



For the rotor of their small Pigo wind turbine, the Dutch company EverkinetIQ uses an ASA material with 15 % glass fibers that is particularly resistant to weathering, UV and aging (photo: Styrolution)

Styrene Copolymers (ABS, ASA, SAN, MABS, and ABS Blends)

Opportunities with Specialties. The market for styrene copolymer appears to be even more divided than ever. The “commodification” of ABS has continued. Competition on the market is hard, and some suppliers with an unfavorable cost structure have withdrawn. If business models can be adapted to changed conditions, however, the market may still hold further considerable opportunities. The same applies to ASA, SAN, MABS, and ABS or ABA blends. These polymers can still be considered specialties, which – if used in a targeted way – can solve many applications problems.

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The market for styrene copolymers has been extremely turbulent in the past three years – not only because the global economic crisis in 2008 and 2009 trashed all predictions, but also because of the foreseeable commodification of the most important styrene copolymer ABS, which was accelerated by the crisis.

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Happily, the recession is V-shaped, and the recovery took place faster than was expected at first. It is assumed that the pre-crisis level will be reached in about 2013/2014. Nevertheless, manufacturers of styrene copolymers were already seeing an unexpectedly rapid growth in demand for their products in 2010 (**Table 1**). This led to delivery bottlenecks for many polymer materials. With styrene copolymer specialties, too, the situation became tight in Western markets because the raw materials manufacturers were only able to return their plants slowly to the pre-crisis level, and alternative sup-

pliers were lacking in many cases. There were also bottlenecks in pigments and additives – many of which are batch products with an annual production cycle. Analysts are now assuming that the ABS market in Europe, after growing at about 5 % in 2010, will expand at about 3 % – presupposing

continued untroubled development of the global economy.

ABS

Acrylonitrile-butadiene-styrene is still the most important of the styrene copolymers. It clearly dominates the entire market, followed by SAN, ABS

Year	Quantity (million t) Europe	Quantity (million t) World
2006	0.925	6.612
2007	0.989	7.083
2008	0.872	6.457
2009	0.765	6.640
2010	0.806	7.283

Table 1.
Development of
ABS demand (date:
mid-2011)

(source: CMAI)

Rank	Company	Capacity [million t]	Share [%]
1	Chi Mei	1.490	17.20
2	LG Group	1.100	12.70
3	Formosa Group	0.710	8.19
4	BASF SE	0.677	7.81
5	Ineos	0.515	5.94
6	Samsung Group	0.430	4.96
7	Toray	0.422	4.87
8	Sabir	0.377	4.35
9	Grand Pacific	0.310	3.58
10	CNPC	0.306	3.53
Total		6.337	73.13

Table 2. The ten leading ABS producers in the world (date: mid 2011; the styrene copolymers of BASF SE are now marketed under the name Styrolution) (source: CMAI)

blends, ASA and MABS. The list of the ten ABS suppliers with the largest capacities (Table 2) is dominated by Asian manufacturers. ABS from Far-East sources now covers significantly more than half the world market.

In the toy sector, for example, growth of 4 to 5 % is expected in the coming five years (Table 3). The specialists believe extruded sheets and profiles (for the construction sector, among others) to be capable of 3 to 4 % growth p.a.; in the furniture sector, there is a trend away from PVC and PP; in the sanitary sector, ABS/PMMA coextrudates are increasingly replacing metals. Some 6 to 8 % p.a. growth is even expected in medical technology. The material is used, for example, in housing parts, and is profiting from a strong trend towards cost-reducing self-medication.

One of the most important consumers in recent years continued to be the automotive industry. Here, the material lost market share as a result of inter-polymer competition with polypropylene. However, the automotive market is recovering at an extremely promising rate, so that ABS is supposed to grow in this sector after all – an increase of 2 to 3 % p.a. is expected.

ABS demand in the electrical and electronics sector has

been declining in recent years as a result of the shift of processors to Asia, combined with a migration to ABS blends instead of the pure polymer. Here, too, experts expect an increase of 2 to 3 % p.a. for ABS.

For domestic appliances, there are two conflicting tendencies, the trend towards smaller devices, which require less ABS to produce them (growth of only 1 to 2 % p.a.) and increasing domestic appliance imports from Asia, at the cost of the ABS demand from European sources. On the other hand, consumption is supported by the trend towards designer products, such as coffee machines or handheld vacuum cleaners (plus 2 to 3 % p.a.).



