PERP Program - HDPE
New Report Alert
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Nexant's *ChemSystems* Process Evaluation/Research Planning program has published a new report, ***HDPE (05/06-3)***. To view the table of contents or order this report, please click on the link below:
http://www.chemsystems.com/search/docs/toc/0506_3_toc_r1.pdf

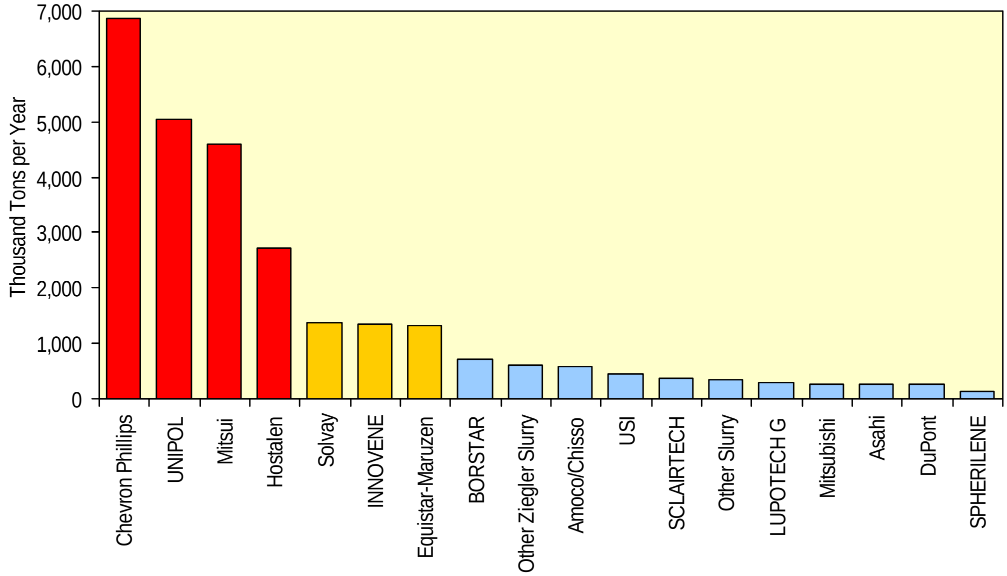
Technology

Polyolefins originated with the invention of low density polyethylene (LDPE) in 1933, and its subsequent commercialization in 1938 using the ICI autoclave process. In the mid-1950's, the first catalytic low pressure polyolefins were produced following the award-winning work of Karl Ziegler and Giulio Natta. The step change in commercial low pressure polyethylene technology came with the development of the chromium-catalyzed Phillips loop process in the mid-1960's, which led to the production of HDPE. The commercialization of the gas phase process by Union Carbide Corporation heralded a decade of new technology developments throughout the 1970's, which saw the introduction of a number of solution, slurry, and gas phase processes. In this period of rapid new developments, there were new bimodal technology introductions, which resulted in improvement of existing technologies, such as Basell's Hostalen and Mitsui's CX high density processes, and in the 1990's, the introduction of competing new bimodal technologies including Borealis' BORSTAR, Basell's SPHERILENE, and Mitsui's EVOLUE processes, as well as metallocene/single-site catalysts (for LLDPE production). Since 2000, the most recent development has been the commercialization of Univation's bimodal UNIPOL process, producing bimodal HDPE in one reactor.

A small number of technologies dominate the HDPE market, as shown in Figure 1. Four technologies (Chevron Phillips, UNIPOL, Mitsui, and Hostalen) accounted for 70 percent of installed capacity in 2005. With the addition of three more technologies (Solvay, gas phase INNOVENE, and Equistar-Maruzen), 85 percent of global capacity is accounted for. The slurry loop and Ziegler slurry processes continue to dominate HDPE production, accounting for 68 percent of installed capacity, as shown in Figure 2. Gas phase plants that produce predominantly HDPE, account for an additional 25 percent of capacity.

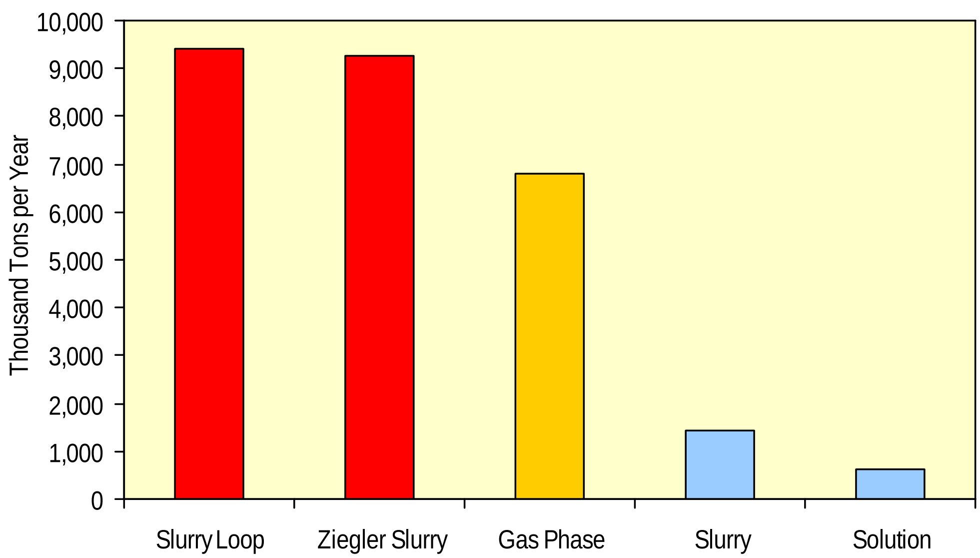
A major development thrust for HDPE has been into bimodal grades for high performance film, pressure pipe, and to a lesser extent blow molding applications. Pressure pipe producers are now pursuing the next pressure rating standard of PE125, with a number of producers well established in

