

Note: Key data/information in these pages is hidden, while in the report is not.

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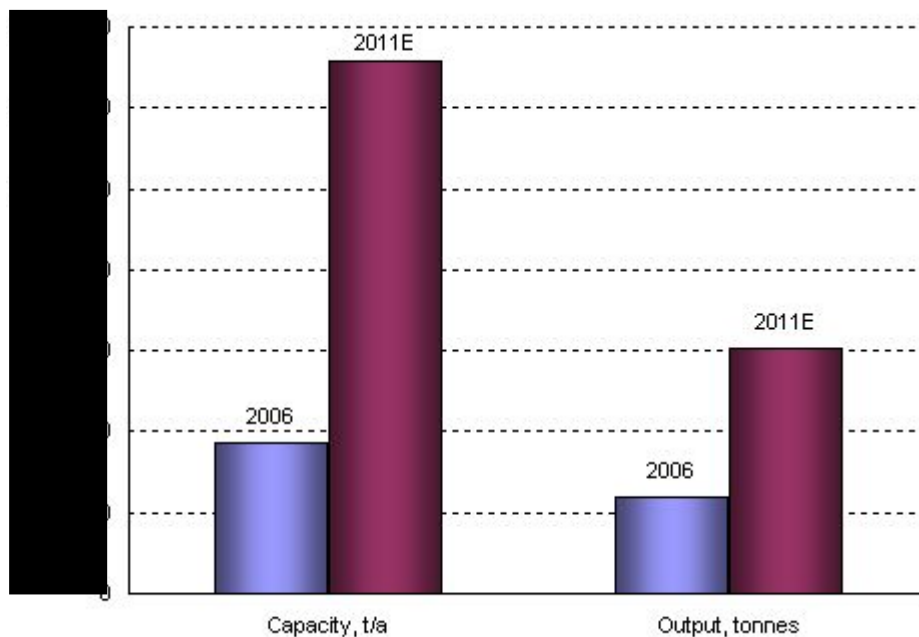
2.1 Overview

Summary of production

China's flame retardant industry has been developing fast in the past 5 years. The capacity and output have reached XXXXXXXXXt/a and XXXXXXXX tonnes in 2011, with the CAGR of XXXXX% and XXXXX% respectively from 2006 to 2011. The average annual growth rate of domestic flame retardants' consumption has maintained over 15% since 2005, and the consumption volume reaches XXXXXXXX tonnes in 2011.

With the increasing demand for upscale products which require highly effective flame retardants, new varieties of products have been developed in China.

Figure 2.1-1 Comparison of capacity and output of China's flame retardants, 2006 and 2011E



Source: CCM International

With several years' development, Chinese flame retardant industry is becoming more and more regular. The capacity proportion of BFRs and CFRs is declining and that of inorganic flame retardants is climbing. For example, the capacity proportion of MH & ATH has risen from XXXX% in 2006 to XXXXX% in 2011, compared with that of BFRs dropping to XXXXX.% in 2011 from 38.34% in 2006. And the future prospect of inorganic flame retardants is considered to be prosperous.

However, some superior deep processing products are still underdeveloped in China because

of technology limits and their high price. A few flame retardant producers focus on environment-friendly products such as DOPO, MCA, ATH, MH, etc.

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BFRs have been the leading flame retardants consumed in China for many years, but they are experiencing decreasing market share in total flame retardants. Currently, with the safety dispute, the capacity growth has gradually slowed down in recent years and no expansion plans of relevant products are reported. However, it is expected that the capacity of some new products of BFRs without safety dispute for the moment may enlarge in the future, such as DBDPE and BPS.

On the contrary, PFRs' capacity has enlargedIn Chinese flame retardant market, PFRs' capacity accounts for about XXXXX% of the total, in which non-halogenous PFRs take up

As for CFRs, both the capacity and output increase

China's ATH&MH industry developed greatly in recent years. The capacity and output is XXXXXXXt/a and XXXXXXX tonnes in 2011, accounting for XXXXX% and XXXXX% respectively of China's total flame retardant capacity and output, compared with those of XXXX% and XXXX% respectively in 2006. And it is estimated to develop fast in the following years.

The capacity of ATO in China ...

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2.2.1 Brominated compounds

General introduction

At present, brominated flame retardants (BFRs) are still the major type of flame retardants in China. The capacity of BFRs was XXXXXXXt/a in 2010 in China, about XX% higher than that of XXXXXXXt/a in 2006, with the CAGR of XXXXX%. Nevertheless, domestic output has only increased to XXXXXXX tonnes in 2010, from 94,000 tonnes in 2006 with the CAGR of XXXX%. Unlike other kinds of flame retardants, BFRs' production grew slowly in the past five years and even reduced in 2010 according to CCM International's investigation. And it is estimated that its output will increase to XXXXXXX tonnes in 2011, which is near to the output in 2009.

