It has been found that, surprisingly, the use of higher amounts of at least one cyclic diamine than described in EP 0 667 367 A2 achieves copolyamides with significantly higher glass transition temperatures, combined with high crystallinity and equally high melting point. The copolyamides thus obtained are thus processible at the same temperatures, but feature better mechanical properties at high temperatures. This is especially true when the amine component of the copolyamides comprises isophoronediamine or consists of isophoronediamine.

SUMMARY

The disclosure firstly provides a semiaromatic copolyamide PA) comprising in copolymerized form:

a) 36 to 50 mol% of terephthalic acid,
b) 0 to 14 mol% of isophthalic acid,
c) 35 to 42.5 mol% of hexamethylenediamine,
d) 7.5 to 15 mol% of at least one cyclic diamine,

where components a) to d) together add up to 100 mol%.

The disclosure further provides polyamide molding compositions comprising a semiaromatic copolyamide as defined above and hereinafter.

The disclosure further provides for the use of a semiaromatic copolyamide for production of polyamide molding compositions which serve especially for production of components for high-temperature automotive applications and the electrical/electronics sector.

In an aspect, there is provided a semiaromatic copolyamide PA) comprising, in copolymerized form:

a) 36 to 50 mol% of terephthalic acid,
b) 0 to 14 mol% of isophthalic acid,
c) 35 to 42.5 mol% of hexamethylenediamine,
d) 7.5 to 15 mol% of at least one cyclic diamine,

where components a) to d) together add up to 100 mol%;
wherein the cyclic diamine d) is selected from bis(3-methyl-4-aminocyclohexyl)methane (MACM), 4,4'-(aminocyclohexyl)methane (PACM) and mixtures thereof.

Claims

1. A semiaromatic copolyamide PA) comprising, in copolymerized form:

a) 36 to 50 mol% of terephthalic acid,
b) 0 to 14 mol% of isophthalic acid,
c) 35 to 42.5 mol% of hexamethylenediamine,
d) 7.5 to 15 mol% of at least one cyclic diamine,

where components a) to d) together add up to 100 mol%;

wherein the cyclic diamine d) is selected from bis(3-methyl-4-aminocyclohexyl)methane (MACM), 4,4'-(aminocyclohexyl)methane (PACM) and mixtures thereof.

2. The copolyamide according to claim 1, which comprises terephthalic acid and isophthalic acid copolymerized in a molar ratio of 100:0 to 80:20.

3. The copolyamide according to claim 1 comprising, in copolymerized form:

a) 36 to less than 50 mol% of terephthalic acid,
b) more than 0 mol% and up to 14 mol% of isophthalic acid,
c) 35 to 42.5 mol% of hexamethylenediamine,
d) 7.5 to 15 mol% of at least one cyclic diamine,

where components a) to d) together add up to 100 mol%;

wherein the cyclic diamine d) is selected from bis(3-methyl-4-aminocyclohexyl)methane (MACM), 4,4'-(aminocyclohexyl)methane (PACM) and mixtures thereof.

4. The copolyamide according to claim 3, which comprises terephthalic acid and isophthalic acid copolymerized in a molar ratio of 100: >0 to 80:20.

5. The copolyamide according to any of the preceding claims, which comprises hexamethylenediamine and at least one cyclic diamine copolymerized in a molar ratio of 75:25 to 85:15.

6. The copolyamide according to any of the preceding claims, which has a glass transition temperature Tg_2 of at least 145°C.

7. The copolyamide according to any of the preceding claims, which has a heat of fusion ΔH_2 of at least 40 J/g.

8. A polyamide molding composition comprising at least one copolyamide as defined in any of claims 1 to 7.

9. The polyamide molding composition according to claim 8, comprising:

A) 25 to 100% by weight of at least one copolyamide as defined in any of claims 1 to 7,
B) 0 to 75% by weight of at least one filler and reinforcer,
C) 0 to 50% by weight of at least one additive,

where components A) to C) together add up to 100% by weight.

10. A molding produced from a polyamide molding composition according to either of claims 8 and 9.

11. The molding according to claim 10, in the form of or as part of a component for the automotive sector, especially selected from cylinder head covers, engine hoods, housings for charge air coolers, charge air cooler valves, intake pipes, intake manifolds, connectors, gears, fan impellers, cooling water tanks, housings or housing parts for heat exchangers, coolant coolers, charge air coolers, thermostats, water pumps, heating elements, securing parts.

12. The molding according to claim 11, in the form of or as part of an electrical or electronic component, especially selected from printed circuit boards and parts thereof, housing constituents, films, wires, switches, distributors, relays, resistors, capacitors, windings, lamps, diodes, LEDs, transistors, connectors, regulators, memory chips and sensors.

13. The use of a semiaromatic copolyamide as defined in any of claims 1 to 7 or of a molding composition as defined in either of claims 8 and 9 for production of electrical and electronic components and for high-temperature automotive applications.

14. The use according to claim 13 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).