

Differentiated Market Development.

Styrene copolymers define a comprehensive spectrum of products and properties, from standard ABS thru SAN up to specialties such as ASA, MABS and their blends. Products employed predominantly in the automotive and construction sectors have suffered significant losses in volumes and profit margins in recent years. On the other hand, specialties for applications in the medical technology and pharmaceuticals segments have remained on course for further growth.



Crystal-clear SAN (Luran CC) is also used for particularly high-quality packagings for cosmetic articles (photo: BASF)

Styrene Copolymers (ABS, SAN, ASA, MABS)

Styrene copolymers and their blends are regarded as the link between commodity plastics (polyolefins, polyvinyl chloride and polystyrene) on the one hand, and engineering plastics on the other. The most important members of this material class are styrene-acrylonitrile copolymers (SAN), acrylonitrile-butadiene-styrene copolymers (ABS), acrylonitrile/styrene/acrylic copolymers (ASA) and methyl methacrylate acrylonitrile styrene copolymers (MABS).

The world consumption of styrene copolymers in 2009 totaled around 7.6 million tonnes (Fig. 1), whereby a strong rise in consumption in 2007 was followed by a significant drop in the years thereafter. The sales markets did not recover until the second half of 2009. Table 1 gives an overview of the breakdown of total consumption be-

tween the individual products. In the meantime the Asian market that has shown above-average growth of around 6.5 % p.a. in the last 15 years (1995–2009) accounts for over 70 % of the worldwide consumption (Fig. 2).

The installed production capacities worldwide for all styrene copolymers are estimated to total 10 million tonnes today. A breakdown of this total capacity between the individual copolymer grades is rather more difficult, as the manufacturers generally quote only total capacities, and many of the plants can be changed over as required (swing plants).

The development of the individual material classes is summarized below.

Acrylonitrile-butadiene-styrene Copolymers (ABS)

Of the styrene copolymers, ABS is the most significant product by volume which – including the ABS blends – accounts for around 86 % of the total consumption of styrene copoly-

mers (6.5 million tonnes in 2009). Of this total, around 75 % are processed by injection molding and 25 % by extrusion.

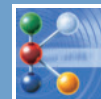
Manufacturers, Capacities: The list of leading ABS manufacturers is headed by the two Asian producers, Chi Mei and LG Group, with capacities above 1 million t/a (Table 2). The competitors follow a long way behind. New production facilities are currently being installed particularly in China and the Middle East. In the last three years alone, new plants with a total capacity of over 1.5 million t/a have gone into production in China. Today plants with a total capacity of around 8.7 million t/a exist worldwide.

There are reports of further expansion plans. The Iranian company NPC that already has an ABS capacity of 90,000 t/a intends to expand its ABS capacities by 250,000 t/a in the next two years. The Sabic subsidiary, Petrokemya, is currently building a plant with a capacity of 200,000 t/a in Al-Jubail that is scheduled to go into production in 2011.

The structural streamlining of the European ABS market has continued in recent years, with the number of ABS producers in Western Europe declining between 1990 and today from nine to four after Sabic closed its last two European sites in France (2008) and Scotland (2009). In the meantime Lanxess has completely divested itself of its ABS activities and sold its minority shareholding to Ineos at the end of 2009. Dow has now sold Styron, its initially hived off styrene and polystyrene activities to the financial investors, Bain Capital.

In the meantime (up to the middle of 2008) the remaining European producers (BASF, Styron, Ineos and Polimeri) enjoyed an improved profit situation. In the second half of 2008, however, sales dropped by 25 to 30 %; all the producers cut back their production, works were shut down. Since the second quarter of 2009, the markets have recovered noticeably, but it will still take a number of years before the consumption level of 2007 is reached again.

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Consumption, Applications: ABS is now considered one of the commodity plastics, even though a distinction still has to be made between standard ABS that accounts for approx. 90 % of the ABS consumption, and ABS specialties. Between 2006 and 2009, the world consumption of ABS stagnated. In Western Europe the producers suffered a drop in sales of over 20 % in the last two years alone (Table 3). Customers, particularly from the automotive industry, cancelled orders already placed. In addition, increased stock clearance by the customers further impacted sales. Supply and demand have now since normalized again. Good use is being made of the production capacities, but all manufacturers continue to operate on the principle of “margin before volume”.

