Exolit OP Terra). Since mid of 2023, Clariant's Daya Bay plant in China is producing a variety of Exolit OP grades. Many products are identical to the well known grades from Knapsack in Germany, others are specifically produced only in Daya Bay for regional use (= local grades).



Exolit™ OP Terra
Flame retardants go renewable

Clariant is continuously developing products that are more beneficial for the environment. We offer products based on Mass Balance certified renewable feedstock, which will be marketed under the name »Terra«. The ethylene content of these innovative, halogen-free flame retardants comes from renewable sources, such as waste cooking oil or plant-based oil. Problematic raw materials such as palm or animal-based oils are excluded.

In terms of physical, chemical and other application properties, Exolit OP Terra is completely identical with regular Exolit OP products. Therefore, no additional testing or approvals are necessary. Depending on the Exolit OP Terra grade, from 50 % up to 100 % of the carbon content is certified as renewable-based.

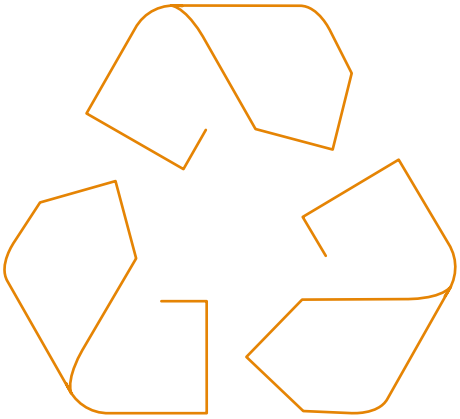
OUR HALOGEN-FREE EXOLIT FLAME RETARDANTS:

— Have excellent health and safety profiles
— Contribute to saving lives and property
— Have superior environmental compatibility
— Help customers' products to fulfill the requirements of eco-labels
— Show high material efficiency
— Have been developed in close cooperation with our customers

Flame retardants maintaining functionality after recycling

CASE STUDY: FLAME RETARDANCY AND RECYCLING

At the end of their lifetime, most flame-retarded plastic components from electronic waste are currently incinerated to recover energy. From an environmental and economic perspective, mechanical recycling offers several advantages. However, it requires an unmixed and clean material stream.



REQUIREMENTS:

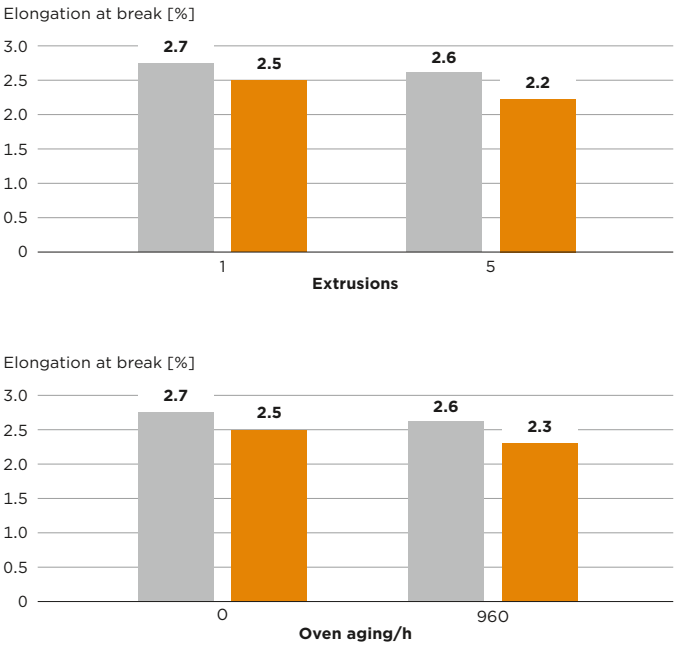
— UL 94 V-0 maintained after aging and after multiple extrusion
— Good mechanical properties of recycled materials
— No severe color shifts

SOLUTION:
EXOLIT OP 1400 FOR PA6 OR PA66 GF

In a research collaboration with pinfa, Fraunhofer LBF confirmed that PA6 and PA66 GF containing Exolit OP 1400 maintain their UL 94 V-0 rating when recycled back into production streams multiple times. In addition, the flame-retarding properties were 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.

In addition, Exolit OP is not subject to eco-design application restrictions like the upcoming EcoDesign Regulation for electronic displays based on the EcoDesign Directive (2009/125/EC) covering the recycling of plastics and limiting the use of halogenated flame retardants in enclosures and stands of electronic displays.

INFLUENCE OF RECYCLING ON ELONGATION AT BREAK

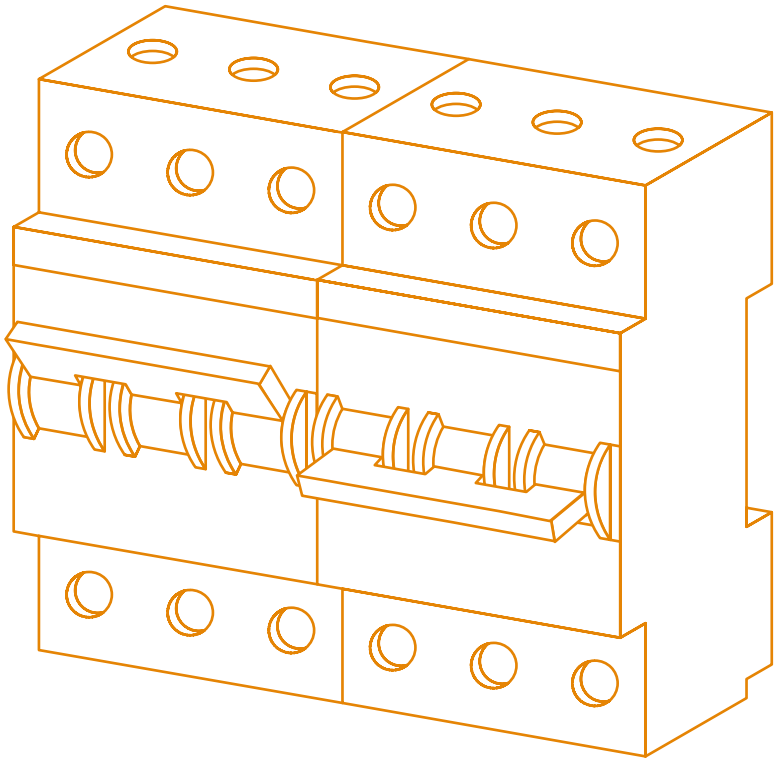


The Exolit™ OP product range for aliphatic polyamides

— UL 94 V-0 down to 0.4 mm
— CTI of up to 600 V
— GWFI 960 °C and GWIT 775 °C from 0.75 to 3.0 mm
— Low material density
— Low impact on mechanical properties
— Good colorability
— Good contrast in laser marking
— Halogen-free

