[0005] In order to compete in the global economy, it has become necessary to install polymerization plants having larger capacities (in some cases exceeding 330,000 metric tons per annum, 330 KTA). In plants of that size, even the most efficient conventional designs (such as those disclosed in US Patent 5,453,158) typically reach or exceed the physical size limitations of the flat plate heaters which can be constructed economically and operated successfully, as a practical matter. In particular, those conventional designs are inadequate to achieve the both the necessary degree of devolatilization and the high throughputs of these larger plants, and therefore those heat exchangers have become the capacity-limiting component in the design of devolatilization apparatus for larger polymerization plants.

[0006] Thus a need exists for an improved devolatilization apparatus incorporating a plate heat exchanger having an improved heating channel design, which design would allow higher efficiency and throughput, while achieving sufficiently low residual volatiles in the devolatilized material.

SUMMARY ~~OF THE INVENTION~~

[0007] In a first aspect, there is ~~This invention~~ provided a devolatilization apparatus comprising:

a supply means for supplying a pressurized flowable material comprising at least one liquid or flowable solid, as well as at least one entrained or dissolved volatile component, which flowable material is characterized by a bubble point pressure which varies with the temperature of the flowable material,

a collection-and-volatile-separation means, and

a multiplicity of plates defining a plurality of heating channels, each channel having two zones comprising:

a first zone having (1) an average hydraulic radius, and (2) an inlet adapted to receive the flowable material from the supply means, and

a second zone constituting the remainder of each channel, which second zone is adapted to receive the flowable material from the first zone and has at least one outlet adapted to discharge the flowable material into the collection-and-volatile-separation means, wherein at least a portion of the second zone has a smaller hydraulic radius than the average hydraulic radius of the first zone, and

wherein the design or operation of at least some of the heating channels is such that the pressure of the flowable material at essentially all positions within the first zone of those heating channels exceeds the bubble point pressure of the flowable material.

[0008] In a second aspect, there is ~~This invention also~~ provided a devolatilization apparatus comprising:

(a) a pump for supplying a pressurized flowable material comprising at least one molten polymer and at least one dissolved or entrained volatile component, which flowable

material is characterized by a bubble point pressure which varies with the temperature of the flowable material,

(b) a collection-and-volatile-separation vessel, and

(c) a multiplicity of plates defining a plurality of heating channels, each channel having a substantially uniform height and having two zones comprising:

a first zone having (1) an average hydraulic radius, and (2) an inlet adapted to receive the flowable material from the pump, and

a second zone constituting the remainder of each channel, which second zone is adapted to receive the flowable material from the first zone and has at least one outlet adapted to discharge the flowable material into the collection-and-volatile-separation vessel, wherein at least a portion of the second zone has a smaller hydraulic radius than the average hydraulic radius of the first zone, and

wherein the design or operation of at least some of the heating channels is such that the pressure of the flowable material at essentially all positions within the first zone of the heating channels exceeds the bubble point pressure of the flowable material, and

(d) a plurality of heating elements adapted to heat at least some of the plates so as to increase the temperature of the flowable material as it flows through the heating channels.

[0009] In a third aspect, there is~~This invention also~~ provides~~d~~ a process for the devolatilization of a flowable material comprising a liquid or flowable solid, as well as at least one entrained or dissolved volatile component, which process comprises passing that flowable material through the devolatilization apparatus described above while operating under devolatilization conditions so as to separate the volatile component and produce a substantially devolatilized product.

[0010] In a fourth aspect, there is~~Further, this invention~~ provides~~d~~ a method for the manufacture of a polymer from at least one monomer and optionally one or more comonomers in the presence of a supported or unsupported catalyst, wherein the polymer being produced is dissolved or suspended within a solvent, and wherein a flowable material comprising the polymer in molten form, the solvent, and one or more unreacted monomers or comonomers is processed to remove a majority of the solvent and unreacted monomer or comonomer from the molten polymer, the improvement comprising using the devolatilization apparatus described above~~of Claim 1~~ to process the flowable material so as to produce a substantially devolatilized polymer product having a residual content of the solvent and the unreacted monomer or comonomer of less than 2000 wppm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 depicts a single heating channel useful in one embodiment of the apparatus of the invention.