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SANE ZENCHEM

善贞实业（上海）有限公司

Sane ZenChem (Shanghai) Co., Ltd.

环保阻燃剂发展趋势及应用

Environmental Protection Fire Retardant Development Trend and Application

进取 Enterprising　　高效 Efficient　　共赢 Win-Win

Mar.3, 2024

---- 橡胶解决方案的服务商

Rubber Solution Provider

SANE ZENCHEM 善贞

Content

- Classification of flame retardants
- Flame retardant market trends
- Flame Retardant Mechanisms
- Flame Retardant Regulations
- Practical Applications of Flame Retardants.

Flame Retardant — Unstoppable Force for Safety

Fire incidents are catastrophic:

1.Fires can cause enormous harm to people, property, the environment, and society and politics.

2. Deadly factors of fires include heat release, toxic substances, smoke, and lack of oxygen.

EN13501 /GB31247-2014 标准

- **Heat**
  - Total Heat Value
  - Total Heat Release
  - Total heat release
  - Heat release rate
- **Smoke**
  - Smoke toxicity
  - Smoke production rate
  - Total smoke production
  - Smoke density
- **combustion**
  - Combustion growth rate index
  - Burning droplets/particles
  - Flame spread
  - Vertical flame spread
- **Toxic**

Classification of flame retardants

Globally, the most widely used flame retardants are aluminum hydroxide and antimony trioxide in inorganic flame retardants, halogen-based flame retardants in organic flame retardants and phosphorus based flame retardants. The flame retardant market in Europe and the United States is dominated by aluminum hydroxide, phosphorus flame retardants and bromine flame retardants, and China is dominated by bromine flame retardants. With the strengthening of people's environmental awareness, the improvement of product requirements, the development trend of flame retardants must be toward environmental protection, low toxicity, high efficiency, multi-functional direction, halogen-free environmental protection compound efficient flame retardants are more and more widely used.

Classification of flame retardants

Classification of Fire Retardant

1. Composition division:

Organic flame retardant

Inorganic salt flame retardants

Mixed organic and inorganic flame retardants

2. Contains flame retardant elements divided:

Phosphorus based flame retardants

Halogen-based flame retardants, phosphorus-halogen-based flame retardants

Nitrogen based flame retardants, phosphorus - nitrogen based flame retardants
agent

3. Use method division:

Reactive flame retardants

Additive flame retardants

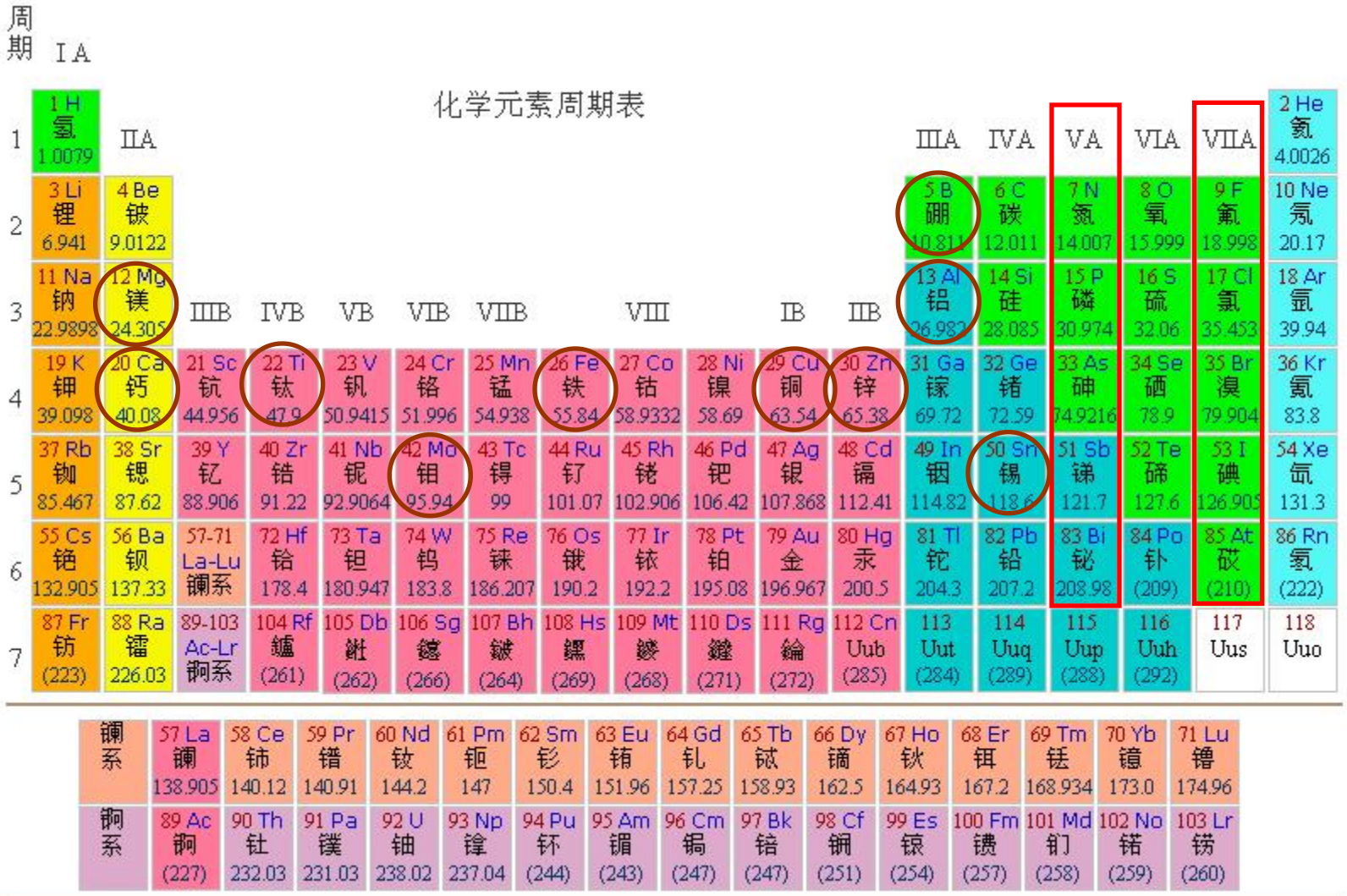
Environmentally friendly flame retardant trends

