Polyvinyl Chloride (PVC)

PVC Is Showing a Positive Growth Trend, however, It Has Still Not Entirely Regained its Former Strength

Even if the European market is currently only showing modest growth, PVC has continued its global growth unbroken. The plastic is becoming ever more environmentally compatible and is benefiting from global trends. The restructuring of the industry has made progress; the consolidation pressure on Western European PVC raw materials manufacturers has eased for the time being.

Global production capacity for PVC grew to about 62 million t in 2016 (source: IHS Chemical). It has increased by over 8 million t since 2012. Over 90% of this growth comes from China, which now has over 51% of global capacity without even approaching the full utilization of its plants. While global PVC production predominantly uses the ethylene route, the coal-based acetylene process, with its environmental disadvantages, predominates in China. The average global capacity utilization is below 70%, though according to forecasts it has reached its lowest point in 2014/2015.

Because of China’s strong position, Northeast Asia, with 59% of global capacity, is the leader, followed by North America with 14%, which is continuing to benefit from a shale gas bonus, even though this has significantly shrunk in times of lower oil prices. This is followed by Western Europe, with a 10% share of capacity (Fig. 1).

Changes among Manufacturers and Global Capacities

The production capacities of the ten world’s biggest manufacturers (as of June 2016) are shown in Figure 2. There have been significant changes in recent times. Shin-Etsu Chemical, Tokyo/Japan, and Formosa Plastics Group, Taipei, Taiwan, still hold 1st and 2nd place in the capacity ranking. The new third place is held by Inovyn, which was formed as a merger of the PVC activities of Ineos and Solvin (Solvay). According to the original plans, Inovyn would even have moved into 2nd place, ahead of Formosa Plastics, however, it had to divest significant parts of its business to meet the requirements of the EU Commission (see below).

Following in 4th, 5th and 6th place are ChemChina (China National Chemical Corporation) and – newly – Mexichem, of Mexico, after the acquisition of Vestolit, and the US company Westlake, after the purchase of Vinnolit. The 7th to 10th places are held by OxyVinyls, CNSG, LG Chem and Axiall respectively. There will be a shake-up before the end of 2016 as Westlake, currently in 6th place, intends to...
complete the purchase of Axiall, the number 10, in the 4th quarter. Such a merger will advance the new Westlake to 3rd place.

Many major players are of Asian origin; North America, too, is strongly represented. With the exception of Inovyn, the European raw materials manufacturers are well behind in terms of capacity. However, the scene is entirely different for PVC specialties. The Europeans have a strong tradition here. With Vinnolit (Westlake), Inovyn, Vestolit (Mexichem) and Kem One, four companies are represented in the top ten specialty producers.

The consolidation of industry in Europe had made major advances in the last three years. The important developments are: the Klesch Group’s transfer of Kem One to the financial investor OpenGate Capital and the private investor Alain de Krassny in December 2013 for reasons of insolvency. There was also the purchase of the PVC specialty manufacturer Vinnolit by the US Westlake Chemical in July 2014. It is also worth mentioning the start of production by the Sibur/Solvin joint venture RusVinyl in September 2014 to supply the local Russian PVC market (+330 kt). Other significant events were the purchase of Vestolit by Mexichem in December 2014, and the merger of significant parts of the PVC business by Ineos and Solvay under the name Inovyn in July 2015. There was also the purchase of the chlorovinyl activities divested from Inovyn for antitrust reasons by the International Investors Group, which were given the new name Vynova, in August 2015. A surprise was also caused by the September 2015 announcement of the final closure of Inovyn’s PVC production in Schkopau, Germany, which had already been idled since December 2014 (-310 kt).

With its early withdrawal from Inovyn in July 2016 due to the complete takeover of the former joint venture by Ineos, Solvay came a big step closer to exiting from the PVC business. Solvay Indupa of South America is also for sale.

**Demand and Foreign Trade**

Worldwide PVC demand in 2015 was 41.9 million t (source: IHS Chemical) and was thereby 3.6 % year on year. In the period from 2013 to 2015, it rose by 3.8 % per year on average (CAGR). PVC thus continued its steady growth after the crisis of 2008/09, though with a growth rate well below the pre-crisis level (CAGR 2000 to 2007: 4.7 %).

World demand for PVC is primarily determined by construction activities. Globally, the most important applications for PVC continue to be pipes and fittings (43 %), profiles and tubes (17 %), rigid film and sheet (17 %) and cables (8 %) (Fig. 3). In addition, there is a strong segment “Others” with a share of 13 %, which also includes the biggest specialties segment paste PVC (6 %) (Fig. 4). Since construction activity in Europe is still historically very low and lagging behind the global average, growth was primarily driven by countries and regions such as North America, India, Asia and the Middle East (incl. Turkey). The world’s biggest market for PVC, at 47 %, is Northeast Asia, followed by North America with 13 % and Western and Central Europe with 12 % together (Fig. 5).

While trade in commodity PVC, which makes up 92 % of the total amount, is still a relatively “regional” business be-
cause of the high transport costs, PVC specialties, which only have a share of 8%, are marketed globally. In total, the global (net) PVC trade in 2015 held a share of 4.7% of the greater attractiveness of business in the EEA, local producers in the CIS have been able to assert themselves by bringing on stream additional capacities to counter imported material.

**Development and Technology Trends**

**More Plasticized PVC in Europe.** The trend reversal in Europe between 2009 and 2012 toward stronger growth of flexible PVC applications – due to the relative weakness of the major construction applications – has continued. The share of flexible applications has thus risen further from 33% in 2012 to almost 35% in 2015. Nevertheless, rigid profiles (27%), pipes and fittings (22%) and rigid film/sheet (11%) remain the biggest applications in Europe (source: ECVIM).