POLYAMIDES			EXOLIT OP 1312/1322	EXOLIT OP 1314/1324	EXOLIT OP 1380	EXOLIT OP 1400	EXOLIT OP 1420	EXOLIT OP 1466	EXOLIT OP 1480
Short-chain aliphatic	PA 4.6					■			
	PA 5.6	●	■			■	■		
	PA 6		■	■	■	■	■	■	
	PA 6.6		■	■	■	■	■		■
Long-chain aliphatic	PA 6.10	●	■	■		■	■		
	PA 6.12		■	■		■	■		
	PA 10.10	●	■						
	PA 11	●	■			■	■		
	PA 12		■			■	■		

● Bio-based polyamides



Clariant's Exolit OP 13xx and OP 14xx are blends containing an organic aluminium phosphinate and synergists. Exolit OP 1380, OP 1466 and OP 1480 are recommended when a GWIT of 775 °C is required in addition to UL 94 V-0. They offer many advantages compared to other types of flame retardants on the market:

Compounds made with Exolit OP have a low density and combine good mechanical properties with high CTI values. Exolit OP 1312 is the most efficient grade regarding UL94 and glow wire ignition temperature (GWIT) test performance. Exolit OP 1314 and OP 1400 provide enhanced thermal stability and are therefore especially suitable for high processing temperatures and compounds which are injection-molded into complex cavities. Exolit OP 1400 extends the application range with its better stability to hot and humid environments.

Reinforced polyamides with UL94 V-0 classification down to 0.4 mm thickness can be achieved with the Exolit OP products. Exolit OP 1312 can be used to obtain a glow wire ignition temperature (GWIT) of 775 °C, optionally in combination with further synergists. A glow wire flammability index (GWFI) of 960 °C can be attained with Exolit OP 1312, OP 1314 and OP 1400 within the range of typical UL 94 V-0 dosages.

The main application of Exolit OP is in glass fiber reinforced polyamides. The glass fiber content will typically vary from 10 to 50 %. Exolit OP can also be used in non-reinforced polyamides, resulting in a non-dripping V-0.

Flame-retarded polyamides with Exolit OP can be used for laser marking on light and dark colors and show good contrasts. The compounds are suitable for laser welding. Polyamides with Exolit OP achieve CTI values of 600 V.

The Exolit™ OP product range for aliphatic polyamides

CASE STUDY: CIRCUIT BREAKER

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. Whereas a fuse operates only once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

REQUIREMENTS:

— UL-listed polymers, globally available
— Laser marking
— All colors
— High elongation
— CTI > 400 V
— Cost-effective

PA 6 GF25 with Exolit OP 1312 – PV Fast Blue BG

PA 6 GF25 with Exolit OP 1312 – PV Fast Violet RL

PA 6 GF25 with Exolit OP 1312 – PV Fast Pink E

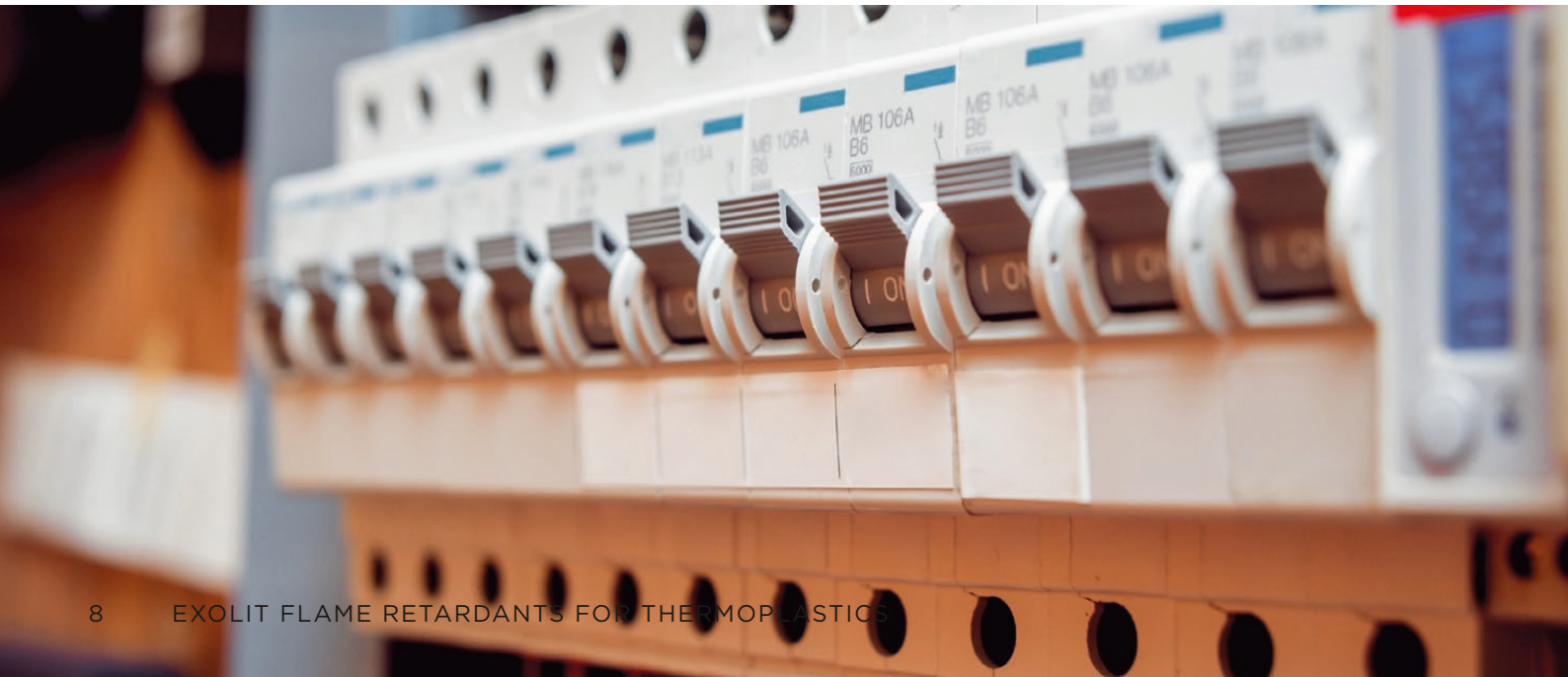
PA 6 GF25 with Exolit OP 1312 – PV Fast Red B

PA 6 GF25 with Exolit OP 1312 – Yellow NR

PA 6 GF25 with Exolit OP 1312 – virgin

SOLUTION: EXOLIT OP 1312/OP 1400 FOR PA 6 GF

— UL 94 V-0 rating from 0.4–3.2 mm thickness
— Suitable for all colors
— CTI up to 600 V
— Good mechanical properties
— Cost-effective
— Registered and available in all regions
— GreenScreen Benchmark 3 (pure phosphinate)



CASE STUDY: RAST CONNECTORS FOR APPLIANCES

RAST connectors are connectors of the so-called »home appliance standards« RAST 2.5 and RAST 5. The abbreviation »RAST« stands for German language »Raster-Anschluss-Steck-Technik« or »grid connection plug-in technique«, the digits indicate the millimeter distance between the contact centers. Household appliances, commonly referred to as »white goods«, form a key segment in the consumer goods market. These include a variety of larger appliances, such as washing machines and dryers, refrigerators and freezers, dishwashers and stoves or microwaves, as well as small appliances such as coffee machines, toasters, mixers, vacuum cleaners and razors. With the new Exolit OP 1380, OP 1466 and OP 1480, PA 6 & PA 66 GF compounds can pass GWIT 775 °C from 0.75 to 3.0 mm with excellent processing performance and mechanical properties.