Figure 1
Installed HDPE Capacity by Technology, 2005



q406_00101.0006.4110_HD_Capacity.xls\HDPE by Technology

Figure 2
Installed HDPE Capacity by Process, 2005



Q406_00101.0006.4110_HD_Capacity.xls\HDPE by

the PE100 category. Currently, most commercial bimodal polyethylene is produced in multiple reactor configurations, particularly dual reactor processes, which are optimal for the tailoring of resin
structure. There is an increasing trend to bimodal products, where the combination of better processability without the loss of mechanical strength, permits downgauging, a reduction in product profile or thickness. For film, the same area of film can be made with less polymer, while for pressure pipes, reduced wall thickness reduces raw material requirements and makes more flexible pipe. However, conventional unimodal HDPE will maintain a significant market share. Bimodal HDPE is expected to maintain some price premium in the market, based upon a genuine performance advantage over unimodal material.

Since the early 1990's, metallocene/single-site catalyst developments have dominated advances in polyethylene technology, mainly for LLDPE applications. While traditional HDPE applications are not expected to see significant metallocene penetration in the short-term, there are metallocene-based advances in HDPE. The introduction of dual-site catalysts for the production of single reactor bimodal HDPE may become a significant metallocene application, as dual-site catalyst research has typically focused on at least one metallocene component in the catalyst system.

For this report, Nexant evaluated many state-of-the-art dedicated HDPE and swing HDPE/LLDPE 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 including simplified flow sheets.

The focus on the Technology Assessment section is on the Ziegler slurry, slurry loop, gas phase, and solution processes that are well-established, commercially practiced technologies for the production of HDPE resin and are generally available for license. The recent developments, background, and process description for each technology are covered in this section.

Economics

Investment and cost of production (COP) estimates are 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 pricing basis and cost of production estimates are included. Estimates for cost of production were developed for bimodal film and injection molding grade HDPE resins.

The following cost of production estimates are provided in this report:

Bimodal HDPE Film (300,000 metric tons/yr; USGC; Q1, 2006)

- Unipol Prodigy
- Innovene PEs
- Spherilene C
- Borstar
- Hostalen
- Chevron Phillips
- Equistar-Maruzen
- Mitsui CX

Injection Molding HDPE (300,000 metric tons/yr; USGC; Q1, 2006)

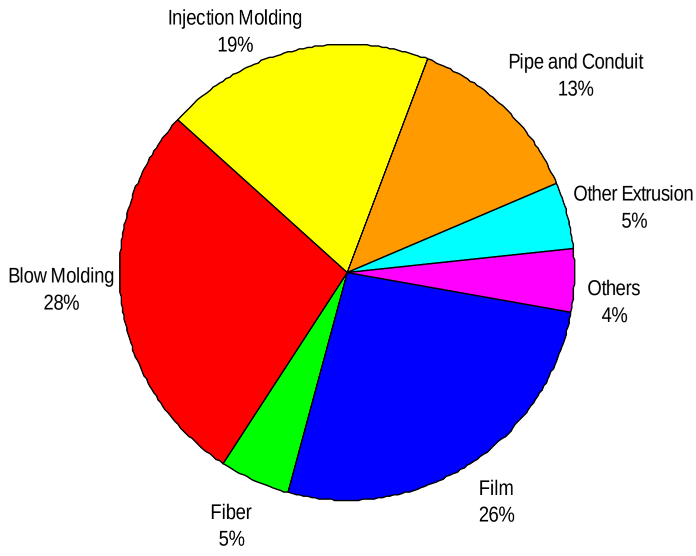
- Unipol
- Spherilene
- Innovene PEg
- Chevron Phillips
- Advance Sclairtech

Commerical Analysis

Global demand for HDPE in 2005 was 28.2 million tons and is projected to reach 30.5 million tons in 2006. Eastern/Central Europe, South America, Asia Pacific, the Middle East, and Africa will have growth rates higher than the global average, with Asia Pacific having the highest growth in terms of volume.

HDPE demand by end use is presented in Figure 3. Blow molding is the largest end use, accounting for 28 percent of total demand in 2005. Film represents the next largest segment with 26 percent market share. Other significant end uses are injection molding (19 percent) and pipe and conduit (13 percent). This pattern is not expected to change significantly over the forecast period.

Figure 3
Global HDPE Demand by End Use, 2005



Current HDPE global capacity is 31.4 million tons per year. Over the forecast period, capacity is forecast to grow at an average rate of 5.5 percent per year, including speculative capacity that will be required to account for supply/demand issues. The HDPE production capacity profile will change significantly over the forecast period. North America and Western Europe are forecast to lose share in the global market, while Asia Pacific and the Middle East will increase their shares.

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