Inorganic flame retardants
Aluminium hydroxide
Red phosphorus

Organic flame retardants
Phosphorus based flame retardants

Compound flame retardants such as nitrogen and phosphorus expansion flame retardants

Common flame retardant



Environmentally friendly flame retardant

The flame retarder has developed rapidly and healthily in the direction of environmental protection, low toxicity, high efficiency and multi-function. Halogen-free environmentally friendly flame retardants will become a trend.

Environmentally friendly flame retardant

Classification	Organic halide series	Halogen-free flame retardants			
		Organophosphate series	Inorganic series	Expansive IFR	Silicone flame retardant
Representative product	Decabromodiphenyl ether, tetrabromodiphenol A	Tri (2-chloropropyl) phosphate (TCPP), diphenyl phosphate (BDP)	Aluminum hydroxide, magnesium hydroxide	Phosphorus-nitrogen expansion type	Silicone and polysilboroxane
Flame retardant efficiency	Highest	High	Low	High	Low
Environmental protection property	Release toxic and corrosive gases	Low toxicity, low corrosion, good smoke suppression effect	Low toxicity, low corrosion, good smoke suppression effect	Low toxicity, low corrosion, good smoke suppression effect	Low toxicity, low corrosion, good smoke suppression effect
Compatibility	Good	Good	Bad	Bad	
Price	Moderate price	Moderate price	Lower	Not bad	Higher
Major disadvantage	Burning smoke, release toxic corrosive gas	High volatility and poor thermal stability	The addition amount is large, which affects the physical and mechanical properties of the material	The addition amount is large, affecting the material properties, low thermal stability, poor water resistance	The process is immature and the cost is high
Applications with advantages	General plastics, engineering plastics, rubber, etc	Polyurethane, engineering plastics, rubber, etc	General purpose plastic, rubber	General purpose plastic, rubber	General purpose plastic, rubber

Overview of global flame retardant development

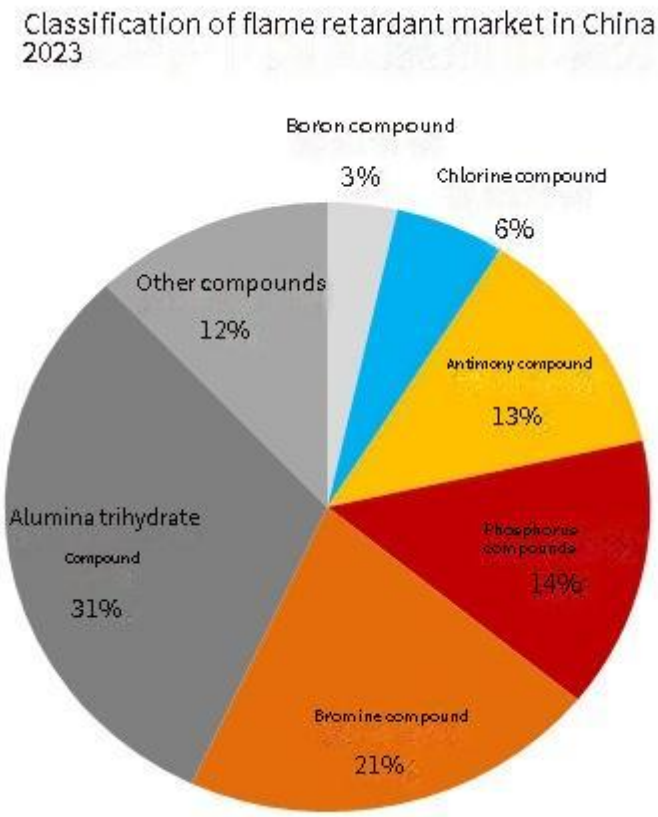
In 2018, the global demand for flame retardants was about 2.96 million tons, with an average annual growth rate of about 5%, and the development was relatively stable. Among them, the Asia-Pacific region is growing fast, and the focus of consumption of flame retardants in the world is gradually shifting to the Asian region, with the main increment coming from the Chinese market . In recent years, the domestic flame retardant market has maintained rapid growth, of which inorganic flame retardants have become the growth highlight and main driving force of the industry. In 2019, China's demand for flame retardants reached 1 million tons, and the market size of flame retardants was about 17.24 billion yuan. In 2020, the global market demand for flame retardants was about 2.91 million tons, an increase of about 10.6%. By 2021, the market demand is about 3.05 million tons, an increase of about 4.8 percentage points, and the market demand of the global flame retardant industry will reach about 3.13 million tons in 2022, and the growth potential of the global flame retardant market demand is greater.

Proportion of various flame retardants in China

Bromine series occupy a higher proportion in the flame retardant market, but halogen-free flame retardants will become the trend. It is expected that the consumption of flame retardants will reach nearly 3.6 million tons in 2024, and the halogen-free flame retardants such as alumina compounds and phosphorus series will reach more than 60%.

