

# GPPS

General Purpose  
Polystyrene

Proprietary  
process technology



polimeri europa



# POLIMERI EUROPA PRODUCTION TECHNOLOGIES FOR LICENSING

## Licensing

### Proprietary process technologies

#### Phenol and derivatives

PBE-1 Zeolite catalyst based Cumene \*  
Phenol, Acetone, Alkylphenylstyrene \*  
Isopropyl Alcohol Acetone hydrogenation \*  
Isopropyl Alcohol to Cumene \*

PBE-1 Zeolite catalyst

TS-1 Titanium silicalite catalyst based Ammoxidation

#### DMC and derivatives

Dimethylcarbonate

via Carbon Monoxide and Methanol \*

Dimethylcarbonate / Diphenylcarbonate \*

#### Polyethylene

LDPE

HDPE

EVA

#### Styrenics

PBE-1 and PBE-2 Zeolite catalyst based Ethylbenzene

Styrene monomer

GPPS

HIPS

EPS

ABS continuous mass polymerization

SAN

#### Elastomers

e-SBR

s-SBR

SBS / SB / LCBR

Polybutadiene

### Proprietary catalyst technologies

Titanium silicalite

PBE-1 Zeolite

PBE-2 Zeolite

### Polimeri Europa

Polimeri Europa – the petrochemical company of Eni – manages the production and marketing of Basic Chemicals, Polyethylene, Elastomers and Styrenics.

With its 17 production sites throughout Europe and a widespread sales network, Polimeri Europa can present itself to the intermediates, thermoplastic resins and elastomers market as a sound and comprehensive supplier whose key strength is its integration. From raw materials to production plants, from research laboratories to technology, through to the interface with the market which can turn to a single source with the certainty of finding solutions to its requirements not only in terms of products, but also in terms of assistance and service. Thanks to the definition of the e-commerce and the logistic portal express, Polimeri Europa can offer to its customers the opportunity to use their tailored made e-shopping and logistics. Saving time and money.

On the basis of its first hand experience, Polimeri Europa can also license its proprietary production technologies aiming to satisfy the even more specific customers needs.

Polimeri Europa's commitment to quality, improvement and innovation continues, as does its pledge to promote sustainable growth with regard to the community and the environment.

\* Co-licensing in cooperation with Lummus Technology

## NOW AVAILABLE



### Introduction to Polimeri Europa General Purpose Polystyrene process

At the beginning of the 70s, Polimeri Europa (at that time Montedison and then EniChem) began producing general purpose polystyrene (GPPS), using the continuous-mass process. During the following decade, the plant was modified by the introduction of new equipment, designed by its R&D at the Mantova Research Centre.

In 1989 a new unit, acknowledging the improved proprietary technology developed meanwhile by Polimeri Europa R&D, was started up in Belgium.

The main features of Polimeri Europa GPPS process technology are as follows:

- proprietary, accurate process and mechanical design of key equipment (reactor, devolatilizer);
- simple process scheme and easy process control;
- flexible technology allowing tailor-made solutions for specific needs, in terms of plant capacity and products range;
- minimum quantity of foreign materials introduced in the process.

Even though GPPS production technology can be considered to be well consolidated and mature, especially in the last decades the market requirements in terms of quality and environmental impact of GPPS pushed Polimeri Europa R&D to continuously update its technology and product portfolio, by improving its key proprietary equipment and optimising the process cycle. The results of this effort make Edistir® GPPS, with its wide product portfolio, a benchmark within the European scenario.

# TECHNICAL DATA

## Material balance and process economics for typical GPPS unit

Raw materials
Electricity
Fuel gas (10 <sup>4</sup> kcal)
Steam

## Process performance and economics

Assuming 99.9% styrene purity, the typical raw materials and utilities consumptions per metric ton of polymer are reported in table above.

The versatility of Polimeri Europa GPPS technology makes easily possible to provide convenient solution in a broad range of capacities, from 50 to 200 kt/y.

The plant arrangement can be tuned to fit required targets, such as special grades and/or peculiar products range.



*per MT GPPS*

1,005-1,008 kg

65 kWh

15-20 kg

0-50 kg

## Industrial applications

Polimeri Europa GPPS units, based on proprietary technology, are on-stream in Italy (1971, 75 kt/y), and in Belgium (1988, 80 kt/y), making Polimeri Europa one of the major European producer of general purpose polystyrene. One GPPS unit (80 kt/y) licensed by Polimeri Europa is on-stream in Hong Kong since the early 1990s. A second one (50 kt/y) was started up in Brazil in 2000.

## The Edistir® GPPS product portfolio

Polimeri Europa GPPS products are characterized by a very good balance between key properties:

- very low residual monomer and oligomer content;
- low amounts of chemical consumption for the same property balance;
- fine-tuned macromolecular structure (molecular weight and its distribution).

This set of characteristics allows the Edistir® products portfolio to cover even the most challenging fields of application.

### Packaging

- thermoformed and injection-moulded cups and food containers;
- injection-moulded disposable items and cutlery.

### Direct gassing

- insulation panels (XPS);
- expanded trays.

### Others

- injection moulding of CD boxes, house wares, medical articles and toys;
- injection moulding of refrigerator clear internal components;
- extrusion of clear panels and shower boxes;
- oriented and bi-axially oriented extruded films.

# Process description

The Polimeri Europa GPPS technology is based on a continuous mass peroxide-initiated polymerisation of styrene.

The monomer is added with chemicals in a mixing section. The mass reaction occurs in the presence of solvent. This mixture is thus fed to the polymerisation section, generally composed by a sequence of 2 continuously stirred tank reactors (CSTRs), where the reaction heat is removed by evaporation of the volatile matter.

