



TECH 2018S2: Thermoplastic Polyurethanes (TPUs)

Thermoplastic Polyurethanes (TPUs) is one in a series of reports published as part of Nexant's 2018 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Segmented thermoplastic polyurethanes are two-phase systems, consisting of hard and soft blocks. The crystalline portions of the polymer provide rigidity and strength, while the amorphous phases provide elastomeric properties. Increasing crystallinity increases hardness, stiffness, and load-bearing properties. Without crystalline regions, TPUs would lack elastomeric characteristics and be gum-like materials.

This TECH report provides an updated overview of the technological, economic, and market aspects of TPUs. The following issues are addressed in this report:

- What are the major technologies for TPUs production? How do the technologies differ? Which technologies are available for new entrants?
- How do the process economics compare across line sizes and different geographic regions?
- Who are the top producers of TPUs? What expansion plans have been announced?
- What is the current market environment for TPUs? What are key end-uses?

Commercial Technologies

Early processes for TPU manufacture involved the preparation of a prepolymer, pouring this prepolymer onto a moving belt, then dicing the prepolymer and passing the diced prepolymer through an oven. This process suffered from a number of disadvantages, most notably difficulties in controlling the reaction, problems in product reproducibility and in producing a homogeneous product, high labor costs, and high maintenance costs.

In the 1970s, the "one-shot" process was perfected whereby the three ingredients, plus a catalyst, were fed into a twin screw extruder. The reaction was initiated and completed in the extruder. A twin screw extruder was used with a length to diameter ratio of about 40:1 so as to provide sufficient residence time to complete the reaction. The "one-shot" process is now commonly used in the industry.

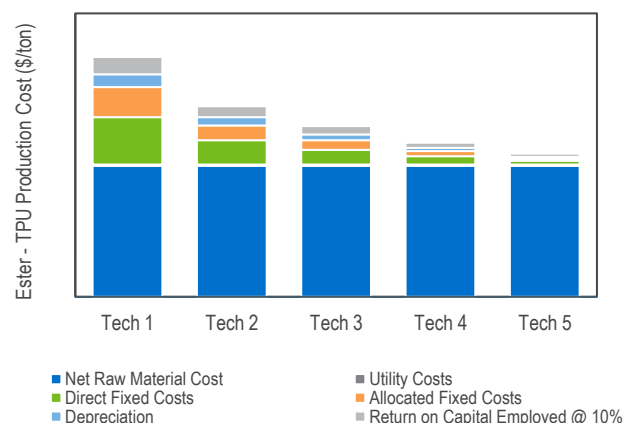
Process Economics

Economics were developed for ether TPUs and ester TPUs for both USGC and Coastal China as produced by five different sizes (screw diameters) of reactive extrusion equipment. These five sizes span the range of extrusion equipment presently in commercial use.

Commercial Overview

China represents the largest TPU consuming region, with demand driven by footwear, automotive industrial and consumer applications. The markets in Europe and North America are generally mature; both of these regions have lost much of their footwear, industrial and consumer goods manufacturing industries to Asia, notably China, over the past 30 years. Footwear will be a key demand driver, especially in Asia. Regional demand and forecasts are provided in this report.

Ester-TPU: Cost Comparison of Twin Screw Reactive Extrusion Equipment





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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program (formerly known as PERP), the Biorenewable Insights program (BI), the Sector Technology Analysis, 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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