REQUIREMENTS:

— Meet UL, VDE, and CQC (China quality certification) requirements
— UL 94 V-0 and GWIT of 775 °C without flame compliant models
— Highly resistant to cold, dry heat, soldering heat, and humidity
— High flowability

SOLUTION: EXOLIT OP 1380/OP 1466/OP 1480 FOR PA 6 & PA 66 GF

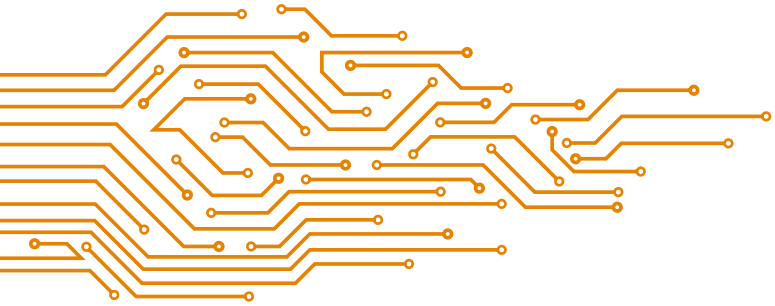
— UL 94 V-0 rating from 0.4 to 3.2 mm
— GWFI 960 °C and GWIT 775 °C from 0.75 to 3.0 mm
— Good mechanical properties
— Cost-effective
— Registered and available in all regions
— GreenScreen Benchmark 3 (pure phosphinate)

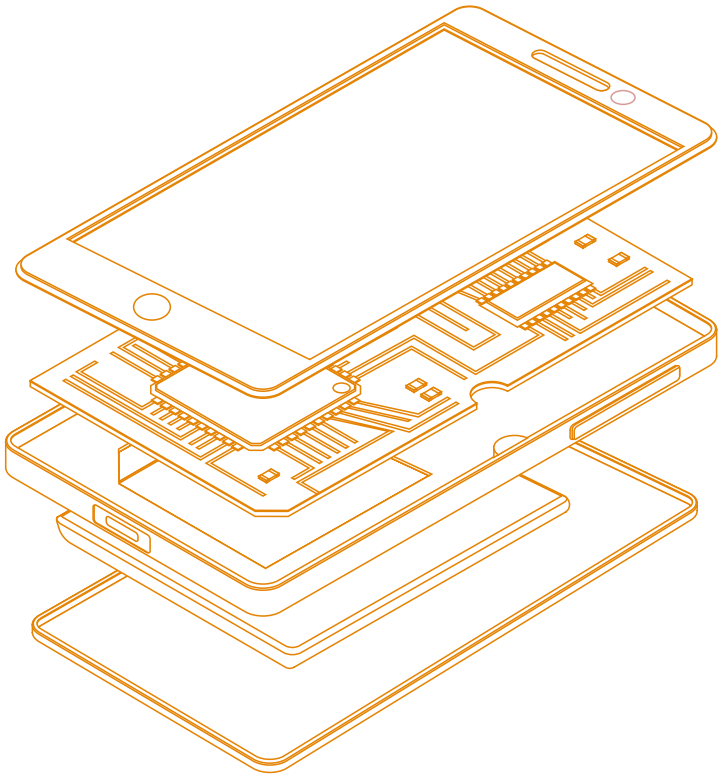
The Exolit™ OP product range for aromatic nylons

— UL 94 V-0 down to 0.4 mm
— GWFI 960 °C and GWIT 775 °C from 0.75 to 3.0 mm
— High thermal stability
— Excellent electrical properties
— Good colorability
— Halogen-free

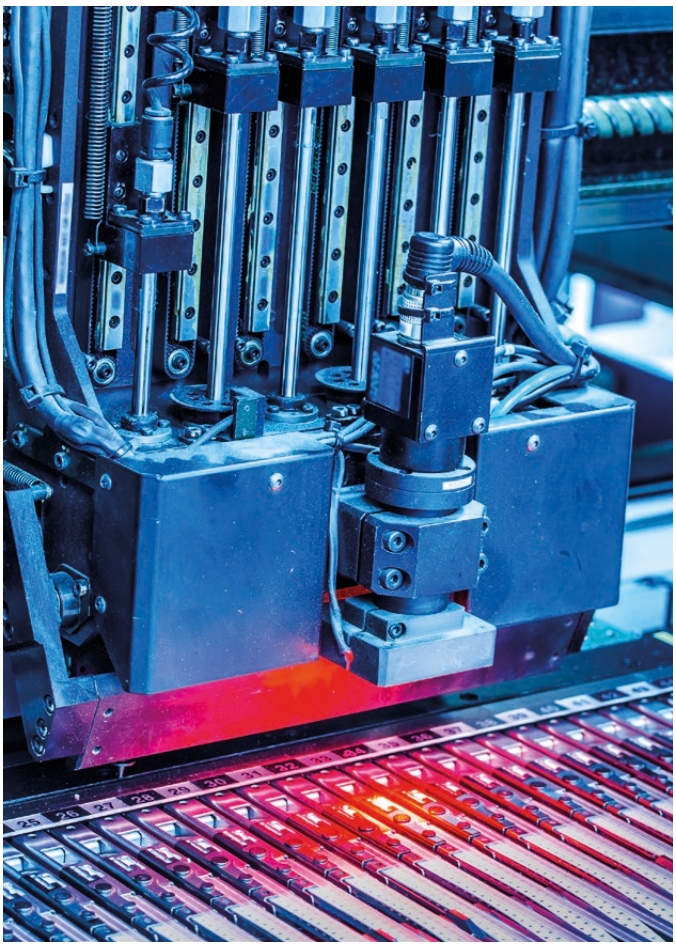
POLYAMIDES		MELTING POINT [°C]	**EXOLIT OP 1230**	**EXOLIT OP 1312/1322**	**EXOLIT OP 1314/1324**	**EXOLIT OP 1400**	**EXOLIT OP 1466**
Aromatic	PA 4T	330	▬				
	PA 6T	320	▬			▬	▬
	PA 9T	305	▬			▬	
	PA 10T	315	▬			▬	
	PA 11T	315				▬	
	PA MXD 6 ●	243		▬	▬	▬	
Amorphous	6I/X ●	250–265	▬	▬	▬	▬	

● Bio-based polyamides





Within the last years, high-performance polyamides (HPPA) have experienced a tremendous growth. The use of aromatic monomers like terephthalic acid or isophthalic acid increases their mechanical strength as well as temperature and chemical resistance. They are used wherever a standard polyamide or polyester is not stable enough. Due to their high thermal stability as well as their easy processing, HPPAs are a very competitive choice versus liquid crystal polymers (LCP).