Note: Environmentally friendly antimony trioxide refers to the specification of antimony trioxide, in line with European Union standards, that is, ROHS standards, heavy metals within 1000 PPM.
Data source: Zhiyan Consulting

Proportion of various flame retardants in China



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Data source: Zhiyan Consulting

Progress of flame retardant materials for vehicles-3442 (Class 250)

Flame retardants for Automotive Materials Regulation (Flame retardants covered by the Global List of Declared Substances for Motor Vehicles (GADSL))

Fire Retardant	Classifcation	Fire Rtardant	Classifcation
三氧化二锑 Antimony trioxide	D	硼酸 Boric acid	D
短链/中链氯化石蜡 Chlorinated paraffins, short & medium chain	P（短链） D（中链）	六溴环十二烷 Hexabromocyclododecane (HBCD)	D/P
多溴联苯 Polybrominated biphenyls (PBB)	P	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	P, 除十溴二苯醚(D)外
多溴化三联苯 Polybrominated terphenyls (PBT)	D	四溴双酚A Tetrabromobisphenol A (TBBPA)	D
三(2-氯乙基)磷酸酯 Tris (2-chloroethyl) phosphate (TCEP)	D	磷酸三甲酯 Trimethyl phosphate	D
磷酸三苯酯 Triphenyl phosphate (TPP)	D	磷酸三(1,3-二氯-2-丙基）酯 Tris (1,3-diehloro-2-propyl) phosphate (TDCPP)	D
三(1-氮丙啶)氧化膦 Tris-1-aziridinyl phosphine oxide Triethylene phosphoramide (TEPA)	P	三(2,3-二溴丙基)磷酸酯 Tris (2,3-dibromopropyl) phosphate (TRIS)	P

Note:
P is prohibited, prohibited by regulation in certain parts or materials, or the amount cannot exceed the prescribed limit;
D to be declared, the substance must be declared after the amount exceeds a specified limit value;
D/P The same chemical substance has different classifications for different uses

Combustion mechanism of polymers

- The combustion process generally includes heating, melting, depolymerization, decomposition, oxidation ignition, combustion, delayed combustion and other stepsThe combustion process of combustible gas produced by thermal decomposition of polymers is a free radical chain reaction, and the ignition sensitivity and combustion rate of polymers are closely related to the production of a large amount of highly active •OH and O• during combustion
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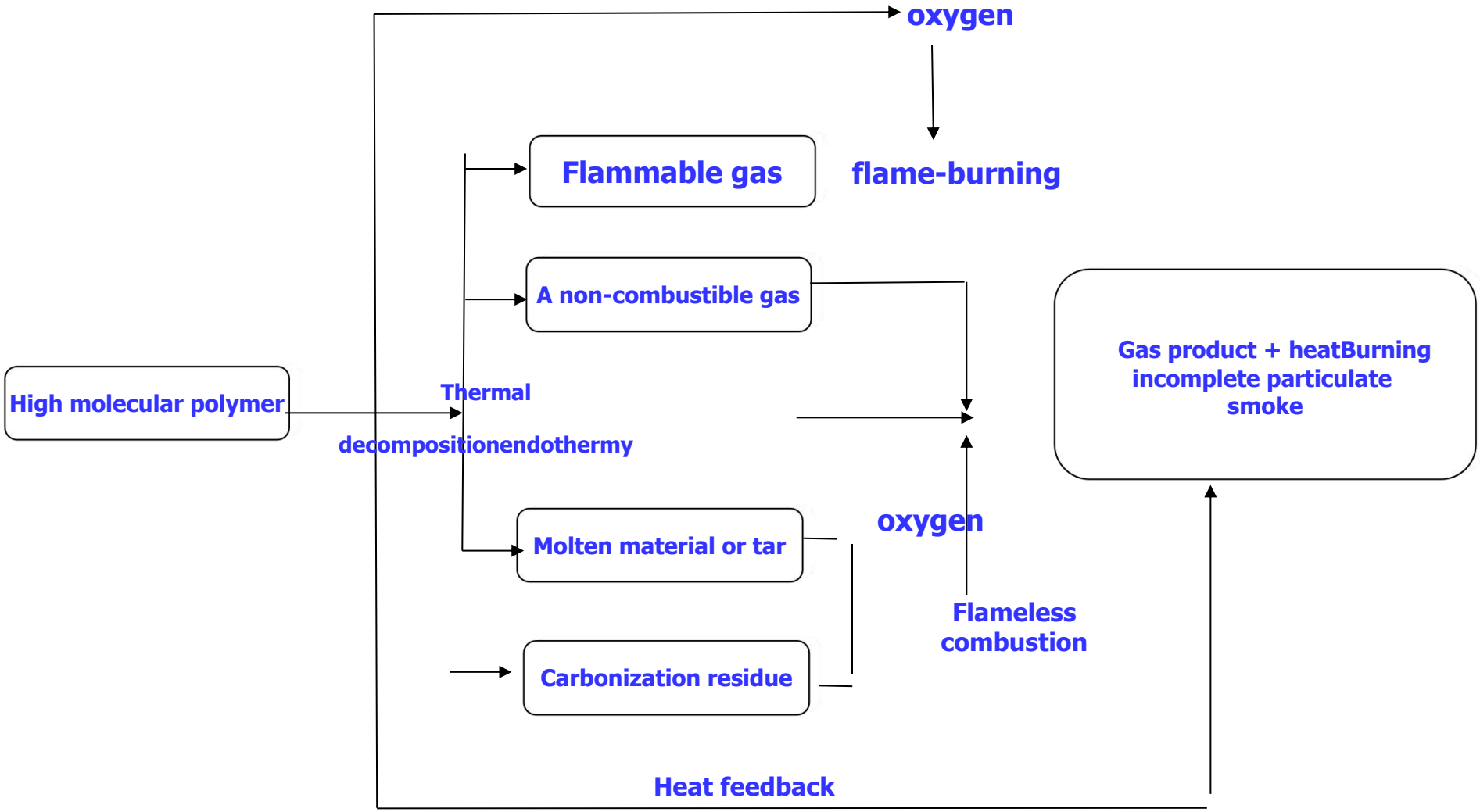
Combustion mechanism of polymers