Figure 3 gives an overview of the most important fields of application for ABS worldwide. ABS is employed in a wide va-

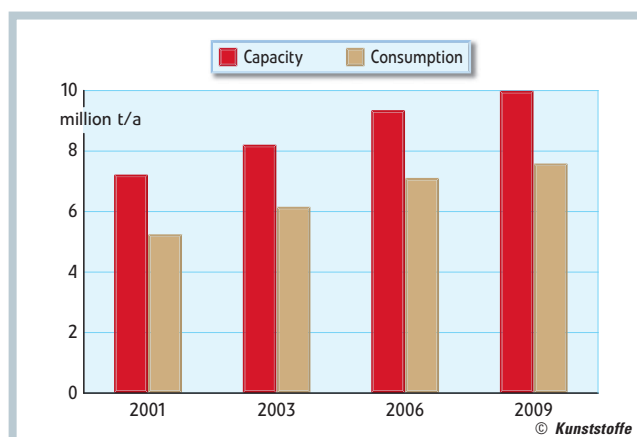


Fig. 1. Development of total consumptions and capacities for styrene copolymers (worldwide) from 2001 to 2009

riety of household applications, e.g. as fridge inliners, and the material has innumerable uses in automotive engineering for both interiors and exteriors. The communication/computer/small electronic appliances sector plays a significantly greater role worldwide than in Europe, as this industry is predominantly at home in Asia. On the other hand, automotive ap-

plications account for far larger proportions of the consumption in Europe than on the world market as a whole.

ABS is also constantly faced with inter-polymer substitution pressure between polypropylene and polystyrene. Newly developed high-gloss PS grades, for example, target classic ABS applications for decorative components, while polypropylene offers a more favorable price/performance ratio for some fields of application.

Price Development, Foreign Trade: The dramatic drop in →

Product type	Consumption 2009 [kt]	Proportion [%]
ABS (without blends)	6,100	81
ABS blends	400	5
SAN*	750	8
ASA + ASA blends	200	4
MABS	170	2
Total	7,620	100

* without proportion for ABS production

Table 1. Consumption of styrene copolymers and their blends worldwide (as of 2009)

sales of ABS in the second half of 2008 was accompanied by a sharp decline in prices from around EUR/t 1,950 in October 2008 (example ABS natural) to EUR/t 1,350 in January 2009 (-31 %). In the second quarter of 2009, orders gradually recovered and led to an increase in prices again. In the meantime (July 2010) the reference price in Western Europe is above EUR/t 1,800 [1] again with a stable trend.

The collapse of the market in Western Europe and the increasingly high consumption in Asia, and particularly in China, stemmed the imports from Asia. These supplies, which in the boom years made up approx. 25 % of the demand in Western Europe, currently play only a subordinate role. This is further exacerbated by the weak Euro exchange rate that offers the Asian producers practically no attractive market chances in Europe. Intercontinental foreign trading with ABS as a whole is weak; the globally active producers have long since followed the market demand in Asia with their capacity expansions.

Product Development: With the shift away from vast portfolios and towards a smaller number of grades with universal applications, the Western producers have succeeded in countering the challenges from the low-cost production plants in the Far East. The main driving forces behind this "commoditization" in the past were Dow and BASF. Since 2004, for example, the world-scale production plants of BASF in Antwerp, Belgium and Altamira, Mexico have supplied the world market with only five (Altamira) or three (Antwerp) standard ABS grades instead of previously 1,500. Despite the increases in efficiency and the successful cost reduction programs in recent years, tough competition continues to place pressure on profit margins.

Parallel to this trend towards "commoditization" there is also a market for special applications on which individual pro-

ducers – in particular compounders – have focused. This has been driven by the trend in the consumer industries to distinguish themselves from the competition through individualization, design and smaller product series.

Nevertheless, standard ABS grades in the broader sense continue to be good for innovations. One example of more recent innovations that do not lose sight of the profitability are ABS grades for sheet and profile extrusion with low melt flow rates and products that are particularly suitable for metallization (for applications in the automotive and plumbing installation sectors).

A relatively high heat distortion temperature generally leads to a loss of strength and flowability during the ABS product development. BASF has now introduced a new product to the market that remains dimensionally stable at temperatures of up to 112 °C, and at the same time offers high strength and good flowability (trade name Terluran HH 102; HH stands for High Heat). The material is easy to process and can be easily painted and metalized.