Most of these HPPA compounds need to be flame-retarded according to UL 94 rating in order to fulfill the requirements in their specific applications. HPPAs used as insulating materials have to be stable against tracking (high comparative tracking index (CTI) is often required).

High processing temperatures and the trend towards miniaturization challenge the performance of flame retardants in HPPAs. Additionally, when applied in the SMT process (surface mounting technology) used for printed circuit boards, HPPAs have to resist high temperature in lead-free reflow soldering. Exolit OP 1230 is a unique flame retardant which can withstand the demanding requirements of this high-end segment of engineering plastics. In a recent study, HPPA compounds with Exolit OP 1230 passed the blistering test when pretreated according to JEDEC-J-STD 020C (MSL 2) and being exposed to the reflow soldering process with a peak temperature of 260 °C.

The Exolit™ OP product range for aromatic nylons

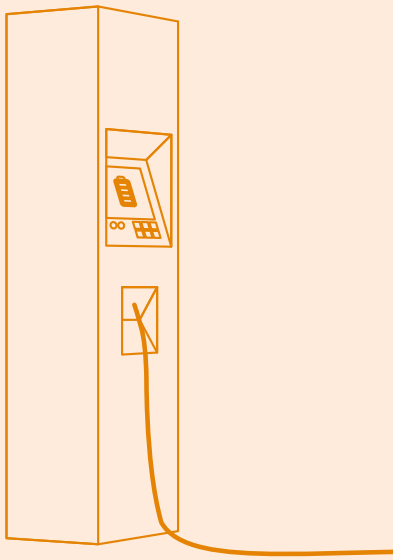
CASE STUDY:
CONSUMER ELECTRONICS – DDR4 RAM
DDR4 RAM (double data rate random access memory) is a class of memory integrated circuits used in computers. The primary advantages of DDR4 over its predecessor, DDR3, include higher module density and lower voltage requirements, coupled with higher data rate transfer speeds. Main growth for DRAMs is seen in server applications.

REQUIREMENTS:
— UL-listed polymers, globally available
— High temperature resistance (SMT surface mount technology)
— Excellent molding capabilities and high strength characteristics
— Halogen-free engineering plastics with low eco-footprint

SOLUTION: EXOLIT OP 1230 IN HPPA (HIGH-PERFORMANCE POLYAMIDE*)
— UL 94 V-0 rating from 0.4–3.2 mm thickness
— Outstanding thermal stability
— No blistering in reflow soldering
— GreenScreen Benchmark 3

* Semi-aromatic polyamides or PA 46

The Exolit™ OP/AP product range for polyesters



— UL 94 V-0 down to 0.4 mm
— For reinforced and unfilled polyesters
— Excellent electrical properties (CTI up to 600 V)
— Good colorability
— Versatile use with synergists
— Halogen-free

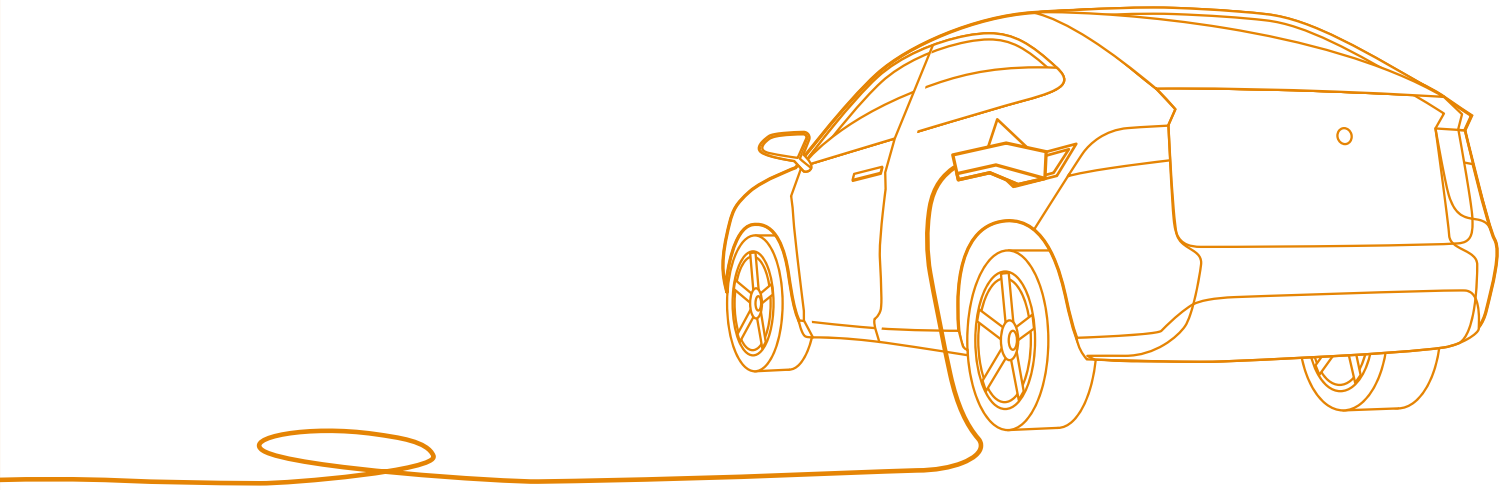
Exolit OP 1240 is a flame retardant based on an organic aluminium phosphinate. It can be easily compounded into polyesters and subsequently processed again to manufacture flame-retarded parts used in consumer or industrial products. Thermoplastic polyesters like PBT and PET feature excellent dimensional stability due to low moisture absorption, a good resistance against solvents and high insulating capacity, making them preferred polymers for many applications in the automotive, E&E and appliances industry. Many of these PBT or PET materials, especially glass fiber reinforced grades, need to be flame-retarded to fulfill international safety requirements like the classifications of the UL 94 standard.

Exolit OP 1240 can be used together with melamine polyphosphate and/or melamine cyanurate. Exolit OP 1248 and Exolit OP 1260 are synergistic blends. PBT compounds with Exolit OP 1260 achieve UL 94 V-0 with 18 wt% loading and show enhanced melt flow and mechanical properties. Exolit OP 1248 shows an improved efficiency in UL 94 V-0.

Compared to a PBT containing a brominated flame retardant combined with antimony oxide, materials based on Exolit OP 1240 can achieve CTIs of up to 600 V and in general have a lower density.

