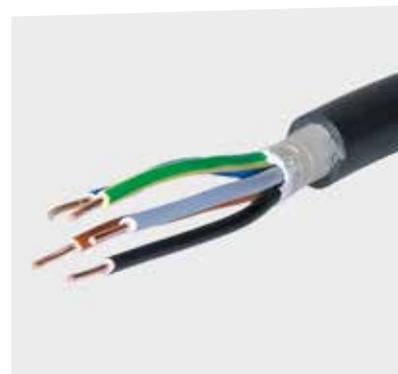


LUVOBATCH® Flame Retardants





We **LW** it.

Hanseatic Reliability – for more than 45 years

We look back on a long-lasting success story in the development and production of masterbatches for the plastics processing industry. Under the brand name LUVOBATCH® specialised additive masterbatch solutions for different application and processing methods have been produced and marketed for more than 45 years.

Discover the world of customised solutions

The internationally operating LEHVOSS Group, led by Lehmann&Voss&Co. in Hamburg, develops, produces and markets chemical, mineral and technical specialties for many different industries.

Founded 125 years ago as a trading company in Hamburg, our owner-managed group of companies has continuously developed into a high-performance organisation – long-term business relationships with renowned suppliers stand for strong partnerships and distributions. As a result, the own production sites in Europe, the USA and Asia can rely on a broad network of raw materials.

The focus of the LEHVOSS Group is on innovative products and services for individual customer requests. With its presence on the markets around the world, the LEHVOSS Group is consistently implementing the appreciative culture of a family-owned business. One of the specialties of this company is proximity to the people which finds its expression in a trustful and reliable co-operation.

Because we love what we do: **We LuV it.** Since 1894.



LUVOBATCH® FR – Flame Retardants

In many areas we cannot manage without them, even if they often remain invisible for us in everyday life. With the use of flame retardants, for instance, in electrical engineering, the building industry and public transportation, our environment has become significantly safer. To ensure and improve our safety, products must be subjected to the respectively applicable standards and test methods. A flame retardant system adapted to materials and applications is needed to meet these requirements and take the most recent findings into account.

Based on our long-standing experience and technical know-how in the field of flame retardants, we can offer products for your applications in many different areas. If needed, we develop customised solutions together with you.

The product series LUVOBATCH® FR – Flame Retardants by LEHVOSS includes masterbatch solutions, which are processed together with a carrier material and, if necessary, further additives. The masterbatch solutions offer a high flexibility, e.g. with a view to the requested dosage or additional formulation ingredients. In addition we manufacture PP compounds (directly usable) which are likewise available.

Regardless of whether a masterbatch or compound solution is chosen: with the LUVOBATCH® FR products you receive products in granular form which can be processed easily and safely. They stand out with their good dispersion; they can be easily dosed and allow for dust-free work. The absence of dust is particularly important for the processing of powders with a low occupational exposure limit value such as antimony trioxide. LEHVOSS offers antimony trioxide masterbatches on different carrier materials so that it's possible to process antimony trioxide safely.

Flame Retardant Systems

How do flame retardants work?

Flame retardant systems influence a smouldering or developing fire through different physical and/or chemical mechanisms of action.

You can, for instance, reduce the fire load, i.e. the proportion of flammable materials in a product. Some form a protective layer which prevents heat, material and gas exchange so that the fire is deprived of its 'fuelling'.

Flame retardants are used with the objective of preventing and/or delaying the fire event and hence improve the possibilities of firefighting and evacuation.

What is used as a flame retardant?

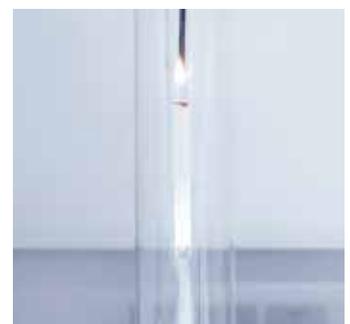
Since the term "flame retardant" is defined through the mechanism of action in connection with a fire event, many different material classes are hidden behind it. They are selected individually to adapt them to the requirements of the respective end products, applications and regulations to be complied with.

Halogenated flame retardant systems

The use of halogenated flame retardant systems is widely spread; mainly brominated compounds are used. They are very effective and are often used together with synergists, so that the dosage and hence the influence on other important material properties in the end product is relatively low.

Halogen-free flame retardant systems

Halogen-free flame retardant systems, whose use is prescribed or desirable for certain applications, can be subdivided into different material classes: there are nitrogen- and phosphorous-based as well as mineral additives. Another class includes intumescent systems with which in the event of a fire a formation of a stable protective layer is formed by foaming of the material.



