CO-CATALYST EFFECTS IN ZIEGLER-NATTA ETHYLENE POLYMERIZATION

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Polyolefines dominate the plastics market due to their price and performance and Ziegler-Natta (ZN) catalysts are among the most important types of catalyst systems for the industrial production of this class of materials. The main components of ZN catalysts are a titanium compound in combination with an organic aluminum cocatalyst [1]. This aluminum compound is one of the most decisive factors in the polymerization of ZN catalysts [2]. Therefore a systematic study was carried out to determine the influence of different aluminum alkyls on the homo-polymerization of ethylene with a ZN catalyst system.

The tested cocatalysts showed different polymerization activities, with each aluminum alkyl exhibiting a particular behavior. When comparing all alkyls, there is an activity drop for steric hindered alkyls. For increasing aluminum alkyl concentration, more bulky Al alkyls reached a plateau whereas tri-ethyl-aluminum led to a peak activity followed by a decrease. Based on the experimental findings a model was created to simulate for the concentration of the aluminum alkyl and its steric conditions.

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[1] D. Jeremic, “Polyethylene”, in Ullmann’s Encyclopedia of Industrial Chemistry, M. Bohnet, Ed. 6th ed., Weinheim, Germany: Wiley-VCH, 2003, pp. 1-42.

[2] H. Fuhrmann and B. Strübing, “Studies on the polymerization of ethylene using a high-yield $MgCl_2$-supported titanium catalyst, 3. Chemical composition of the standard system and its alterations”, Macromol. Chem. Phys. Vol. 195, No. 1, pp. 229-241, 1994.