Structural Change in the Polyester Industry

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In the past 20 years, the techniques for the manufacturing and processing of polyester have developed as dynamically as the market itself has been. The capacity in polyester manufacturing using the traditional vacuum polycondensation process aims now foe 800 t/d, it has thereby reached its physical limits according to present technology. In solid phase condensation the capacities of around 400-600 t/d/line are coming to a point where growth is limited too.

The new DuPont NG3 process, at present only demonstrated in a pilot plant is only destined for bottle chips or for general granulate production., offers future potential for capacity development. Some process steps, such as granulation or SSP will remain limited to there present capacity level and, with a line capacity of, for example, 1000 t/d, will need to be set up in parallel operation.

In fiber production, plants with 200 t/d per line will become standard. In the spinning of POY, the use of additives (Teijin, Zimmer-AG, Inventa-Fischer, Acordis) and the intelligent design of the thread take-off (EVOSPEED of DuPont / Barmag) will allow for take-up speeds of between *4,500* and 5,000

m/min. The fully automatic transport, testing, packing and sending of the POY bobbins will only become lucrative if a considerable increase in the spinning speed with, at the same time, a continued maximum yarn breakage of<< 0.5 per ton and a long service lift of the spinnerets arc achieved.

With the new NG3 process on the one hand and the geometrical and capacity limits of the direct spinning plants on the other, it may be that filament yarns will begin be spun more in extrusion plants. The general low product temperature of the NG3 process and the removal of the volatile degradation products and oligomers, make it possible to achieve a degree of purity in thus manufactured polyester, that makes it extremely interesting for the spinning process. Very high qualities can be achieved in

compact extruder spinning mills, due to the very short melting time. The high degree of flexibility is another important factor in favor of granulate spinning.

The manufacturing of preforms is on a very high level, due to the perform machines with 96 cavities per tool and the process optimizations (e.g. the double tool by HUSKY) introduced in die past few years. The direct processing of the PET granulate from SSP into performs using the solid phase condensation process, is a further step towards rationalization. Some preform manufacturers are already working with this technology. The question does remain however, who will venture to take the first step towards direct performing. This process causes a build up of viscosity and de-aldehydisation during die melt phase. Just as during the introduction of direct spinning 25 years ago the move towards chemical process technology in perform production is still considered as being something to be wary of. The increasing number oh patent publications is, however, a sure sign that things arc beginning to change.

The question is, how the polyester industry‘s planning targets will change when the growth phase moves into a ripening phase. One thing is certain und that is that today, much more than five years ago, rationalized production with the lowest costs, high quality yields and flexibility are the basis for long-term survival. The key-points of development have therefore already been determined.

If one has kept up with patent literature in the field of polyester over the past 20 years, it can be seen that especially over the past two years, the number of patent applications concerning core processes of the polyester industry has dropped considerably. At present, numerous patent applications concern themselves with the improvement of the barrier characteristics of PET, the manufacturing und processing of PTT und the development of antimony-free catalysts. Most oh the patent applications come from Japan. In scientific literature the drop of the number of publications is even more noticeable. The reasons for this might be, on the one hand, the large number of ownership changes und the reduction in R&D as a connected effect. On the other hand it can be seen as an objective sign that the changeover from the growth phase to the ripening phase is already under way. It is interesting to note that scientific publications to date come mainly from Asia, mainly from Japan, Korea, China and Taiwan. It is of interest to the polymer chemist that polyesters used in toner for the electro photography, biologically decomposable

polyesters und PLA are going through a period of high expansion.

Important goals in large-scale technical process development are still awaiting realization. In particular the process Integration OIL - p-xylene - PTA/EG - PET - fiber/bottle/film will play an important role in die next ten years with regards to earnings The continued bonding oft he polymer prices to the prices of raw materials means that the vertical integration is an important prerequisite for the long term economic success of the polyester manufacturers. Coupled to this is the growth in size of the various plant locations and companies, die most economically advantageous size in this vertical integration will be with a production capacity of 1000 t./d and above per location. A pronounced concentration of the polymer industry in locations directly at die site of the oil fields or that of refineries will be a result these developments.

For process technicians and engineers this means most of all that the intersection points between die various processes must be examined with a view to cost-saving couplings. One idea might be to put PTA paste and slurry preparation together or esterification in PTA manufacturing. Another issue to think about might be the direct conversion of ethylene oxide and PTA. The number of process steps can thereby be reduced, transport and conveyance can be minimized considerably.

The growth in capacity of the various plants needs especially a consequent use of active process simulation which supports process controls and optimizes the operation of large-scale plants.

Another key-point is the change in chemical process controlling from wet-chemical, traditional laboratories to automatic on-line analysis. The idle time for sample taking, laboratory analysis and manual evaluation are simply no longer viable in plants with a daily capacity of 400 t and above. The enormous risk of possible low qualities in plants of this size is the motor of development for on-line analysis.

An important share in the dynamic development of the polyester industry in the last 20 years has been machine and plant engineering in Europe, USA and Japan.

With the growth in capacity of the individual plants, the market for plant engineering will become even more fought over. The annual growth in production of polyester

that has been conservatively estimated at 6% or 1 .5 million tons PET is equivalent to approx. ten new plants of 400 t/d or seven plants with 600 t/d. Going from the estimation that plant size will increase to between 800 and 1000 t/d during the next ten years, this will mean four or five new plants annually by the end of this decade.

With the declining number of new units to be built per annum the market for services will grow considerably, this is caused by the increase of the number of companies that only produce polyester products and have no R&D of their own, by the aging process of the plants that exist at present, and by the continued trend towards outsourcing.

One prognosis for 2010 might be for 35 - 40 million tons of polyester to be produced and processed per year worldwide.