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Fire safety and environmental protection: How companies can meet the challenge

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Why do we need fire safety?

We are continually threatened by fires:

- **they cost human lives**
- **destroy property and**
- **damage the environment**

We therefore need fire safety

- **to protect our buildings, transportation systems and electrical and electronic installations**
- **enforced by national and international fire protection regulations**




Fire safety requirements and tests for plastics

Materials (including plastics) and finished components have to meet fire protection requirements:

- **In laws and statutory regulations (construction, transportation)**
- **In “voluntary” provisions with de facto legal effect (electrical engineering, UL*, VDE**)**

***US Underwriters Laboratories**

****German Association for Electrical, Electronic & Information Technologies**

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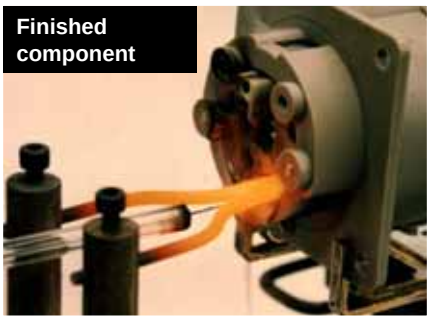
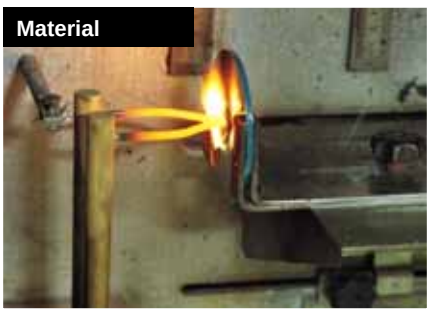
How is fire safety tested in the electrical/electronics sector?

Finished component

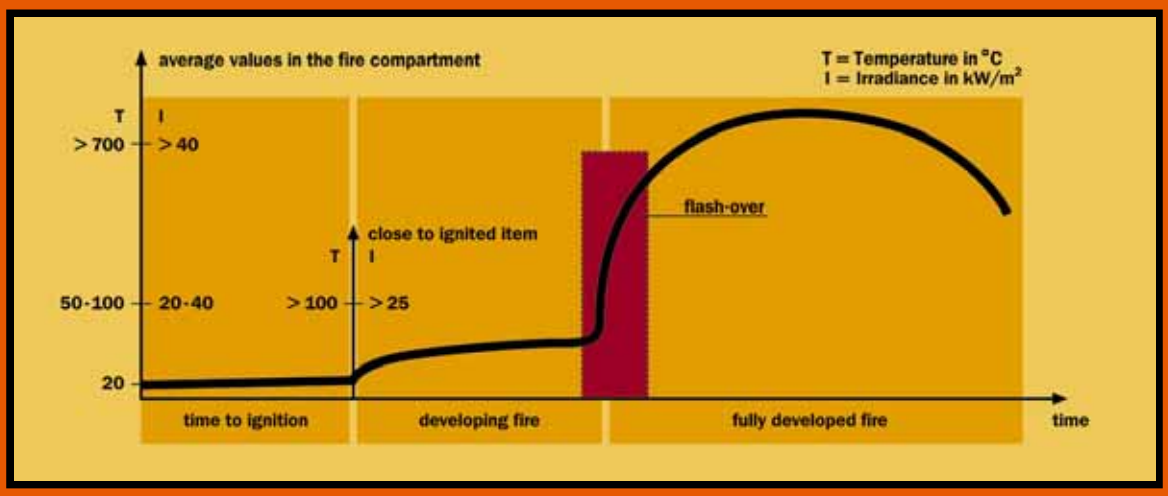


Material



… or with a glow wire that simulates a faulty component in an appliance.

How is fire safety achieved?



By preventing fire outbreaks or delaying ignition and flame spread in the developing fire by interrupting the combustion process

