CLAIMS

1. A method of producing bimodal ethylene-based polymer comprising:

reacting ethylene monomer and C_3-C_{12} α-olefin comonomer in solvent in the presence of a first catalyst in an agitated solution polymerization reactor to produce a first polymer fraction;

outputting effluent from the agitated solution polymerization reactor, wherein effluent comprises the first polymer fraction, unreacted ethylene monomer, and unreacted C_3-C_{12} α-olefin comonomer;

adding a second catalyst to the effluent downstream of the agitated solution polymerization reactor and upstream from a non-agitated solution polymerization reactor, wherein the second catalyst facilitates further reaction of the unreacted ethylene monomer and unreacted C_3-C_{12} α-olefin comonomer to produce a second polymer fraction having a density and melt index (I_2) different from the first polymer fraction and the second catalyst and effluent mix in at least one mixer downstream from the agitated solution polymerization reactor and upstream of the non-agitated solution polymerization reactor;

passing the second catalyst, second polymer fraction, and the first polymer fraction to the non-agitated solution polymerization reactor; and

passing additional ethylene monomer, additional C_3-C_{12} α-olefin comonomer, and solvent to the non-agitated solution polymerization reactor, wherein the additional ethylene monomer, additional C_3-C_{12} α-olefin comonomer react in the presence of the second catalyst to produce more second polymer fraction and thereby the bimodal ethylene-based polymer, the bimodal ethylene-based polymer comprising the first polymer fraction and the second polymer fraction.

2. The method of claim 1, wherein the agitated solution polymerization reactor is a continuous stirred tank reactor (CSTR) or a loop reactor.

3. The method of claim 1, wherein the non-agitated solution polymerization reactor is a tubular reactor.

4. The method of claim 1, wherein the first catalyst is a molecular catalyst.

5. The method of claim 1, wherein the second catalyst is a Ziegler-Natta catalyst.

6. The method of claim 1, wherein the second catalyst is a molecular catalyst.

7. The method of claim 6, wherein the at least one mixer is a flow shaper or static mixer.

8. The method of claim 1, wherein hydrogen is fed to the agitated solution polymerization reactor.

9. The method of claim 1, wherein the first polymer fraction has a density and melt index (I_2) which is less than the density and melt index (I_2) of the second polymer fraction.

10. The method of claim 1, wherein the bimodal ethylene-based polymer is a bimodal ethylene-based polymer that comprises from 70 to 92% by weight of the first polymer fraction, and 8 to 30% by weight of the second polymer fraction.

11. The method of claim 1, further comprising feeding a third catalyst to the agitated solution polymerization reactor, wherein the third catalyst facilitates polymerization of third polymer fraction.

12. The method of claim 1, wherein ethylene is introduced downstream from the agitated solution polymerization reactor and upstream from the non-agitated solution polymerization reactor.

13. The method of claim 1, wherein a density of the bimodal ethylene-based polymer is from 0.900 to 0.960 g/cc.

14. The method of claim 1, wherein a melt index (I_2) of the bimodal ethylene-based polymer is from 0.5 g/10 mins to 7.0 g/10 mins.

15. The method of claim 1, wherein a melt index ration (I_{10}/I_2) of the bimodal ethylene-based polymer is from 5.5 to 7.5.