Fig. 1. A commodity material, but still good to look at: the cross trainer Satura P 7653 from Kettler is clad with a standard ABS; Kettler pigments the resin itself and thereby saves time and costs

(photo: Kettler)

For ABS, therefore there are signs of growth in many markets. Nevertheless, it will be difficult to remain profitable as a manufacturer with this material.

Commodification: The causes of commodification were already apparent in the 1990s: In the course of globalization, European ABS manufacturers came increasingly under pressure from imports from Asia. Moreover acrylonitrile-butadiene-styrene gradually became a mature material. It was predictable that suppliers without expensive R&D departments, too, would be able to take a slice of the pie, and the material price alone would become the decisive argument for more and more customers.

BASF, Ludwigshafen, Germany, met this challenge by investing in a cost-efficient large plant at its Antwerp site in Belgium, where it restricted itself to producing unpigmented standard resin with an optimum price/performance ratio. At the same time, the company introduced its Colorflexx service brand, which enables users to pigment inexpensive ABS with special masterbatches according to their own preferences (Fig. 1), so that, in effect, the customary quality was actually available much more economically.

The situation was made worse by unfavorable euro/dollar exchange rates, which

made imports from Asia increasingly attractive, and a growing price volatility on the raw materials markets. This ultimately led to a changed supplier structure: the share of imported ABS on the European market increased from about 12 % to almost 30 % between 1995 and today (Fig. 2).

In total, however, suppliers were not able to return the utilization of their plants back to the level of the 1990s. During the economic crisis, it fell quite considerably again. At the same time, competition from the Far East began to establish a long term presence in Europe, the construction of a compounding plant by Samsung in Hungary being one example.

ABS margins have thus been continually eroded since the mid-90s. According to some market participants, consolidation is not yet completed. BASF took one possible way out of the spiral of decline by founding Styrolution GmbH, Ludwigshafen, Germany. This is firstly a pure BASF subsidiary, which continues the group's styrene copolymer business with a stronger focus. From October 2011, Styrolution GmbH will be incorporated into a 50:50 joint venture of the same name with Ineos Industries Holdings Limited, Lyndhurst, UK. The joint venture creates a world leading supplier of styrene polymers that should be able to stand up to competition from the Far and Middle East in the long term: BASF's styrene business achieved a revenue of EUR 3.9 billion in 2010, and that of Ineos, about EUR 2.8 billion.

Specialties: Regarding ABS entirely as a commodity, does not do full justice to this material. There are still applications in which ABS specialties are required. While the most important factors for ABS commodities are price (or costs), constant quality and reliability of delivery – excessive warehouse stocks often become a risk with strongly fluctuating prices – specialties are required for applications where the material's properties are crucial. →

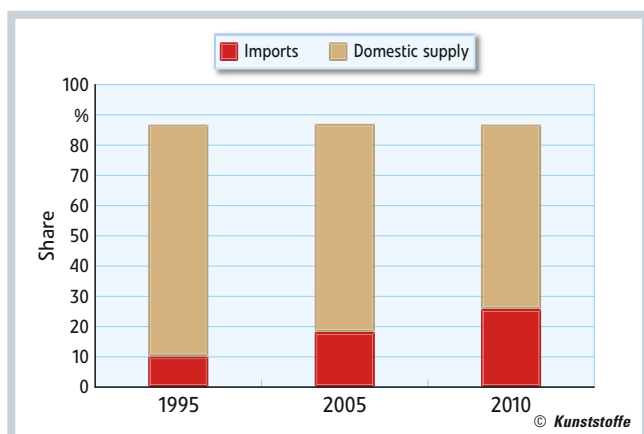


Fig. 2. Since 1995, ever more of the ABS consumed in Europe has been imported (source: Styrolution)

tuating raw materials prices – specialties, which in many cases solve application problems in complex products, are not available without considerable R&D efforts and investment in a far-sighted market development. Thus, ABS business split years ago into a competition-driven commodity market and an innovation-driven specialties market. Suppliers who serve both markets – such as Styrolution – now market specialties and standard goods according to completely different, adapted business models.

A niche in which the corresponding ABS variants act as specialties is still the growing medical market. Materials predestined for this market include, e.g., ABS special grades such as Terluran HD-15 (Styrolution). Although many ABS manufacturers now offer products with special medical service packages, there are still considerable differences in detail. It is worthwhile for many users to compare the offerings in detail.

High-temperature modifications such as Terluran HH-106 (Styrolution) and Terluran HH-112 (Styrolution) also have a highly promising market. Terluran HH, for example, remains dimensionally stable even at temperatures up to 112°C. About 80 % of these high-heat products are used in automotive applications, for example in metallized rear light housings. Although the market for HH-ABS is still rel-

atively small, making up only 10 % of the ABS market, it is characterized by a less dynamic price development and shows a growth similar to the automotive market itself.