From production to testing: masterbatch and test specimen production as well as analytics and fire tests are mandatory for the product understanding.

Which product is suitable for your application?

Here you receive a first overview of the masterbatches presented in this brochure:

- In which plastics are they used?
- Are they halogenated or halogen-free products?
- For which processing methods are they suited?

More detailed information on the listed products can be found on pages 6 – 7.

LUVOBATCH®	PE	PP	PA	EVA	PET	PS	ABS	Others	Halogen-free	Extrusion (E) / Injection Moulding (I)
PE FR 1150	•	•						ASA		E+I
PE FR 4775	•	•								E+I
PP FR 6142		•								E+I
UC FR 7525			•			•	•	PBT, PC, PA-GF		E+I
PP FR/AO 0370		•								E+I
EV FR 1106	•			•				TPE		E
PS FR 0038						•				E+I
PP FR 0234		•							• ^a	I
PE FR 4011	•								•	E+I
PP FR 0376		•							•	E+I
PP FR 0377		•							•	E+I
PA FR 0014			•						•	E+I
PA FR 0266			•						•	E+I
PET FR 5499					•				•	E+I
PET FR 0378-80					•			PBT / PET-G	•	E+I

^a Very low bromine fraction

Halogen-free products

In this overview you find a selection of our **halogen-free** products with examples of recommended dosage to meet the applicable flame retardant standards/classifications. Depending on the material, processing and geometry, the results may vary and must, therefore, be tested in the end product.

LUVOBATCH®	Use in	UL94		DIN 4102		Application examples
		V-2	V-0	B2	B1	
PP FR 0234	H-PP	3 – 5 %				Pipes, profile plates, masterbatch especially for PP with low halogen content
	Copo-PP	5 – 8 %				
	R-PP	3 – 5 %				
PE FR 4011	PE			1 – 5 %		Masterbatch especially for thin applications like films
PP FR 0376	PP		≥ 25 %			Thick-walled components such as plates, profiles
PP FR 0377	PP	15 %		10 – 15 %		Profile plates
PA FR 0014	PA6	2 %	6 – 10 %			Plates, pipes, injection-moulded parts, masterbatch especially for the application in PA6
PA FR 0266	PA12		15 – 20 %			Pipes, tubes, cables, injection-moulded parts, masterbatch especially for the application in PA12
PET FR 5499	PET	5 %	15 %			Fibres, films, plates, thick-walled applications, injection-moulded parts
PBT FR 0378	PET	5 %	≥ 25 %			Fibres, films, plates, thick-walled applications, injection-moulded parts, masterbatch suited for the application in PET and PBT, allows for lower processing temperatures in PBT
PET FR 0379	PET	5 %				Fibres, films, plates, thick-walled applications, injection-moulded parts, masterbatch especially suited for transparent PET applications
PET FR 0380	PET	5 %	15 %			Fibres, films, plates, thick-walled applications, injection-moulded parts, masterbatch especially for use in PET and PET-G
	PET-G	5 %				

Halogenated products

In this overview you find a selection of our **halogenated** products with examples for recommended dosage to achieve the corresponding flame retardant standards/classifications. Depending on the material, processing and geometry, the results may vary and must, therefore, be tested in the end product.

LUVOBATCH®	Use in	UL94		DIN 4102		Application examples
		V-2	V-0	B2	B1	
PE FR 1150	PE	8 – 10 %	20 %	5 – 10 %	12 – 15 %	Films, pipes, plates, thick-walled applications, injection-moulded parts
	PP	8 %	≥ 20 %			
PE FR 4775	PE	5 – 10 %		5 – 9 %	16 %	Films, pipes, especially suited for the use in outdoor applications (increased UV resistance)
	PP	15 %		8 – 12 %		
PP FR 6142	PP	5 – 10 %	10 – 15 %			Pipe extrusion, injection-moulded parts, thin-walled parts, especially for applications in PP
UC FR 7525	ABS		23 – 25 %			Universally usable flame retardant masterbatch in different polymer matrixes
	HIPS	20 %	25 – 30 %			
	PA6		25 – 30 %			
	PA6 +30 % GF		20 – 25 %			
	PA6.6		20 – 30 %			
	PBT		15 – 20 %			
	PC		10 %			
PP FR/AO 0370	PP	10 – 15 %	≥ 25 %			Pipes, profile plates, black masterbatch with flame retardancy and thermal stabilisation especially for use in PP
EV FR 1106	PE	7 – 10 %	25 – 30 %	8 – 10 %		Films, cables, suited for use in PVC
	EVA			8 – 10 %		
PS FR 0038	PS	10 – 12 %	25 – 30 %			Profile plates, thick-walled parts

Antimony trioxide masterbatches

Antimony trioxide is a highly effective synergist in combination with halogenated flame retardants.