Outlook: Apart from a brief drop in consumption (2008/2009), the ABS market has developed well over the last decade. More than 70 % of the consumption is attributable in the meantime to Asian customers, and this share is expected to increase to 75 % by

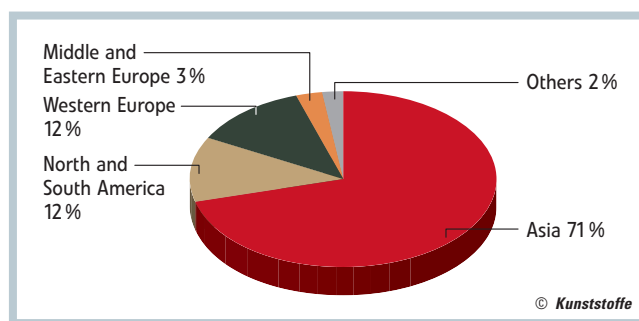


Fig. 2. Consumption of styrene copolymers and their blends by regions (world consumption 2009: approx. 7.6 million tonnes)

2012 (Fig. 4). An increase in consumption of 4.9 % p.a. is expected worldwide over the next five years, with the markets in Asia growing much faster (+5.7 % p.a.) than the markets in North America (+2.2 % p.a.) and Western Europe (+1.9 %).

Styrene-acrylonitrile Copolymers (SAN)

All ABS producers also have facilities for the production of SAN, but for many SAN is only an intermediate product for the ABS production (captive use).

Manufacturers, Capacities: Very few companies offer SAN products as engineering plastics. In Europe these include in particular BASF, the only producer to operate a plant dedicated to SAN in Europe, together with Styron and Polimeri; in Asia we also have Chi Mei, LG and Samsung/Cheil. Imports from Asia currently cover around 20 % of the European demand. It is not possible to state capacities, as styrene copolymer plants are

generally designed as swing plants on which different styrene copolymers can be produced.

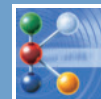
Consumption, Applications: SAN is characterized by good resistance to oil and chemicals, high transparency and brilliance; the material is scratchproof and can be used in microwave ovens and dish washers. For many years SAN was regarded predominantly as a material for household applications, from drinking water filters through to mixer bowls. Further typical SAN applications are the fields of cosmetic article packagings, sanitary, electronics (housing parts) and office equipment. In recent years, however, this material has also found new applications that were previously covered by other plastics. Examples here are lights and designer furniture – applications where SAN represents an alternative to PMMA. SAN is also widely regarded as a cost-effective competitor for polycarbonate; compared with PC, SAN is more scratchproof and has a higher resistance to stress cracking.

After a weaker period in 2008/2009, the SAN world market is starting to grow again. In 2009, the European market suffered drop in sales of more than 10 % to approx. 100,000 t. Over the same period, the world consumption probably fell also by around 10 %, reaching a volume of roughly 750,000 t in 2009 (without the volumes used for ABS production).

In the meantime, consumption is rising again significantly; an increase in consumption of 15 to 20 % is anticipated in

Producer	Capacity [kt/a]	Production locations
Chi Mei	1,750	Asia
LG Group	1,050	Asia
Ineos	650	Europe, Nafta, Asia
BASF	600	Europe, Nafta, Asia
Formosa Plastic Group	600	Asia
Samsung/Cheil	500	Asia
Styron	400	Europe, Nafta
Toray	400	Asia
Sabic IP	350	Nafta
Techno	300	Asia
Others	3,300	worldwide
Total	8,700	

Table 2. The ten largest ABS producers worldwide and their capacities (as of mid-2010) (source: [2, 3], company figures)



Europe for 2010, i.e. the drop in consumption of the last two years should be compensated again. As only small volumes of SAN are currently being imported from Asia to Europe due to the weak Euro, the capacities here are now being well utilized again. Following a price erosion at the end of 2008/beginning of 2009, the SAN prices have risen again by EUR/t 300 since the middle of 2009.

A further increase in consumption is expected for SAN in the coming years. The growth rates will probably be higher in Asia than in Europe and North America.

Product Development: The product development for SAN is driven by the applications. Developments of heat-resistant SAN powders (Luran HH) as a blending additive for PVC (heat stabilization component) and special product types for medical technology (Luran HD) have already been reported on earlier [2]. Luran HH is also being increasingly used in combination with standard ABS (ABS+SAN blends).

Styrene Copolymer Specialties (ASA, MABS, Blends)

By contrast with the "parent polymers" ABS and SAN, the rules of the specialty business generally apply to ASA, MABS and styrene copolymer blends. Growth in these markets is being driven in particular by the development of new and innovative applications. Despite their higher volume price, styrene copolymer specialties help the user to reduce system costs by eliminating processing steps and/or to give products additional characteristics that increase their market chances [2, 3].

Acrylonitrile-styrene-acrylic Copolymers (ASA): There are very few producers of ASA offering a broad product spectrum worldwide: BASF, LG Group, Samsung/Cheil, Sabic, Chi-Mei. Ineos just recently sold its ASA activities to Diamond Polymers, a compounder.

