PERP Program – New Report Alert

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Chem Systems' Process Evaluation/Research Planning program has published a new report, ***PTMEG/Spandex (01/02S11)***.

Polytetramethylene ether glycol (PTMEG), derived from tetrahydrofuran (THF), is a key ingredient in the production of a variety of elastomeric products, a major component of spandex fibers, and is also used in copolyester ether production.

In recent years processes for production of THF from butane via maleic anhydride, which could lead to wider availability and lower cost for this product, have been developed. Coupled with improved technology, this lowers the cost of producing the polyether glycol and could have a significant effect on the demand for this material.

One of the barriers to the production of PTMEG has been the utilization of fluorine- containing acids (e.g. fluorosulfuric acid, hydrogen fluoride, or boron trifluoride) to catalyze the polymerization of THF. Aside from the high cost of these catalysts, there is the problem of neutralization and disposal of the by-product salts, and the requirement for acid-resistant construction materials.

In Japan, Asahi Chemical has commercialized a technology for PTMEG production, which eliminates the problems cited previously, via the use of a recyclable heteropolyacid as the catalyst. The comparison of this technology with the conventional route is therefore of considerable interest.

The heteropolyacid catalyst can be recovered from the polymerization and recycled, thus eliminating the need to neutralize and dispose of salts as in the fluorsulfuric or other fluoride catalyzed systems. The heteropolyacid is non-volatile and not particularly corrosive. The heteropolyacid leads directly to the polymeric glycol rather than an ester, thus eliminating any discrete hydrolysis step.

Production economics have been estimated for PTMEG. While the economic modeling of the PTMEG processes has been carried out at a historically typical 10kt capacity, the recent trend has seen capacities moving towards a Leader position of 35kt – larger in some cases. This report examines the effect on cash costs of PTMEG that result from running both conventional and Asahi processes at 35kt.

PTMEG constitutes the difunctional glycol component in a variety of polyurethane systems, and is used for the soft flexible block in the production of thermoplastic and thermoset polymer systems - predominantly elastomeric systems, thermoplastic urethane cast elastomers, and RIM (Reaction Injection Molding).

The only polyurethane fibers of commercial importance today are the elastic fibers known collectively as spandex. Spandex fibers are chemically similar to thermoplastic polyurethane

elastomers, in which the soft segments are polyether or polyester chains in the molecular weight range of 1,000 to 3,000, and the hard segments usually consist of substituted polyurethanes and polyureas. They are usually made by a continuous two-stage process using an isocyanate-terminated prepolymer that is chain-extended with a low molecular weight diol, diamine, or hydrazine. Several methods of spinning have been used: dry spinning from solution, reaction spinning, wet spinning, and hot-melt extrusion.

Spandex fiber applications have experienced tremendous growth in recent years. Traditional applications are supportive clothing such as belts, women's lingerie, and surgical stockings. Apparel trends have changed, and spandex is sought after for use in garments such as swimwear, sports wear (i.e. cycling outfits, and football uniforms), and dance wear/body wear. Spandex is expected to further penetrate the textile market as a blend with other synthetic and natural fibers.