High safety requirements on production plants are needed concerning the dust limit values. To solve this problem in your production, we can offer our dust-free masterbatch solutions on various carrier systems.

LUVOBATCH®	ATO content	Carrier	MFI (carrier)	Application examples
EV FR 0284	80 %	EVA	6 g/10 min. (190 °C/2.16 kg)	Dust-free processing of ATO in PVC processing
PBT FR 0279	80 %	PBT	33 g/10 min. (250 °C/2.16 kg)	Dust-free processing of ATO in PET processing

Individual carrier systems on request.



Compounds

Even if masterbatches offer a major advantage in terms of flexibility through dosage adaptations and a change in additives, ready-to-use compounds are the first choice for some products. An overview of our compound solutions is provided below.

LUVOGARD®	UL94	Tensile modulus	Charpy notched impact strength	MFR (230 °C / 2.16 kg)	Application examples
COM PP 54 HF	V-0	1.6 GPa	7 kJ/m ²	3.5 g/10 min.	Halogen-free PP flame retardant compound, use e.g. in the E&E field For further mechanical properties, see TDS.
COM PP 50 HF	V-0	2.3 GPa	2 kJ/m ²	7 g/10 min.	Halogen-free PP flame retardant compound, use e.g. in the E&E field For further mechanical properties, see TDS.
COM PP8 Sb	V-0	> 3.2 GPa	4 kJ/m ²	2.5 g/10 min.	Halogenated PP flame retardant compound, use e.g. in the E&E field For further mechanical properties, see TDS.



The products listed in the brochure do not cover the entire portfolio. Please contact us on specific topics.

Fire tests

Suitable flame retardant products

The selection of a flame retardant system for the end applications depends on various criteria. Not every flame retardant acts in every polymer material; furthermore, important properties of a product (e.g. mechanical properties, colour) can be influenced in an undesirable way.

In addition, there is the required flame retardant effect: depending on the function and place in which a product can be found in the different applications, there are rules and standards on fire protection on a national or international level. Typical fire tests are, for instance, the UL94 test and the so-called oxygen index (Limiting Oxygen Index, LOI).

Fire tests at LEHVOSS

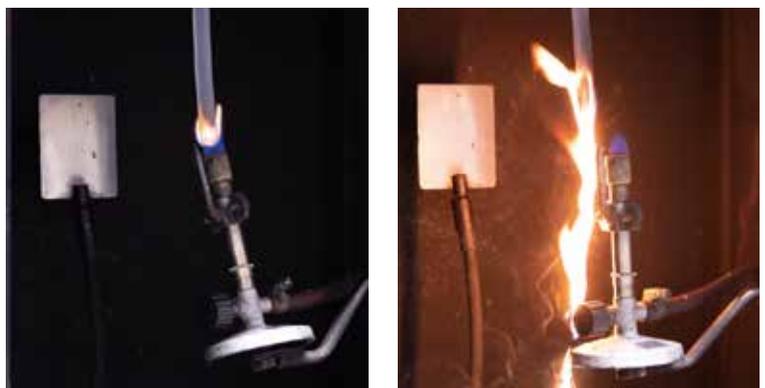
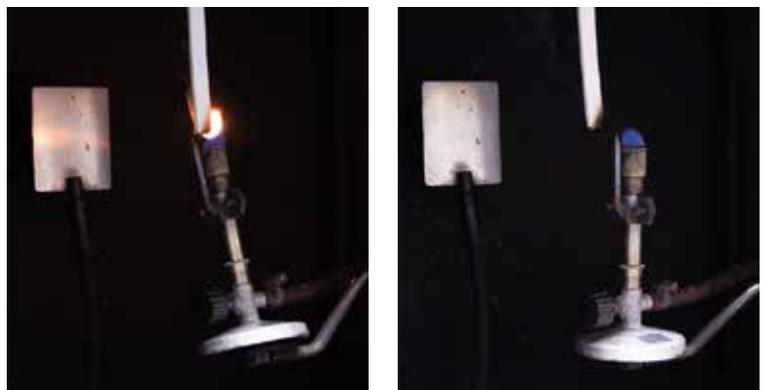
For the purpose of internal testing in its own technical centre and laboratory, LEHVOSS can rely on a selection of fire tests. Consequently, the success of a product development can be checked in examples of formulations or the influence of other raw materials on the fire behaviour can be tested. With reference to the different standards, the following tests are available:

