Abstract

Process Economics Program Report 128C

POLYPROPYLENE UPDATE

(November 2001)

This report continues our evaluation of polypropylene processes. Isotactic polypropylene produced with metallocene catalyst represents less than 0.5% of the total global polypropylene capacity. The vast majority of polypropylene is produced with Ziegler-Natta catalyst. However, growth rate for metallocene polypropylene (mPP) is expected to be good, approximately 8% annual from 2001-2006. ExxonMobil Chemical and Basell are the leading producers of mPP. ExxonMobil Chemical produces the resin in the Sumitomo stirred reactor bulk process and Basell produces it in the Novolen™ vertical stirred-bed process. With ExxonMobil and Basell recent mPP research and development agreement, it should soon be introduced into the Spheripol™ process.

In this report, we compare the operating economics for Ziegler-Natta and metallocene catalysts for the production of polypropylene impact copolymer. The three leading process technologies are chosen for the analysis. They are the Spheripol™, Unipol™, and Novolen™ processes. The Spheripol™ process uses two bulk slurry loop reactors in series with a fluidized bed gas-phase reactor. The Unipol™ process uses two fluidized bed gas-phase reactors in series. Lastly, the Novolen™ process uses two vertical stirred-bed gas-phase reactors in series. We have selected a design capacity of 441-million lb/yr (200,000 t/yr). Both metallocene catalyst and Ziegler-Natta catalyst are evaluated. In addition, a speculative second-generation metallocene catalyst is evaluated. For the Unipol™ and Novolen™ processes, SHAC™ and PTK™ Ziegler-Natta catalysts are used, respectively. For the Spheripol™ process, Basell “fifth-generation” Ziegler-Natta system is used. The first-generation metallocene catalyst system, a silica supported metallocene catalyst with methyl aluminoxane (MAO) co-catalyst that was developed jointly by Exxon and Hoechst, is used for the case studies. The speculative second-generation metallocene catalyst is a silica supported metallocene catalyst with a non-coordinating anion, e.g., tri(n-butyl)ammonium tetrakis(pentafluorophenyl)boron and tris(pentafluorophenyl)borane, as a co-catalyst.

We conclude that the operating economics for a first-generation metallocene catalyst is 1.3-2.2 cent/lb higher than for the Ziegler-Natta systems. A speculative second-generation metallocene catalyst can reduce the margin to 0.3-1.2 cent/lb but these systems are known to be difficult to commercialize because of their sensitivity to poisons. Although Basell “fifth generation” Ziegler-Natta catalyst has a much higher catalyst activity, nearly four times, than either SHAC™ or PTK™ catalysts, the operating economics are slightly higher for the Spheripol™ process.

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