Region	Consumption [kt]						
	2007	2008	2009	2010*	2011*	2012*	2015*
World	6,600	6,200	6,100	6,400	6,800	7,200	8,200
Western Europe	800	740	660	670	700	720	740

* Forecast

Table 3. ABS consumption worldwide and in Western Europe (without blends) in the period 2007 to 2015 (source: CMAI)

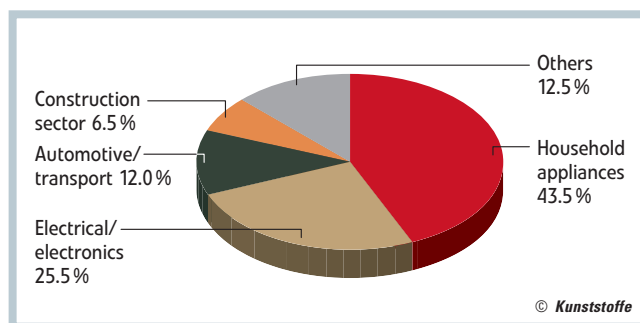


Fig. 3. Worldwide ABS applications in 2009 (source: CMAI)

ASA is characterized by high thermal stability, impact strength, scratch resistance and good resistance to chemicals and exposure to UV light. Typical applications are to be found in the automotive sector, in household products, in the sanitary sector, in the construction industry, in leisure articles and as a blend with PC, PBT, SAN and PA in automotive engineering and in the electrical engineering/electrical appliances sector.

The worldwide quantitative consumption of ASA and ASA blends is difficult to estimate accurately, but probably lies in the order of around 200,000 t/a. What is sure is that this product class also suffered drops in volume over the last two years, as the automotive industry is a major customer for ASA. A significant upturn in consumption is expected again for the current year in view of the worldwide recovery of automobile production.

Demands (standards/codes) with respect to higher weathering resistance are growing in many fields of application, in particular for products for the automotive and construction industry. Producers are therefore increasingly striving to improve and further develop the UV stabilization. BASF reports

on a new stabilization concept. It allows a significantly improved color consistency to be achieved for the products over a broad color spectrum – from deep black through to snow white surfaces – compared with the standard product. Corresponding benefits with respect to gloss retention and color fastness with prolonged exposure to sunlight are expected to drive applications in the automotive industry and in the construction sector.

Apart from processing by injection molding, ASA is also suitable for mono and co-extrusion of sheets and profiles. BASF has developed a new "High Gloss ASA" (Luran S 776 KE) for this field of application. This product with its improved flowability and gloss-optimized formulation can be co-extruded with PVC even at low melt temperatures. ASA top coats on PVC outdoor applications produce a firmly adhering, particularly glossy and weathering-resistant (color-stable) surface; the first applications are pigmented, coextruded gutters.

Methyl-methacrylate-acrylonitrile-styrene Copolymers (MABS): There are only a few producers for the special MABS copolymers. BASF is market leader in Europe, Asian produc-

ers are LG Group, Toray, Chi-Mei, Samsung/Cheil. Figures for the production capacities of the producers are not known.

MABS is a material with ABS-typical properties (balanced toughness-rigidity ratio) with at the same time high transparency, good resistance to chemicals, outstanding surface quality and brilliance. Products made from MABS can be sterilized. Typical applications are to be found i.a. in medical technology (cannulas, inhalation systems, infusion taps, filters, generally for products with brief body contact), for transparent packagings for pharmaceutical and cosmetic products, as consumer articles for office and leisure applications. MABS frequently competes here with PMMA and PC.

Thanks to its special fields of application, the consumption of MABS has also risen steadily in recent years at a rate of 3 to 4 % p.a. and is expected to reach around 170,000 t in 2010. Comparable growth rates in consumption can also be expected for the coming years.

The product and application development for MABS is predominantly "project-driven". Products are further developed and new fields of application explored in close cooperation with the customers. At BASF, the main focus is in particular on products for medical technology ("Healthcare & Diagnostic Grades"). Terlux 2802 HD and 2812 HD (free-flowing grade) are targeted at the substitution of PC.

Styrene Copolymer Blends: Most ABS producers have ABS blends in their product range, and all polycarbonat producers offer ABS+PC blends, the largest product group by volume among the ABS blends (accounting for roughly 85 to 90 %). The leading European suppliers of styrene copolymer-based blends are BASF (ABS+PA, ASA+PA, ASA+PC, ABS+PMMA), Bayer (ABS+PC, ASA+PC, SAN+PC), Sabic (ABS+PC, ASA+PC) and Styron (ABS+PC, SAN+PC).



