CLAIMS

1. A method of increasing efficiency of separating residual hydrocarbon from polyethylene particles in a purge vessel, comprising: polymerizing ethylene on a catalyst in a reactor system to form polyethylene particles, the reactor system comprising a first polymerization reactor and a second polymerization reactor in series; discharging the polyethylene particles from the second polymerization reactor to a separation vessel to separate hydrocarbon from the polyethylene particles; discharging the polyethylene particles from the flash vessel to a purge vessel to separate residual hydrocarbon from the polyethylene particles; and adjusting a particle size of the polyethylene particles discharging from the second polymerization reactor to increase separation of residual hydrocarbon from polyethylene particles in a downstream purge vessel.
2. The method of claim 1, wherein adjusting the particle size comprises adjusting particle size of fractured polyethylene particles in the reactor system.
3. The method of claims 1 through 2, wherein adjusting the particle size comprises adjusting productivity of the catalyst in the reactor system.
4. The method of claims 1 through 3, wherein adjusting the productivity comprises adjusting a first productivity of the catalyst in the first polymerization reactor or adjusting a second productivity of the catalyst in the second polymerization reactor, or adjusting both the first productivity and the second productivity.
5. The method of claims 1 through 4, wherein adjusting the productivity comprises adding an activity inhibitor to the first polymerization reactor or the second polymerization reactor or both.
6. The method of claims 1 through 5, wherein adjusting the productivity comprises adjusting residence time of the catalyst in the reactor system.
7. The method of claims 1 through 6, wherein adjusting the particle size comprises adjusting residence time of the catalyst in the reactor system.
8. The method of claims 1 through 7, wherein adjusting the particle size comprises adjusting a first residence time of the catalyst in the first polymerization reactor or adjusting a second residence time of the catalyst in the second polymerization reactor, or adjusting both the first residence time and the second residence time.

9. The method of claims 1 through 8, wherein discharging the polyethylene particles from the second polymerization reactor comprises discharging continuously the polyethylene particles from the second polymerization reactor.
10. The method of claims 1 through 9, wherein adjusting the particle size comprises selecting and feeding an alternative catalyst having a catalyst particle density to give a desired amount of fracturing of the polyethylene fluff particles in the reactor system.

What is claimed is:

1. A method of operating a polyethylene reactor system, the method comprising:

polymerizing ethylene on a catalyst in a first polymerization reactor to form intermediate particles having the catalyst and a first polyethylene;

discharging the intermediate particles from the first polymerization reactor to a second polymerization reactor;

polymerizing ethylene on the catalyst in the intermediate particles in the second polymerization reactor to form product particles having the catalyst, the first polyethylene, and the second polyethylene;

discharging the product particles from the second polymerization reactor; and

controlling a particle size of the product particles by adjusting a residence time of the catalyst through the first polymerization reactor and/or the second polymerization reactor,

wherein adjusting the residence time of the catalyst comprises adjusting a rate of a diluent feed stream to the first polymerization reactor.

2. The method of claim 1, comprising feeding ethylene, diluent, and the catalyst to the first polymerization reactor, and feeding ethylene and diluent to the second polymerization reactor.

3. The method of claim 1, wherein adjusting the residence time of the catalyst comprises adjusting a rate of a diluent feed stream to the second polymerization reactor.

4. The method of claim 1, wherein adjusting the residence time comprises adjusting a solids concentration in the first polymerization reactor and/or in the second polymerization reactor.

5. The method of claim 1, wherein adjusting the residence time comprises adjusting a first residence time of the catalyst in the first polymerization reactor or adjusting a second residence time of the catalyst in the second polymerization reactor, or adjusting both the first residence time and the second residence time.

6. The method of claim 5, wherein adjusting the first residence time comprises adjusting a rate of a diluent feed stream to the first polymerization reactor.

7. The method of claim 5, wherein adjusting the second residence time comprises adjusting a rate of a first diluent feed stream to the first polymerization reactor and/or adjusting a rate of a second diluent feed stream to the second polymerization reactor.

8. The method of claim 5, wherein adjusting the first residence time comprises adjusting solids concentration in the first polymerization reactor, and wherein adjusting the second residence time comprises adjusting solids concentration in the second polymerization reactor.

9. The method of claim 1, wherein the first polymerization reactor and the second polymerization reactor each comprise a liquid-phase reactor.

10. The method of claim 1, wherein the first polymerization reactor and the second polymerization reactor each comprise a loop reactor.

11. The method of claim 1, comprising further controlling the particle size of the product particles by adjusting activity of the catalyst in the first polymerization reactor and/or in the second polymerization reactor.

12. The method of claim 11, wherein adjusting activity comprises adding an activity inhibitor to the first polymerization reactor and/or to the second polymerization reactor.

13. The method of claim 12, wherein the activity inhibitor comprises a catalyst poison.

14. The method of claim 1, comprising selecting an alternative catalyst and feeding the alternative catalyst to the first polymerization reactor to give alternative product particles discharging from the second polymerization reactor, the alternative product particles comprising a different mean particle size than the product particles

15. The method of claim 1, comprising feeding more hydrogen to the first polymerization reactor than to the second polymerization reactor, or feeding more hydrogen to the second polymerization reactor than to the first polymerization reactor.

