

High and medium throughput polyolefin characterization.

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In polyolefin research, accelerating catalyst discovery/catalyst fine-tuning as well as material development requires screening combinations of catalyst systems and conditions, and fast analytical methods. However, conventional methods allow only a limited number of experiments to be executed per day. In order to ensure a shorter time-to-market cycle, SABIC Technology & Innovation has recently invested in state-of-the-art high- and medium-throughput polyolefin research facilities. The workflow consists of a Product Development Reactor (PDR) and various analytical methods integrated via a unique sample preparation station. The PDR was designed to accelerate the process and product development phases for complex single- and multi-stage polymerization processes. Its eight individually controlled reactors have incorporated sampling and measurement of headspace concentrations to control monomer, co-monomer, and hydrogen concentrations/ratios for each reactor simultaneously. This feedback scheme is achieved by utilizing multi-channel process gas chromatographs for rapid separation and detection of individual gases from the complex mixture. The PDR can be used for gas, slurry, and bulk phase polymerization of ethylene and propylene, affording up to 24 polymerizations a day and more than 30 grams of a single polymer for product characterization and performance testing. The polymers produced in the PDR are then analyzed by various integrated analytical techniques including high-temperature size exclusion chromatography, Fourier transform infrared spectroscopy, high-temperature two-dimensional liquid chromatography, crystallization elution fractionation, differential scanning calorimetry and melt rheology. The obtained characterization data is then integrated with process parameters to finally establish structure-property relationships. The presentation will cover various experimental and scientific concepts of the high- and medium-throughput research with the focus on polyolefin characterization.