Characterizacion of Bimodal Polyolefins: New Routes for Polyethylene Pipes Production.

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According to the literature, bimodal polyethylene used for pipe manufacture can be produced by three different methodologies:

- Producing the components or fractions separately and then physically melt mixing into a uniform blend. However, these blends usually contain high gel levels, and as a result, miscibility problems can take place [1, 2].
- Using a two stages cascade polymerization process. In the first reactor a low molecular weight ethylene homopolymer is formed (high hydrogen concentration) and, in the second one, the polymer particles with the still active catalyst polymerize under different conditions (low hydrogen concentration and presence of a comonomer) leading to the high molecular weight fraction [3]. This schema is inherently complex involving higher capital and operation costs than a single reactor technology.
- Using binary catalytic systems able to produce an in situ blend of polyethylene chains with different predominant molecular weights in only one-step polymerization process. For this single reactor bimodal technology, a greatly advanced catalyst design is required [4, 5]: development of hybrid catalysts (consisting on two kinds of active sites loaded on the same support) or mixed catalysts (physical mixture of two independent catalysts that are introduced together to the reactor at the beginning of the reaction).

Related to the last alternative, we have recently reported the synthesis of a novel chromium oxide/metallocene hybrid catalyst suitable for bimodal polyethylene manufacture [4, 5]. Results indicate that a clear bimodality can be easily obtained in only one-step polymerization process by adjusting catalysts properties and reactions conditions. Likewise, properties of bimodal products show very promising behavior since several mechanical parameters are improved in comparison with a commercial PE100 resin. In this work we evaluate in depth molecular, rheological and mechanical properties of our bimodal polyethylene and their relationship with different synthesis variables. Effects of the catalyst type, pressure and temperature used during the polymerization, hydrogen pressure and comonomer concentration have been studied in order to optimize the synthesis conditions for the production of high quality polymer pipes (improving properties in comparison with PE100 commercial resins).

References:

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