16. The method of claim 1, comprising feeding comonomer to the first polymerization reactor and/or to the second polymerization reactor.

17. The method of claim 16, wherein the comonomer comprises propylene, butene, 1-pentene, 1-hexene, 1-octene, and/or 1-decene.

18. The method of claim 1, comprising feeding more comonomer to the first polymerization reactor than to the second polymerization reactor, or feeding more comonomer to the second polymerization reactor than to the first polymerization reactor.

19. The method of claim 1, wherein the first polyethylene and the second polyethylene combine to give a monomodal polyethylene or a bimodal polyethylene.

20. A method of operating a polyethylene reactor system, the method comprising:

polymerizing ethylene on a catalyst in a first polymerization reactor to form a first polyethylene and to form intermediate polyethylene particles comprising the catalyst and the first polyethylene;

discharging the intermediate polyethylene particles from the first polymerization reactor to a second polymerization reactor;

polymerizing ethylene on the catalyst in the second polymerization reactor to form a second polyethylene and to form product polyethylene particles comprising the catalyst, the first polyethylene, and the second polyethylene;

discharging the product polyethylene particles from the second polymerization reactor; and

controlling a particle size of the product polyethylene particles by adjusting activity of the catalyst in the first polymerization reactor and/or in the second polymerization reactor,

wherein adjusting activity comprises adding an activity inhibitor to the first polymerization reactor and/or to the second polymerization reactor.

21. The method of claim 20, wherein the activity inhibitor comprises a catalyst poison.

22. The method of claim 20, wherein controlling the particle size of the product polyethylene particles further comprises selecting an alternative catalyst and feeding the alternative catalyst to the first polymerization reactor.

23. The method of claim 20, comprising feeding more hydrogen to the first polymerization reactor than to the second polymerization reactor, or feeding more hydrogen to the second polymerization reactor than to the first polymerization reactor.

24. The method of claim 20, comprising further controlling a particle size of the product particles by adjusting a residence time of the catalyst through the first polymerization reactor and/or the second polymerization reactor.

25. The method of claim 24, wherein adjusting the residence time comprises adjusting a rate of a diluent feed stream to the first polymerization reactor.

26. The method of claim 24, wherein adjusting the residence time comprises adjusting a rate of a diluent feed stream to the second polymerization reactor.

27. The method of claim 24, wherein adjusting the residence time comprises adjusting a solids concentration in the first polymerization reactor and/or in the second polymerization reactor.

28. The method of claim 24, wherein adjusting the residence time comprises adjusting a first residence time of the catalyst in the first polymerization reactor or adjusting a second residence time of the catalyst in the second polymerization reactor, or adjusting both the first residence time and the second residence time.

29. The method of claim 20, wherein adjusting activity comprises adjusting temperature in the first polymerization reactor and/or the second polymerization reactor.

30. A method of increasing efficiency of separating residual hydrocarbon from polyethylene particles in a purge vessel, comprising:

polymerizing ethylene on a catalyst in a reactor system to form polyethylene particles, the reactor system comprising a first polymerization reactor and a second polymerization reactor in series;

discharging the polyethylene particles from the second polymerization reactor to a separation vessel to separate hydrocarbon from the polyethylene particles;

discharging the polyethylene particles from the separation vessel to a purge vessel to separate residual hydrocarbon from the polyethylene particles; and

adjusting a particle size of the polyethylene particles discharging from the second polymerization reactor to increase separation of residual hydrocarbon from polyethylene particles in a downstream purge vessel, wherein adjusting the particle size comprises adjusting productivity of the catalyst in the reactor system, and wherein adjusting the productivity comprises adding an activity inhibitor to the first polymerization reactor, the second polymerization reactor, or both the first polymerization reactor and the second polymerization reactor.

31. The method of claim 30, wherein adjusting the particle size comprises adjusting particle size of fractured polyethylene particles in the reactor system.

32. The method of claim 30, wherein adjusting the productivity comprises adjusting a first productivity of the catalyst in the first polymerization reactor or adjusting a second productivity of the catalyst in the second polymerization reactor, or adjusting both the first productivity and the second productivity.

33. The method of claim 30, wherein adjusting the productivity comprises adjusting residence time of the catalyst in the reactor system.

34. The method of claim 30, wherein adjusting the particle size comprises adjusting residence time of the catalyst in the reactor system.

35. The method of claim 30, wherein adjusting the particle size comprises adjusting a first residence time of the catalyst in the first polymerization reactor or adjusting a second residence time of the catalyst in the second polymerization reactor, or adjusting both the first residence time and the second residence time.

36. The method of claim 30, wherein discharging the polyethylene particles from the second polymerization reactor comprises discharging continuously the polyethylene particles from the second polymerization reactor.

37. The method of claim 30, wherein adjusting the particle size comprises selecting and feeding an alternative catalyst having a catalyst particle density to give a desired amount of fracturing of the polyethylene fluff particles in the reactor system.

38. The method of claim 30, wherein adjusting the particle size comprises adjusting temperature in the first polymerization reactor and/or second polymerization reactor.