PERP Program - Polypropylene

February 2008

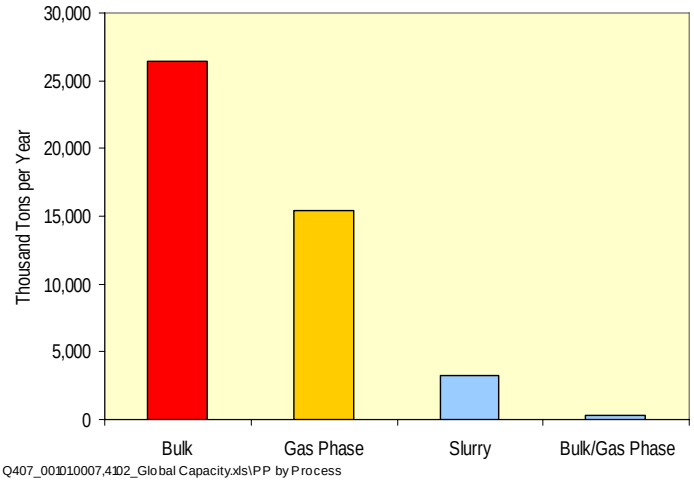
Nexant's *ChemSystems* Process Evaluation/Research Planning program has published a new report, ***Polypropylene (06/07-2)***. To view the table of contents or order this report, please click on the link below: http://www.chemsystems.com/reports/index.cfm?catID=2

Introduction

The polypropylene technology market is one of the most competitive, with the number of technology providers in double figures. Technology developers continue to push the product performance envelope, with companies extending performance in a wide range of applications. Two of the areas of greatest activity are in heterophasic or impact copolymers and in metallocene-catalyzed resins. The objective of the impact copolymer developments is to improve the stiffness/impact strength balance.

The high performance of the leading technologies makes it very difficult to separate the technologies on a performance basis, particularly in the less differentiated homopolymer market. The possible over supply of technology raises the question of the sustainability of all the currently offered technologies in the longer term. The installed capacity by process technology is broken down in the report and it is notable that the top four technologies account for 65 percent of the market. In addition, the once dominant slurry process now accounts for only 7 percent of capacity, while bulk processes account for more than 58 percent of capacity, as shown in Figure 1.

Figure 1
Installed Polypropylene Capacity by Process
(2006)



Over the next decade, feedstock issues are likely to influence the shape and direction of the polypropylene business. With polypropylene growing faster than polyethylene, the demand for propylene is set to rise ahead of that of ethylene, yet since much of the propylene supply is linked to ethylene production in steam crackers, propylene supply is not expected to keep pace with polypropylene growth. Conventional economics would suggest that propylene price is likely to rise compared to ethylene price, and similarly the polyethylene to polypropylene price differential would narrow. Also, the location of future polypropylene plants is likely to be influenced as much by feedstock availability as market demand for product.

The strong demand for polypropylene will assure the need for new build in the industry and with it demand for technology licenses. Globalization in end user markets such as the automotive sector results in pressures on suppliers to match the geographic requirements of clients and offer the capability to supply the same specification resin at multiple locations on different continents. The likely outcome of developments of this nature is increasing standardization of technology platform for global producers, which is likely in turn to exaggerate the performance difference, in terms of licenses sold, between the more successful technologies and the less successful.

Technology

For technology licensors, cost reduction and product enhancement of their technologies are critical, with numerous technologies competing for each new plant. In an effort to reduce unit operating costs, technology licensors have continued to increase reactor capacity, with most licensors offering single-line capacities of at least 300 thousand tons (661 million pounds) per year. The largest single-line licensed has a capacity of 500 thousand tons (1.1 billion pounds) per year. However, there are some disadvantages to increasing single line capacity, such as grade flexibility (e.g., transition material composition), greater inventory requirements due to less grade flexibility, and product/feedstock logistics (i.e., if the line goes down and production stops, the feedstock plant may be disrupted). In addition, the current technical limitation is governed by the limits of extrusion and pelletizing equipment, which also continues to expand.

For this report, Nexant *ChemSystems* evaluated many state-of-the-art polypropylene processes that are available for license. The evaluation provides:

- Recent developments, highlighting key developments relating to the process technology.
- Background on the technology, including general product capabilities, and a list of licensees, where applicable.
- Process description with simplified flow sheets.
- Investment and cost of production (COP) estimates for a grassroots facility. This is a generic plant constructed by a third party and does not reflect special situations that could result in a lower or higher capital investment. It is generally believed that a licensor can build its own plant for a lower capital cost relative to a third-party company.

The focus of Section 2 is on the various gas phase, bulk, and slurry processes that are well-established, commercially practiced technologies for the production of polypropylene resin, and are generally available for license. The recent developments, background, and process descriptions are covered in this section.

The economic analysis for the technologies is presented in Section 3. The pricing basis and cost of production estimates are included. Estimates for cost of production were developed for homopolymer and impact copolymer polypropylene production. The following processes are included in this analysis (in alphabetical order):

- Borstar
- Horizone
- Hypol II
- Innovene
- Novolen
- Spheripol
- Spherizone
- Sumitomo
- Unipol

Commercial Analysis

United States

After a 10-year period of greater than 7 percent per year growth, U.S. polypropylene demand has grown relatively slowly since 2000. Future growth is forecast at or above GDP. The largest market segment for polypropylene is injection molding, accounting for 59 percent of demand in 2006. This segment is dominated by rigid packaging (cups, containers, caps, closures, crates, totes) and consumer products (housewares, furniture). It also includes transportation/automotive applications and appliances. Growth for injection molding is expected to be average, as more finished and semi-finished goods are imported from Asia. Fiber is the second largest market segment, accounting for 23 percent of demand. This segment includes healthcare/non-wovens, carpet face, and carpet backing. Fiber is a mature market that has exhibited limited growth, but has also been negatively impacted by a slowdown in the housing market and competition from nylon carpets. Film (9 percent) and sheet/other extrusion (7 percent) account for most of the remaining demand. Both of these markets are expected to have higher than average growth, as packaging applications are not as dependent on the economy.

The United States has historically been a large net exporter of polypropylene. This is expected to change over the forecast period as large amounts of capacity will be added in China and the Middle East and very little capacity will be added in the United States, while demand continues to grow.

Operating rates have remained high for a number of years, but are forecast to decrease during the next downturn in 2010/11.

Western Europe

Polypropylene is a versatile polymer that is used in a variety of applications. The largest market segment for polypropylene in Western Europe is injection molding, accounting for 51 percent of demand in 2006. Fiber is the second largest market segment, accounting for 19 percent of demand. Film, with 16 percent, and sheet/other extrusion, with 11 percent, account for most of the remaining demand.

Western Europe has also historically been a large net exporter of polypropylene. As with the United States, this is expected to change over the forecast period as a large amount of capacity will be added in the Middle East and the downstream manufacturing industry continues to grow in Central Europe. In addition, very little capacity will be added in Western Europe, while demand continues to grow.

Asia Pacific

The largest market segment for polypropylene in the Asia Pacific region is injection molding, accounting for 37 percent of demand in 2006. Fiber is the second largest market segment, accounting for 29 percent of demand. Film, with 21 percent, and sheet/other extrusion, with 8 percent, account for most of the remaining demand.

With the large amount of capacity starting up in the Asia Pacific region, net imports are forecast to decrease in the near term. However, strong demand is forecast for the region and despite significant further capacity additions, net imports will increase by the end of the forecast period. Operating rates have remained high for a number of years, but are forecast to decrease somewhat during the next downturn in 2010/11.

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