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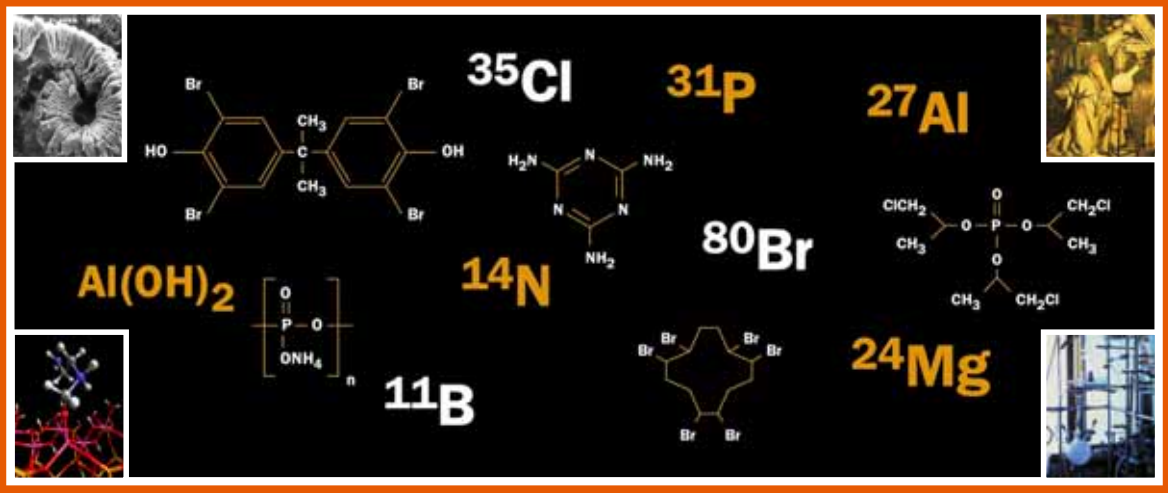
Fire protection with flame retardants

- **Flame retardants make it possible to meet strict fire protection requirements for flammable products in construction, transportation, the electrical and electronics sector, textiles and furniture**
- **Flame retardants therefore protect lives and property**
- **Flame retardants provide fire safety with optimum cost-effectiveness**

What are flame retardants?



Flame retardants are compounds or preparations

- **that prevent the development of a fire or**
- **can delay it long enough to allow sufficient time to escape**