	MELTING POINT [°C]	**EXOLIT OP 935**	**EXOLIT OP 950***	**EXOLIT OP 1240**	**EXOLIT OP 1242**	**EXOLIT OP 1248**	**EXOLIT OP 1260**	**EXOLIT AP 462****
PET	250–260		■	■	■		■	
PBT	220–230		■	■	■	■	■	
PTT ●	220–230		■					
PCT	270–285			■				
PLA ●	150–160							■
PHB ●	175			■		■	■	
TPC	150–220	■		■				

● Bio-based polyesters
* Exolit OP 950 melts at about 200 °C and gives a high-viscous, polymer-like molten mass
** Exolit AP 462 is a microencapsulated ammonium polyphosphate



CASE STUDY: HIGH VOLTAGE CONNECTORS FOR E-VEHICLES

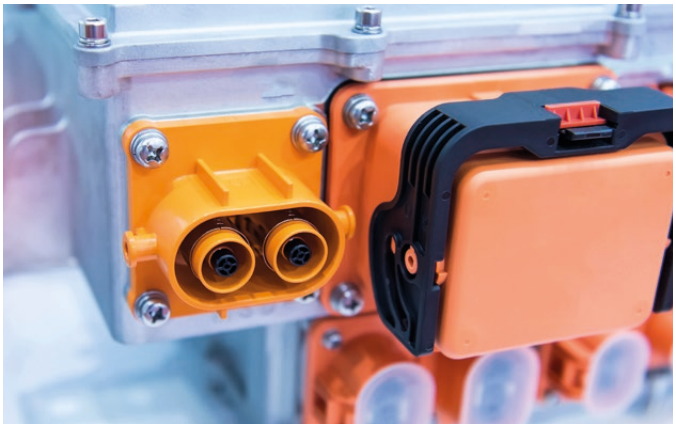
With the electrification of cars, many electricity-powered parts and high voltage connections will be integrated into cars, with the result that fire safety has become an inevitable concern and initiated plenty of investigations. Exolit flame retardants bring state-of-the-art fire safety solutions without sacrificing the electrical performance of materials.

REQUIREMENTS:

— UL 94 V-0 classified materials
— High comparative tracking index (CTI 600 V) to ensure safety against arcing at high voltages
— Mechanical stability and orange color fastness at elevated temperature
— Halogen-free chemicals and no emission of hazardous substances
— Good balance of mechanical performance
— Reliability over a temperature range
— Sufficient stability under hydrolysis conditions, e.g. 85 °C/85 % humidity climate chamber test

SOLUTION: EXOLIT OP 1242 FOR PBT-GF

— UL 94 V-0 rating from 0.4–3.2 mm thickness
— CTI of up to 600 V
— No blooming nor mold deposit
— No copper contact corrosion
— Improved hydrolysis resistance



The Exolit™ OP product range for thermoplastic elastomers (TPE)

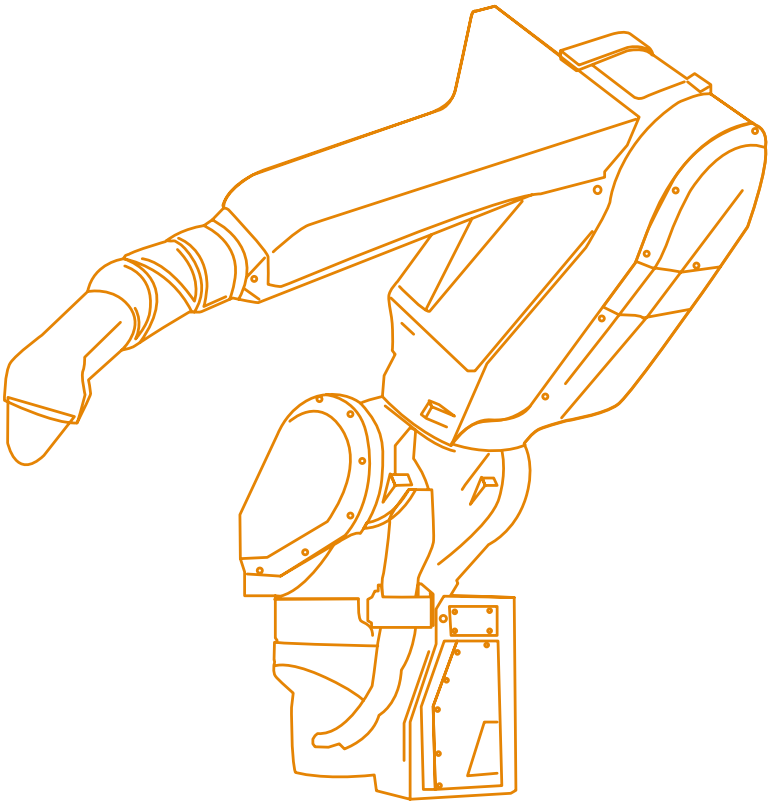
— UL 94 V-0
— Cable tests (VW-1, FT-2, FT-4) passed
— Low smoke toxicity
— Good electrical and mechanical properties
— Good hydrolysis resistance
— Halogen-free

Thermoplastic elastomers (TPE) are materials combining the processing advantages of thermoplastics with the flexible, low modulus properties of elastomers. Block copolymer TPEs include thermoplastic polyurethanes (TPU), copolyesters (TPC) and polyether block amides (TPA). A huge number of TPE grades are on the market, ranging from shore A 10 to shore D 75. Exolit OP can effectively balance mechanical properties and flame retardancy in TPEs. TPCs combine toughness and resilience with excellent resistance to creep, impact, tearing as well as flexural fatigue. Exolit OP 1230 can effectively flame-retard these elastomers.

A loading of 20–40 % flame retardant is recommended depending on the chemical structure of the polymer and the desired fire resistance. Mechanical and fire performance can be enhanced by using fine-grade phosphinate like Exolit OP 930. Adding small amounts of fumed silica can prevent dripping, an important criterion in the UL 94 test. The addition of nitrogen-containing synergists can help to improve the fire resistance. Flame-retarded TPEs are used for cable extrusion, wire coating, connectors, plugs, conveyor belts, corrugated pipes, etc. Flame-retarded TPU is also a base material for artificial leather.

THERMOPLASTIC ELASTOMERS		PROCESSING TEMPERATURE [°C]	**EXOLIT OP 930* 935* 1230***	**EXOLIT OP 1311**	**EXOLIT OP 1312/1322**	**EXOLIT OP 1314/1324**	**EXOLIT AP 422/422 A****	**EXOLIT AP 766**
TPU	Polyether-based	180–220	■	■	■	■		
	Polyesther-based	180–220	■	■	■	■		
TPC	Rigid	200–235	■	■	■	■		
	Soft	170–215	■	■	■	■		
TPA	Rigid	180–260		■				
	Soft	170–235		■				
TPS	Styrenic-based	150–250					■	■
	Blends with PO	150–250	■				■	■
TPO	Elastomer-modified PO	160–220					■	■
TPV	PO/EPDM cross-linked	180–230					■	■

* We recommend to combine with flame retardant synergists to enhance flame retardant effectiveness. Please contact us for more information.
** Basic material for developing individual intumescent formulations at customers.



CASE STUDY: SENSOR DATA CABLES FOR AUTOMATION

There is hardly an industry which does not need any sensors and cables transferring data and signals. This highly sophisticated technology sets demanding requirements on materials. TPU with its outstanding wear resistance is often chosen as jacket material for multi-conductor cables. Requirements on mechanical and electrical performance should not be compromised by high fire safety.

