

Polyethylene Terephthalate (PET) technology

An efficient, cost-effective continuous polycondensation process

PET is the most recognized, used and versatile polymer. In the Zimmer® PET process, PET is produced from pure terephthalic acid (PTA) and ethylene glycol (EG). Designed using a three or four-reactor process, the Zimmer technology offers a low process temperature, fewer byproducts and an excellent polymer quality.

Proven technology

Zimmer's track record of working with PET polycondensation plants stretches back more than 60 years. We build plants ranging from small batch facilities for specialty products to single-line plants with capacities of up to 2,000 tons of PET per day for commodities.

Efficient reactors: high reliability at a low cost

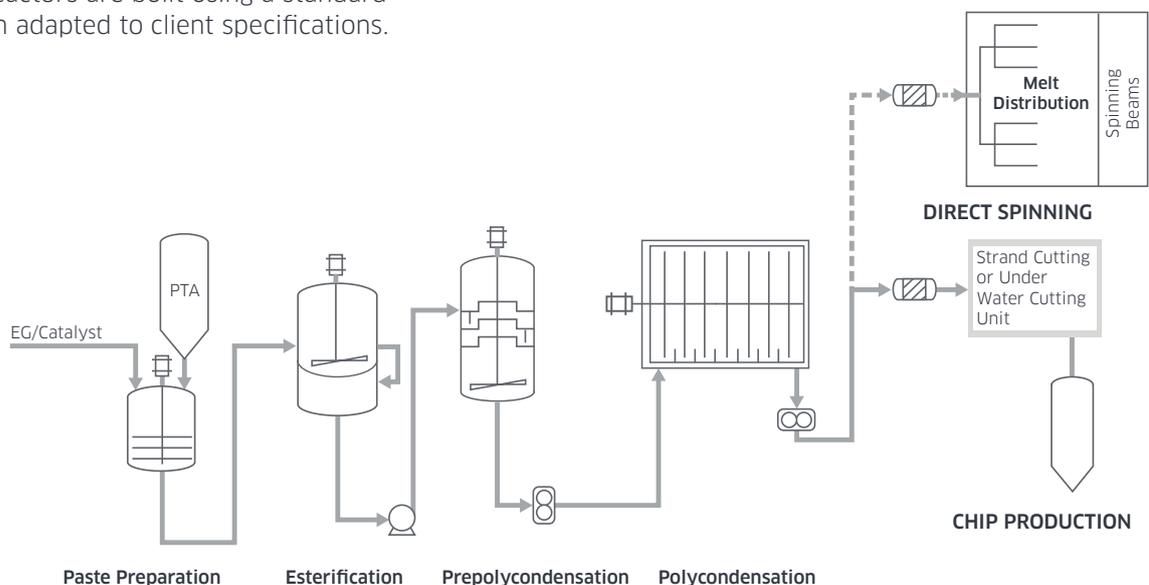
Our proven reactors ensure a long-life time of the plant with low maintenance. The reactors are built using a standard design adapted to client specifications.

The PET production process

In our three-reactor process, PET is produced starting from EG and PTA. The raw materials are esterified in a two-stage reactor while the final reaction step is done in our proprietary Disc Ring Reactor (DRR). Our robust disc ring reactor design is based on decades of experience, in-depth research and development and technological expertise. This proprietary reactor system, available as single- or double-drive, guarantees a smooth and reliable operation with a high viscosity lift and/or large capacities.

Advantages of the Disc Ring Reactor compared to other finisher designs:

- ▶ Higher viscosity lift
- ▶ Lower process temperature
- ▶ Lower thermal stress and product degradation
- ▶ Exceptional availability and reliability



PET for packaging: You have the choice

We offer two processes for producing PET for packaging or film. Our substantial global project experience enables us to help you select the best option for your application.

Direct High Intrinsic (DHI) viscosity – a cost effective process

Years of continuous improvement and development of the PET process have culminated in the DHI process and eliminated the Solid State Polycondensation step. The dealdehydization (DAH) step is integrated with palletization and crystallization to remove the acetaldehydes. By reducing the number of process steps, the DHI process increases yield, resulting in lower energy consumption (utility cost savings), less capital investment, which directly translates to CAPEX and OPEX savings.

Flexible PET Recycling

The production plants can be designed for recycling up to 50 percent PET flake feed. Potential contaminants are effectively reduced below the threshold of regulatory concern of the U.S. Food and Drug Administration.

Standard melt polycondensation with Solid State Polycondensation (SSP)

In the SSP method, amorphous or medium viscosity chips are fed into the SSP plant. Under elevated temperature and residence time, and in a nitrogen atmosphere, the viscosity is increased.

During the SSP process, acetaldehyde is removed and the nitrogen is purified and reused. The resulting resin is dried and can be easily loaded into big bags or containers. Zimmer is well known for having decades of experience and a long track record with this dependable technology.

Crystal SSP

Our latest crystal SSP process combines the traditional PET melt production with latent heat, underwater cutting, thus producing crystallized chips. In crystal SSP the crystallization step of SSP is eliminated from the traditional SSP, resulting in a lower-cost operation. The result is an economical operating SSP process. The Crystal SSP is suitable for debottlenecking traditional SSP processes.

Direct spinning for filament and staple fiber

To achieve economies of scale, the PET melt is pumped directly to the spinning system for filament or staple fiber. Highlights of our direct spinning technology include:

- ▶ Optimized melt pipe distribution system
- ▶ Bottom loading spin packs with quick connection
- ▶ Self-sealing spin packs
- ▶ Closed outside-to-inside quenching for staple fiber
- ▶ Special designed spin finish applicator.

TechnipFMC Zimmer Polymers Technology

We provide technology, engineering, project management and procurement services for polyesters (PET, PBT, PTT, PBS) and polyamide (PA6, PA6.6) production plants. We are focused on our customers' needs. Over the last 60 years, our engineers have worked to enhance our portfolio of well-proven technologies using in-house research and development facilities. This dedication to quality has helped us to build an outstanding track record of placing our technologies in more than 800 plants.

As part of a global network of centers which manages the company's expanding portfolio of onshore process technologies in petrochemicals, refining, hydrogen and syngas, polymers, gas monetization and renewables, we have access to TechnipFMC's leading global engineering, procurement, project management and construction network. TechnipFMC operates in 48 countries around the world with more than 37,000 employees.



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