

METALLOCENE-CATALYZED, NONISOTHERMAL ETHYLENE POLYMERIZATION: A SELECTED CASE STUDY

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ABSTRACT

Polyethylenes produced, under isothermal conditions, by a single-component metallocene catalyst have processing limitations because of their narrow molecular weight distributions ($2 \leq$ polydispersity indices ≤ 3). To overcome this limitation, three methods of polymerization have been reported in the literature. These include the application of mixed-metallocenes, metallocene structural modification in the π -ligand, and temperature-variational two-step polymerization with intermediate starvation of feed. The overall drawbacks of these methods are bimodal molecular weight distribution, increased aliaged interaction, and cumbersome ligand synthesis. The present study shows that $\text{Et}(\text{Ind})_2\text{ZrCl}_2$ -catalyzed, nonisothermal polymerization of ethylene (in presence of MAO) with partial removal of heat of polymerization can eliminate these drawbacks. Under the experimental conditions, the polymerization catalytic activity was 1,438 kg PE/(mol Zr hr). The synthesized polyethylene showed a weight-average molecular weight of 1.97×10^5 , 71.6% crystallinity, a melting temperature of 142°C, a density of 0.948 g/cm³ and had no soluble fraction. The resulting molecular weight distribution was both spectacularly broad with a polydispersity index of 15.5 and monomodal. Such a finding has not yet been cited in the literature including the patents. The above properties will suit processing methods such as thermoforming, extrusion, and blowmolding, and formation of foams and films. The present mode of polymerization can be effectively used for scale-up and process development through programmed removing of heat of polymerization and stirring of the reaction mass.