Abstract
Process Economics Program Report 185A
POLYETHYLENE BY SLURRY-PHASE POLYMERIZATION
(October 2000)

This report, Supplement 185A to PEP Report 185, Slurry-Phase Polypropylene, which was issued in June 1988, reviews the technology for producing high-density polyethylene (HDPE) or linear low-density polyethylene (LLDPE) by slurry-phase polymerization.

Either double-tube loop reactors or autoclaves (stirred-tank reactors) are commercially employed for slurry-phase polymerization, in the presence of a catalyst system and a diluent. The double-tube loop-reactor slurry process with a light diluent, such as isobutane, is mostly used in the United States and Western Europe, whereas the stirred-tank slurry process with a heavy diluent, such as n-hexane or n-heptane, is widely used in Japan. Several types of catalyst systems are used in the commercial slurry processes; namely, advanced Ziegler catalysts, Ziegler-Natta catalysts, chromium catalysts, and metallocene catalysts. In this report, we review the current technology for slurry-phase polymerization, and evaluate and compare the economics of three slurry processes:

1. Polyethylene by a Slurry Process Using Stirred-Tank Reactors. The design of the process is based on patents assigned to Asahi Chemical and Dow Chemical with polymerization taking place in stirred-tank reactors in the presence of a single-site zirconocene catalyst supported on borate-activated silica.

2. Polyethylene by a Slurry Process Using a Double-Tube Loop Reactor (Zirconocene Catalyst). The design of the process is based on patents assigned to Phillips Petroleum with polymerization taking place in a double-tube loop reactor in the presence of a zirconocene catalyst supported on an organo-aluminoxy compound.

3. Polyethylene by a Slurry Process Using a Double-Tube Loop Reactor (Chromium Catalyst). The design of the process is based on patents assigned to Phillips Petroleum with polymerization taking place in a double-tube loop reactor in the presence of dual-site chromium catalysts supported on calcined aluminum phosphate.

In 1998, world production capacity of HDPE and LLDPE amounted to 25.6 million tons, of which over 57% was from slurry processes. Most commercial slurry processes are, however, basically dedicated to HDPE production, with only a small amount of LLDPE produced.
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