Claims

1. A process for producing a polymer composition comprising the steps of:

(A) polymerising, in a first polymerisation reactor (2) in a first solvent,

- a first olefin monomer having two or more carbon atoms and
- optionally a first comonomer,
- in the presence of a first polymerisation catalyst and optionally a chain transfer agent for producing a first solution comprising a first polymer of the first olefin monomer and the optional first comonomer and the first solvent;

(B) withdrawing a first stream of the first solution from the first polymerisation reactor (2);

(C) passing the first stream of the first solution into a first separator (4) wherein a first liquid phase comprising the polymer and a first vapour phase coexist;

(D) withdrawing a first vapour stream and a first concentrated solution stream comprising the polymer from the first separator (4);

(E) passing at least a part of the first vapour stream to a first fractionator (5);

(F) withdrawing a first overhead stream and a first bottom stream from the first fractionator (5);

(G) recovering at least a part of the first overhead stream as a first recycle stream and passing it to the first polymerisation reactor (2);

(H) passing the first concentrated solution stream from the first separator (4) to a second separator (8) wherein a second liquid phase comprising the polymer and a second vapour phase coexist;

(I) withdrawing a second vapour stream and a second concentrated solution stream comprising the polymer from the second separator (8);

(J) passing at least a part of the second vapour stream to a second fractionator (12);

(K) withdrawing a second overhead stream and a second bottom stream from the second fractionator (12);

(L) recovering at least a part of the second overhead stream as a second recycle stream and passing it to the first polymerisation reactor (2);

(M) passing the second concentrated solution stream from the second separator (8) to a third separator (11) wherein a third liquid phase comprising the polymer and a third vapour phase coexist;

characterised in that the mass flow rate of the first recycle stream is at least 80 % of the mass flow rate of the first vapour stream and the mass flow rate of the second recycle stream is at least 70 % of the mass flow rate of the second vapour stream.

2. The process according to claim 1 wherein the first bottom stream is passed from the first fractionator (5) back to the first separator (4).

3. The process according to claim 1 or 2 wherein at least a part of the second bottom stream is passed from the second fractionator (12) back to the first separator (4).

4. The process according to any one of claims 1 to 3 comprising the additional steps of:
(N) passing at least a part of the third vapour stream to a third fractionator;
(O) withdrawing a third overhead stream and a third bottom stream from the third fractionator;
(P) passing at least a part of the third overhead stream to solvent recovery.

5. The process according to any one of claims 1 to 4 comprising the additional steps of:
(Q) passing the first recycle stream and optionally at least a part of the second recycle stream to a first feed vessel (1);
(R) withdrawing a first feed stream from the first feed vessel (1);
(S) passing the first feed stream via a first cooling step to the first polymerisation reactor (2).

6. The process according to any one of claims 1 to 5 comprising the additional steps of:
(T) polymerising, in a second polymerisation reactor (14) in a second solvent,
-a second olefin monomer having two or more carbon atoms and
-optionally a second comonomer,
-in the presence of a second polymerisation catalyst and optionally a chain transfer agent for producing a second solution comprising a second polymer of second olefin monomer and the optional second comonomer and the second solvent;(U) withdrawing a first stream of the second solution from the second polymerisation reactor (14);

(V) passing the first stream of the second solution into a fourth separator (16) wherein a fouth liquid phase comprising the polymer and a fourth vapour phase coexist;

(W) withdrawing a fourth vapour stream and a fourth concentrated solution stream comprising the polymer from the fourth separator (16);

(X) passing at least a part of the fourth vapour stream to a fourth fractionator (18);

(Y) withdrawing a fourth overhead stream and a fourth bottom stream from the fourth fractionator (18);

(Z) recovering at least a part of the fourth overhead stream as a fourth recycle stream and passing it to the second polymerisation reactor (14);

(AA) passing the fourth concentrated solution stream from the fourth separator (16) to the second separator (8) wherein the second liquid phase comprising the polymer and the second vapour phase coexist;

characterised in that the polymerisation in the first polymerisation reactor (2) in step (A) and the polymerisation in the second polymerisation reactor (14) in step (T) are conducted in parallel configuration;

and the mass flow rate of the fourth recycle stream is at least 80 % of the mass flow rate of the fourth vapour stream.

7. The process according to claim 6 wherein the fourth bottom stream is passed from the fourth fractionator (18) back to the fourth separator (16).

8. The process according to claim 6 or 7 wherein at least a part of the second bottom stream is passed from the second fractionator (12) to the fourth separator (16).

9. The process according to any one of claims 6 to 8 comprising the additional steps of:

(AB) passing the fourth recycle stream and optionally at least a part of the second recycle stream to a second feed vessel (13);

(AC) withdrawing a second feed stream from the second feed vessel (13);

(AD) passing the second feed stream via a second cooling step to the second polymerisation reactor (14).

10. The process according to any one of claims 1 to 5 comprising the additional steps of:

(T') polymerising, in a second polymerisation reactor (14) in a second solvent,

-a second olefin monomer having two or more carbon atoms and

-optionally a second comonomer,

-in the presence of a second polymerisation catalyst and optionally a chain transfer agent for producing a second solution comprising a second polymer of second olefin monomer and the optional second comonomer and the second solvent;

(U') withdrawing a first stream of the second solution from the second polymerisation reactor (14);

(V') combining the first stream of the second solution from the second polymerisation reactor (14) with the first stream of the first solution from the first polymerisation reactor (2) to produce a combined first stream of the first solution and the second solution;

(W') passing the combined first stream of the first solution and the second solution into a first separator (4) wherein a first liquid phase comprising the polymer and a first vapour phase coexist;

characterised in that the polymerisation in the first polymerisation reactor (2) in step (A) and the polymerisation in the second polymerisation reactor (14) in step (T') are conducted in parallel configuration.

11. The process according to any one of claims 6 to 10 wherein the first solvent and the second solvent are the same.

12. The process according to any one of claims 6 to 11 wherein the first comonomer and the second comonomer are the same.

13. The process according to any one of claims 6 to 12 wherein the first polymerisation catalyst and the second polymerisation catalyst are the same.

14. The process according to any one of claims 6 to 13 wherein the first olefin monomer and optionally the second olefin monomer are the same and are ethylene or propylene.

15. The process according any one of claims 6 to 14 wherein the first comonomer or optionally the second comonomer or optionally the first comonomer and the second comonomer is selected from the group consisting of alpha-olefins different from an olefin monomer having from 2 to 10 carbon atoms; polyenes having from 4 to 10 carbon atoms, cyclic olefins having from 6 to 20 carbon atoms and cyclic polyenes having from 6 to 20 carbon atoms.

16. The process according to any one of claims 6 to 15 wherein the first and second separators (4), (8) and the optional fourth separator (16) are flash units.

17. The process according to any one of claims 6 to 16 wherein the first separator (4) and the optional fourth separator (16) are operated at a pressure of from 5 to 15 bar and the second separator (8) is operated at a pressure of from 1 to 5 bar.

18. The process according to any one of claims 6 to 17 wherein the first and second fractionators (5), (12) and the optional fourth fractionator (18) are distillation columns or stripping columns.