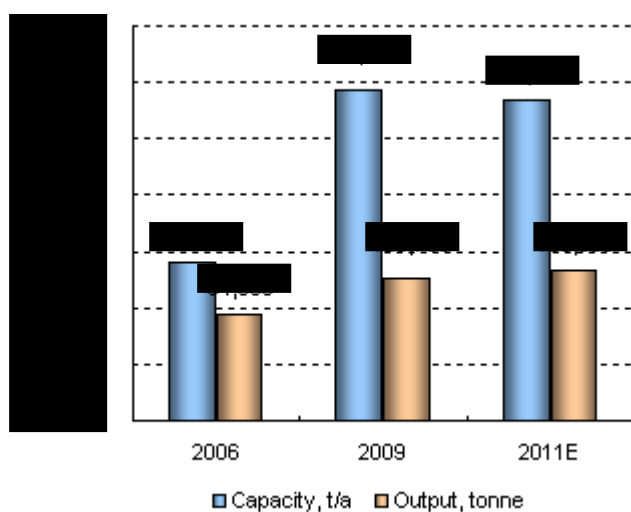
The stagnant growth of BFRs' production is mainly attributed to the following two reasons.

Firstly, the EU has finally banned the usage of polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) in electrical and electronic products after 2008, which is stated in RoHS instructions. As a direct effect of the RoHS, the output of decabromodiphenyl

oxide (DBDPO), which used to be one of the important BFRs in China, has dropped sharply in 2009. Because DBDPO was widely used in printed circuit board (PCB) industry and the PCB products are mainly exported to the EU.

Secondly, the price of bromine has soared up after 2009, from about USDXXXXX/t in 2009 to over USDXXXXX/t at the peak in 2010, which has greatly raised the production cost of BFRs and swallowed up BFRs producers' profits. Thus...

Figure 2.2.1-1 Capacity and output of BFRs, 2006, 2009 and 2011E



Source: CCM International

BFRs as one important type of flame retardant in the world have some obvious advantages:

- Rich raw material source and mature manufacturing technique
- Low price
- Wide applications
- Low addition quantity
- High efficiency especially working with synergistic agents such as antimony trioxide
- Little influence on physical properties of polymer materials
- Good compatibility with polymer materials and no precipitation in low temperature
- Decomposition temperature of BFRs is close to the burning temperature of many polymer materials, ranging from 200°C to 300°C.

On the other hand, BFRs also have some disadvantages leading to its decreasing market share:

- Large volume of smoke, as well as toxic and corrosive gases are generated from the burning of polymer materials containing BFRs.
- BFRs are usually used with antimony trioxide, which would cause more smoke and antimony trioxide is irritating to skin and extremely harmful to aquatic organism.
- Intensifying debates on whether all the BFRs are harmful to the environment and humans.

Despite the safety dispute, BFRs still play an important role in flame retardant industry in China, thanks to their notable advantages especially their high cost performance. Meanwhile, there are no substitutes of BFRs for many downstream industries at present.

Product structure in China

In the world, there are more than 70 products of BFRs that can be categorized into aliphatic series, alicyclic series, aromatic series and aromatic-aliphatic series by different chemical constitutions.

In China, there are ...

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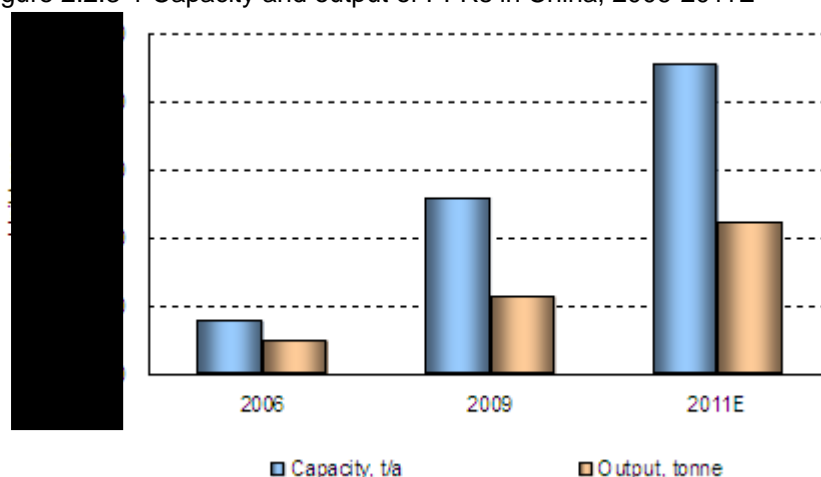
2.2.3 Phosphorus compounds

General introduction

Phosphorus flame retardants (PFRs) contain a wide varieties of products, which are also used in many different fields. In China, PFRs have been widely used as effective flame retardants and become the main series of flame retardants nowadays.

