

Licensed Polyolefin Technologies and Services

Spheripol

Leading polypropylene process technology for the production of homopolymers, random and heterophasic copolymers

www.lyondellbasell.com/technology



With over 100 licensed lines around the globe, LyondellBasell has pioneered the *Spheripol* polypropylene process, which represents over 40 years of continuous commitment to innovative polypropylene technology development.

More companies use the *Spheripol* technology than the technologies of the three closest competitors combined. More than 20 million tonnes of *Spheripol* process capacity has been licensed worldwide, providing licensees with an elegant and economical method to produce a wide range of premium-quality polypropylene grades.

LyondellBasell's development of a third-generation high-yield, high-selectivity catalyst has dramatically simplified the *Spheripol* process steps and significantly improved product quality.

Additional breakthroughs have subsequently occurred in the process design through the refinement of the bulk-polymerization and gas-phase reactors.

The latest-generation *Spheripol* process design utilizes the newest catalysts, enabling the production of market-leading, reactor-based product families with improved properties that reinforce the technology's industry-benchmark status.

Key characteristics of *Spheripol* process technology

Safety and environment

- A safety record among the best in the industry
- Leading resource consumption, monomer efficiency and emissions
- No undesired by-products from the reaction

Product capability and versatility

- Wide range of homopolymers, random copolymers and heterophasic impact and specialty impact copolymers, as well as terpolymers for all polypropylene applications
- Unmatched product quality with minimum property variation due to excellent process stability and catalyst performance

Reliability

- Average overall operability rate is approximately 98% – in an average of 2% downtime, less than 1% is due to process features

Design flexibility

- Single-line capacities, from 40 up to 550 kt/a are available for homopolymer, random copolymer and heterophasic impact copolymer production
- Tailored design for chemical or polymer grade monomer feedstock

Modular flexibility

- Expansion achievable through minor adjustments
- Extension of product range possible through introduction of *Metocene* PP process as an add-on technology
- Flexible modular design facilitates low investment costs

Economics

- Capital costs are competitive with currently available polypropylene processes
- Lowest operating costs of any PP process and high transition efficiency

Spheripol process description

The *Spheripol* process is a modular technology consisting of three main process steps – catalyst and raw material feeding, polymerization and finishing. The catalyst, liquid propylene and hydrogen for molecular weight control are continuously fed into the loop reactor. The bulk polymerization typically occurs in two tubular loop reactors filled with liquid propylene and optional gas-phase copolymerization reactors. Reduced reactor residence time and economically optimized equipment sizing can be achieved relative to other technologies, due to the high monomer density and increased catalyst activity.

The finishing section consists of highly efficient liquid propylene vaporization operations at very high polypropylene concentrations, separation of the unconverted monomers, and complete recycling of the monomers back to the reactor.

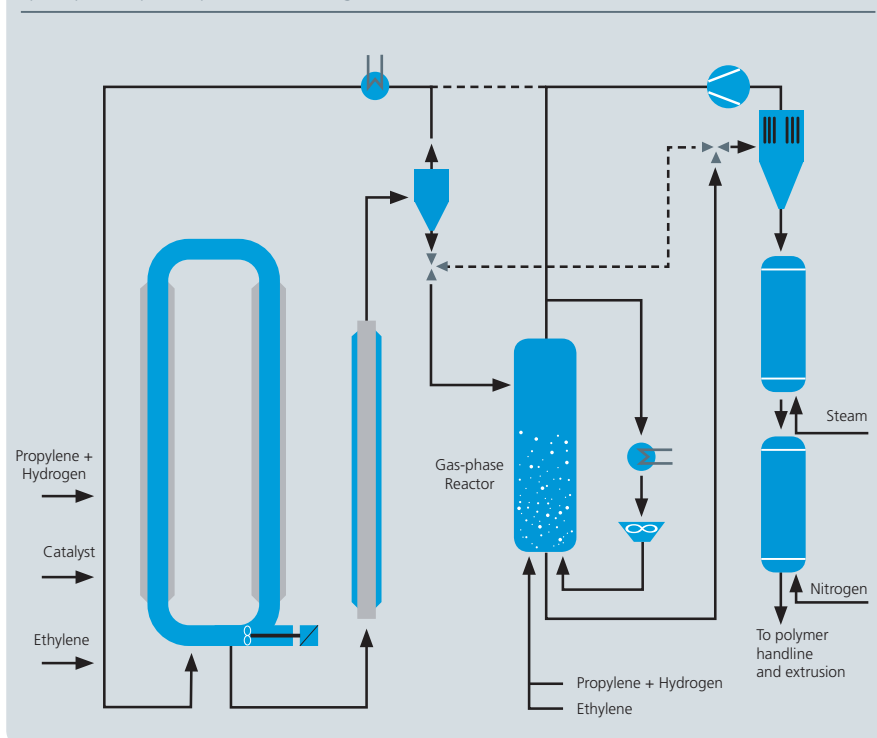
A leading advantage of the *Spheripol* process, in combination with *Avant* catalysts, is its unique ability to produce polymer spheres directly in the reactor. Spherical polypropylene provides superior process reliability and best in class operability, in contrast to the processability of small, irregularly shaped, granular polymer particles produced by other technologies.

Spheripol process – Capabilities and product properties

The *Spheripol* technology produces a complete portfolio for use in the full range of polypropylene applications. Many *Spheripol* process resins are recognized as industry-leading products in many application areas.

Spheripol polypropylene homopolymers range from grades with a fractional melt flow rate for pipe and sheet extrusion applications to very high flow specialty grades for melt blown applications. The comprehensive product portfolio includes a vast number of tailor-made products for a variety of film and fiber applications.

Spheripol simplified process flow diagram



Spheripol polypropylene random copolymers are characterized by excellent optical properties and extremely low catalyst residues. The product portfolio also includes specialty grades for pressure pipe applications and copolymers with very low seal initiation temperatures.

Spheripol polypropylene heterophasic copolymers have outstanding low-temperature impact strength. The product portfolio includes a broad range of grades for specialty applications such as pipes and automotive bumpers, and reactor-grade, high-flow heterophasic copolymers for thin-wall injection molding applications.

LyondellBasell is one of the world's largest plastics, chemical, and refining companies. The company manufactures products at 59 sites in 18 countries. LyondellBasell products and technologies are used to make items that improve the quality of life for people around the world including packaging, electronics, automotive parts, home furnishings, construction materials and biofuels. More information about LyondellBasell can be found at www.lyondellbasell.com

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