Video Microscopy: Investigation of Gas-Phase Polymerization with Heterogeneous Catalysts

Daniela Ferrari, Gerhard Fink, Bernd Tesche
Max-Planck-Institut für Kohlenforschung, Mülheim an der Ruhr, Germany

Conventional methods for copolymerization kinetics investigation are based on integral measurements, which are not suitable for observing single particle behavior. In our group the video microscopy technique was further developed for direct measurement of polymer growth in gas-phase polymerization under industrial process condition. Single particle kinetics of heterogeneous olefin polymerization was determined by following size expansion of a large number of single catalyst grains.

We propose now for the first time video microscopy as a tool to investigate single particle gas-phase olefin copolymerization with different catalyst systems at different monomer ratios. The study of the kinetic behaviour of a ZN catalyst shows a linear relationship between copolymer composition and monomer ratio in the feed gas. The investigation of an industrial supported metallocene system shows the so called “comonomer effect”. Moreover, two supported metallocenes characterized by a long bridging unit but bearing differently bulky ligands were compared during ethylene-propylene copolymerization in the gas-phase and showed different propylene incorporation allowing to determine the relationship between particle growth, in terms of Equivalent Circle Diameter (ECD), and catalyst structure. Together with $^{13}$C NMR analysis it was possible to describe the copolymer composition with time. Finally, the study of various supporting materials is shown in Fig.1. Each support is characterized by a determined ECD-profile in dependence on the material consistency.

![Fig.1](image-url)