Smoke mechanism of burning polymers

- The most representative mechanism of black smoke in burning polymers is the carbon double bond polycondensation mechanism. That is, the combustible gas produced by decomposition is polymerized to produce aromatic or polycyclic polymer compounds, and then the condensation polygraphitization produces carbon particles, which are mixed into the gas to form black smoke
- The C/H ratio is related to the molecular structure of the gas produced in the thermal decomposition process of the polymer, and the gas molecules with large C/H value are easy to precipitate excess carbon during combustion, and the black smoke is large.
- When the amount of plasticizer containing aromatic ring (such as aromatic oil, DOP, DBP, etc.) added to the polymer is large, it will also produce black smoke during combustion. Adding flame retardants tends to increase the amount of smoke.
- Black smoke also occurs when polymers are not completely burned in an environment with insufficient oxygen supply. This is due to insufficient thermal decomposition combustion and the formation of a large number of carbon atoms (6 or more) caused by compounds, which release a large number of carbon particles during incomplete combustion and emit black smoke.
- The water vapor generated by the dehydration of high polymer condenses in the air and combines with the flue gas to form a large amount of smoke.

Flame retardant mechanism

- In the process of burning polymers can prevent or inhibit its physical change or oxidation reaction rate, which is the main reason for the flame retardant effect of flame retardants.
- Endothermic effect: The thermal decomposition of the compound or the release of crystal water or dehydration, because of its heat absorption and the temperature rise of the material is inhibited, resulting in a flame retardant effect, called endothermic effect. Such as borax, aluminum hydroxide, calcium carbonate and so on to play a flame retardant role.
- Covering effect (isolation effect) : the flame retardant generates a stable covering layer at a high temperature or decomposing into a foam-like substance, which covers the surface of the polymer, making it difficult for the flammable gas generated by thermal decomposition of the polymer material to escape, and plays the role of heat insulation and air isolation on the material, so as to achieve the flame retardant effect. Such as phosphate ester compounds and fireproof foam coatings.
- Dilution effect: its mechanism of action is that it can produce a large number of non-flammable gases when it is heated and decomposed, so that the flammable gases generated by the polymer materials are diluted and cannot reach the flammable concentration range. Such as CO2, NH3, HCl, H2O and so on can be used as dilution gases. Ammonium phosphate, ammonium chloride, ammonium carbonate, etc. can produce this non-combustible gas when heated.
- Transfer effect: Its role is to change the mode of thermal decomposition of polymer materials, thereby inhibiting the production of flammable gases. For example, using acids or bases to dehydrate cellulose causes it to decompose into carbon and water, rather than flammable gases, so that it cannot catch fire. The flame retardant effect of ammonium chloride and ammonium phosphate is both.

Flame retardant mechanism

- Inhibitory effect: This is a class of inhibitors that can cut off the chain reaction of burning free radicals. This kind of substance can react repeatedly with •OH to generate H2O, cut off the reaction chain of free radicals, inhibit the oxidation reaction, so that it is not intense to the extent of fire, that is, it is in a strong heat source environment, the fire will also leave the external heat source, due to less heat and can not maintain combustion, from the fire. Commonly used organic halogens such as bromine and chlorine have this inhibitory effect.

$$\cdot O \cdot + H_2 \longrightarrow \cdot OH + \cdot H$$

$$\cdot O \cdot + RH \longrightarrow \cdot OH + \cdot R$$

$$R_1CHO + \cdot OH \longrightarrow \cdot CO + \cdot H_2O + R_1$$

$$CO + \cdot OH \longrightarrow CO_2 + \cdot H$$

- Synergies: Here is mainly the use of flame retardants. Some compounds used alone have no flame retardant effect or little effect, and can be used to enhance the flame retardant effect. If antimony trioxide/phosphorus is combined with halogen compounds, the flame retardant efficiency can be greatly improved, and the total amount of flame retardants can be reduced; Now efficient compound flame retardants.

Flame retardant development trend

➢ Disadvantages of bromine flame retardants:

1.Toxic hydrogen halide and antimony halide - harmful corrosive gases; The formation of dioxins.

2. Polybrominated diphenyl ethers, under conditions of low oxygen content incineration, will produce dibenzodioxins and dibenzofurans, and confirm that both substances cause cancer, this issue is controversial.

3. There is a strong call for banning or restricting the use of polybrominated flame retardants in Europe.

➢ Development trend

1.The development direction of halogen-based flame retardants: new products with relatively low toxicity; High molecular polymer type brominated flame retardant.

2.Micro-refinement, smoke inhibition and heat resistance are the development directions of inorganic flame retardants.

3.The development of flame retardants to compound synergistic system development.

