The disclosure provides a process for continuously preparing an aliphatic or semiaromatic polyamide, in which

a) an aqueous composition comprising at least one component which is suitable for polyamide formation and is selected from dicarboxylic acids, diamines, salts of at least one dicarboxylic acid and at least one diamine, lactams, ω-amino acids, aminocarbonitriles and mixtures thereof is provided, and the composition provided is supplied to an oligomerization zone,

b) in the oligomerization zone, the composition is subjected to an oligomerization at a temperature of 170 to 290°C and an absolute pressure of at least 20 bar and a liquid output comprising the polyamide oligomers is withdrawn from the oligomerization zone,

c) the output from the oligomerization zone is optionally fed into a flash zone E1) and subjected to expansion to obtain a water-containing gas phase and a liquid phase comprising the polyamide oligomers, and at least a portion of the water-containing gas phase is removed,

d) the liquid output from the oligomerization zone or the liquid phase from the flash zone E1) is subjected to rapid heating to a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide, and

e) the heated composition from step d) is fed into a flash zone E2) and expanded to obtain a water-containing gas phase and a polyamide-containing liquid phase, at least a portion of the water-containing gas phase is removed and the polyamide-containing phase is subjected to a postpolymerization at a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide.

In a first aspect, there is provided a process for continuously preparing a semiaromatic polyamide, in which

a) an aqueous composition comprising at least one component which is suitable for polyamide formation and is selected from dicarboxylic acids, diamines, salts of at least one dicarboxylic acid and at least one diamine, lactams, ω-amino acids, aminocarbonitriles and mixtures thereof is provided, and the composition provided is supplied to an oligomerization zone,

b) in the oligomerization zone, the composition is subjected to an oligomerization at a temperature of 170 to 290°C and an absolute pressure of at least 20 bar, the oligomerization in step b) being effected without mass transfer with the environment, wherein no introduction and also no discharge of components, from the interior of the vessel into the environment, or vice versa, takes place, and a liquid output comprising the polyamide oligomers is withdrawn from the oligomerization zone,

c) the output from the oligomerization zone is optionally fed into a flash zone E1) and subjected to expansion to obtain a water-containing gas phase and a liquid phase comprising the polyamide oligomers, and at least a portion of the water-containing gas phase is removed,

d) the liquid output from the oligomerization zone or the liquid phase from the flash zone E1) is subjected to rapid heating to a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide, and

e) the heated composition from step d) is fed into a flash zone E2) and expanded to obtain a water-containing gas phase and a polyamide-containing liquid phase, at least a portion of the water-containing gas phase is removed and the polyamide-containing phase is subjected to a postpolymerization at a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide.

The disclosure further provides polyamide oligomers obtainable by a process as defined above and hereinafter.

The disclosure further provides a process for preparing a polyamide, in which a polyamide oligomer obtainable by a process as defined above and hereinafter is subjected to a further polymerization. The disclosure also provides the polyamides thus obtainable.

The disclosure further provides a polyamide molding composition comprising at least one polyamide, obtainable by a process as defined above and hereinafter. The disclosure further provides a molding produced from such a polyamide molding composition.

The disclosure further provides for the use of a semiaromatic polyamide obtainable by a process as defined above and hereinafter, preferably for production of electrical and electronic components and for high-temperature automotive applications.

In another aspect, there is provided the use of a semiaromatic polyamide obtainable by a process as defined above and hereinafter for production of electrical and electronic components and for high-temperature automotive applications.

In another aspect, there is provided the use of an aliphatic polyamide obtainable by a process as defined above and hereinafter for production of films, monofilaments, fibers, yarns or textile fabrics.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows a simple apparatus for performance of the process according to the invention, comprising

- a mixing vessel for provision of the aqueous composition comprising at least one component suitable for polyamide formation (in the specific implementation, the aqueous composition is preferably provided in a mixing vessel and transferred into a reservoir vessel for continuous feeding),

- a tubular reactor as an oligomerization zone (in a departure from the specific implementation, other reactors can also be used for oligomerization, as described in detail hereinafter),

- a draw point from the oligomerization zone with an apparatus for pressure reduction,

- a heat exchanger for rapid heating of the reaction mixture,

Claims

1. A process for continuously preparing a semiaromatic polyamide, in which

a) an aqueous composition comprising at least one component which is suitable for polyamide formation and is selected from dicarboxylic acids, diamines, salts of at least one dicarboxylic acid and at least one diamine, lactams, ω-amino acids, aminocarbonitriles and mixtures thereof is provided, and the composition provided is supplied to an oligomerization zone,

b) in the oligomerization zone, the composition is subjected to an oligomerization at a temperature of 170 to 290°C and an absolute pressure of at least 20 bar, the oligomerization in step b) being effected without mass transfer with the environment, wherein no introduction and also no discharge of components, from the interior of the vessel into the environment, or vice versa, takes place, and a liquid output comprising the polyamide oligomers is withdrawn from the oligomerization zone,

c) the output from the oligomerization zone is optionally fed into a flash zone E1) and subjected to expansion to obtain a water-containing gas phase and a liquid phase comprising the polyamide oligomers, and at least a portion of the water-containing gas phase is removed,

d) the liquid output from the oligomerization zone or the liquid phase from the flash zone E1) is subjected to rapid heating to a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide, and

e) the heated composition from step d) is fed into a flash zone E2) and expanded to obtain a water-containing gas phase and a polyamide-containing liquid phase, at least a portion of the water-containing gas phase is removed and the polyamide-containing phase is subjected to a postpolymerization at a temperature above the melting temperature Tm_2 of the aliphatic or semiaromatic polyamide.

2. The process according to claim 1, wherein the composition provided in step a) has a water content of 20 to 55% by weight, based on the total weight of the composition.

28. The process according to any of the preceding claims, wherein the water phase obtained in step c) and/or that obtained in step e) is used at least partly for preparation of the aqueous composition in step a).

29. The process according to any of the preceding claims, wherein step e) is followed by withdrawal of an output from the flash zone E2) and the latter is then subjected to further processing, preferably selected from

- devolatilization,
- postcondensation,
- compounding,
- pelletization,
- combinations thereof.

30. The process according to claim 29, wherein the further processing comprises an extrusion.

31. The use of an aliphatic polyamide obtainable by a process as defined in any of claims 1 to 30 for production of films, monofilaments, fibers, yarns or textile fabrics.

32. The use of a semiaromatic polyamide obtainable by a process as defined in any of claims 1 to 30 for production of electrical and electronic components and for high-temperature automotive applications.

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33. The use according to claim 32 in soldering operations under lead-free conditions (lead free soldering), for production of plug connectors, microswitches, microbuttons and semiconductor components, especially reflector housings of light-emitting diodes (LEDs).