US 2993842 A describes an apparatus for the distillation of liquids and a process for the fractional distillation of liquids.

SUMMARY

The disclosure firstly provides an apparatus for synthesis of a polymer with separation of a gaseous substance, comprising a reaction space which is delimited by two circular faces and one shell face and has a longitudinal cylinder axis and comprises a lower section, the upper section and the lower section being joined to one another via the first circular face, an inlet orifice, a first outlet orifice disposed in a wall to the lower section, a second outlet orifice disposed in the second circular face or in the shell face between the inlet orifice and the second circular face, and at least one first removal device which is disposed so as to be movable along the longitudinal cylinder axis between the second circular face and the inlet orifice and is in contact with the shell face.

The disclosure further provides a process for synthesizing a polymer, comprising the feeding of a prepolymer melt into a circular cylindrical first section of a reaction space through an inlet orifice tangentially to a shell face of the first section, the polymerization of the prepolymer melt to give a polymer melt, the removal of the polymer melt from the reaction space through a first outlet orifice of the reaction space, and the removal of a gaseous substance from the reaction space through a second outlet orifice of the reaction space above the inlet orifice. In the process, deposits on at least one inner wall of the first section of the reaction space above the inlet orifice are removed by at least the first removal device.

In an aspect, there is provided a continuous process for synthesizing a polymer with separation of a gaseous substance in an apparatus comprising

- a reaction space comprising an essentially circular cylindrical upper section which is delimited by two circular faces and one shell face and has a longitudinal cylinder axis, and a lower section, the upper section and the lower section being joined to one another via the first circular face,
- an inlet orifice is disposed within the shell face such that tangential introduction of a liquid through the inlet orifice along the shell face into the upper section is enabled,
- a first outlet orifice disposed in a wall of the lower section,

- a second outlet orifice disposed in the second circular face or in the shell face between the inlet orifice and the second circular face, and
- at least one first removal device which is disposed so as to be movable along the longitudinal cylinder axis at least between the second circular face and the inlet orifice and is in contact with the shell face,

having the following process steps:

a) feeding a prepolymer melt into a circular cylindrical first section of a reaction space through an inlet orifice tangentially to a shell face of the first section,
b) polymerizing the prepolymer melt to give a polymer melt,
c) removing the polymer melt from the reaction space through a first outlet orifice of the reaction space, and
d) removing a gaseous substance from the reaction space through a second outlet orifice of the reaction space above the inlet orifice,

wherein deposits on at least one inner wall of the upper section of the reaction space above the inlet orifice are removed by at least the first removal device.

A specific embodiment is a process for synthesizing an aliphatic or semiaromatic polyamide, in which a prepolymer of the aliphatic or semiaromatic polyamide is provided and supplied to the apparatus used in accordance with the disclosure.

DESCRIPTION OF THE INVENTION

A prepolymer in the context of the invention refers to a composition comprising polymeric compounds having complementary functional groups capable of a condensation reaction to increase the molecular weight.

The term "prepolymer melt" in the context of the invention refers to a free-flowing composition of the respective reaction mixture comprising the prepolymers. In the course of this, the temperature of the prepolymer melt need not necessarily be above the melting temperature of the pure prepolymer. The flowability may also result from

Claims

1. A continuous process for synthesizing a polymer with separation of a gaseous substance in an apparatus comprising

- a reaction space comprising an essentially circular cylindrical upper section which is delimited by two circular faces and one shell face and has a longitudinal cylinder axis, and a lower section, the upper section and the lower section being joined to one another via the first circular face,
- an inlet orifice is disposed within the shell face such that tangential introduction of a liquid through the inlet orifice along the shell face into the upper section is enabled,
- a first outlet orifice disposed in a wall of the lower section,
- a second outlet orifice disposed in the second circular face or in the shell face between the inlet orifice and the second circular face, and
- at least one first removal device which is disposed so as to be movable along the longitudinal cylinder axis at least between the second circular face and the inlet orifice and is in contact with the shell face,

having the following process steps:

a) feeding a prepolymer melt into a circular cylindrical first section of a reaction space through an inlet orifice tangentially to a shell face of the first section,
b) polymerizing the prepolymer melt to give a polymer melt,
c) removing the polymer melt from the reaction space through a first outlet orifice of the reaction space, and
d) removing a gaseous substance from the reaction space through a second outlet orifice of the reaction space above the inlet orifice,

wherein deposits on at least one inner wall of the upper section of the reaction space above the inlet orifice are removed by at least the first removal device.

2. The process according to claim 1, wherein the first removal device is rotated about the longitudinal cylinder axis of the first section.

3. The process according to claim 1, wherein the inlet orifice is connected by means of an inlet line to the second circular face of the upper section, the first removal device having an orifice through which the inlet line is conducted.

4. The process according to any of claims 1 to 3, wherein the second outlet orifice is connected to an outlet line in which there is disposed a second removal device which is disposed so as to be movable along the outlet line and is in contact with the inner face of the outlet line.

5. The process according to any of claims 1 to 4, wherein a cross section of the lower section decreases from the upper section toward the first outlet orifice.

6. The process according to claim 1 or 2, wherein the speed with which the polymer melt moves toward the first outlet orifice rises with falling distance from the first outlet orifice.

7. The process according to claim 6, wherein the polymer melt is transported by means of a transport apparatus to the first outlet orifice.

8. The process according to any of claims 1, 2, 6 and 7, wherein the polymer is selected from thermoplastic polymers, preferably polyamides, thermoplastic polyurethanes, polyolefins, vinylaromatic polymers, polyesters, polyacetals, polycarbonates, polysulfones, polyether sulfones and mixtures thereof.

9. The process according to any of claims 1, 2, 6, 7 and 8, wherein the polymer is a polyamide and the gaseous substance is steam.

10. The process according to any of claims 1, 2, 6, 7, 8 and 9, wherein the polymer is a semiaromatic polyamide comprising at least one repeat unit having an aromatic group and at least one repeat unit having an aliphatic or cycloaliphatic group in incorporated form.

11. The process according to any of claims 8 to 10, wherein the polymer is a polyamide selected from