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Supported SiO_2-$^{n}BuSnCl_3$/MAO/$(^{n}BuCp)_2ZrCl_2$ catalyzing MAO cocatalyst-free ethylene polymerization: Study of hydrogen responsiveness

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ABSTRACT

A supported metallocene catalyst was synthesized by sequentially loading methylaluminoxane (MAO) (30 wt % in toluene) and $(^{n}BuCp)_2ZrCl_2$ on partially dehydroxylated silica ES 70 modified by $^{n}BuSnCl_3$. Its shock load hydrogen responsiveness was evaluated by polymerizing ethylene for 1 h at 8.5 bar (g) and 75°C without separately feeding the MAO cocatalyst.

The shock load hydrogen feeding increased the ethylene consumption (at a fairly constant rate), catalyst productivity, as well as the resin bulk density and average particle size at ΔP (of hydrogen) $\geq \sim$3.0 psi. The bulk density increased from 0.25 to 0.31 g/cm^3. This shows a procedure for overcoming the inherent drop in catalyst productivity caused by heterogenization of metallocenes (that is a method for catalyst activation) and improving the resulting resin bulk density. The volume-weighted mean particle diameter of the resulting polyethylenes was found to be 5.80-11.12-fold that of the catalyst corresponding to ΔP = 0.00-7.11 psi, respectively. The resulting kinetic profiles showed to be fairly stable. However, M_w and polydispersity index were not affected. The particle size distribution, average particle size, and the scanning electron microscope photographs of the resulting resin particles confirmed the occurrence of the *replication phenomenon*. On the basis of the above findings, the mechanism of ethylene polymerization under the present experimental conditions has been revisited. © 2007 Wiley Periodicals, Inc. J Appl Polym Sci 2007

KEYWORDS

supported zirconocene catalysts • silica functionalization • replication phenomenon • hydrogen responsiveness • particle size distribution • bulk density

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