NexantECA

Technology and Costs

TECH 2020S1: Thermoplastic Polyolefin Elastomers

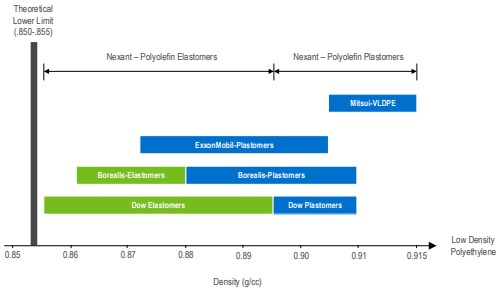
Thermoplastic Polyolefin Elastomers is one in a series of reports published as part of Nexant's 2020 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Up until the 1950s, vulcanized rubber was the primary elastomer available. It was not until the late 1950s that thermoplastic elastomers (TPEs) were developed. TPEs provide modest elastomeric properties, but are melt processable, and can thus be recycled repeatedly and fabricated more rapidly than vulcanized rubber.

Many TPEs are now commercially available, and a number of them utilize olefinic raw materials. These Thermoplastic Polyolefin Elastomers are covered in this report:

- Thermoplastic Olefinic (TPO) materials display a combination of stiffness and elastomeric. For the purposes of this report, an in-situ TPO is defined as a polyolefin material containing between 20 and 35 weight percent ethylene as produced in the reactor, with the ethylene concentrated in an ethylene/propylene rubbery phase; essentially all of the remaining composition is propylene.
- Compounded TPOs are defined as a mixture of an olefinic semi-crystalline thermoplastic (typically polypropylene), and an amorphous elastomer or rubber. The relative proportions of polypropylene and rubber can vary, but compounded TPOs typically contain 20 to 40 weight percent elastomer such as EPDM, EPR, SBS, polyolefin elastomers, or olefin block copolymers
- Thermoplastic Vulcanizates (TPVs) are blends of elastomers, typically 60 to 70 weight percent rubber such as EPDM, dispersed in 30 to 40 weight percent of a thermoplastic matrix, typically polypropylene. Even though the rubber phase has been crosslinked, these products are still true thermoplastic materials.
- Polyolefin Elastomers (POEs) and Polyolefin Plastomers (POPs) based on ethylene typically contain about 65 to 85 percent ethylene and 15 to 35 percent octene-1, hexene-1 or butene-1, whether as a single comonomer or a combination of comonomers. *For the purpose of this report, NexantECA has used the definition of Polyolefin Elastomers as having a density of 0.857 to 0.895 g/cc while Polyolefin Plastomers have a density in the range of 0.895 to 0.915 g/cc as illustrated below.*
- Olefin Block Copolymers (OBCs) are a relatively new category of elastomers, commercialized recently by Dow Chemical. These olefin multi-block copolymers contain polyethylene plus ethylene/alpha olefin copolymer blocks or, if propylene-based, polypropylene plus ethylene/propylene multi block copolymers. The OBCs are characterized by hard and soft blocks with differing properties, either chemical or physical.



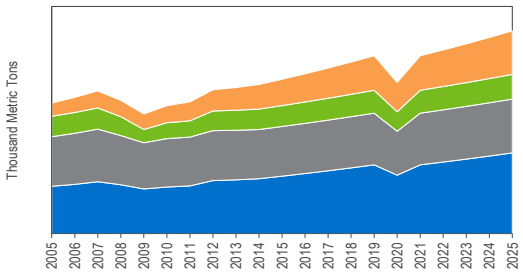
Commercial Technologies and Economics

The economic assessment provided in this report includes:

- **In-Situ TPO** – SPHERIPOL technology facilities in the USGC, Western Europe and Southeast Asia; Grace UNIPOL facility located in the USGC; a BORSTAR facility located in Western Europe, and CATALLOY facilities located in the USGC and Western Europe.
- **Compounded TPO and TPV** – Twin-screw compounding extruder technology facilities modeled for the USGC, Western Europe, and Coastal China.
- **Polyolefin Elastomers, Plastomers, and OBCs** – DOWLEX technology plants for making POEs and POPs have been modelled for USGC, Western Europe and Southeast Asia. A UNIPOL facility in the USGC has been modeled to make a polyolefin plastomer, while a generalized metallocene solution plant to make propylene-based POEs has been modelled for the USGC and Southeast Asia. An OBC facility to make propylene- and ethylene-based OBCs has been modelled for the USGC.

Commercial Overview

Key end-use markets, applications and market trends were developed for the in-situ TPOs, compounded TPOs, TPVs, and POE/POP/OBCs. Global and regional demand patterns for 2005-2025 were developed (shown below for one type of material).



A list of global producers was provided.

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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