Polymethyl Methacrylate (PMMA)

Growth through Diversity for Molding Compounds and Semifinished Products

The global market for PMMA continues to benefit from an increasing demand, mainly from the construction and electronics industry as well as the automotive and transportation sector. However, continuing raw material bottlenecks have damped sales, which has also pushed up the price for PMMA.

The trend continues: the market for PMMA molding compounds and sheet products exhibits a stable annual growth of some 3%. In 2018, slightly more than 2.1 million t of the material was sold worldwide – in 2016, sales were below 2 million t. Hereby, the major growth industries are construction, automotive, and transportation as well as electronics. It is expected that the PMMA demand will continue at this level. Different from previous years, sales are not influenced as strongly by individual applications as in the past, like e.g. the backlight units used in flat-screen TVs. In fact, growth is based on an increasing total number of applications.

But negative economic influences can definitely be seen as a risk for the PMMA market. For example, the reduced growth forecast for China, the trade conflict between China and the USA, Brexit, and not least the emission scandal in the automotive industry have already caused an overall economic downturn in the second half of 2018. These developments also encumber PMMA sales directly. Firstly, because they have dampened overall worldwide consumption, and secondly, the introduction of a new, uniform test pro-

Lower energy consumption, better plant growth: a company in the Netherlands builds functional greenhouses with the help of lens optics made of a Plexiglas PMMA molding compound (© Technokas)
Fig. 1. A visual aid demonstrates the different neutral gray special colorings for various translucent effects. This assists the selection of products for specific components (© Röhm)

Procedure to determine exhaust emissions has slowed down e.g. vehicle production. Simultaneously, lower prices for several alternative plastics that are used in various fields such as the construction industry, have increased the pressure on PMMA producers.

On the supplier side, the PMMA market benefited from expanded capacities in the Middle East and Asia in 2017 and 2018. In contrast, the supplier field in Europe and North, Central, and South America has consolidated, particularly for PMMA sheets. However, massive production bottlenecks and the continuing high demand for the methyl methacrylate (MMA) feedstock put a strain on the PMMA market. The result was a clear hike in prices, both for standard as well as specialty products.

**Differences in the Regions**

The most important market for increased global PMMA sales is the economic development in Asia. Again, almost two thirds of worldwide demand came from the Asia-Pacific region. The rest was divided equally between the American continent and the EMEA region (Europe, Middle East, and Africa). China continues to be the leader in PMMA demand, with a share of more than 30% of the overall global market. Moreover, compared with other countries and regions, China recorded the largest growth in sales from 2017 to 2018 (4 to 5%).

This growth was driven mainly by the opto-electronic industry and the booming construction business. In order to become less dependent from imports, China has further expanded its domestic production capacity in the past two years: slightly more than half of the Chinese demand was covered by local production capacities in 2018. Nonetheless, compared with 2017, PMMA imports increased by 20% due to the higher overall demand.

Following the two recessions in 2008/2009 and 2012/2013, PMMA sales in Europe recovered again, and has grown for the fourth time in succession. Growth in North, Central, and South America was slightly less. These developments were fired primarily by robust growth in the automotive industry in spite of the economic downturn in the last quarter of 2018. In contrast, the price increases for PMMA, combined with a price decline for alternative plastics, restricted sales in the construction business. Consequently, construction was regressive in Europe and America – even though the building sector still accounts for almost one third of sales in Europe. The second-largest PMMA market in Europe was lighting and illuminated signage (26%), followed by transport and traffic (22%). But also smaller application areas, such as e.g. medical devices enjoyed good growth rates during the past years.

**Market Movement apart from Top Leaders**

In the ranking list of major PMMA producers worldwide, a trio is still in the lead – some of them under new names: Mitsubishi Chemical Co. Ltd. in Tokyo, Japan, top leader for many years, and previously called Mitsubishi Rayon Co. Ltd., has increased its capacities. The most recent expansion at the end of 2017 and beginning of 2018 in Saudi Arabia increased Mitsubishi’s lead even further. In July 2019, Evonik Industries AG in Essen, Germany, – the previous second-largest producer – successfully concluded the outsourcing of its methacrylate division. Consequently, the methacrylate business was transferred as an independent company to the new owner Advent International Corporation in Boston, MA/USA. The investor will continue the previous strategy under the long-standing traditional name of Röhm GmbH. In 2018, for example, Evonik commissioned a new plant in Weiterstadt, Germany, for the production of stretched PMMA sheets, as used in the aviation industry. In order to keep pace with growth in the specialties field, the compounding capacity in Oscoda, AR/USA was doubled. Place three is taken by Arkema SA in Colombes, France. Together, these three producers account for almost 40% of global PMMA capacity.

