Polyethylene is a thermoplastic resin obtained by polymerizing the gas ethylene \([C_2H_4]\). Because of its exceptional application flexibility, polyethylene’s rise in popularity for both consumer and industrial uses means that today it is the largest volume plastic produced in the world.

Low density polyethylene (LDPE) are polymerized at very high pressures and temperatures, and high density types (HDPE) at relatively low temperatures and pressures. Another type, linear low density polyethylene (LLDPE), is manufactured through a variety of processes of which gas phase is the most common. This most widely used manufacturing process yields both HDPE and LLDPE with a wide range of copolymers. The simplicity of the process accounts for its popularity: a high efficiency catalyst system aids in the polymerization of ethylene and allows for lower temperatures and pressures than those required in making conventional low density polyethylene. In addition, it accommodates a broad range of interesting property combinations used in both HDPE and LLDPE markets.

The gas phase process requires the production of a high quality product while maintaining high standards of process safety. The highly accurate, reliable measurements provided by Servomex gas analyzers – many of them using cutting-edge sensing techniques – ensures the highest standards of product purity, highly responsive process control and dependable safety across the process.

When integrated as a complete solution by Servomex Systems and supported by the Servomex Service Network, the low-maintenance, long-life performance delivered by our analyzers delivers a total solution for gas phase HDPE/LLDPE production.
Polymer grade ethylene and any comonomers are blown into the base of a fluidized bed reactor. To maximize yield, the ethylene and nitrogen comonomer need to be as pure as possible, a process ensured through the highly accurate and reliable PPM O₂ measurement provided by the DF-340E (1) (2). The light hydrocarbon measurement provided by the SERVOTOUGH SpectraScan 2400 (3) also delivers a faster, more cost effective analysis of ethylene feed than traditional Gas Chromatograph techniques.

A highly reactive catalyst based on titanium and magnesium chloride is then injected and mixes with the ethylene; the SERVOTOUGH Oxy 1900 provides a safety measurement for percentage O₂ before the catalyst is introduced (4). Polymerization takes place at 66-104°C (150-220°F) and 2.1Mpa/300psi; polymer particles stay in the fluidized state as the ethylene moves through the reactor. Since the temperature is controlled at or below the melting point, the particles form a white powder. At the top of the bottom section of the reactor, the polyethylene powder is separated from the unreacted ethylene and dispatched out of the side of the reactor to a degassing tower. The ethylene continues to the top of the reactor, losing pressure and dropping out any remaining powder. Any residual ethylene is recovered in the degassing tower and recycled together with the ethylene from the top of the reactor. In this recycle loop (5), the SpectraScan delivers a fast hydrocarbon measurement to control the recycle process more efficiently.

Additives can be added to the final product stream before the polyethylene powder is transported to the finishing area where it is extruded, pelletized, dried and bagged; at both the additive stage (6) and pelletization phase (7), quality remains paramount so a PPM O₂ measurement is again proved by the DF-340E at both stages.