Ziegler-Natta PP catalyst calorimetry

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By performing a simple slurry polymerization of propylene, four different Ziegler-Natta catalysts have been investigated. A 0.5 L reactor equipped with an internal heating system was used. The internal heating system can control the set temperature through a compensating heating method. That way, the temperature is kept constant. By keeping the jacket heating of the reactor lower than the wanted polymerization temperature, temperature changes are controlled by the internal heating. Therefore, exothermal changes on the temperature such as the heat of polymerization can be observed. For this, a calorimetric approach must be considered. It follows a balance of polymerization heat, internal heating, jacket cooling as well as environmental heat loss. By doing so, it is possible to record the whole activity curve of the catalyst throughout the polymerization.

The catalysts were examined through hydrogen amount as well as polymerization temperature. Effects on the activity as well as kinetics throughout the polymerization were observed and documented. With the compensating heating power curve obtained, kinetic parameters can be fitted using an estimating mathematical fitting model for those kinetic parameters. Those parameters help to reveal the catalyst reaction performance as well as help characterizing the catalysts activity profile. [1]

Characterization of the yielded polymer gave insights of the influence of hydrogen amount on the molecular weight distribution. It has been shown, that higher hydrogen amounts result in lower molecular weights but higher activity.

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[1] V. Touloupidis, A. Albrecht, J.B.P. Soares, *A Methodology for Estimating Kinetic Parameters and Reactivity Ratios of Multi-site Type Catalysts Using Polymerization, Fractionation, and Spectroscopic Techniques*, Macromol. React. Eng. 2018.