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Figure 2.2.3-1 Capacity and output of PFRs in China, 2006-2011E



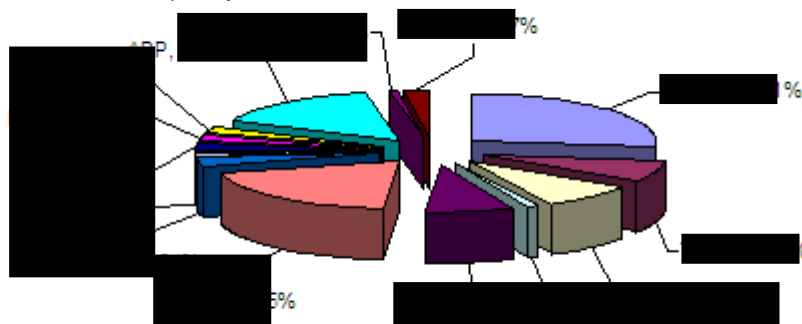
Source: CCM International

Production situation

China's PFRs have developed rapidly in the past few years. In 2011 their domestic capacity has reached about XXXXXXt/a, and the total output is XXXXXX tonnes. Major products of PFRs in Chinese market currently are TCPP, TCEP, TDCPP, FR-V6, TEP, BDP, RDP, TCP,

TPP, DOPO, IPPP, APP, RP, etc.

Figure 2.2.3-2 Capacity structure of PFRs in China, 2011



Source: CCM International

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As of 2011, there are more than 60 producers involved in PFRs production. Based on CCM International's investigation, PFRs production situation in China has the following characteristics:

➤ Highly concentrated production

Owing to the increasing demand from downstream industries and mature phosphate chemical industry chains in Jiangsu and Zhejiang provinces, many PFRs producers are located in these two regions, accounting for ...

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Research on enterprise cluster

Compared with 2009, the number of Chinese PFRs enterprises has not changed greatly in 2011. But the situation in each enterprise has changed. Based on CCM International's investigation, the producers can be categorized into three clusters:

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Major products

1) TCPP: Tris(β -chloroisopropyl) phosphate

TCPP, a chloric and phosphorous-based flame retardant, is now the most popular product of PFRs in China and has developed rapidly these years, because its production cost is relatively low, and it has the best hydrolysis stability among all available halogenated organic phosphates currently.

➤ Capacity and output

With the capacity of XXXXXXt/a in 2011, TCPP is the largest halogenated phosphates flame retardant in China. And its output is about XXXXXX tonnes in 2011.

➤ Price and gross profit margin

The price of TCPP in Dec. 2011 is about USDXXXXX/t, and many producers complain that the gross profit of this product is very low, mainly due to intense competition among domestic producers and its mature technology.

➤ Application and demand

TCPP is currently the most widely used product of PFRs in China, and it is mainly used in PU, PVC, PP and other plastics. Its consumption volume has increased tremendously in recent years and its demand will keep large in the next few years.

➤ Import/export

Above XX% of this product produced in China was exported overseas, with the main market in the EU, the US, Japan and the Asia-Pacific region.

➤ Technology

As a major product of PFRs, TCPP enjoys the advantage of mature technology. Some domestic producers said that the quality of domestic products is of similar level, and some key enterprises like Jiangsu Yoke have reached the internationally advanced level.

➤ Major producers

As of 2011, there are about 12 main producers engaged in TCPP in China. To meet the increasing demand for TCPP from domestic and overseas markets, some companies have started the expansion of their production capacity. For example, the top producer, Jiangsu Yoke, has built a new XXXXXXt/a TCPP production line in its subsidiary and its total TCPP capacity reaches XXXXXXt/a in 2011.

Table 2.2.3-2 Major TCPP producers in China, 2011E

No	Company	Status' 11	Ownership	Capacity' 11, t/a	Output' 11, tonne	Export ratio, %
1	XXXXXXXXXXXXXXXXXXXX	Active	Private	XXXXX	XXXXX	XX
2	XXXXXXXXXXXXXXXXXXXX	Active	Private	XXXXX	XXXXX	XX
3	Zhejiang Jiande Huahai Chemical Co., Ltd.	Active	Private	XXXXX	XXXXX	XX
4	XXXXXXXXXXXXXXXXXXXX	Active	Private	6,000	3,000	45
5	XXXXXXXXXXXXXXXXXXXX	Active	Private	XXXXX	XXXXX	XX
6	Hebei Xinji Hongzheng Chemical Co., Ltd.	Active	Foreign-owned	XXXXX	XXXXX	XX
7	XXXXXXXXXXXXXXXXXXXX	Active	Private	5,000	2,500	40
8	XXXXXXXXXXXXXXXXXXXX	Active	Private	XXXXX	XXXXX	XX
9	Jiangsu Wuxi Zhenhu Chemical Co., Ltd.	Active	Private	XXXXX	XXXXX	XX
10	XXXXXXXXXXXXXXXXXXXX	Active	Private	5,000	2,800	45
11	XXXXXXXXXXXXXXXXXXXX	Active	Private	XXXXX	XXX	XX
12	Shandong Taian Dinuo Chemical Co., Ltd.	Active	Private	XXXXX	XXX	XX
	Others	/	/	5,000	2,000	N/A
	Total	/	/	XXXXX	XXXXX	N/A

Source: CCM International