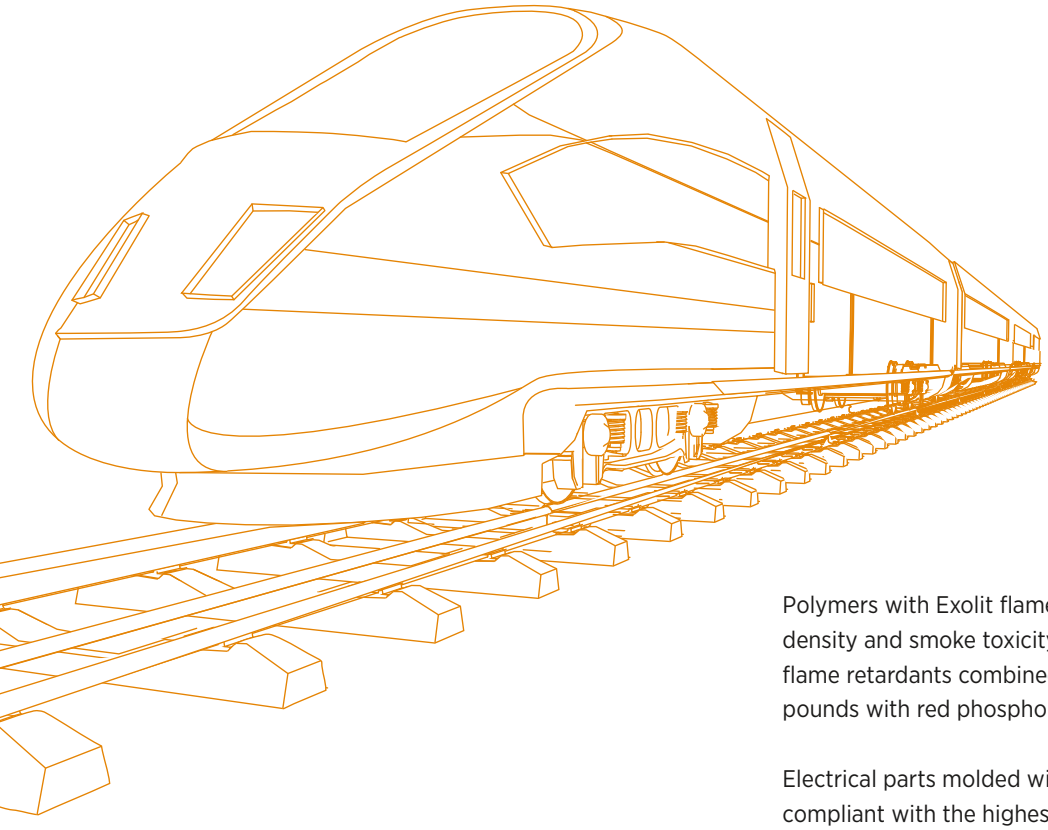
REQUIREMENTS:

— Cable tests passed: VW-1, FT-2, FT-4
— Low smoke toxicity
— High resistance to wear
— Oil resistance
— Halogen-free materials

SOLUTION: CUSTOMIZED FORMULATION BASED ON EXOLIT OP 1230 FOR TPU

— Robust fire resistance with self extinguishing behavior: UL 94 V-0 non-dripping also in thin parts, high LOI, low heat release
— Cable test can be passed e. g. 4 mm three-wired cable
— Non-corrosive smoke
— High elongation and balanced tensile strength with good aging behavior and hydrolysis resistance
— GreenScreen Benchmark 3

Exolit™ flame retardants for rolling stock applications

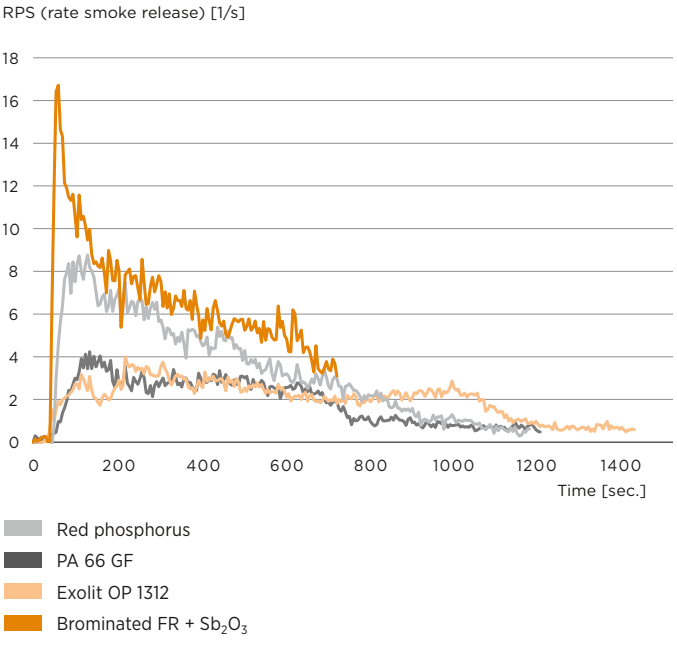


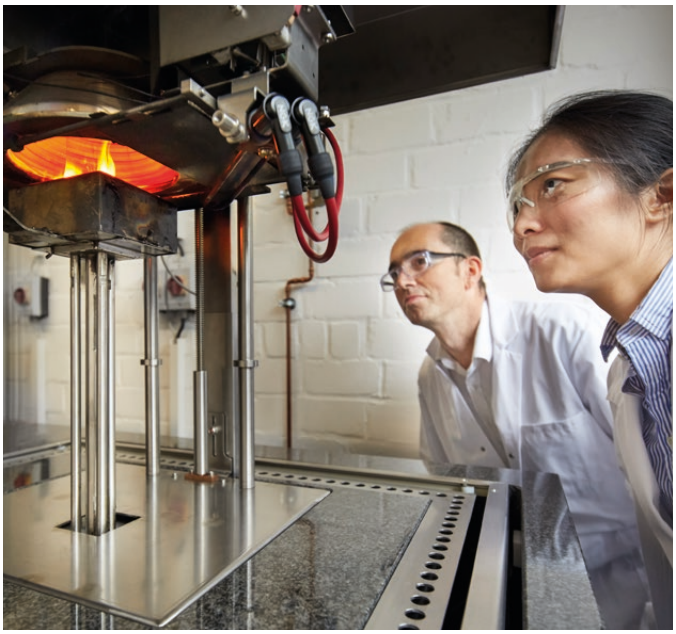
Polymers with Exolit flame retardants provide a lower smoke density and smoke toxicity than compounds with brominated flame retardants combined with antimony trioxide or compounds with red phosphorus.

Electrical parts molded with PA 66 GF containing Exolit OP are compliant with the highest fire safety standard for rolling stock: category R22, hazard level 3 (HL3) according to EN TS 45545-2, the European standard for railway rolling stock.

