US 2003/0176624 A1 describes a process for solid phase drying or solid phase polymerization of a polyamide based on xylylenediamine. This solid phase polymerization takes place in an inert gas stream or under reduced pressure.

WO 2007/048728 describes polyamides formed from m-xylylenediamine and adipic acid having an amino end group content of less than 15 mmol/kg. A prepolymer is first prepared, which can optionally be subjected to an extraction and a solid phase condensation. The solid phase condensation can be effected either under reduced pressure or under inert gas.

It is an object of the present invention to provide an improved process for preparing aliphatic or semiaromatic polyamides. These are to feature advantageous product properties, more particularly not too broad a molecular weight distribution and/or a low gel content.

It has been found that, surprisingly, this object is achieved when a prepolymer of an aliphatic or aromatic polyamide is subjected to a solid state polymerization in a closed vessel at elevated pressure and in the presence of an inert gas. This is especially surprising since no discharge of components, specifically of water, from the interior of the vessel into the environment is possible during the solid state polymerization.

SUMMARY

There is provided a process for preparing an aliphatic or semiaromatic polyamide, in which

a) a prepolymer of the aliphatic or semiaromatic polyamide is provided,

b) the prepolymer provided in step a) is subjected to a solid state polymerization in a closed vessel at elevated temperature and elevated pressure in the presence of a gas which is inert under the treatment conditions.

In an aspect, there is provided a process for preparing an aliphatic or semiaromatic polyamide, in which

a) a prepolymer of the aliphatic or semiaromatic polyamide is provided,

b) the prepolymer provided in step a) is subjected to a solid state polymerization in a closed vessel at a temperature within a range from 200

to 290°C and a pressure within a range from 1.5 to 20 bar in the presence of a gas which is inert under the treatment conditions.

There is also provided an aliphatic or semiaromatic polyamide obtainable by a process as defined above and hereinafter.

There is also provided a polyamide molding composition comprising at least one polyamide, obtainable by a process as defined above and hereinafter. There is also provided a molding produced from such a polyamide molding composition.

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.

There is also provided 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 for production of electrical and electronic components and for high-temperature automotive applications.

DESCRIPTION OF THE INVENTION

A "solid state polymerization" is generally understood to mean a condensation reaction to increase the molecular weight within a temperature range above the glass transition temperature and below the melting temperature of the polyamide. Within this temperature range, unwanted thermal degradation of the polyamide can substantially be avoided.

A "solid state polymerization in a closed vessel" is understood to mean that no mass transfer between the interior of the vessel and the environment takes place after the polymerization temperature has been attained. More particularly, no gas stream is passed through the vessel during the solid state polymerization. Thus, during the solid state polymerization, there is no discharge of components, for example of water, from the interior of the vessel into the environment. Exchange of heat between the interior of the vessel and the environment is, in contrast, permitted in the invention solid state polymerization in a closed vessel.

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 condensation of the monomers of the acid component and of the diamine component, and also of any lactam component used, forms repeat units or end groups in the form of amides derived from the respective monomers. These monomers generally account for 95 mol%, especially 99 mol%, of all the repeat units and end groups present in the copolyamide. In addition, the copolyamide may also comprise small amounts of other repeat units which may result from degradation reactions or side reactions of the monomers, for example of the diamines.