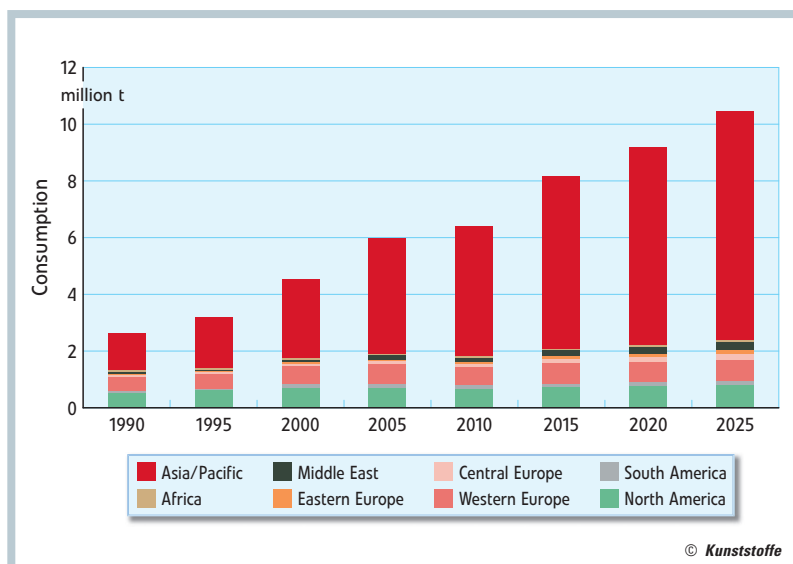


Fig. 4. Development of ABS consumption by regions
(source: CMAI)

The consumption of **ABS+PC blends** in 2008 was in the order of approx. 500,000 t; in 2009 this consumption fell worldwide to 350,000 to 400,000 t. With a proportion in excess of 60 %, ABS+PC blends are used in the automotive industry, a fact that explains this dramatic drop in consumption during the automobile sales crisis. Around 40 % are used as flameproof products in the electronics and electrical industry (particularly for mobile telephones and computer and TV housings).

The suppliers of ABS+PC blends have added new developments to their product ranges in recent years. Last year, for example, Bayer presented a sterilizable product specially for medical engineering applications with Bayblend M850XF that satisfies the demands of the FDA with respect to biocom-

patibility. In view of the drop in sales, however, the producers have concentrated of late predominantly with topics such as cost savings, efficient production and capacity adjustments.

The world consumption for **ABS+PA blends** is currently still well below 50,000 t/a, but the market for this product class is showing above-average growth rates. Components of ABS+PA blends have a higher heat distortion temperature, a high-quality matt surface and a good acoustic damping behavior. Despite the slightly lower scratch resistance, the demand for cost savings is increasingly leading to the substitution of ABS+PC blends with ABS+PA blends, as good surface qualities are achieved without painting. They are recommended for components in vehicle interiors, such as center and roof consoles.

The trend in the product development is towards improved flowability and hence more energy-efficient and cost-effective processing. With Terblend NM-21 EF (EF stands for excellent flow), BASF is aiming at large and complex visible parts in the vehicle interior that have to absorb a great deal of energy in the event of a crash. A comparable glass fiber-reinforced product combines increased flowability with high mechanical stability (Terblend N NG-02 EF) and allows thin-walled, strong and visually attractive components to be cost-effectively injection molded.

ASA+PA blends combine toughness with high UV stability. A newly developed, highly flowable product grade with high resistance to chemicals (Terblend N BX 13043) from BASF targets applications with high exposure to light, such as

rear shelves in automobiles or garden chairs. This product can also be easily processed by injection molding thanks to its good flowability; components made from this material can also be employed unpainted.

ABS+PMMA-based blends open up new fields of application for the trend towards products with high-gloss colored surfaces. Such "high-gloss applications" (coffee percolators, TV housings, decorative strips and also automobile interior parts) are, however, greatly driven by fashion and design.

The market for blends will not reach the level of 2007/2008 again until 2012/2013. Although the European producers achieved large increases in sales during the first half of 2010 (+30 %), the buildup of stocks and the lack of imports from Asia also play a role here. The further development will be marked more strongly by the global growth of the consumer markets.

Outlook

The market for ABS, SAN, ASA and specialties will expand again significantly in the coming years. In the medium term, however, the importance of the traditional markets in Europe and America will continue to decline (particularly for the ABS consumption). Above-average growth, on the other hand, is expected in Eastern Europe and particularly in the Asian region.

With cost-effective world-scale production facilities on the one hand, and a selective further development of the specialty sector on the other, the remaining European producers see themselves well-equipped for facing the impending global competition. ■

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