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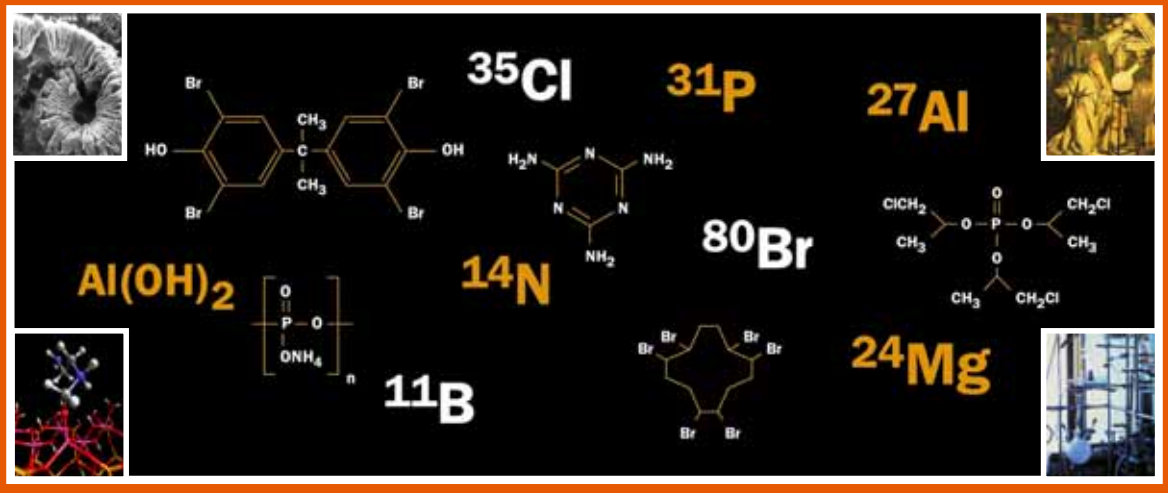
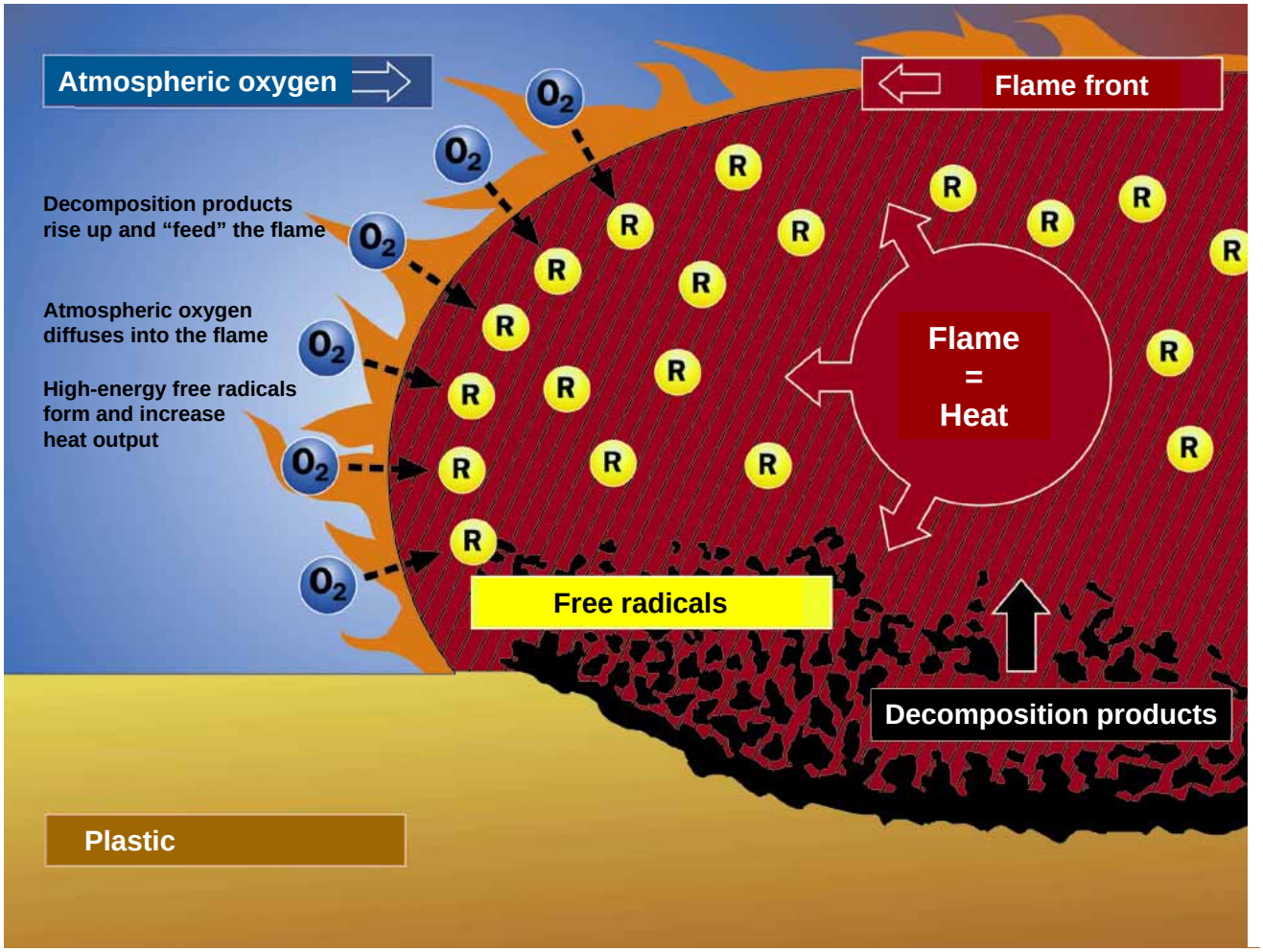
How do flame retardants work?



Flame retardants work by

- **interrupting the combustion process of the decomposition products in the gas phase or**
- **on the surface of the product itself**



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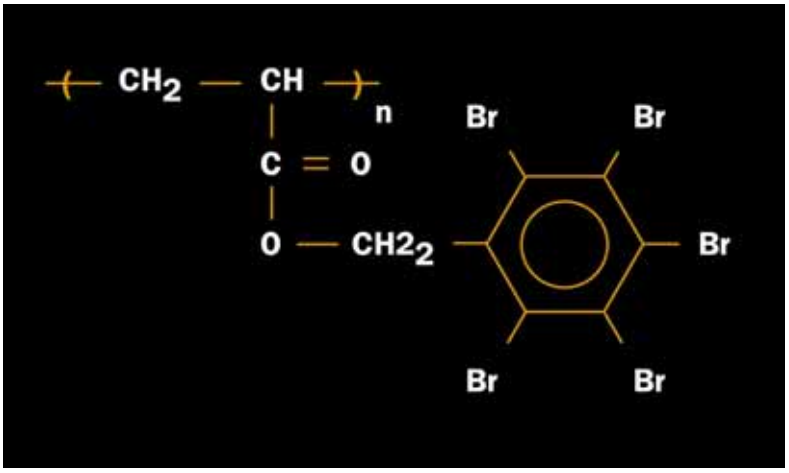
What different types of flame retardant are there?