SAN

Styrene-acrylonitrile was able to assert itself well in its niches in recent years and has retained its specialty character. Besides Styrolution, another SAN manufacturer of world importance is primarily Trinseo (formerly Styron LLC, Berwyn, PA, USA, founded by Dow Chemical Company) (Tyril); Polimeri SpA, San Donato Milanese, Italy, (Kostil) focuses chiefly on South Europe. When the market conditions are right, Asian ABS producers also sporadically crop up globally as SAN suppliers. However, new opportunities for this material can be seen rather in the development of new markets for existing, though highly refined, SAN grades. For example, Styrolution, with Luran HD, has offered a version with a medical technology service package since 2008; other applications are available to this highly grease-resistant material in domestic appliances – such as water filters, kitchen machines or refrigerator inserts. A particularly clear SAN variant that is largely free of specks and haze is offered by Styrolution in the form of Luran Crystal Clear.

One application in which glass fiber-reinforced SAN is increasingly widely used are spacers in double-glazed windows. Luran 378 PG7 has a high tensile modulus and a coefficient of thermal expansion similar to that of aluminum, and can therefore increasingly replace this metal. In window profiles, Luran shows double-digit growth; in other applications, SAN is growing with its markets; replacement by other materials is not likely at present in view of the polymer's specific range of properties.

ASA

Acrylate-styrene-acrylonitrile (ASA) has been able to retain its specialty character in the past three years. The two ma-

terials ABS and ASA are very similar in terms of their mechanical characteristics. Because of its better UV and weathering resistance, however, ASA is superior to ABS in a wide range of applications. The list of ASA manufacturers includes almost all well-known ABS suppliers. Asian manufacturers still live well from growing markets; nevertheless, the competitive pressure is intense and can be expected to increase here, too. ASA manufacturers currently still offer a wide range of grades.

"Traditional" ASA applications are automotive body parts, such as mirror housings or radiator grilles, with an impressive optical appearance even without painting. In the automotive sector, Luran S, the

Applications	Growth rates [%]	
	2003–2007	2010–2015
Automotive	1 %	2–3 %
Electronics	1 %	2–3 %
Large appliances	-3 %	1–2 %
Small appliances	2 %	2–3 %
Sheet and profile extrusion	6 %	3–4 %
Toys	5 %	4–5 %
Medical	6 %	6–8 %

Table 3. Growth rates: ABS is still in demand in many markets (source: Styrolution)

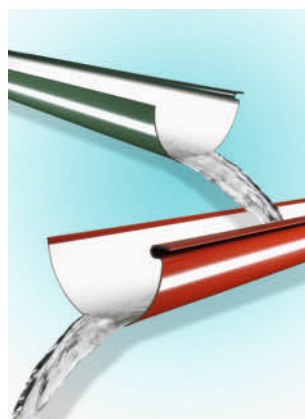


Fig. 3. An ASA formulated for optimized flow and gloss can be readily coextruded with PVC and provides PVC exterior applications with a highly gloss surface that withstands weathering effects better than pure PVC (photo: Styrolution)

ASA from Styrolution, is growing stronger than the market. The motor is clearly a growing demand for UV-resistant polymer materials. Styrolution has gone with the trend since 2010 with Luran S SPF 30, an ASA variant, whose UV resistance has been increased even further compared to the standard material. Besides the automotive sector, other strong ASA customers are in the fields of building and construction, electrical and electronics, and sport and leisure (e.g. lawnmower housings).

A current and particularly interesting application example for glass fiber-reinforced ASA are Piquo microwind turbines of the Dutch manufac-

turer EverkinentIQ International made of Luran S KR 2858 G3 (15 % glass fibers) (**Title photo**). With Luran S767 KE, Styrolution now offers a particularly easy-flow extrusion ASA, characterized by a particularly attractive surface as well as high color brilliance and durability for outdoor applications. The material is also suitable for co-extrusion with PVC and processing by injection molding. A possible field of application is glossy, colorful weathering-resistant rain guttering (**Fig. 3**).

MABS

Sales of transparent methyl methacrylate-acrylonitrile-butadiene-styrene (MABS) are more dependent on fashion trends than those of other styrene copolymers; MABS is particularly suitable for producing transparent or translucent housing parts. Compared to PMMA, MABS can often prevail because of its good stress cracking resistance; the material scores because of its lower melt viscosity compared to polycarbonate. MABS can be processed in any ABS mold – that, too, is a benefit in times of growing cost pressure. Terluxe, the MABS from Styrolution, shows stable growth in, e.g., cosmetics packaging (e.g. dishes and lipstick cases); its most important application field is medical technology.