➢ The ideal flame retardant should have the following properties:

1.High flame retardant efficiency, small amount of addition 2.Non-toxic and smoke-free, environmentally friendly

3.Good thermal stability, easy to process, easy to use 4.Wide range of use, little impact on the performance of the flame retardant

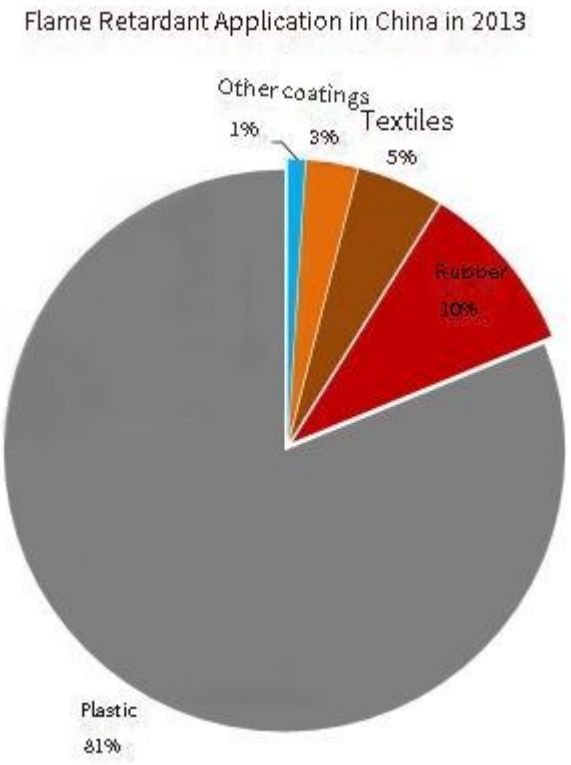
5.Easy to recycle and cheap

Flame retardant regulations

Train	Ship	Car	Building materials
	Marine Equipment Directive (MED) 2014/	GB 38262-2019 Bus Interior	EN ISO 9239-1:20
DIN 5510 German Fire Protection Standard	Marine Equipment Directive MED Certification -IMO Ships	Taiwan Fire Protection Standard for Automotive Materials: CNS 1	EN ISO 1182:2010
BS 6853:1999 British Standard for Fire Protection	IMO Standard for Marine Fire Protection	ECE R118 Testing of Automotive Fender Material	EN 13823 2010+A1
NF F 16-101 / NF F 16-102 French fire protection standards	IMO FTPC Part 1:	Annex 6 to ECE R 118	EN ISO 11925-2:2
NFPA130: 2017 American Standard for Fire Protection	IMO FTPC Part 2:	DBL 5307 Mercedes-Benz Automotive Interior Requirements	EN ISO 1716:2018
EN 45545-2 European Union's latest standards for fire protection Quasi	IMO FTPC Part 3:	BS AU 169A Motor vehicle fire protection in the United Kingdom	European Union's Latest Fire Rating Test in 2018
Italian fire protection standard	IMO FTPC Part 4:	DIN75200 Automotive Interior Materials Fire Protection	EN ISO 11925-2:2
UIC 564-2 International Union of Railways Standard	IMO FTPC Part 5:	GB 8410-2006 Automotive Interior Trim	EN ISO 1716:2018
National standard for fire test	IMO FTPC Part 6:	FMVSS302 United States Federal Transit Vehicle	EN13501-3 Fire Resistance Test _ EN
DIN 5510-2 Wire Fire Protection Standard	IMO FTPC Part 7:	CMVSS 302 Canadian Automotive Interior	EN13501-2 Fire Tests _ EU
	IMO FTPC Part 8:	95/28/EC European Automotive Interior Materials	GB8624-2012 National Standard Building Materials
	IMO FTPC Part 9:	Fire Test of Automotive Interior Materials GB8410	GB 23864-2009 Fireproof Sealing
	IMO FTPC Part 10		Cable CPD fire performance test

Application of rubber flame retardants

Flame retardants are mainly used in the plastics industry, followed by the rubber industry. In general, the oxygen index of more than 27% for self-extinguishing materials, lower than this value for flammable materials, and higher oxygen index of refractory materials. Basically halogen-free rubber are flammable materials, halogen-free rubber and the main chain of inorganic rubber (such as chloro-sulfonated polyethylene, neoprene rubber, silicone rubber, etc.) has excellent flame retardant properties. Usually rubber requires flame-retardant materials such as EPDM, NBR, IIR, NR, etc.



Oxygen index of various types of rubber

Raw rubber	Oxygen index,%	Vulcanized rubber	Oxygen index,%
EPM	18	CPE	30~35
PE	18	CR	29~57
PP	18	CSM	25~52
IR	18	ECO	20~33
BR	18	EPDM	10~29
SBR	18	FKM	42~100
CSM	27	IIR	18~19
CR	40	NBR	17~20
Nylon fiber	20~22	Q	20~43
Polyester fiber	20~22	SBR	18~25

GreenThinking ® FR Series - Highly Effective Compound Flame Retardants - Mature EPDM formulations containing this flame retardant are UL certified

Powerflex(under SanZen Group) is an innovative company specializing in the development and production of new materials. After years of research and development and public relations by an expert team, we developed a GreenThink ® FR series of highly efficient composite flame retardants.

GreenThinking ® FR flame retardant mechanism:：
When heated: The GreenThinking® FR series decomposes and expands on the surface of the product, creating a thick crust, fluffy insulator that insulates the diffusion of oxygen, heat and small molecules during combustion. In addition, the decomposition of free radicals and the H· and OH· reactions that promote combustion, terminate the chain reaction of combustion, release water and carbon dioxide, and efficiently absorb a large amount of heat generated, play a role in inhibiting the flame, so as to achieve the purpose of high efficiency flame retardant.