In PBT GF category R22, hazard level 2 (HL2) according to EN TS 45545-2 can be achieved.

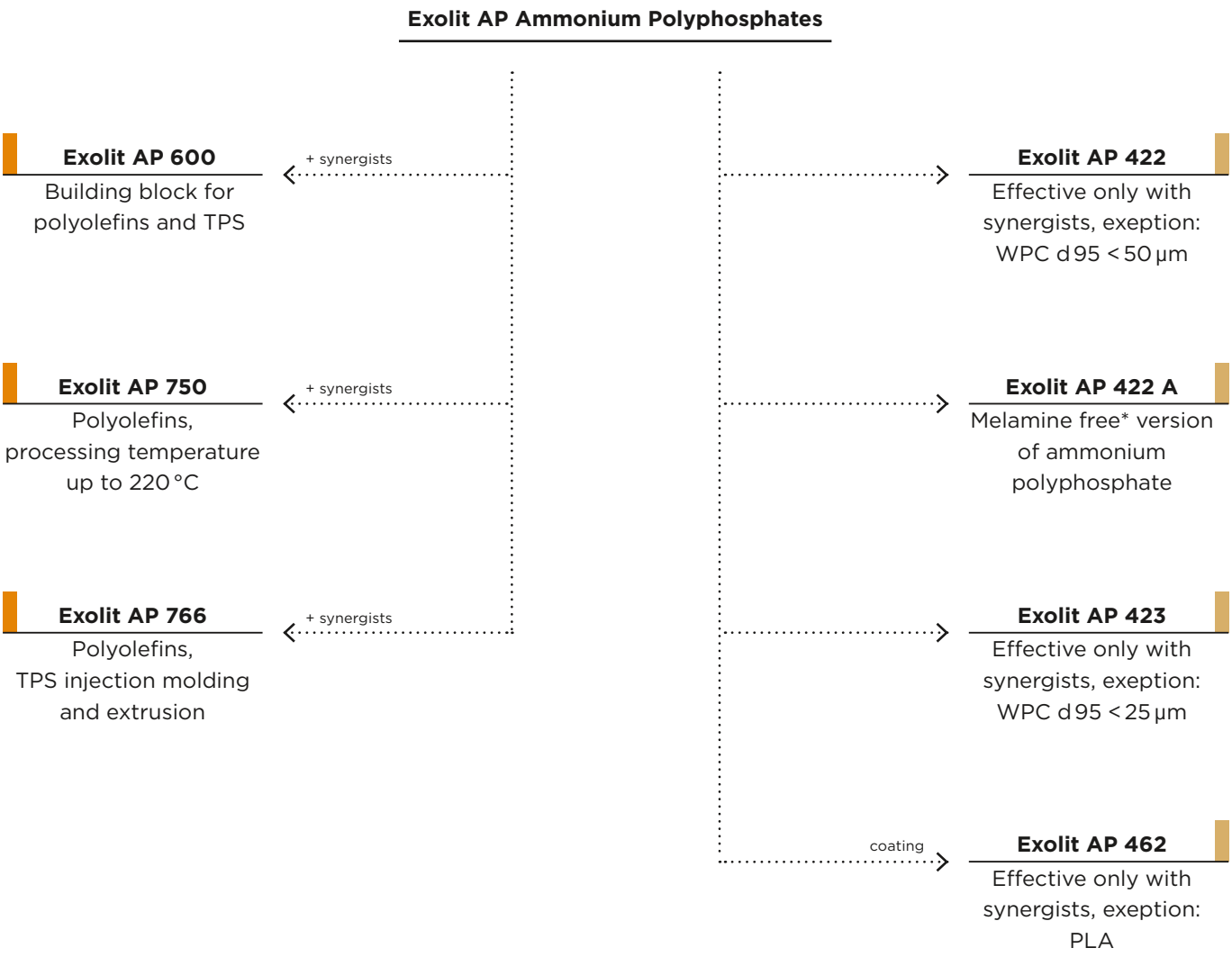
RATE OF SMOKE RELEASE OF PA 66 GF COMPOUNDS





Exolit™ AP and AddWorks™ solutions for Polyolefins

Polyolefins can be efficiently protected with the synergist-enhanced flame retardants from our Exolit AP range. Powerful protection is provided by our HALS-based solution from the AddWorks range.



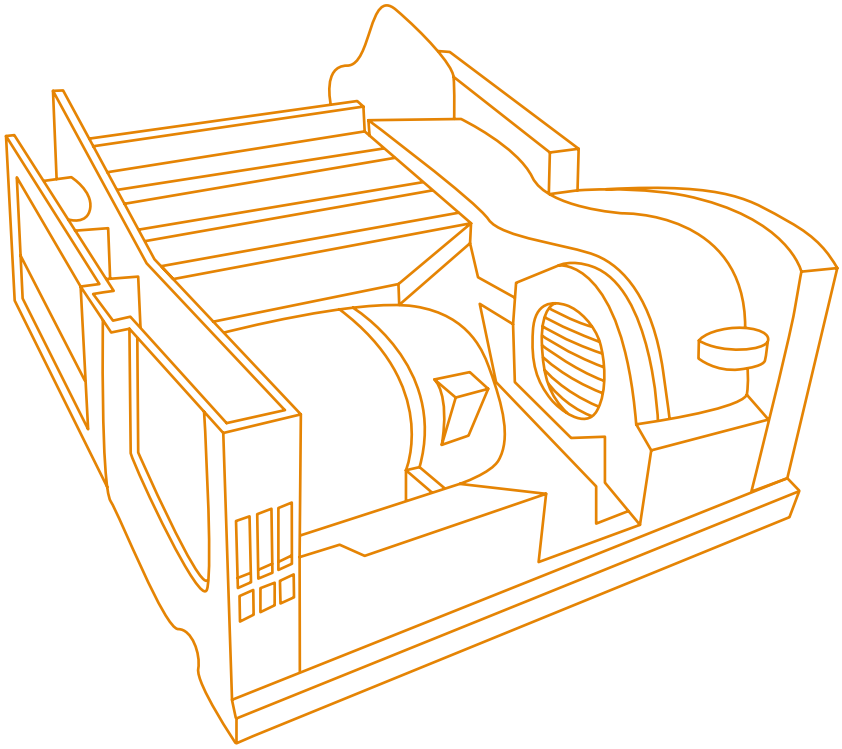
*according to Article 31 of the REACH Regulation (Regulation (EC) No 1907/2006)

The Exolit™ AP/AddWorks™ product range for polyolefin

— UL 94 V-0 at 1.6 and 3.2 mm
— Low smoke density
— Low smoke gas corrosivity
— Good electrical and mechanical properties
— Excellent UV stability
— Good recyclability
— Halogen-free

