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## PERP Report 2016S6: Isoprene Derivatives

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

### Report Overview

Isoprene is an important intermediate that is primarily consumed in the production of three polymers: polyisoprene (also known as isoprene rubber), styrene block copolymer (SBC) and butyl rubber (also known as isobutylene-isoprene rubber). Polyisoprene (IR), which is similar in structure and properties to natural rubber, is mainly used in tire production. SBC, specifically the styrene-isoprene-styrene (SIS) and styrene-ethylene/propylene-styrene (SEPS) copolymers, are mainly used in the manufacture of pressure-sensitive adhesives and coatings. Butyl rubber (IIR) has major applications in the inner tubes and inner liners of tires.

The commercial technologies for all three isoprene derivatives are mature and well established. The chemistry for producing these polymers is well understood and developments on catalyst performance are fairly advanced. These polymers are relatively resistant to substitution by other synthetic rubber/plastics due to their unique properties. However, feedstock availability is one of the primary considerations for new entrants into the industry.

This PERP report provides an overview of the commercial technologies, process economics and markets for polyisoprene, SIS/SEPS and butyl rubber. The following issues are addressed in the report:

- What are the commercial production routes for polyisoprene, SIS/SEPS and butyl rubber?
- How competitive are the different production routes for the new entrants from a production economics standpoint?
- What is the current market environment for the isoprene derivatives?
- How is the capacity of the isoprene derivatives distributed in major regions of the world today?

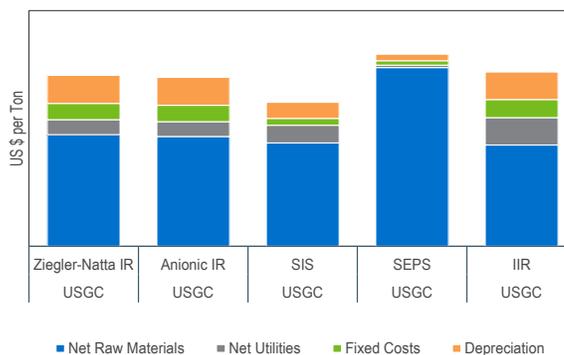
### Commercial and Developing Technologies

Polyisoprene is produced through two commercial routes: coordination polymerization (also known as Ziegler-Natta polymerization) and anionic polymerization. The majority of polyisoprene is produced through the coordination polymerization route as it provides the most flexible stereospecific configuration of the resulting polymer. SIS is produced by a two-stage anionic polymerization of styrene and isoprene through a semi-batch operation. SEPS is the hydrogenated form of SIS. Butyl rubber is commercially produced by the cationic polymerization of isobutylene and isoprene, in a process that resembles the production of polyisobutylene in many aspects. Butyl rubber typically contains only 0.5 to three weight percent of isoprene.

### Process Economics

Detailed cost of production estimates for commercial polyisoprene, SBC and butyl rubber technologies are presented in the report. A comparative analysis of the cost of production in different regions is also included.

#### COMPARATIVE COST OF PRODUCTION OF ISOPRENE DERIVATIVES



### Commercial Market Review

Global polyisoprene demand was approximately 622 000 tons in 2016, with around 74 percent consumed in tire-related applications. SBC demand was estimated at around 2 million tons in 2016, with around 68 percent consumed in bitumen modification and footwear. Butyl rubber demand was around 1.3 million tons in 2016, with over 85 percent consumed in tire-related products. This PERP report provides an overview of the supply, demand, and trade of all three isoprene derivatives on both a global and regional basis, and includes capacity listings for each region.

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