GreenThinking ® FR Series： Because it does not contain polybrominated biphenyls, polybrominated diphenyl ethers, chlorine, fluorine, antimony trioxide and other halogen flame retardants. With high flame retardant efficiency, smoke elimination, non-toxic, halogen-free, in line with the EU Rohs and WEEE environmental protection directives, compared with the current market equivalent products have high flame retardant efficiency, excellent physical performance, relatively low density, convenient molding and processing, belonging to the halogen-free and efficient environmental protection co-flame retardant. It is widely used in cable, rail transit parts, electronic and electrical parts, automobiles, oil and coal and other industries flame retardant rubber and plastic, flame retardant and other products.

Excellent performance in rubber ：

1. High efficiency synergistic flame retardant, easy to reach V0 level
2. Halogen-free, in line with increasing environmental requirements
3. Comply with EU Rohs and WEEE environmental protection directives
4. Extrude the product smooth
5. The proportion of products is relatively low

Good performance of rubber processing:

1. Good dispersion in the compound
2. Good fluidity of rubber material, easy to extrudeGood dimensional stability
3. Less energy consumption during mixing
4. Shorten the positive curing time

Main features:

1. Sheet structure and surface treatment
2. Large specific surface area
3. Small particle size and reasonable particle size distribution
4. Low impurity content, non-toxic, tasteless
5. Excellent chemical stability

Flame retardant	Unit	Standards	FR35RP	FR97RP	FR21RP	FR51RP	Competitor 1	Competitor 2	Competitor 3	Competitor 4
Vulcanization characteristic	180℃×5min									
ML dN.m			1.79	2.45	1.92	2.25	2.29	4.26	3.87	3.08
MH dN.m			16.04	21.29	17.78	17.92	18.60	28.77	23.12	25.46
MH-ML dN.m			14.25	18.84	15.86	15.67	16.31	24.51	19.25	22.38
TS2 m:s			0:21	0:17	0:19	0:18	0:18	0:17	0:15	0:14
TC10 m:s			0:26	0:21	0:25	0:23	0:23	0:24	0:20	0:21
TC90 m:s			3:26	2:25	3:24	1:48	3:15	3:34	2:39	2:56
Test piece	Vulcanization characteristic 180℃×6min									
Test button	Vulcanization characteristic 180℃×10min									
Hardness	Point	ASTM D2240	68	67	73	66	68	75	75	77
Tensile strength	Mpa	ASTM D412	8.0	5.5	7.0	6.0	6.9	7.8	7.0	7.2
Elongation at break	%	ASTM D412	601	446	519	559	586	560	591	543
(100%)Constant elongation modulus	Mpa	ASTM D412	1.6	1.4	2.0	1.3	1.8	2.8	2.3	2.1
Tear strength	KN/m	ASTM D624	29.3	21.8	33.2	25.5	27.9	33.1	35.0	32.9
Gravity	g/cm3	GB/T 533	1.387	1.336	1.380	1.292	1.444	1.318	1.302	1.333
Compression deformation	%	100℃×22h	54.5	67.8	57.5	70.8	63.0	67.3	69.5	61.0
Flame retardant level			UL94V0	UL94V0	UL94V0	UL94V0	UL94V0	UL94V0	UL94V0	UL94V0
Oxygen index			33	31	39	35	33	33	33	31

Formula composition	PHR
EPDM512E	100
CZ500R	50
Nano reinforcing agent PF81	30
Fire retardant	110
Sanepar916	25
ZnO(805)	6
STA	1
PEG4000	1
Flow aid L-24	1
S-80	1.28
AG-60	5
CaO	8

Experimental conclusions:

1.FR35RP has the most outstanding performance in comprehensive performance such as flame retardant, oxygen index and comprehensive physical property.

2.FR21RP has the highest flame retardant level and the best oxygen index in all flame retardants.

3. The smoke density of FR97RP is the best compared with all flame retardants; The positive curing time is the shortest.

Sanesil®FR35RP - Highly effective composite flame retardants – Mature EPDM Formulations containing this flame retardant are UL and Rohs certified

Test Report No.: 1150018937a 001 *Page 1 of 7*

Client: **SHANGHAI POWERFLEX NEW MATERIALS CO. LTD**
Puhuitang Road No. 11 building, room 1607 broad business, Xuhui District, Shanghai city

Identification/ Model No(s): Flame retardant
Sanesil FR35RP

Sample Receiving date: 2017-06-07

Testing Period: 2017-06-07 - 2017-06-13

Test specification: ***Test result:***

Customer's requirement:
1. According to RoHS (recast): Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment, 2011/65/EU last amended by — PASS

Test Report No.: 1150018937a 001 *Page 4 of 7*

Test result:

	Cd	Cr(VI)	Pb	Hg	PBBs(*)	PBDEs(*)
Maximum permissible Limit (mg/kg)	100	1000	1000	1000	1000	1000

Material No.	(mg/kg)					
	Cd	Cr^	Pb	Hg	PBBs(*)	PBDEs(*)
	RL (mg/kg)					
	10	10	10	10	5	5
M001	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Material no.	Hexavalent Chromium Content (mg/kg)(**)
	RL: 100mg/kg

Test Summary

LIMS Master Sample	
Master Sample Number:	334344
SubSample(s) Used:	334346,334347
LIMS Project Number:	1000081188

Material Designation:	E65D160422ZR
Color:	Black
Expected Thickness:	4.5 mm
Flame Rating:	None

