

## REFERENCES

- Boor, J. (1979). Ziegler-Natta catalysts and polymerizations. New York: Academic Press.
- Barbé, P. C., Cecchin, G., and Noristi, L. (1987). The catalytic system Ti-complex/MgCl<sub>2</sub>. Advances in Polymer Science, 81, 1-81.
- Chien, J. C. W. and Kuo C. I. (1986a). Magnesium chloride supported high-mileage catalyst for olefin polymerization: IX. Molecular weight and distribution and chain-transfer processes. Journal of Polymer Science: Part A: Polymer Chemistry, 24, 1779-1818.
- Chien, J. C. W. and Kuo C. I. (1986b). Magnesium chloride supported high-mileage catalyst for olefin polymerization: X. Effect of Hydrogen and Catalytic Site Deactivation. Journal of Polymer Science: Par A: Polymer Chemistry, 24, 2707-2727.
- Corradini, P., Busico, V., and Guerra, G. (1989). Monoalkene polymerization: Stereospecificity. In Eastmond, G.C., Ledwith, A., Russo, S., and Sigwalt, P. (Eds.), Comprehensive polymer science, Vol 4, 29-49, Pergamon Press: Oxford.
- Cossee, P. (1960). On the reaction mechanism of the ethylene polymerization with heterogeneous Ziegler-Natta catalysts. Tetrahedron Letters, 17, 12-16.
- Cossee, P. (1961). Proceedings of the 6<sup>th</sup> International Congress on Coordination Chemistry, 241, Macmillan: New York.
- Dumas, C. and Hsu, C. C., (1989). Propylene polymerization in a semibatch slurry reactor over supported TiCl<sub>4</sub>/MgCl<sub>2</sub>/ethyl benzoate/triethyl aluminum catalyst. I Catalytic behaviors. Journal of Applied Polymer Science, 37, 1605-1623.

- Härkönen, M., Seppälä, J. V., Väänänen, T. (1990). Effects of the structure of external alkoxy silane donor in high activity Ziegler-Natta catalyst on the microstructure of polypropylene. In Keii, T., and Soga, K. (Eds.), Studies in surface science and catalysis 56: Catalytic olefin polymerization, 87-105. Tokyo: Kodansha-Elsevier.
- Hoppin, C. R. and Tovrog, B. S. (1989). U. S. Patent 4 829 038.
- Iiskola, E., Pitkanen, P. L., Leinonen, T., Tulisalo, J., Harkonen, M., Bjaland, A. B., Soderberg, T., and Jaaskelainen, P. (1999). U. S. Patent 5 869 418.
- Kakugo, M., Miyatake, T., Naito, Y., and Mizunuma K. (1988). Microtacticity distribution of polypropylenes prepared with heterogeneous Ziegler-Natta catalysts. Macromolecules, 21, 314-319.
- Kang, K. K., Shiono, T., Jeong, Y. T., and Lee, D. H. (1998). Polymerization of highly isotactic polypropylene with  $Mg(OEt)_2/DNBP/TiCl_4-AlEt_3$ /external donor catalyst systems: Effects of alkoxy monosilanes as external donors. Korea Polymer Journal, 6(2), 167-173.
- Karol, F. J. (1984). Studies with high activity catalysts for olefin polymerization. Catalysis Review in Science and Engineering, 26 (3&4), 557-595.
- Kashiwa, N. (1983). The role of ester in high-activity and high-stereoselectivity catalyst. In Quirk, R.P. (Eds.), Transition metal catalyzed polymerization alkenes and dienes: Part A (pp. 379-388). New York: Harwood Academic Publishers.
- Kashiwa, N., Toyota, A., and Kioka, M. (1988). U. S. Patent 4 725 656.
- Keii, T., Suzuki, E., Tamura, M., and Doi, Y. (1983). A kinetic study on the role of ethyl benzoate additive during propene polymerization with magnesium chloride supported Ziegler catalyst. In Quirk, R.P. (Eds.), Transition metal catalyzed polymerization alkenes and dienes: Part A (pp. 97-113). New York: Harwood Academic Publishers.

