

Licensed Polyolefin Technologies and Services

Spherilene

Flexible gas-phase process technology for the production of the entire range of polyethylene products

www.lyondellbasell.com/technology



Spherilene process plant – LyondellBasell, Wesseling, Germany

The *Spherilene* technology from LyondellBasell is a fluidized-bed, gas-phase process for the production of the entire density range of polyethylene (PE) products, from linear low density (LLDPE) to medium density (MDPE) and high density (HDPE). The flexibility of this technology, which is demonstrated by an extensive portfolio of grades, enables licensees to effectively manage the continuously dynamic polyethylene markets well into the future.

Simple and efficient process

The combination of extended process flexibility, very competitive capital costs and very low operating costs, especially due to efficient monomer recovery, underscores the attractiveness of this technology for world-scale plants. The proven plant reliability enables the scale-up of the design, based on simple principles, to capacities of up to 600 kt/a.

The extensive *Spherilene* PE portfolio includes HDPE grades (0.940 – 0.965 g/cm³), MDPE grades (0.930 – 0.940 g/cm³) and LLDPE grades (0.918 – 0.930 g/cm³), which have been developed by LyondellBasell and are marketed by the company and a growing number of licensees in all major markets. Products also cover the full range of melt index (190 °C, 2.16 kg) values, from 0.01 g/10min to 100 g/10 min and beyond, as well as monomodal, broad and bimodal molecular weight distributions that ensure good processability in all applications.

Key characteristics of *Spherilene* process technology

Safety and environment

- ▮ A safety record among the best in the industry
- ▮ Minimized hydrocarbon emissions
- ▮ No undesired by-products from the reaction

Process Capabilities

- ▮ Simple process design
- ▮ Best-in-class monomer efficiency
- ▮ Morphologically and kinetically controlled catalysts, providing smooth product flow dynamics
- ▮ High on-stream factors
- ▮ Capacities available up to 600 kt/a

Product capabilities

- ▮ Entire range of products covering the full density range from 0.918 – 0.965 g/cm³
- ▮ Monomodal, broad and bimodal molecular weight distributions covering all market needs
- ▮ Butene, hexene copolymers and terpolymers
- ▮ Broad range of film grades, from LLDPE to HDPE
- ▮ Specialized applications include caps & closures, geomembranes, industrial bulk containers and PE100 pressure pipe

Flexibility

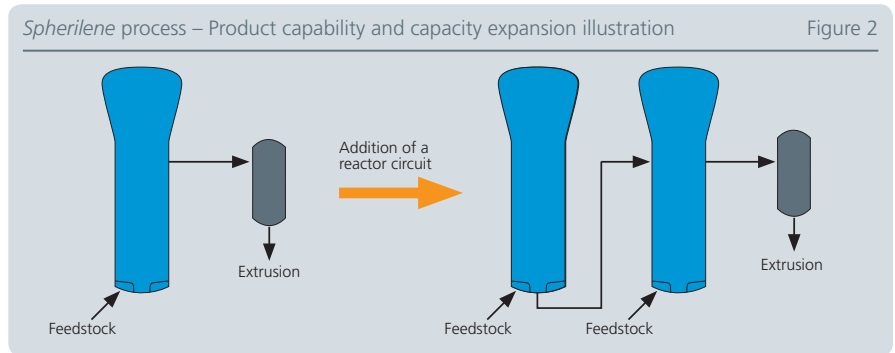
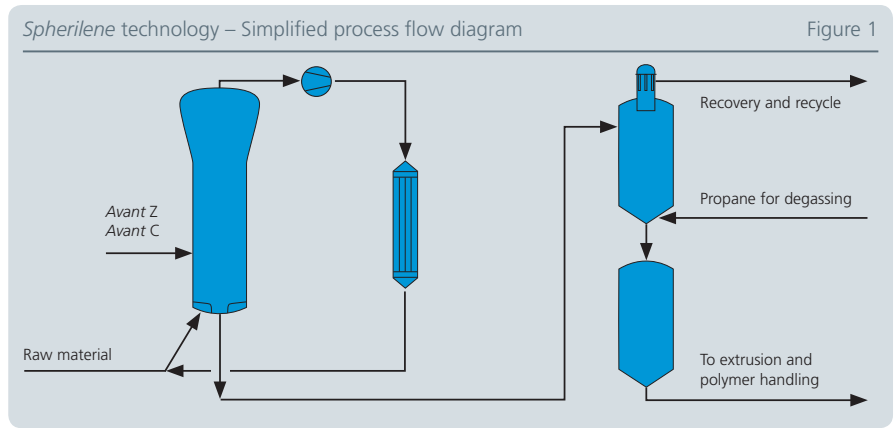
- ▮ Modular design enabling capacity and product capability expansion at low cost
- ▮ Bimodal HDPE grades with gas-phase economics
- ▮ Full range of *Avant* Ziegler and Chromium catalysts

