

# Flame Retardants

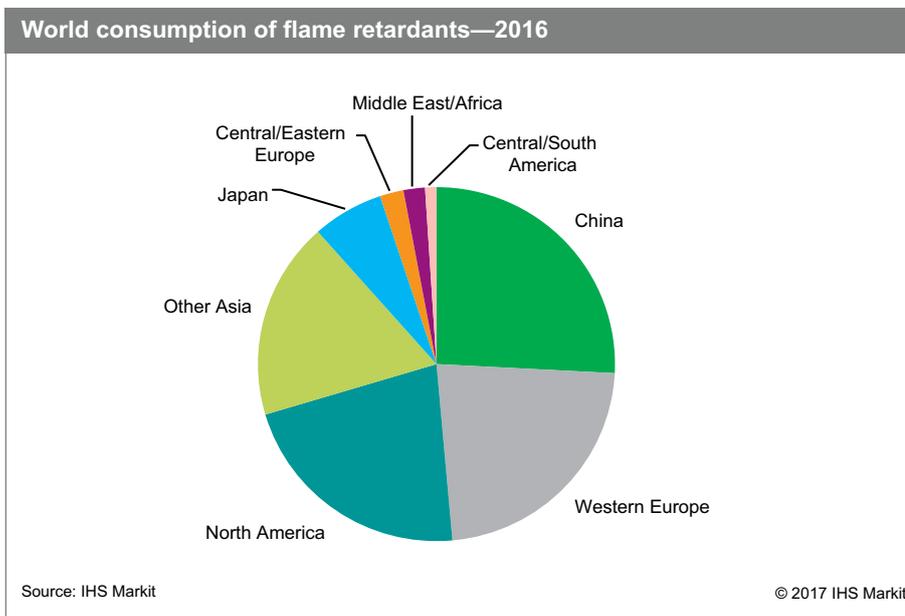
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## Abstract

Flame retardants are materials or chemicals that are used to deter or extinguish flame propagation in plastics, resins, textiles, elastomers, coatings, adhesives, and sealants. The most important product categories are brominated compounds, organophosphorus compounds, chlorinated compounds, aluminum trihydroxide, antimony oxide, boron compounds, magnesium hydroxide, and “other” flame retardant products. In 2016, the most important flame retardant product types by volume were aluminum trihydroxide, with 38% of the total market, followed by organophosphorus compounds (18%), brominated compounds (17%), and antimony oxides (8%). The product mix varies widely by region.

The flame retardant industry is highly affected by the regional regulations and standards (and differences) for construction and electrical/electronic applications. An increase in high-rise fires around the world has shown the need for improved safety standards for aluminum composite panel cladding used in building siding (or a method for upgrading older building materials [with older standards] to newer standards) using flame retardants for improved safety.

The following pie chart shows world consumption of flame retardants:



The flame retardant industry is affected when a widely used product such as the brominated compound, hexabromocyclododecane (HBCD), is no longer allowed to be used in certain regions—Japan (2014), European Union (2015), and Canada (year-end 2016). This led to different timing on the use of the HBCD replacement developed by Dow Chemical Company (now DowDuPont after the merger of Dow Chemical Company and E.I. du Pont de Nemours &

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Company on 31 August 2017) called the BLUEEDGE™ Polymeric Flame Retardant Technology (also known as PolyFR and under the trade names Albemarle [GreenCrest™], ICL-IP [FR-122P™], LANXESS [Emerald Innovation™ 3000]).

In China, flame retardants have been experiencing rapid development following growth in the plastics market and also as a result of policy requirements. Brominated flame retardants were once the largest competitors in the Chinese market. However, as a result of environmental issues, the use of brominated compounds has been restricted gradually in recent years. Production and consumption of and trade in hexabromocyclododecane (HBCD) have been forbidden since 26 December 2016 except for its use in polystyrene in construction as a flame retardant, which is still allowed until 25 December 2021.

Aluminum trihydroxide will be the largest market segment in the Chinese flame retardant market. The Chinese government has highlighted the importance of halogen-free flame retardants, which will help promote the rapid development of ATH.

Consumption of flame retardants in Europe, the Middle East, and Africa is driven primarily by regulations in many industries, such as the building and construction (including housing, public, and commercial buildings) and transportation industries (automobiles and buses). These regulations are done predominantly on a national level, which means there are no EU-wide unified fire protection regulations in place. Regulations differ from country to country within Europe, the Middle East, and Africa. The disastrous fire at the Grenfell tower on 14 June 2017 in London showed that there are still areas where fire protection needs to be improved in order to avoid such disasters in the future.

The North American market for flame retardants, which is driven by the US market, will grow at average annual rates of 2.5–3% during 2016–21. The most important product segment in terms of value is brominated compounds. As in most other regions, this segment is moving toward greater volumes of polymeric and reactive (chemically bound into polymer or other end-use product) brominated products.

The fastest growing flame retardant segments are organophosphorus compounds and aluminum trihydroxide, both expected to grow at an average annual rate of just over 3% in 2016–21. This growth rate assumes that no major product restrictions take place in the organophosphorus segment.

Manufacturing industries have been moving from Japan to Other Asian countries. As a result, consumption of resins in Japan has decreased, especially for epoxy resins, unsaturated polyester resins, and polyurethane resins. Consumption of most flame retardants has decreased, especially brominated flame retardants, which decreased at an average annual rate of around 3% for the last three years.

In Other Asia, because of the growing manufacturing industry, consumption of resins has been increasing. Consequently, flame retardant consumption has been increasing. Brominated flame retardants are the largest flame retardant category in Other Asian countries, while organophosphorus flame retardants show the highest growth because of increasing consumption of engineering plastics for the electronics, automotive, and other industries.

The top global flame retardant companies are ICL-IP (brominated compounds, organophosphorus compounds, MDH; Israel), LANXESS (brominated compounds, organophosphorus compounds, ATO, boron compounds; headquartered in the United States, major operations in the United States and Germany), Nabaltec AG (ATH, MDH; Germany), Jiangsu Yoke Technology Co., Ltd. (organophosphorus compounds; China), and Daihachi Chemical Industry Co., Ltd. (organophosphorus compounds; Japan).

Globally, consumption of flame retardants is forecast to grow at an average annual rate of about 3% during 2016–21.

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