50W (20MM) VERTICAL BURNING TEST; V-0, V-1, V-2 — UL94 Paragraph 8
>48hrs@23±2C/50±10%RH
Sample #: 334346

#	Thk. (mm)	t1 (s)	Comments - t1	t2 (s)	t2 + t3 (s)	Comments - t2
1	4.599	1.0	Specimen did NOT drip	2.0	2.0	Specimen did NOT drip
2	4.537	0.0	Specimen did NOT drip	1.0	1.0	Specimen did NOT drip
3	4.456	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
4	4.610	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
5	4.663	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip

Total Flame Time, t1+t2 (s): 4.0
Vertical Flame Result: V-0

Note: t1 = Afterflame Time; t2 = Afterflame Time; t2+t3 = Afterflame + Afterglow Time

50W (20MM) VERTICAL BURNING TEST; V-0, V-1, V-2 — UL94 Paragraph 8
168±2hrs@70±2C|>4hrs@23±2C/<20%RH
Sample #: 334347

#	Thk. (mm)	t1 (s)	Comments - t1	t2 (s)	t2 + t3 (s)	Comments - t2
1	4.571	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
2	4.513	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
3	4.417	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
4	4.627	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip
5	4.662	0.0	Specimen did NOT drip	0.0	0.0	Specimen did NOT drip

Total Flame Time, t1+t2 (s): 0.0
Vertical Flame Result: V-0

Note: t1 = Afterflame Time; t2 = Afterflame Time; t2+t3 = Afterflame + Afterglow Time

Comply with laws and regulations

POWERFLEX 玄珞

- High efficiency, no halogen, low smoke, environmental protection
- N kinds of coordination - high flame retardant efficiency - the addition amount is relatively small
- Raw material 100% surface treatment - good dispersion
- Flame retardant particle size, good physical properties of the vast majority of raw materials, from abroad - global raw material selection
- Flame-retardant application practice rich - total solution .Full range of products, more targeted

Manufacturers of high efficiency and environmental protection halogen-free flame retardants: Widely used: EPDM NBR NR SBR PVC CPE VMQ, etc

FR65 RP

FR76RP

FR98RP

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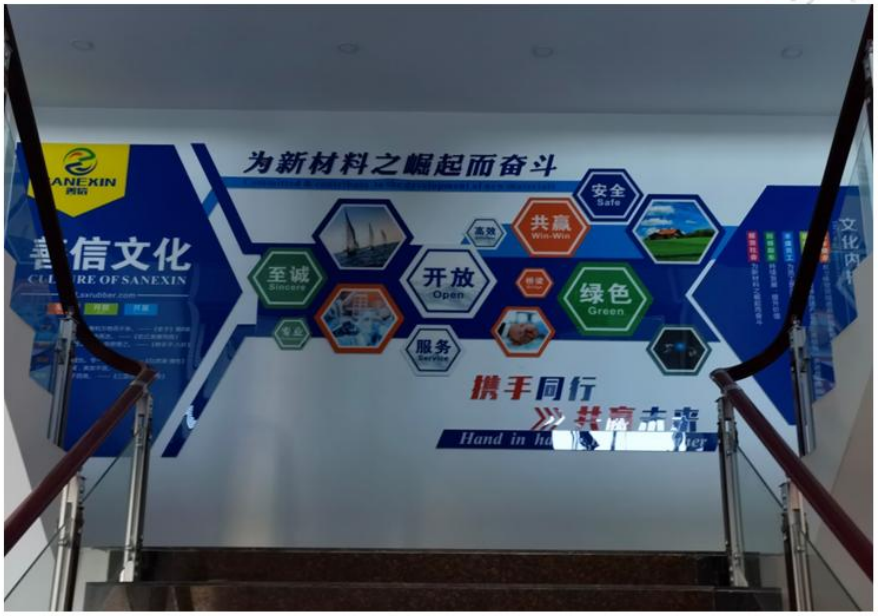
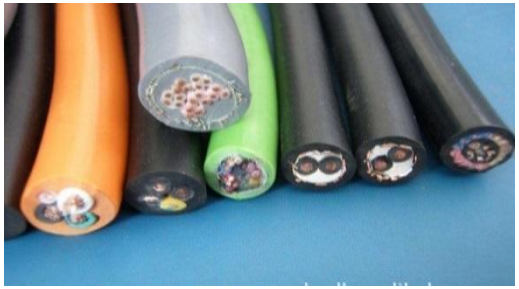
Grade	Price	Flame retardant	Color	Smoke	Characteristic	Package
FR98RP	highest	*****	high whiteness	**	Halogen-free environmental retardant with high oxgen index,low smoke ,high whiteness	Packaging：25 KG/ Bag, 1000 KG/Pallet.
FR65RP	economical	*****	dark purple	*****	Halogen-free environmental retardant with good machnical properties , light purple	
FR76RP	economical	***	high whiteness	**	Halogen-free environmental retardant with low smoke and heat generation, high whiteness	

Anhui Sanexin Polymer Fine Material Co.,Ltd



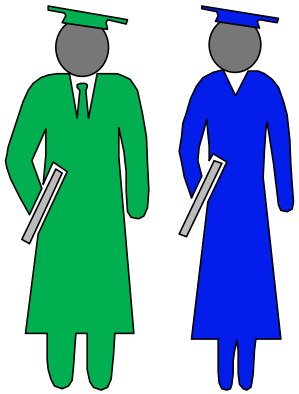
FR lab

FR production line



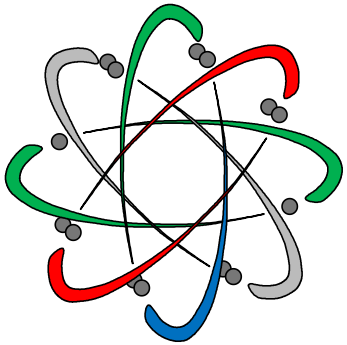
The development trend of flame retardants： Environmental protection, low toxicity, high efficiency, multi-functional