Spherilene process description

The *Spherilene* process, in combination with the consistent performance of *Avant* catalysts, provides excellent operational stability leading to high reliability. A unique reactor outlet system at the base of the reactor enables a highly efficient, continuous withdrawal of product with minimal gas carry-over. Unlike competing technologies that require a seed-bed and associated storage and transfer systems, the reactor in the *Spherilene* process can be started up with *Avant Z* catalysts and do not require a polymer seed-bed.

The *Spherilene* technology has a unique and proven ability to operate with two reactors in series. The second reactor can either be installed at plant construction, or added to a single reactor plant at a later stage to extend product capabilities.

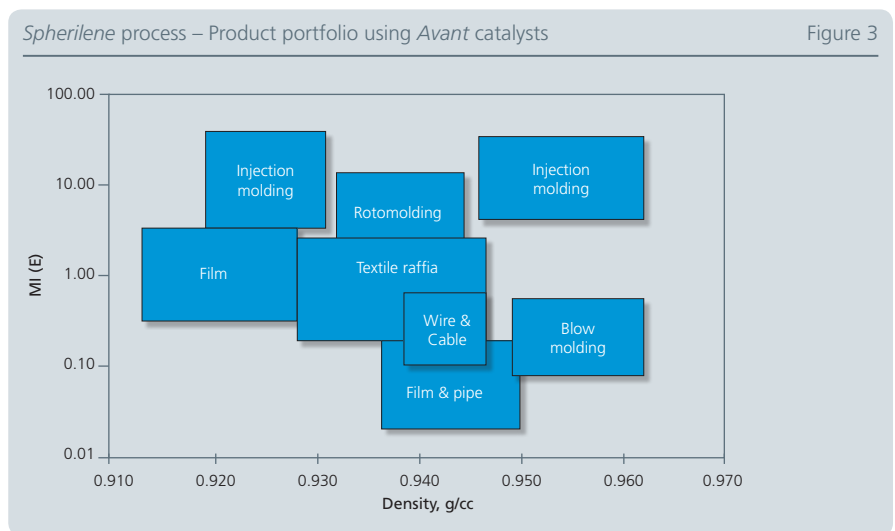
On-stream factors exceeding 96 percent can be achieved with a proprietary, patented static-control technology that virtually eliminates sheeting on the reactor walls.



Spherilene process – Product properties and performance

The standard process configuration for the *Spherilene* technology features a single reactor and recirculation system. This design covers the entire PE density range from 0.918 to 0.965 g/cm³, and a melt index range from 0.01 to 100 g/10 min. Using *Avant Z* Ziegler catalysts and *Avant C* Chromium catalysts, the *Spherilene* process produces monomodal products such as LLDPE for film, HDPE for injection molding, and MDPE for rotomolding and textiles. The HDPE and MDPE produced by the *Spherilene* process cover the full range of grades for blow molding, pipe and film applications.

A plant with dual gas-phase reactors provides access to bimodal HDPE grades for film, blow molding and pressure pipe applications including PE100. The plant also continues to produce high quality monomodal grades by operating the two reactors with identical gas compositions.



Supported by LyondellBasell research & development and technical service experts, the capability and flexibility of the *Spherilene* process ensures that an optimal grade slate is always available. This unique combination provides operators of *Spherilene* plants with the ability to respond to rapidly changing market conditions.

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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