**More Alternative Plasticizers.** Worldwide plasticizer demand in 2015 is 8.4 million t; in Europe, it is 1.3 million t. In Europe, over 90% of this is used for plasticizing PVC (source: IHS Chemical/ECPI). The biggest share of this is held by higher molecular phthalate plasticizers such as DINP, DIDP and DPHP (57% in total). The share of DEHP and other low-molecular orthophthalates, in comparison, is still only 13%.
Besides phthalates, alternatives such as cyclohexanoates (e.g. DINCH), terephthalates, citrates, trimellitates and benzoates have increasingly become established on the market (30% in total). They are used both in sensitive applications, such as children’s toys, food packaging and medical articles, but also increasingly in other consumer applications, such as floor coverings. Whereas DEHP is on the retreat and higher molecular phthalates are prevailing as standard plasticizers, the market share of alternative plasticizers will continue to increase in order to meet the corresponding consumer needs.

**100% Calcium-Zinc Stabilization.** The trend towards Ca-Zn systems in PVC stabilization has continued. After cadmium-containing stabilizer systems have for some time no longer been used in the EU, the complete elimination of lead-based stabilizers was achieved last year (source: ESPA/VinylPlus). Here, the associations of the European manufacturers of stabilizers (ESPA) and PVC processors (EuPC sector groups) had committed themselves to a complete elimination by the end of 2015 as part of the voluntary commitments Vinyl 2010 and VinylPlus. The use of formerly lead-stabilized recyclates (see below) is exempted from this.

**More PVC Recycling.** The Vinyl-Plus (www.vinylplus.eu) sustainability program was successfully continued. In 2015, almost 515,000 t of PVC could thus be recycled as part of the voluntary commitment. About 40% of this is plasticized PVC (source: VinylPlus). To continue recycling at a high level, and extend it further, legislators are required to sustainably enable recycling of the additives formerly used (“legacy additives”), such as cadmium and lead stabilizers, through appropriate regulations.

**More Membrane Processes.** The changeover of chlorine production in the EU from mercury to the energy efficient and environmentally friendly membrane process, which was driven by members of the European chemical association Euro Chlor as part of their voluntary commitment, has gained a further boost with the publication of the BAT (best available technique) Conclusions for the Production of Chlor-alkali by the EU Commission. By the end of 2014, the market share of the mercury process in Europe has declined to below 23% (source: Euro Chlor). The BAT Conclusions demand the elimination of mercury technology by the end of 2017.
Market Forecasts

The global growth of PVC demand has not yet entirely recovered its former strength. However, the upward trend is unbroken, and growth of the order of 3.5% per year, analogous to the change of the global GDP, is expected from 2016 to 2020 – with significant regional differences. In the emerging market economies India and Southeast Asia, above-average PVC growth (5 to 6%) is expected, while North and South America (2.5%), Western Europe and CIS (1 to 1.5%) will only increase at a below average rate. Central Europe, the Middle East and Northeast Asia represent the global average (source: IHS Chemical/Vinnolit).

The significant drivers for the (regionally different) growth of PVC demand are demographic factors, growth of the world population, on the one hand, and aging or decline of the population in the developed markets on the other. In addition, there is continuing globalization with a growing global middle class and higher demands and living standards (per capita consumption), increasing urbanization with the associated infrastructure demand, and a more sustainable resource management and changing consumer behavior. Here, PVC is well positioned as a resource-efficient, durable, safe and recyclable material.

The crucial factor for continued development in the European Economic Area is the further development of the construction sector. About 70% of PVC consumption is dependent on this industry. It is questionable whether the level of PVC demand of 2007 in the EEA will be reached again so quickly, or whether this will be prevented by structural effects. The transfer of processing capacities from Western to Eastern Europe that has been seen in the past will lead to an even more rapid decline in the export of semifinished and finished products to these regions than before.

After the major changes among Western European PVC raw materials manufacturers that have taken place in recent years (see above) the consolidation pressure at the supply side has eased significantly in recent times. Here, the signs for the near future point to integration, creation of synergies and internal optimization of the business model. A major financial challenge for some manufacturers remains the legally required speed up in conversion to the membrane process by the end of 2017. With the exception of the expansion of paste PVC announced by Vestolit (+40 kt), there are no additional capacities currently in the pipeline.

PVC is increasingly globally marketed. Global (net) PVC trade will grow by 36% from 2015 to 2020 to 6.4 million t per annum (source: IHS Chemical). North America and Northeast Asia will profit from this. A lower oil price has relieved the situation with raw materials prices, and thereby improved the competitiveness of the European suppliers. Nevertheless, shale-gas-based manufacture of PVC will remain the most favorable route. In the medium term, it is also expected that the shale-gas bonus of the North American PVC manufacturers will increase again in the form of lower energy and raw materials prices. This will then mainly affect the export business of European manufacturers. Strong signals regarding shale gas are being given by Shintech with investments in PVC (planned: +300kt in 2016/17) and the construction of an ethane cracker (completion in 2018) in Addis and Plaquemine, LA/USA, as well as Lotte/Axiall with their ethane cracker joint venture in Lake Charles, LA/USA, projected for 2019. Westlake, in turn, is expanding its ethane cracker in Lake Charles in 2016, and in Calvert City, KY/USA, in 2017. Ineos is focusing strongly on shale gas and, since this year, has been shipping ethane from the Marcellus field in the northeastern USA with special liquid gas tanker ships to its European ethane crackers. Ineos is additionally investing in the exploration of shale gas in the UK.

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