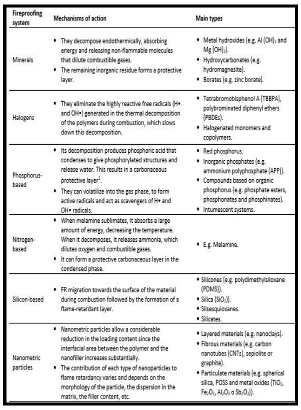
Some notes on flame-retardant mechanisms in polymers

Plastics Institute - Polymers



Fireproofing system	Mechanisms of action	Main types
Minerals	• They decompose endothermically, absorbing energy and releasing non-flammable molecules that dilute combustible gases. • The remaining inorganic residue forms a protective layer.	• Metal hydroxides (e.g. Al $(OH)_3$ and Mg $(OH)_2$). • Hydroxycarbonates (e.g. hydromagnesite). • Borates (e.g. zinc borate).
Halogens	• They eliminate the highly reactive free radicals (H• and OH•) generated in the thermal decomposition of the polymers during combustion, which slows down this decomposition.	• Tetrabromobisphenol A (TBBPA), polybrominated diphenyl ethers (PBDEs). • Halogenated monomers and copolymers.
Phosphorus-based	• Its decomposition produces phosphoric acid that condenses to give phosphorylated structures and release water. This results in a carbonaceous protective layer[1]. • They can volatilize into the gas phase, to form active radicals and act as scavengers of H• and OH• radicals.	• Red phosphorus. • Inorganic phosphates (e.g. ammonium polyphosphate (APP)). • Compounds based on organic phosphorus (e.g. phosphate esters, phosphonates and phosphinates). • Intumescent systems.
Nitrogen-based	• When melamine sublimates, it absorbs a large amount of energy, decreasing the temperature. When it decomposes, it releases ammonia, which dilutes oxygen and combustible gases. • It can form a protective carbonaceous layer in the condensed phase.	• E.g. Melamine.
Silicon-based	• FR migration towards the surface of the material during combustion followed by the formation of a flame-retardant layer.	• Silicones (e.g. polydimethylsiloxane (PDMS)). • Silica (SiO_2)). • Silsesquioxanes. • Silicates.
Nanometric particles	• Nanometric particles allow a considerable reduction in the loading content since the interfacial area between the polymer and the nanofiller increases substantially. • The contribution of each type of nanoparticles to flame retardancy varies and depends on the morphology of the particle, the dispersion in the matrix, the filler content, etc.	• Layered materials (e.g. nanoclays). • Fibrous materials (e.g. carbon nanotubes (CNTs), sepiolite or graphite). • Particulate materials (e.g. spherical silica, POSS and metal oxides (TiO_2, Fe_2O_3, Al_2O_3 o Sb_2O_3)).

Description: -
-Some notes on flame-retardant mechanisms in polymers
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Tags: #Ecofriendly #Flame

Flameretardant Polymeric Materials PDF Book

Phosphorous-containing flame retardants follow this condensed phase mechanism. Halogen-free flame retardants will remain a priority for the next few years at least.

Fire

The purpose of this approach was to make phosphorus-free and -free materials for use in notebook computer housings. MPP can be used in synergistic combination with layered silicates as montmorillonite to increase the barrier properties of the char layer resulting in the intumescent process. Some basic mechanisms of flame retardancy were recognized as early as 1947 when several primary principles were put forward.

Composites Flame Retardant

When a chemical is listed, companies are given a twelve-month period to conform to this requirement. Fire retardant viscose fiber fabric produced by graft polymerization of phosphorus and nitrogen-containing monomer. The gas-phase and the condensed-phase proposals have long been generally considered as the primary, though not the only, effective mechanism of flame retardancy.

Fire

It was found that AHP influences the combustion parameters of the composites.

Understanding Flame Retardant Regulations in North America

In some cases the entire solid may be amorphous, composed entirely of coiled and tangled macromolecular chains.

Flame retardancy of polylactide: an overview

In this case, oligomers with high-boiling point are obtained. As noted above, synthetic HDPE macromolecules have masses ranging from 10 5 to 10 6 amu LDPE molecules are more than a hundred times smaller.

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