Canadian Patent Applications CA 2372121A1; CA 1203348; and German Patent Application DE 19905029.

[0015] The polymerization processes described in the above references are typically energy intensive, requiring heat exchanges between the polymerization reactor and the separator, supercritical polymerization conditions, and/or additional polymer-solvent separation means. There is a need to develop new polymerization processes that use solvent separation means that require less energy to run, and have increased efficiency and reduced costs. There is also a need to eliminate ancillary and energy intensive devices, and thus, reducing capital and operating costs. These needs and others have been met by the following invention.

SUMMARY ~~OF INVENTION~~

[0016] In a first aspect, t~~T~~he ~~invention~~disclosure provides a solution polymerization process comprising:

A) polymerizing one or more monomers in the presence of a solvent that comprises a heavy hydrocarbon solvent and a light hydrocarbon solvent, to form a polymer solution;

B) transferring the polymer solution to a Liquid-Liquid Separator, without adding heat to the solution, and wherein the pressure of the polymer solution is actively reduced in a controlled manner prior to, or within, the Liquid-Liquid Separator, to induce at least two liquid phases, a polymer-rich phase and a solvent-rich phase, and wherein the concentration of polymer in the polymer-rich phase is higher than that in the polymer solution transferred to the liquid-liquid separator; and

C) removing the solvent-rich phase.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 depicts a phase diagram of a polymer solution exhibiting LCST (V = vapor and L = liquid).

Figure 2 depicts a solution polymerization process using liquid-liquid separation.

Figure 3 is a schematic of a Liquid-Liquid Separator.

Figure 4 is a schematic of a Variable-Volume View Cell. In this figure, [1] is the view cell, [2] is a piston, [3] is a hand pump (to move piston), [4] is a temperature bath, [T] is a temperature probe, and [P] is a pressure transducer.

8. The process of any of the previous claims, wherein the pressure in each reactor is from 110 bar (11 MPa) to 150 bar 15 MPa).

9. The process of any of the previous claims, wherein the polymerization temperature of step A is greater than 150°C.

10. The process of any of the previous claims, wherein the solvent in step A is present in an amount greater than 80 weight percent, based on the weight of the polymerization system.

11. The process of any of the previous claims, wherein step B is not repeated.

12. The process of any of the previous claims, wherein no light hydrocarbon solvent is added to the process in steps B and C.

13. The process of any of the previous claims, wherein in Step B, the pressure is reduced to a pressure in the range from 80 bar (8 MPa) to 10 bar (1 MPa).

14. The process of any of the previous claims, wherein the polymer formed in step A is selected from an ethylene-based polymer or a propylene-based polymer.

15. The process of Claim 14~~24~~, wherein the polymer is an ethylene-based polymer.