SYTHESIS OF POLYOLEFINS WITH COMBINED SINGLE-SITE CATALYSTS

J.B.P. Soares, S. Mehdiabadi, Y. Choi, S.Y. Shin

Department of Chemical Engineering, University of Waterloo, Waterloo, ON, N2L 3G1, Canada
E-mail: jsoares@uwaterloo.ca

ABSTRACT

If we read the polyolefin literature over the last decade, we will conclude that the most relevant publications describe new approaches for producing polyolefins with complex microstructures that transform them from commodity plastics into differentiated commodities, specialty polyolefins, and polyolefin hybrids. These new materials are often made with one or more single-site coordination catalysts, sometimes in combination with other polymerization mechanisms as well. A recent example is the production of linear-block or branched-block polyolefins that behave like thermoplastic elastomers.[1-2] There has been also significant interest in the production of polyolefin/clay nanocomposites and functional polyolefins. [3]

For the polymer reaction engineer, these processes are fascinating because they provide ideal systems for the mathematical modeling and control of polymer microstructures, as characterized by their distributions of molecular weight (MWD), chemical composition (CCD), and long chain branching (LCB).[4]

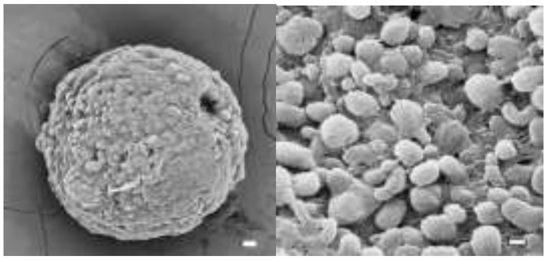

Figure 1. SEM micrographs of a polyethylene particle made with a Ni-diimine catalyst supported on silica. Scale bars: 20 μm (left) and 400 nm (right).[5]

In this presentation, we will review some of the techniques developed in our laboratories to produce polyolefins with controlled MWD, CCD, and LCB using single and dual single-site catalysts. We will also demonstrate how they can be described with elegant mathematical models that give us an in-depth understanding of their microstructures, and help us design polymers with new properties.

References:

1. S. Mehdiabadi, J.B.P. Soares. Dekmezian, A.H. Production of long chain branches polyolefins with two single-site catalysts: Comparing CSTR and semi-batch performance. *Macromol. React. Eng.* **2008**, *2*, 529-550
2. S. Anantawaraskul, P. Somnukguande, J.B.P. Soares. Simulation of crystallization analysis fractionation (Crystaf) of linear olefin block copolymers. *Macromol. Symp.* **2009**, *282*, 205-215.
3. Y. Choi, S.Y. Shin, J.B.P. Soares. Preparation of polyethylene/MMT nanocomposites through in-situ polymerization using a MMT-supported nickel diimine catalyst. *Macromol. Chem. Phys.* **2010**, *211*, 1026-1034.
4. J.B.P. Soares. Polyolefins with long chain branches made with single-site coordination catalysts: A review of mathematical modeling techniques for polymer microstructure. *Macromol. Mater. Eng.* **2004**, *289*, 70-87.
5. Y. Choi, J.B.P. Soares. Synthesis of supported nickel diimine catalysts for ethylene slurry polymerization. *Macromol Chem Phys.* **2009**, *210*, 1979-1988.