Blends

New material developments in pure styrene copolymers are of course becoming ever more difficult. The situation is different for ABS blends, whose total market (together with corresponding ASA blends) is estimated at well over 500 kt/a. The possibilities resulting from the intelligent combination of different material components are by no means exhausted. Blends are therefore strategically capturing new market segments; thus their growth figures are regarded as exceptionally good.



Fig. 4. An enhanced-flow (ABS+PA) blend (Terblend N NM 21-EF) has found a first mass application in automotive interiors as loudspeaker grilles for a German standard vehicle (photo: Styrolution)

Blends of ABS and polycarbonate, for example, still have considerable market importance. Large suppliers are Bayer Material Science AG, Leverkusen, Germany, (Bayblend) and Sabic Innovative Plastics, Bergen op Zoom, Netherlands, (Cycology). The main field of application for the amorphous thermoplastic (ABS+PC) blends is the automotive sector; experts estimate the volume of the European (ABS+PC) market for automotive applications alone at about 50,000 to 60,000 t/a. In the exterior, the material is used, for example, in robust radiator grilles and (electroplatable) decorative elements, in the cockpit, for example in door trim, display consoles and safety parts, such as airbag covers. Here, their high heat deflection temperatures and impact values are particularly in demand; the low splintering tendency and good low-temperature impact resistance are particularly useful in case of a crash. Flame-resistant modified (ABS+PC) blends are used in electrical equipment housings; the electrical and electronic sector is even the main growth segment.

(ASA+PC) blends are still widely used in the automotive cockpit, too. Their key advantage compared to (ABS+PC)

blends is their better weathering resistance. Glass fiber (GF) reinforced grades have excellent flow properties even without large amounts of additives. The applications are, e.g., mirror covers and rear-view mirror fairings. Sabic recently expanded its (ASA+PC) portfolio (Geloy) with new grades for use in medicine, entertainment electronics and electrical applications. For light but matt surfaces in automotive interiors, dust-repellent antistatic grades are available.

Blends of ABS and polyamides are characterized by an independent property profile comprising high impact resistance combined with good chemical resistance and good flow properties. The latter leads to good tool reproduction, allowing matt surfaces to be used without painting. In addition, they offer a range of acoustic and tactile properties; even glass fiber-reinforced parts, which already offer considerable stiffness with low GF admixtures, can be used for visible parts without painting (e.g. Terblend N NG-02). (ABS+PA) blends are therefore predominantly used in the automotive sector.

With Terblend N NM 21-EF, Styrolution has recently added an (ABS+PA) blend, which is characterized by even better flow properties. This pays off for the manufacture of large-area parts with a challenging wall thickness/flow path ratio. The new material thus meets the demands of the market for such applications and has found an interesting mass application in (unpainted) loudspeaker covers for a major German automotive OEM (manufacturer: Peguform, Bötzingen, Germany) (**Fig. 4**). The intricate hole pattern in these covers would be difficult to realize with other materials.

In a similar way to the material pair (ABS+PC) and (ASA+PC), users are also taking advantage of (ASA+PA) blends, if (ABS+PA) does not offer sufficient weathering sta-

bility. (ASA+PA) blends are also suitable for manufacturing light colored parts that are required to offer color fastness and constancy over relatively long periods. Styrolution recently expanded its portfolio of styrene copolymers with a new variant of the material (Terblend S), which is impressive for its further improved UV stability. Potential applications are those with high light exposure, such as automotive interiors (e.g. rear shelves) and parts of gardening equipment. The material is currently in the sampling phase.

Outlook

The commodification of ABS has made great strides in recent years. The market for innovation-driven specialties still holds opportunities if suppliers can adjust their business model early enough. However, the consolidation of the ABS supplier field is probably not yet complete.

An increasing challenge, in particular for commodity ABS, is the volatility of the raw materials. The prices are now no longer adjusted on a quarterly, but on a monthly basis; even butadiene is now subject to this cycle. Polymer producers can no longer bear these fluctuations on their own; their customers, too, will have to adjust their calculations to shorter-term price fluctuations – that is the only way suppliers will be able to survive with low margins.

Moreover cost-reduction potential must be tapped; one possibility could be additivation of cost-effective standard ABS by customers themselves. ABS and the other styrene copolymers thus will remain exciting materials in many ways. ■

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