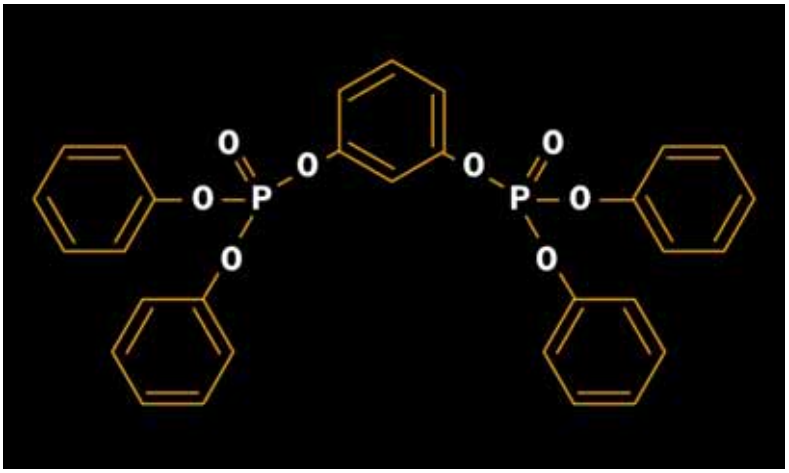
There are several families of flame retardants

Brominated flame retardants



- The halogenated flame retardants, including here the brominated flame retardants, are universally suitable and very effective
- They are widely used in engineering thermoplastics for the electrical and electronics sector

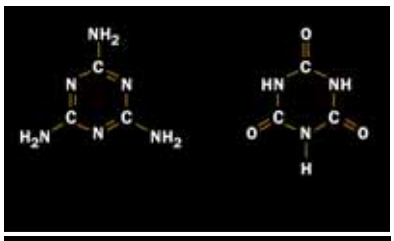
Phosphorus-containing* flame retardants

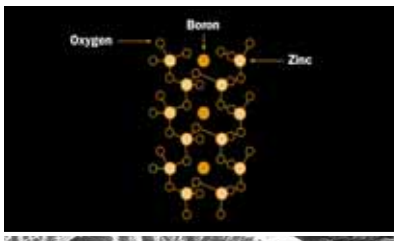


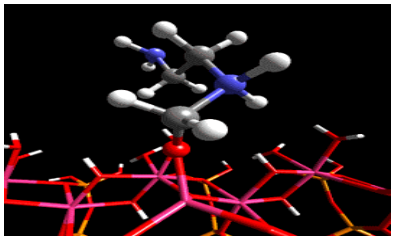
Phosphorus-containing flame retardants are also extremely effective. They are used in many applications but until now have failed to meet the highest fire protection requirements in some engineering thermoplastics.

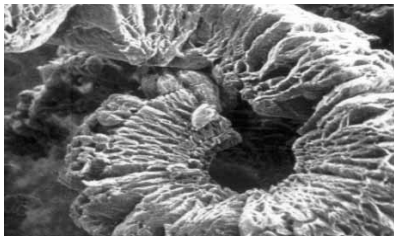
* Phosphoros = light-bringing

Other flame retardants









Other nitrogen-containing and inorganic flame retardants only work in a few plastics and generally have a weaker effect

