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PERP Report 2016S6: Polystyrene

“Polystyrene” is one in a series of reports published as part of the 2016 Process Evaluation/Research Planning (PERP) Program.

Report Overview

Polystyrene, formed by the polymerization of styrene monomer, is produced in three main grades, General Purpose Polystyrene (GPPS), High Impact Polystyrene (HIPS) and Expandable Polystyrene (EPS). GPPS/HIPS markets have modest growth and are considered mature, with main applications in packaging and electronics/electrical sectors. Both GPPS and HIPS have experienced competitive pressure from material substitution with alternative polymers as well as price sensitivity for end uses. EPS markets have shown strong growth and rapid development, with main applications in the construction and packaging sectors.

This PERP report provides an overview of the industry structure, technology holders, commercial and developing technologies, process economics and markets for GPPS, HIPS and EPS. The following issues are addressed in the report:

- What are the major features of the processes for the production of GPPS, HIPS and EPS?
- Which technology holders offer their technology for license and how do their processes differ?
- How do the process economics compare for the different polystyrene grades across different geographic regions?
- What are the current market environments for GPPS/HIPS and EPS? What will the expected global consumption be in 2020 and which regions will have the highest growth?

Commercial Technologies

Polystyrene manufacture has a considerable history, and now is considered to have a mature technology. BASF and Dow were pioneers of polystyrene technology before numerous other companies developed their own processes. Today the largest global producers include INEOS, Loyal Chemical, Total Petrochemicals, Xingda Group and Trinseo (formerly Dow). Several commercial producers are known to grant licenses, although the majority appears to use in-house technology.

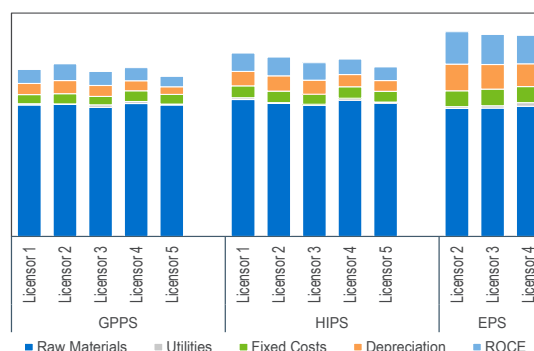
GPPS and HIPS are commercially produced by continuous mass polymerization of styrene. Typical stages of this process include pre-polymerization, polymerization and devolatilization before the final processing of the polymer. For HIPS an additional stage is required to prepare a solution of rubber, which will be combined with polystyrene during the polymerization process.

EPS is commercially produced by either a batch suspension process or a continuous mass polymerization process. The manufacture of EPS requires the addition of a blowing agent, either as the beads are formed in the suspension process or after the polymer melt has left the devolatilizer in the continuous process.

Process Economics

Detailed cost of production estimates for conventional GPPS, HIPS and EPS technologies are presented for the USGC, Western Europe and China. A comparison between offerings from major licensors provides insights into the advantages and disadvantages of each technology.

COMPARATIVE COST OF PRODUCTION OF GPPS, HIPS AND EPS



Commercial Market Review

Global consumption for GPPS/HIPS in 2015 reached almost 10.4 million tons, driven by electronic/electrical and packaging applications. Global consumption for EPS in 2015 exceeded 6.3 million tons, driven by applications in the construction and packaging sectors. This PERP report provides an overview of the supply and demand of GPPS/HIPS and EPS on both a global and regional basis, and includes a capacity listing for each region.

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