- Kim, I., Kim, J. H., and Woo, S. I. (1990). Kinetic study of ethylene polymerization by highly active silica supported  $\text{TiCl}_4/\text{MgCl}_2$  catalysts. Journal of Applied Polymer Science, 39, 837-854.
- Lee, D. H. and Jeong, Y. T. (1993). Propene polymerization with  $\text{Mg}(\text{Oet})_2$ -supported  $\text{TiCl}_4$  catalyst: 4. Effects of hydrogen. European Polymer Journal, 29(6), 883-888.
- Luciani, L., Kashiwa, N., Barbé, P. C., and Toyota, A. (1980). U. S. Patent 4 226 741.
- Monte, A. and Cecchin, G. (1982). U. S. Patent 4 328 122.
- Mori, H., Endo, M., and Terano, M. (1999). Deviation of hydrogen response during propylene polymerization with various Ziegler-Natta catalysts. Journal of Molecular Catalysis A: Chemical, 145, 211-220.
- Morini, G., Albizzati, E., Balbontin, G., Mingozzi, I., Sacchi, M. C., Forlini, F., and Tritto, I. (1996). Microstructure distribution of polypropylenes obtained in the presence of traditional phthalate/silane and novel diether donors: A tool for understanding the role of electron donors in  $\text{MgCl}_2$ -supported Ziegler-Natta catalysts. Macromolecules, 29(18), 5770-5776.
- Moore, E. P. (1996). Polypropylene handbook. Ohio: Hanser/Gardner Publications.
- Mülhaupt, R. (1995). Novel polyolefin materials and processes: Overview and prospects. In Fink, G., Mülhaupt, R., and Brintzinger, H. H. (Eds.), Ziegler catalysts: Recent scientific innovations and technological improvements. (pp.35-55). Berlin: Springer-Verlag.
- Park, H. M. and Lee, W. Y. (1992). The effect of triethylaluminium treatment on a Ziegler-Natta catalyst supported on magnesium chloride prepared by a recrystallization method, for propylene polymerization. European Polymer Journal, 28(11), 1417-1422

- Pino, P. and Mülhaupt, R. (1980). Stereospecific polymerization of propylene: An outlook 25 years after its discovery. Angewandte Chemie International Edition in English, 19, 857-875.
- Proto, A., Oliva, L., Pellicchia C., Sivak, A. J., and Cullo, L.A. (1990). Isotactic-specific polymerization of propene with supported catalysts in the presence of different modifiers. Macromolecules, 23, 2904-2907.
- Sacchi, M.C., Forlini, F., Tritto, I., Locatelli, P., Morini, G., Noristi, L., and Albizzati, E. (1996). Polymerization stereochemistry with Ziegler-Natta catalysts containing dialkylpropane diethers: A tool for understanding internal/external donor relationships. Macromolecules, 29(10), 3341-3345.
- Sacchi, M. C., Tritto, I., and Locatelli, P. (1991). Stereochemical investigation of the effect of Lewis bases in heterogeneous Ziegler-Natta initiator systems. Progress in Polymer Science, 16(2-3), 331-360.
- Sacchi, M.C., Tritto, I., Shan, C., and Norsiti, L. (1990). <sup>13</sup>C NMR investigation on Lewis base activation effect in high yield supported Ziegler-Natta catalysts. In Keii, T., and Soga, K. (Eds.), Studies in surface science and catalysis 56: Catalytic olefin polymerization (pp185-200). Tokyo: Kodansha-Elsevier.
- Shamshoum, E. S. and Rauscher, D. J. (1999). U. S. Patent 5 891 817.
- Soga, K., Shiono, T., and Doi, Y. (1988). Makromolekulare Chemie, 189, 1531-1541.
- Tiat, P. J. T. and Watkins, N. D. (1989). Monoalkene polymerization: Mechanisms. In Eastmond, G.C., Ledwith, A., Russo, S., and Sigwalt, P. (Eds.), Comprehensive polymer science, Vol 4, 533-573, Pergamon Press: Oxford.
- Welch, M. B. and Hsieh, H. L. (1993). Olefin polymerization catalyst technology. In Vasile, C., and Seymour, R. B. (Eds.), Handbook of

- polyolefins: Synthesis and properties. (pp.21-38). New York: Marcel Dekker.
- Xu, J., Feng, L., and Yang, S. (1997). Formation mechanism of stereoblocks in polypropylene produced by supported Ziegler-Natta catalysts. Macromolecules, 30, 2539-2541.
- Yamamoto, T., Furuhashi, H., Imai, M., Ueno, H., and Inaba, N. (1986). U. S. Patent 4 565 798.
- Yang, C. B. (1994). Propylene polymerizations with magnesium chloride/diester/ titaniumtetrachloride-alkylaluminum/ external base catalyst system. Phd. Thesis, The Department of Chemical Engineering, Queen University, Canada.
- Yang, C. B. and Hsu, C. C. (1995a). Propene polymerization with MgCl<sub>2</sub>-supported TiCl<sub>4</sub>/Dioctylphthalate catalyst: I. Catalyst behavior. Journal of Applied Polymer Science, 58, 1229-1235.
- Yang, C. B. and Hsu, C. C. (1995b). Propene polymerization with MgCl<sub>2</sub>-supported TiCl<sub>4</sub>/Dioctylphthalate catalyst: III. Effects of polymerization conditions on molecular weights and molecular weights distribution. Journal of Applied Polymer Science, 58, 1245-1254.
- Yang, C. B. and Hsu, C. C. (1995c). Propene polymerization with MgCl<sub>2</sub>-supported TiCl<sub>4</sub>/Dioctylphthalate catalyst: II. Effects of polymerization conditions on the microstructure of isotactic polymer. Journal of Applied Polymer Science, 58, 1237-1243.
- Ystenes, M. (1991). The trigger mechanism for polymerization of  $\alpha$ -olefins with Ziegler-Natta catalysts: A new model based on interaction of two monomers at the transition state and monomer activation of the catalytic centers. Journal of Catalysis, 129, 383-401.

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