A NEW APPROACH TO STOPPED-FLOW REACTIONS FOR SLURRY AND GAS-PHASE OLEFIN POLYMERIZATION

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Given the industrial relevance of polyolefin production, it is certainly of great interest to understand the phenomena taking place during the reaction start-up. The first few seconds, or fractions of a second, are a determining moment in which morphology formation takes place and where the risk of particle overheating is at its highest. Nevertheless, the main drawback to studying these early stages is the lack of adapted apparatus that allow collecting accurate experimental data. It is, therefore, useful to have specifically designed tools for different processes. In this work, a combined approach of slurry and gas-phase systems was taken to evaluate the initial conditions of catalyst treatment for nascent olefin polymerization in supported catalysts.

A rapid-quench slurry system was set up to perform polymerization reactions. Unlike previous works[1], in which the stopped-flow technique was applied using separate vessels interconnected by tubes, our set-up was conceived in a single vessel under mechanical agitation and the reaction quenching was done by pressurized CO_2.

In parallel, a new stopped-flow gas-phase reactor has been developed for olefin polymerization, aiming to improve certain aspects of previous versions developed over the past few years in the C2P2 lab[2–5]. Our aims were to increase the polymer production capacity and reduce risks of temperature gradients formation inside the reactor, allowing for more accurate kinetic studies in the nascent polymerization phase. A solid porous membrane was incorporated inside the reactor, aiming to improve the gas convection and reduce the possibility of temperature gradients inside the reactor.

The main goal of this study was to compare the impact of initial conditions of catalyst treatment in slurry and gas-phase under industrially relevant conditions and collect experimental data on important phenomena such as catalyst fragmentation and particle morphology development. Following steps include building up a physical interpretation of the impact of the startup conditions on initial particle overheating, reaction rate and morphology (fragmentation).

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