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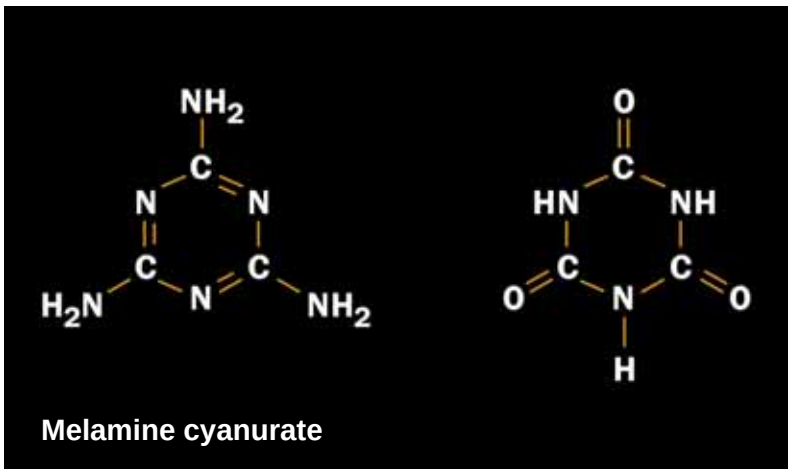
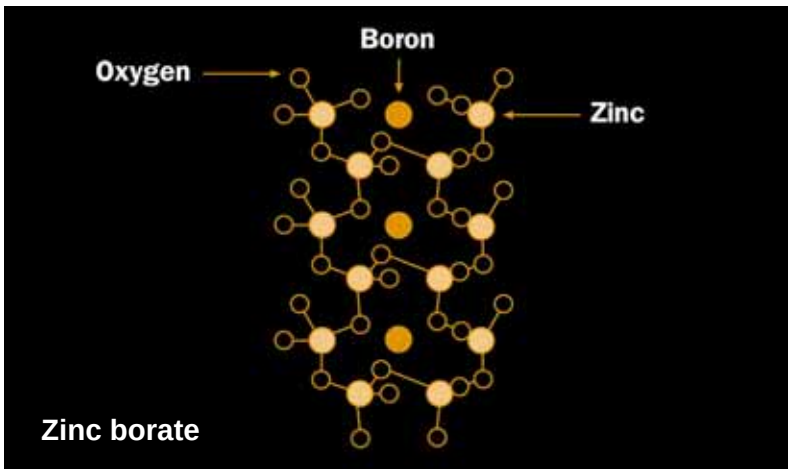
Other flame retardants – melamine cyanurate

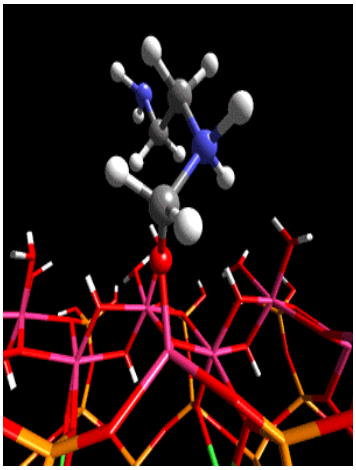


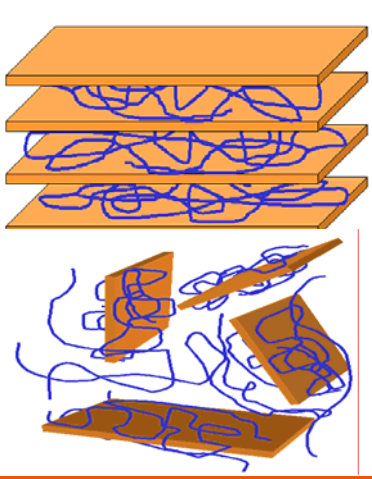
Other flame retardants – metal hydroxides and oxides

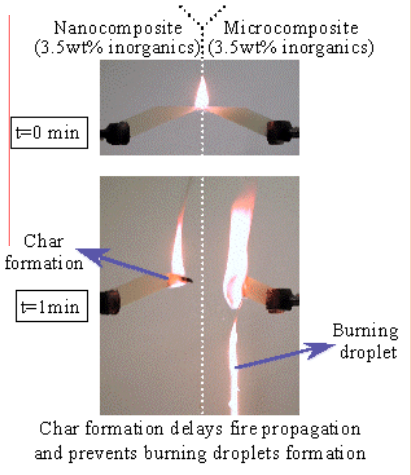


- **Metal oxides: zinc borate**
- **Metal hydroxides: aluminum and magnesium hydroxide**

Other flame retardants – nanocomposites

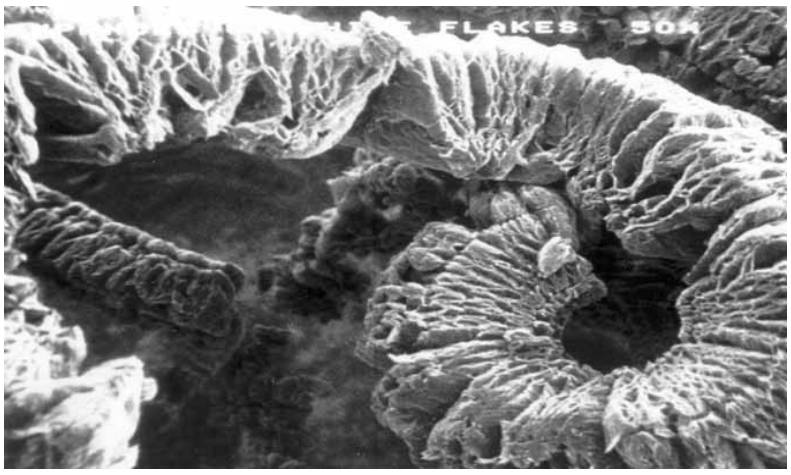






Nanocomposites are aluminum oxides that form a protective layer and prevent the formation of burning droplets