Although there have been no major changes in the PMMA-producing sector during the past two years, there has been movement amongst smaller producers: for example, due to capacity increases following a joint venture with Saudi Aramco in Saudi Arabia, Sumitomo moved further up the global ranking list. Moreover, the supplier side has diversified even more in China – the world’s largest sales market: in 2018, Wanhua Chemical Group started PMMA production, and Double Elephant, a relatively new player in the market, doubled its capacity. There is movement also in other market areas. The Swiss Group 3A Composites, in Horgen, Switzerland (owner: Schweiter Technologies, Switzerland) has purchased Polycasa, with sites in Germany and Slovakia. In addition, Polycasa has acquired the cast acrylic sheet business from Lucite in Darwen, UK (owner: Mitsubishi Chemical). Also in the USA, market leader Mitsubishi Chemical sold its cast acrylic sheet activities. Purchaser was...
Plastics World Market  K 2019

Plaskolite, a North American producer of PMMA and sheets.

Feedstock Shortage

During the past year, feedstock supplies continued to be tight; due to robust demand and numerous planned and unplanned production downtimes, the supply of methyl methacrylate (MMA, required for PMMA production and its precursors) was severely restricted. Even the expanded capacities did not provide any relief on the world market. The results were substantial price increases for MMA between 2016 and 2018, which in turn led to significant price increases for PMMA. Recovery of the market and price situation only started slowly in the last quarter of the past year.

The robust growth of the global PMMA market is based on a wide range of applications. The material is particularly suited where weather resistance, color fastness, high brilliance, and transparency as well as hardness and scratch resistance are required. Therefore, PMMA is an established and highly demanded material in numerous fields, but simultaneously, it is also found repeatedly in new application areas. PMMA has played an important role in the automotive industry since the 1950’s, e.g. as tail lamp covers. Here, the material has contributed decisively that in the course of the years, the originally small and functional signal lamps with a glass cover have evolved into large, brand-specific design elements.

New Applications through Automotive Megatrends

If automobiles are to operate automatically in future, far more sensors must be installed than is usual today. Particularly appealing is if the sensors do not strike the eye, but are hidden discreetly behind other components. The materials used must be suitable for the purpose, and...
In recent times, the “black panel effect” is becoming increasingly popular. Hereby, in the switched-off state, a display appears to be part of a cover. When switched on, the displayed information appears with true colors through a previously dark material. This effect can only be achieved with material in special, neutral gray coloring. Thanks to its precise colorability, PMMA is particularly suited for this. By means of a Plexiglas neutral gray box (Fig. 1), Röhm demonstrates the advantages of the neutral gray special coloring. This also assists the selection of a suitable product for a specific component, by graphically visualizing the dependency between a component’s transmission and its wall thickness (also see Kunststoffe international 3/2018, p. 25). Moreover, it is conceivable that in future, previous purely trim panels on the vehicle’s outside could be converted into multi-function operating elements. For example, displays in the pillar trim could indicate directly, whether a car-sharing vehicle is presently available.

The appearance of vehicles will also be changed significantly by electric drives. One example is the radiator grille, which could be dispensed with completely, because electric drives do not require such a strong airflow as internal combustion engines. Designers could use this freedom e.g. for more decorative elements in the vehicle fronts, some of which could even be illuminated. PMMA is very well suited for interactions with light. In general, the LED technology of recent years has resulted in many new application areas for PMMA. Modern light sources provide a powerful point lighting, and therefore require a surrounding material that directs the light to where it is needed. Very good light-diffusing PMMA products permit the design of extremely flat components, e.g. for luminous decorative elements in vehicles, or elegant recessed lamps in ceilings.

Energy-Saving Lighting

Thanks to its outstanding light guiding properties, PMMA is not only found in flat-screen TVs, mobile phones, decorative designer luminaires and in illuminated signage, but also as part of functional and energy-efficient lighting for offices and supermarkets, streets, sports arenas, and public spaces. Thus, the illumination of many sports facilities is currently being replaced with power-saving alternatives. For lens production, PMMA offers excellent mold surface reproduction. These optics can direct light so precisely, that the LED luminaires can illuminate large areas uniformly and energy-efficiently (Fig. 2). But PMMA lenses are not only used in luminaires. A novel greenhouse from the Netherlands uses Fresnel lenses made of the special molding compound Plexiglas Solar (Title figure). They bundle the sunlight and focus it onto a collector which converts the solar energy into heat, thereby reducing energy consumption and costs. Furthermore, the special PMMA has been modified to transmit the wavelengths of light that plants need for their growth, while at the same time offering even higher UV stability.

Also the weather resistance of PMMA is utilized in construction applications. Thanks to its molecular structure, even the standard material is UV resistant. This protective function can also be used as a surface enhancement of other plastics in windows, doors, and facade elements. The resulting longer and more sustainable service life of the products is beneficial for the booming construction industry, because building operations are increasing in regions in which exterior components are subjected to strong UV radiation and weather influences.

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