Powerflex： Leading halogen-free flame retardants: ultra-fine, active, functional and compound

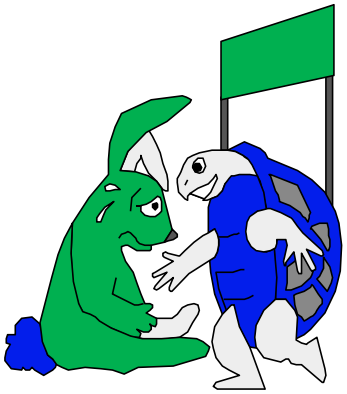


Flame retardant research

Flame retardant application



Laws and regulations



Flame retardant cooperation

SaneZen Industry Service Platform

- **SaneZen Platform**
  - **Resource integration**
    - University cooperation
      - Flame retardant
        New Material
        Plasticizer
    - Expert cooperation
    - Association cooperation
  - **SaneZen'Strength**
    - R&D Center
      - Anhui and Changzhou have Our own R&D center
    - Rubber compound factory
      New Material Factory
      - All rubber compound Customization
        Production of new rubber materials
    - Cooperation with benchmarking enterprises
      - Hose, Sealing, vibration-absorbing function
    - Agent of first-line brand
      - Elkem
        Swedish Nyans
        Japanese ADEKA
        Japanese Sumitomo
        ...
  - **Industry communication**
    - Industry conferences, exhibitions, etc.
      - Industry frontiers, regulations and other sharing

SaneZen Service Scope-Environmental Rubber Raw Materials

SaneZen's Service

Technology-Driven Enterprise in Rubber and Plastics Industry

Functional Filler BU	Functional Additive BU	Plasticizer BU	Silicone Fluorine BU	Rubber Polymer BU	Rubber Compound BU
Functional Reinforcement Materials	Functional Rubber Additives	Special Environmental Paraffin Oil	High Performance Silicone Rubber	High-end Silicone Rubber	Full Range of Rubber Compounds
PF Series Reinforcing Agent	Anti-Fatigue Agent & Heat Resistant Agent	Sanepar9X6	High-Temperature Silicone Rubber	Sanexin	Lixin Rubber
FR Series Flame Retardant	Filler Reinforcing Agent	Ester Environmental Plasticizer	Liquid Silicone Rubber	Acrylate Rubber Sanexin	Sanexin Polymer (Professional Colored Rubber Factory)
PT Series Precipitated Silica	Acid and Alkali Resistant & Wear-Resistant Agent	Sanepar7XX	Room Temperature Silicone Rubber	NBR+PVC Shengxin	Shengxin Rubber
WL Series Calcium Silicate	Adhesive & Dispersing Agent		Fluorosilicone Rubber		
RS Series Wear-Resistant Silicon	Active Crosslinking Agent		Phenyl Silicone Rubber		
SF Series Conduct	Eco-friendly accelerator		Silicone Customization Services		
SA Series Conductive Spherical Aluminumive Silicon	Anti-Blooming&Defoaming Agent				
ASA Series Nano Silicon Aluminum Alloy	Bloom cleaning agent				
LG Series Lignin	Environmentally friendly release agent				

www.sanezen.com --- Technology-Driven Enterprise in Rubber and Plastics Industry

SaneZen Service Scope - environmentally friendly rubber raw materials, full coverage

Sanexin HTV/LSR/PTV

Customized experts in silicone
High tear resistance
High transparency series
Self-lubricating series
Heat and oil resistant series
94UL-V0 flame retardant series
Phenyl silicone rubber, fluorine silicone rubber

ACM rubber

Oil /low temperature resistance,
Excellent physical properties
Full ranges:active chlorine, carboxyl
Double crosslinking, expoxy
Good extrusion process
First choice to replace First-tier brand

Functional filler

PF series: Surface treatment nano reinforcing filler
WL series: Surface treatment wollastonite
SF series: Thermal conduction materials

Paraffin oil / Plasticizer

Severely Hydrotreated Process Oil
High flash point, low VOC, low odor
good environmental protection

Environmentally friendly plasticizer
Low volatility, good aging resistance
Good cold resistance, no phthalines

Flame retardant series

Halogen-free high efficiency
High whiteness, efficient flame retardant
Relatively low dosage
Low smoke. low heat generation
Impact on physical properties lower
Reach 94UL-V0 easier

Precipitated silica

PT210-Economical grade
PT213-Transparent and Reinforced grade
PT218-High transparent grade
PT702-High reinforcement grade

Additive series

AG/AF-Special anti-fatigue agent
AG22- Silica enhancer
AG60- low odor Accelerant
D985S- Release agent -internal
D212 -Dispersant

Lixin /Sanexin rubber compound

Full range rubber compound
One-stop customized solution
Independent colored rubber compound factory
Professional special rubber compound

We are well versed in operating the rubber and plastics industry

Automotive industry

Locomotive industry

Consumer goods industry

Medical industry

Home appliance industry

Wire and cable industry

Our products are mainly used in tires, shock absorption, seals, sealing strips, hoses, compounds, wires and cables, belts and other industries.

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