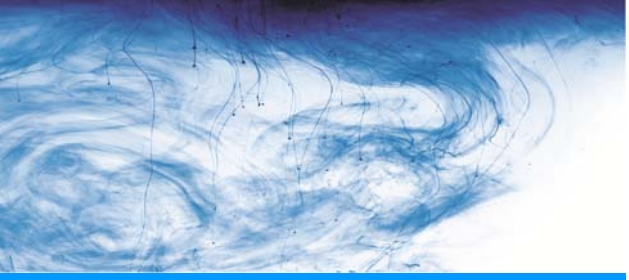

CHEMSYSTEMS
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Report Abstract

PolyOlefins Planning Service (POPS) Technology Review

December 2011

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www.chemsystems.com

Griffin House, 1st Floor South, 161 Hammersmith Road, London W6 8BS, UK
Tel: +44 20 7950 1600 Fax: +44 20 7950 1550

Nexant, Inc. (www.nexant.com) is a leading management consultancy to the global energy, chemical, and related industries. For over 38 years, ChemSystems has helped clients increase business value through assistance in all aspects of business strategy, including business intelligence, project feasibility and implementation, operational improvement, portfolio planning, and growth through M&A activities. Nexant has its main offices in San Francisco (California), White Plains (New York), and London (UK), and satellite offices worldwide.

Nexant's Petrochemical Market Dynamic, Styrenics report investigates the market and growth profile of styrenics, and details the expected plant developments and changes in global trade patterns. The reports are published as part of ChemSystems / Petroleum and Petrochemical Economics Programme (PPE). Subscriptions to the programme are available from www.chemsystems.com. For further details or to request a sample copy, please email chemsystems@nexant.com.

GLOBAL POLYOLEFINS TECHNOLOGY REVIEW

Nexant's POPS technology review comes at a time when the industry has been impacted by a number of plant closures that have occurred simultaneously with new capacity start-ups. In addition, despite the on-going development and promotion of high-performance resins, the industry is becoming increasingly commoditized, with purchasing decisions made on the basis of costs. Production economics for polyolefins show notable disparities both within and between regions, all of which influence market behavior, investment, and consolidation.

As the industry attempts to deal with these major challenges, it becomes more important than ever for companies to have a clear strategic view of the latest polyolefins technology options and opportunities. These technology developments continue to redefine state-of-the-art products and processes throughout the industry.

At this stage, companies are primarily focused on cost reduction and commercialization of new technologies and products. Technology continues to be a strategic differentiation as companies jockey for a leadership position. These dynamics, coupled with the industry's continued competitive pressures, have heightened the competition between technology holders and producers. As a result, companies need a better understanding of the global landscape as a prerequisite for understanding their own technical and commercial positions.

One key development over the last few years has been the dramatic increase in single-line capacity size. 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 400 thousand tons (882 million pounds) per year for polyethylene and polypropylene.

However, there are disadvantages to increasing single line capacity, such as problems managing grade flexibility (e.g., transition material quantity), greater inventory requirements, and product/feedstock logistics (i.e., if the line goes down and production stops, the feedstock plant may be disrupted). In addition the optimum plant size in a given market may not necessarily be the largest single-line capacity, although this of lesser importance in highly advantaged export regions.

While the investment cost per ton of product typically reduces with increased capacity, there may also be higher operating costs (caused for instance by increased catalyst costs due to shorter reactor residence time). In addition, the number and variety of grades to be produced will also affect the optimal size. Since a larger reactor will result in more transition material than a smaller reactor, inventory management becomes more problematic at larger scales. Also, the maximum single reactor line capacity for some licensors is larger than the single-line extruder capacity, resulting in the need for parallel pelletizing lines. The current technical limitation for true single-line capacity for both polyethylene and polypropylene is governed by this limitation on extrusion and pelletizing equipment sizing.

In addition to on-going process improvement, there are other key technology issues facing the industry—such as industry consolidation, which has reduced the number of third-party licenses available, while increased plant scale has also reduced the number of individual licenses that

need granting in any given period (despite an increase in the number of technologies available for license).

The *POPS 2011 Technology Review* presents Nexant's analysis of developments in polyolefin technology and how these changes are likely to affect the polyolefins business. It addresses the fundamental drivers of technology development, including:

- **Product development**—resins for new applications, product substitution and application specific improvements
- **Process technology**—impact of increasing plant scale and the evolution of new technologies
- **Process chemistry**—focuses on new catalysts, modified formulation and increased yields
- **Other issues**—such as trends in technology licensing and impact of steel pricing

Nexant's polyolefins technology review is essential reading for companies concerned with their competitive situation. The analysis includes technology-by-technology benchmarking, plus descriptions of the latest enhancements and developments in each technology. Each major licensor has been encouraged to review and update its information, and every technology profile has been revised with the most recent information and data publicly available.

Report Availability

The report ***PolyOlefins Planning Service (POPS) 2011 Technology Review*** is published by Nexant as part of its ChemSystems POPS program. Subscriptions or single copies of the report are available from www.chemsystems.com

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