polyethylene molecules, the resin is said to have a "broad" composition distribution. When the amount of comonomer per 1000 carbons is similar among the polyethylene molecules of different chain lengths, the composition distribution is said to be "narrow." It is generally known in the art that a polyolefin's MWD and CD will affect the different product attributes.

[005] To reduce or to avoid certain trade-off among desirable attributes, bimodal polymers have become increasingly important in the polyolefins industry, with a variety of manufacturers offering products of this type. Whereas older technology relied on two-reactor systems to generate such material, advances in catalyst design and supporting technology have allowed for the development of single-reactor bimetallic catalyst systems capable of producing bimodal polyethylene. These systems are attractive both from a cost perspective and ease of use.

SUMMARY

[006] Certain aspects relate to a system and method of producing polyethylene, including polymerizing ethylene in the presence of a catalyst system in a reactor to form polyethylene, wherein the catalyst system includes a first catalyst and a second catalyst. The techniques include adjusting reactor conditions and an amount of the second catalyst fed to the reactor to control melt index (MI), density, and melt flow ratio (MFR) of the polyethylene.

[**006a**] In one aspect, there is provided a method of producing polyethylene, comprising:

polymerizing ethylene in presence of a catalyst system in a reactor to form polyethylene, wherein the catalyst system comprises a first catalyst and a second catalyst wherein the first catalyst is fed in a slurry to the polymerization reactor and the second catalyst is added as a trim catalyst to a slurry having the first catalyst fed the reactor, wherein the molar ratio of the catalyst compound in the catalyst component slurry to the catalyst compound in the catalyst component solution, after the slurry and solution have been mixed to form the catalyst composition is from 500:1 to 1:500; and

adjusting reactor conditions and an amount of the second catalyst fed to the reactor to control melt index (MI) and density of the polyethylene based on a target melt flow ratio (MFR) and a desired combination of molecular weight distribution (MWD) and composition distribution (CD) of the polyethylene.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] Fig. 1 is a representative plot of molecular weight distribution of polyolefin polymerized with a two catalyst system in accordance with embodiments described herein.

[008] Fig. 2 is a schematic of a gas-phase reactor system, showing the addition of at least two catalysts, at least one of which is added as a trim catalyst in accordance with embodiments described herein.

[009] Figs. 3A and 3B are plots that illustrate the calculations used to determine a CFC result in accordance with embodiments described herein.

[0010] Fig. 4 is a plot of (Mw1/Mw2) vs. (Tw1 – Tw2) showing a region of polymers.

[0011] Fig. 5A is a diagrammatical representation of techniques for generating targets or recipes, and producing, some of the exemplary BOCD polymers of Table 1, those listed in Table 2a.

[0012] Fig. 5B is a diagrammatical representation of techniques for generating targets or recipes, and producing, some of the exemplary BOCD polymers of Table 1, those listed in Table 2b.

Claims

What is claimed is:

1. A method of producing polyethylene, comprising:

polymerizing ethylene in presence of a catalyst system in a reactor to form polyethylene, wherein the catalyst system comprises a first catalyst and a second catalyst wherein the first catalyst is fed in a slurry to the polymerization reactor and the second catalyst is added as a trim catalyst to a slurry having the first catalyst fed the reactor, wherein the molar ratio of the catalyst compound in the catalyst component slurry to the catalyst compound in the catalyst component solution, after the slurry and solution have been mixed to form the catalyst composition is from 500:1 to 1:500; and

adjusting reactor conditions and an amount of the second catalyst fed to the reactor to control melt index (MI) and density of the polyethylene based on a target melt flow ratio (MFR) and a desired combination of molecular weight distribution (MWD) and composition distribution (CD) of the polyethylene.

2. The method of claim 1, wherein adjusting reactor conditions comprises adjusting an operating temperature of the reactor.

3. The method of claim 1, wherein adjusting reactor conditions comprises adjusting a comonomer concentration in a polymerization mixture in the reactor.

4. The method of claim 1, wherein adjusting reactor conditions comprises adjusting hydrogen concentration in a polymerization mixture in the reactor.

5. The method of claim 1, wherein adjusting reactor conditions comprises adjusting a reactant concentration in a polymerization mixture in the reactor to meet a MI target of the polyethylene over a MFR range of the polyethylene.

6. The method of claim 1, wherein adjusting reactor conditions comprises adjusting a reactant concentration in a polymerization mixture in the reactor to meet a density target of the polyethylene over a MFR range of the polyethylene.

7. The method of claim 1, wherein the first catalyst comprises bis(n-propylcyclopentadienyl) Hafnium dimethyl.

8. The method of claim 1, wherein the second catalyst comprises di(l-ethylindenyl) zirconium dimethyl.