POLYOFIN TYPE		PROCESSING TEMPERATURE [°C]	**EXOLIT AP 422/422 A* 423***	**EXOLIT AP 750**	**EXOLIT AP 766**	**ADDWORKS™ LXR 920**
EVA	IM, EX**	120–220	■	■	■	
	Films	120–220				■
PE-LD	IM, EX*	150–220	■	■	■	
	Films	150–220				■
PE-HD	IM	180–230	■		■	
	Films	170–220				■
PP	IM, Films	170–230	■	■	■	
	Fibers, films	170–230				■
WPC***	EX	150–220	■			
TPO	Elastomer-modified PO	150–220	■		■	
TPV	PO/EPDM crosslinked	180–230	■		■	

* Key component for developing individual intumescent formulations at customers with formulation know-how of their own
** IM = injection molding, EX = extrusion
*** Wood-plastic composites based on PE-LD, PE-HD and PP; Exolit AP 422/AP 423 work on their own



EXOLIT AP 750
- Standard grade for PP and PE
- High flowability for injection molding applications due to melting component
- Standard grade for injection molding applications
- Limited suitability for extrusion applications (PE-LD/EVA, PP copolymers possible; not low MFI PP)
- Highest dosage requirements of product range
- Best flow properties due to melting synergist
- Lowest processing stability of product range in compounding (approx. 220 °C)

EXOLIT AP 766
- Higher efficiency
- Suitable for glass fiber reinforced PP and polyolefin based elastomers
- Suitable for both injection molding and extrusion applications (with non-demanding extrusion requirements: low temperature, low shear)
- Highest FR efficiency of product range
- Best efficiency in glass fiber reinforced PP compounds
- Product of choice for development of TPO and TPS formulations

In E&E equipment a variety of different thermoplastic materials is used. In many cases they need to be flame-retarded in order to comply with fire safety standards. Intumescent flame retardants like Exolit AP 750/766 have been designed for polyolefins to pass the V-0 rating according to the UL 94 flammability test. In PP-based compounds loadings of 22–30 % of flame retardant are needed to meet the test criteria.

Compared to the use of other halogen-free flame retardants like metal hydroxides, the Exolit grades show a better processability. In addition, mechanical properties are less affected due to the lower dosage needed. In case of a starting fire Exolit AP 750/766 products offer advantages compared to halogenated flame retardants. Peak heat release and smoke density from the polyolefins are much lower, resulting in a significantly reduced spread of flame and better chances for people to escape from a fire. Moreover, the lower smoke corrosivity can avoid severe damage of electrical equipment installed close to the fire source.

AddWorks™ LXR 920

AddWorks LXR 920 is an additive that acts simultaneously as a flame retardant and as a UV light stabilizer. Its innovative technology, based on polymeric aminoether-HALS (hindered amine light stabilizer), makes AddWorks LXR 920 compatible with a variety of polymers, especially polyolefins.

The tailor-made AddWorks LXR 920 can be added to polyolefin films to reach B2 classification according to the German DIN 4102 standard without influencing the transparency of the films.

Clariant development and customer support

Our dedicated technical service can help you with your FR-compound development.

Clariant offers a wide range of polymer additives: flame retardants, waxes, antioxidants, UV stabilizers, and antistatic agents. In order to efficiently respond to customers needs, Clariant's Additives Business Unit operates its own application technology plastics centers in Gersthofen, Bangkok and Shanghai.

Our dedicated technical service offers support regarding individual recipe development and optimization of flame retardant and additive packages.

State-of-the-art plastics processing allows compounding and masterbatch preparation including strand and under-water pelletizing as well as die-face cutting. Test specimens are produced via injection molding, profile extrusion and blow molding of films. Flammability tests (UL 94, Cone Calorimeter, LOI, GWFI/ GWIT, DIN 4102 B2, CTI, FMVSS 302) are complemented by a wide range of standard methods to characterize plastics properties (e. g. mechanical and rheological data).

Clariant's analytical labs assist with most suitable and up-to-date methods such as nuclear magnetic resonance (NMR) spectroscopy, high performance liquid and gas chromatography (HPLC, GC), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), Fourier-transform infrared spectroscopy (FTIR), elemental analysis etc., which are accurate and reliable analytical techniques for development work.

At the One Clariant Campus (OCC) in Shanghai, the Additives' Technical Centre supports high-end product development across industries. Our expertise ranges from polymerization, to compounding and conversion, thermoset processing and product development for coating, ink and adhesive applications, all the way to performance testing for various target industries (including E&E, automotive, packaging, fibers and films).

Glossary

APP	ammonium polyphosphate
CQC	China quality certification
CTI	comparative tracking index
DDR RAM	double data rate random access memory
DRAM	dynamic random access memory
DSC	differential scanning calorimetry
E&E	electric and electronic
EPDM	ethylene propylene diene monomer rubber
EVA	ethylene-vinyl acetate
E-vehicle	electric vehicle
EX	extrusion
FMVSS	federal motor vehicle safety standards
FR	flame retardant
GC	gas chromatography
GF	glass fiber
GWFI	glow wire flammability index
GWIT	glow wire ignition temperature
HALS	hindered amine light stabilizer
HL	hazard level
HPLC	high performance liquid chromatography
HPPA	high-performance polyamide
IM	injection molding
LCP	liquid crystal polymers
LOI	limiting oxygen index
MFI	melt flow index
NMR	nuclear magnetic resonance
N-syn	nitrogen synergist
PA	polyamide
PBT	polybutylene terephthalate
PCT	polycyclohexylenedimethylene terephthalate
PE-HD	high-density polyethylene
PE-LD	low-density polyethylene
PET	polyethylene terephthalate
PHB	polyhydroxybutyrate
PLA	polylactic acid
PO	polyolefin
PP	polypropylene
P-syn	phosphorus synergist
PTFE	polytetrafluoroethylene
PTT	polytrimethylene terephthalate
SMT	surface mounting technology
stab.	stabilized
TGA	thermo-gravimetric analysis
TPC	thermoplastic copolyester
TPE	thermoplastic elastomer
TPO	thermoplastic elastomer based on polyolefin
TPS	styrenic based thermoplastic elastomer
TPV	cross-linked thermoplastic elastomer based on polyolefin
UL	Underwriters Laboratories
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik
WPC	wood plastic composite

Hazard information

GHS classification class chemicals according to European Regulation (EC) No. 1907/2006 (REACH) and Regulation (EC) No 1272/2008 (CLP-Classification, Labelling and Packaging):

Exolit OP 950: Serious eye damage, short- and long-term aquatic hazard

Exolit OP 1312/1322: Reproductive toxicity, long-term aquatic hazard

Exolit OP 1314/1324: Reproductive toxicity, long-term aquatic hazard

Exolit OP 1380: Reproductive toxicity, long-term aquatic hazard

Only if there is sufficient exposure, e. g. direct contact with the chemical, will the hazard properties materialize and pose harm to people or the environment.

CLARIANT INTERNATIONAL LTD
Rothausstrasse 61
4132 Muttenz
Switzerland

BUSINESS UNIT
ADSORBENTS & ADDITIVES
Phone: +41 61 469 5111
Email: adsorbents.additives@clariant.com

EXOLIT.COM
CLARIANT.COM

DA 4019 E | 11.2024