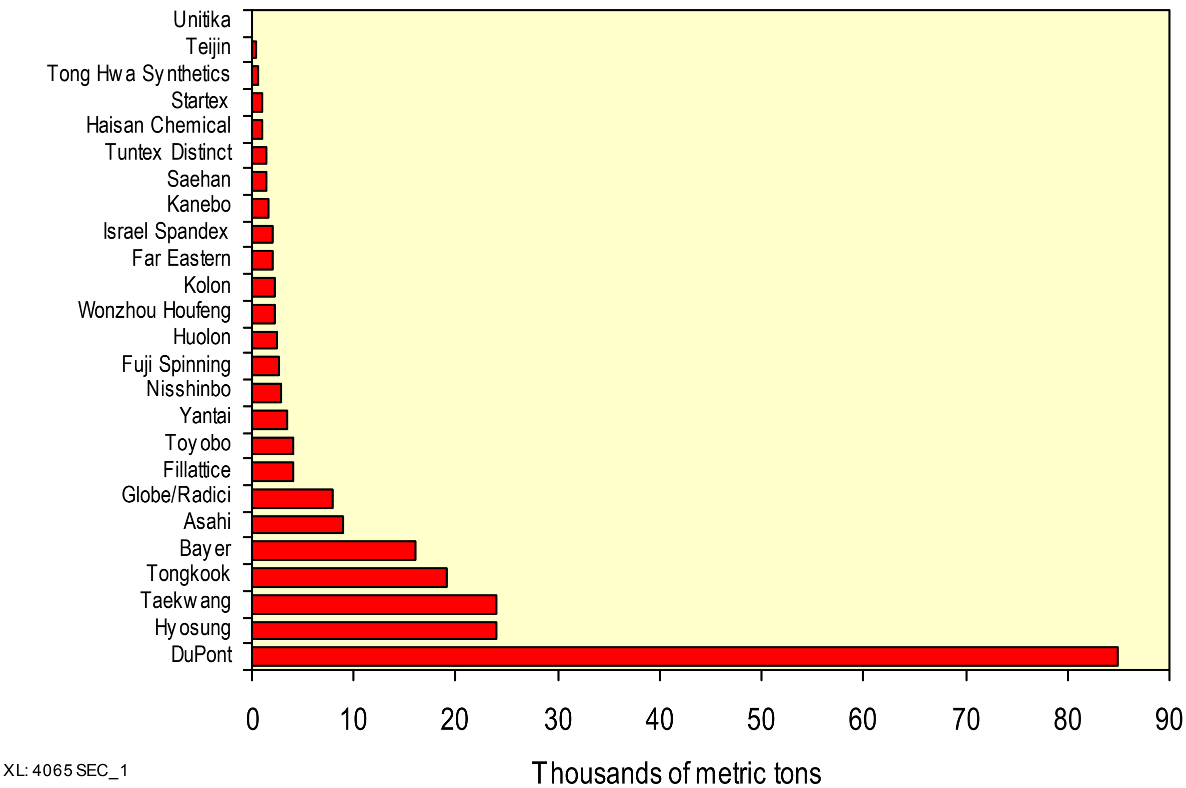
For the purposes of this analysis dry spinning from the dimethyl formamide (DMF) solution in which polymerization has been carried out has been chosen as typical of the business. Two key product groups use this approach. The process is used in Germany by Bayer to make DORLASTAN®, a polyester-polyurea filament yarn and by DuPont to produce LYCRA®, a polyether-polyurea filament yarn.

The cost production of spandex for a hypothetical leader plant is assessed in this report. Given a typical market value for spandex in the region of five dollars per pound and more, the potential margins on this material are attractive. However, the nature of the marketplace for spandex and the degree of competition necessitates a significant expenditure on continuing R&D and on marketing.

In recent years, the very large expansions of spandex capacity in South Korea have led to concerns that the spandex industry is becoming more commoditized. Producers are seeking to either build very large plants, e.g. Hyosung in South Korea, or seek to become more specialized or integrate downstream into apparel manufacture, e.g. Fillattice in Western Europe.

The figure below shows the capacity held by each spandex producer in 2001. DuPont is a clear leader with almost 40 percent of global capacity. Eighty percent of the capacity is held by the top six producers. However, with a total of 25 recognized players there is a significant “tail”. Some of these players, such as Fillattice, are beginning to specialize in specific high-value applications and downstream integration – possibly in preparation for a major change in the industry structure. If Hyosung’s proposed major investment goes ahead, 80 percent of the capacity will be in the hands of only four producers. Nexant’s ChemSystems supply/demand outlook for PTMEG and spandex is also presented.

SPANDEX CAPACITY BY PRODUCER



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