CLAIMS

1. A devolatilizer (devo), which operates at a temperature (T) and at a pressure (P), for the separation of at least a portion of a solvent from a polymer-rich solution comprising the solvent and a polymer, and wherein the devolatilizer comprises at least the following components:

A) a distributor, a heater, or a heater/distributor combination (component A) of length *L*, the vertical distance from the top to the bottom of the component A;

B) a shroud (component B) located around some or all of the periphery of component A; and wherein the shroud comprises at least one cylindrical section situated outside the periphery of component A, and wherein this cylindrical section encloses at least a portion of the periphery of component A, and

C) a gap (component C) located between the outer surface of component A and the inner surface of component B, and wherein the gap has a width (*w*), the distance from the outer surface of component A to the inner surface of the at least one cylindrical section of component B, and the gap has a length $\leq L$; and wherein w may optionally vary continuously or discontinuously along the length *L*; and

wherein component A comprises an inner channel, and a plurality of cross-sectional openings extending from the inner channel to the gap; and wherein some or all of the polymer rich solution enters the inner channel, and moves radially through the cross-sectional openings, and within each opening, some or all of the solvent of the polymer rich solution is vaporized, forming a solvent vapor and a polymer melt; and wherein the polymer melt enters the gap, and flows downward from the point of entrance into the gap, and wherein some or all of the solvent vapor flows downward from the point of entrance into the gap; and
wherein for each vertical distance, *y*, as measured from the top of the outer surface of component A, the total amount of the solvent vapor that leaves component A at the given distance *y*, and flows downward into component C, has the following velocities:

a) within the gap, an average vertical downward velocity, defined as the ratio of "the total solvent vapor flow rate" to "the cross-sectional area available for flow," and wherein each of "the total solvent vapor flow rate" and "the cross sectional area available for flow" is measured at the same vertical distance, *y*, and

b) a radial average velocity exiting the component A, defined as the ratio of "the total solvent vapor flow rate at the exit of component A, at the temperature (T) and pressure (P) of the devolatilizer" to "the number of openings in component A multiplied by the cross-sectional area of each opening;" and

wherein the average vertical downward velocity $\leq$ the radial average velocity exiting the component A.

2. The devolatilizer of claim 1, wherein the width (w) of the gap varies along the length L.

3. The devolatilizer of claim 1 or claim 2, wherein, for each distance y, the average vertical downward velocity ranges from 1.0 m/s to 10.0 m/s.

4. The devolatilizer of any one of the previous claims, wherein, for component B, the cylindrical section comprises a cylindrical flared cylinder, which has a diameter, at the end of the flared cylinder, that is greater than the diameter, at the beginning of the flared cylinder.

5. The devolatilizer of claim 4, wherein the diameter at the end of the flared section is greater than 1.2 x the diameter at the beginning of the flared section.

6. The devolatilizer of claim 4, wherein the shroud of component B comprises $\geq$ 4 separate sections, and each section is located at a distance d_1 from the center of component A.

7. The devolatilizer of claim 6, wherein the shroud of component B comprises at least 8 separate sections, and wherein at least 4 of the sections are located at a distance d_1 from the center of component A, and at least 4 of the sections are located at a distance d_2 from the center of component A; and wherein $d_2 > d_1$.

8. The devolatilizer of claim 7, wherein $d_2 > 1.2 \times d_1$.

9. The devolatilizer of any one of claims 1-7, wherein the cylindrical section of component B comprises an upper continuous radial section of length L_C, and a lower segmented section comprising ≥ 2 separate segments, each of length L_S; and wherein $L_S > L_C$; and wherein L_C is measured from the top of component B to the end of the upper continuous radial section; and wherein L_S is measured from the top of component B to the end of a lower segmented section; and wherein the lower segmented section comprises ≥ 4 separate segments, each of length L_S; and wherein $L_S > L_C$.

10. The devolatilizer of any one of the previous claims, wherein the devolatilizer operates at a temperature (T) from 100°C to 300°C, and at a pressure (P) from 3 mBar to 100 mBar.

11. The devolatilizer of any one of the previous claims, wherein the devolatilizer further comprises an outer vessel, and wherein there is a gap (g_5) located between the outer surface of the cylindrical section of component B and the inner surface of the outer vessel; and wherein the width of g_5 varies continuously or discontinuously along the cylindrical

section of component B; and wherein the ratio of "the minimum width of g_5" to "the maximum width of the gap of component C" is ≥ 0.5.

12. A reactor system comprising at least one reactor and the devolatilizer of any one of the previous claims.

13. The reactor system of claim 12, wherein the at least one reactor is a loop reactor.

14. A solution polymerization process to form a polymer, said process comprising at least the following steps:

i) reacting a mixture comprising a solvent, monomer, and optionally one or more comonomers, in at least one reactor, to form a polymer solution comprising the solvent and the polymer;

ii) separating at least a portion of the solvent from the polymer solution to form a polymer-rich solution comprising the polymer and solvent, and wherein the polymer-rich solution comprises more polymer than the polymer solution;

ii) separating at least a portion of the solvent from the polymer-rich solution using the devolatilizer of any one of claims 1- 11.

15. The process of claim 14, wherein the polymer is an olefin-based polymer.