Other flame retardants – expandable graphite



Used for fire protection in aircraft seating

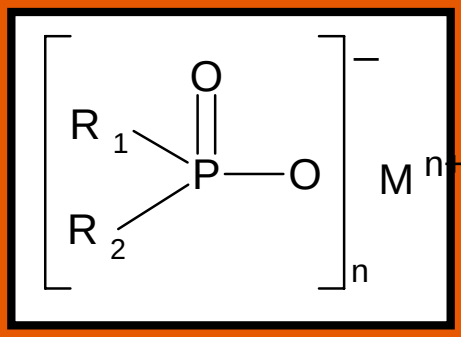
New developments in flame retardants

No fundamentally new developments over the past few years, neither with halogenated nor with other standard commercially available flame retardant systems

With one exception:
The development and launch of a new series of phosphorus-containing flame retardants – organic phosphinates

Organic phosphinates as flame retardants

- Halogen-free, especially suitable for engineering thermoplastics in the electrical and electronics sector
- Meet the highest fire protection requirements specified by the electrical and electronics industry
- Thermally stable up to 350°C
- Meet UL 94 V0 classification requirements in thin parts down to 0.8 mm



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Organic phosphinates as flame retardants

- Organic phosphinates are suitable for flame retardant modification of polyamides, and particularly in linear polyesters such as polybutylene terephthalate (PBT) – shown here.
  The latter were previously the domain of brominated flame retardant systems.

- It is now possible to use connectors, relays and electrical installations produced from halogen-free PBT in a UL 94 V0 formulation

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Why are halogen-free flame retardant systems so important?

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Why are halogen-free flame retardant systems important in the electrical sector? (1)

- **Environmental objections to the use of certain halogenated flame retardants, particularly polybrominated diphenyl ethers**
- **Risk assessments of “existing chemicals” carried out for the European Commission led to a ban on penta- and octabromodiphenylether flame retardants**
- **Two EU directives regulating the disposal of electrical and electronic scrap (WEEE and RoHS), which contain restrictions on the use of certain halogenated flame retardants**

WEEE Directive

- Minimization of electrical and electronic equipment waste
- Promotion of reuse, recycling and recovery
- Minimization of risks and environmental damage by more effective waste treatment and disposal
- Relevance for brominated flame retardants: waste electronic equipment containing brominated flame retardants must be separately sorted as of mid-August 2005 (Annex II)

DIRECTIVE 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 27 January 2003
on waste electrical and electronic equipment (WEEE)

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RoHS Directive

- The RoHS Directive complements the WEEE Directive
- Polybrominated biphenyls (PBB) and diphenylethers (PBDE) are declared hazardous substances
- PBB and PBDE may therefore no longer be used in electrical and electronic equipment as of July 2006
- The possibility of continued approval for the PBDE decabromodiphenylether is being examined

DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 27 January 2003
on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Why are halogen-free flame retardant systems important in the electrical sector? (2)

- To comply with the WEEE and RoHS directives, the electrical and electronic OEMs (original equipment manufacturers) are increasingly relying on halogen-free flame retardant systems
- To avoid increased costs arising from separate collection of waste electronic equipment containing brominated flame retardants

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Why are halogen-free flame retardant systems important in the electrical sector? (3)

- Environmental certification is playing an increasingly important role in the electrical and electronics sector, since it is very often specified in requests for quotations on Information Technology (IT) equipment
- In particular, the TCO mark for office electronic equipment, which prohibits the use of halogenated flame retardants, is a must for this market

Outlook

Halogen-free flame retardant systems will continue to gain importance in the electrical and electronics sector

The major electrical and electronic equipment manufacturers will switch globally to halogen-free systems

The new, highly effective organic phosphinates will fill an important gap in halogen-free flame retardant modification of engineering thermoplastics such as PBT

They will help companies meet the challenges they face