- Vertical fire test: UL94 (IEC/DIN EN 606951110)
- Oxygen index: LOI (Limiting Oxygen Index, ISO 45892)
- B2 test according to DIN 4102

Vertical fire test: UL94 (IEC/DIN EN 606951110)

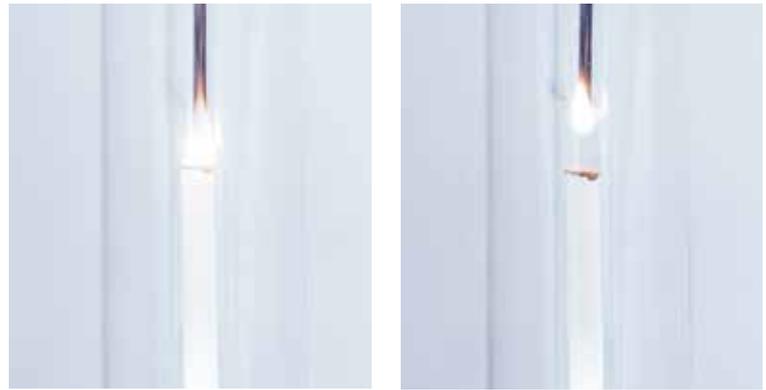
- The test includes test bars with a thickness of 1.6 mm and 3.2 mm in a vertical set-up
- Classification according to fire behaviour (burning time, possibly burning drips) from non-classified/V2/V1/V0

UL94 test of a plastic with flame retardant (above) and a plastic without flame retardant (below) during flame impingement and after removal of the burner.

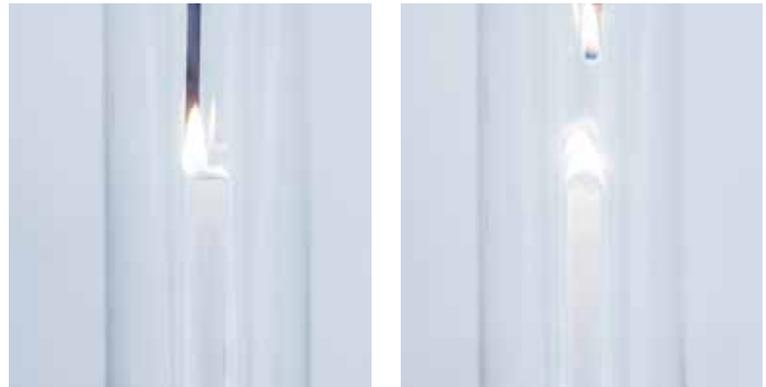


Oxygen index:
LOI (Limiting Oxygen Index,
ISO 45892)

- Test bars with a thickness of 1.6 mm are tested in an air/oxygen mixture with variable O2 content
- LOI value corresponds to the oxygen content in the mixture, which is required for the material to continue to burn after the removal of the source of ignition



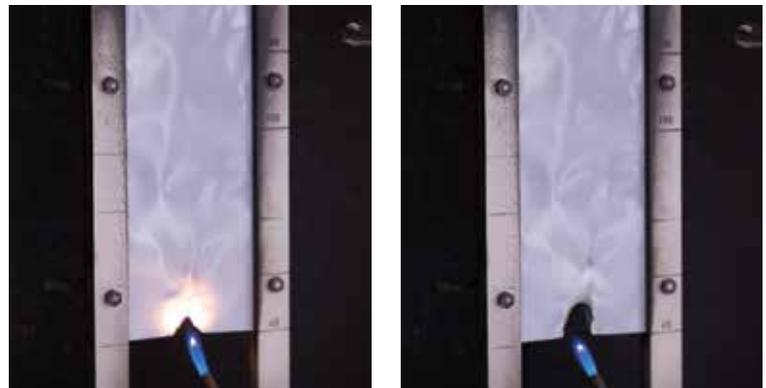
LOI test of a plastic with flame retardant (above) and a plastic without flame retardant (below) during flame impingement and after removal of the burner.



B2 test according to DIN 4102

- National standard for the classification of the fire behaviour of building materials
- Tests for B1 classification (flame retardant) with our test set-up not possible
- Test for B2 classification (normal flammability) possible

B2 fire test for films: test set-up and test. Film with flame retardant (above), film without flame retardant (below) during flame impingement and after the removal of the burner.





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