Different reaction section arrangements are also available, in order to meet specific customer requirements.

At the end of the reaction train, the polymer solution is sent to a devolatilizing section, under vacuum conditions, in two stages in series. The monomer and low-boiling compounds are removed from the polymer, which is finally sent to the pelletizing unit. The heat is provided by a diathermic oil system.

The vapour mixture, after condensation, is constantly recycled to the mixing section. Non condensed vapours/inert gases from the vacuum system and liquid organic purge from the condensation section are recovered as fuel in a furnace, where diathermic oil for the process needs is heated.

## Process design advanced features

Even if the process scheme basically calls to mind the most common current technologies, the Polimeri Europa GPPS technology is unique, being provided with the following proprietary advanced design features:

### Polymerization section

Generally, the main items are continuously stirred tank reactors, with optimised design of the stirrer in such a way to ensure the better compromise between thermal control and polymer production rate. By ensuring a good fluidynamic and thermal homogeneity, the Polimeri Europa CSTR reactor provides maximum control of molecular weight growth and distribution.

Raw materials

Process sections

Products

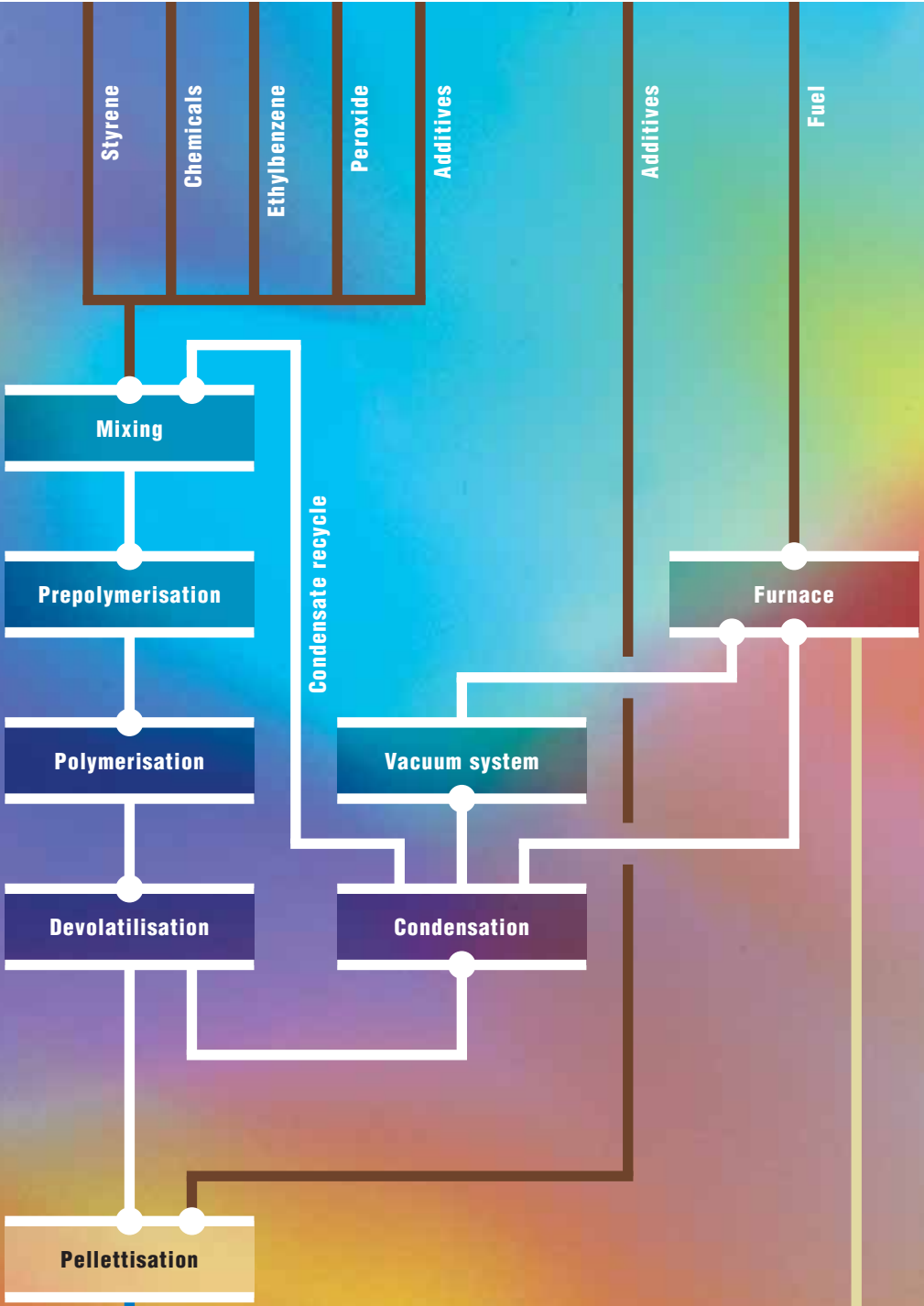
By products

### Devolatilization section

This section involves a two-stage operation, with high heat and mass transfer rates at a very low residence times.

This combination of factors leads to a very efficient monomer and organic matter removal even at relatively low operating temperature (where polymer chain degradation is consequently minimized) and without the addition of water or other stripping agents.

**GPPS**  
General Purpose Polystyrene



**Combustion fumes**

# Polimeri Europa SpA

A subsidiary of Eni SpA  
Sole shareholder company

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Responsible Care



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