## CLAIMS

1. A process of polymerizing a multi-modal polyethylene polymer, the process comprising:

contacting ethylene and optionally one or more α-olefin monomers with at least two catalyst systems in a solution reactor at a reactor temperature of greater than 150°C;

wherein:

the at least two catalyst systems produce a vinyl end group count per 1000 carbon atoms is greater than 0.3, wherein the vinyl end group count per 1000 carbon atoms is measured by 600 MHz nuclear magnetic resonance (NMR) instrument;

a first catalyst system of the at least two catalyst systems comprises a first procatalyst; and

a second catalyst system of the at least two catalyst systems comprises a second procatalyst having a reactivity ratio of less than 20, wherein the reactivity ratio of the first procatalyst is measured in a single reactor with only the first catalyst system in the presence of 1250 grams of ISOPAR-E, with a mol fraction of ethylene in solution of 0.709, and at a reactor temperature of at least 150°C.

2. The process of claim 1, wherein the at least two catalyst systems are in one solution reactor.

3. The process of claim 1 or 2, wherein at least 10% of the multimodal polyethylene polymer is greater than 500 kg/mol.

4. The process of any one of the preceding claims, wherein the solution reactor is a dual reactor comprising a first reactor and a second reactor.

5. The process of claim 4, wherein the first reactor comprises the first catalyst system and the second catalyst system; and the second reactor comprises a third catalyst system.

6. The process of claim 5, wherein the first catalyst system comprises a reaction product of a first procatalyst and a first activator; the second catalyst system comprises a reaction product of a second procatalyst and a second activator, and a third catalyst system comprises a reaction product of a third procatalyst and a third activator.

7. The process of claim 6, wherein the first procatalyst is different from the second procatalyst and the second procatalyst is different from the third procatalyst.

8. The process of claim 7, wherein the first procatalyst is different from the third procatalyst.

9. The process of any one of claims 4 to 8, wherein a first reactor temperature of the first reactor is greater than 150°C, and a second reactor temperature of the second reactor is less than 150°C.

10. The process of claim 1, wherein the solution reactor is a single reactorat a reactor temperature of greater than 160°C.

11. The process of any one of claims 9 to 10, wherein the vinyl end group count per 1000 carbon atoms is greater than 0.40 when measured 600 MHz nuclear magnetic resonance (NMR) instrument.

12. The process of any one of claims 1 to 11, wherein the α-olefin monomer comprises a single vinyl group.

13. The process of any one of the preceding claims, wherein the α-olefin monomer is linear.

14. The process of any one of the preceding claims, wherein the α-olefin monomer is a ($C_3$–$C_{12}$)α-olefin monomer.

15. The process of any one of the preceding claims, wherein the at least two catalyst systems comprises at least one co-catalyst.