CLAIMS

1. A melt-spun fiber, comprising:

(a) a thermoplastic polyurethane composition, comprising the reaction product of:

i. a polyol component, wherein the polyol component comprises a co-polymer diol derived from caprolactone monomer and poly(tetramethylene ether glycol);

ii. a hydroxyl terminated chain extender component; and

iii. a first diisocyanate component; and

(b) an isocyanate functional prepolymer crosslinking agent, wherein the isocyanate prepolymer crosslinking agent comprises or consists of the reaction product of poly(tetramethylene ether glycol) and a second diisocyanate component or neopentyl glycol adipate and a second diisocyanate component.

2. The melt-spun fiber of claim 1, wherein the co-polymer diol comprises the reaction product of 50% by weight caprolactone monomer polyol and 50% by weight poly(tetramethylene ether glycol).

3. The melt-spun fiber of claim 1 or 2, wherein the copolymer has a number average molecular weight of about 2000 Daltons measured by end group analysis.

4. The melt-spun fiber of any preceding claim, wherein the chain extender component comprises or consists of 1,4-bis(β-hydroxyethoxy)benzene.

5. The melt-spun fiber of claim 4, wherein the chain extender component further comprises a co-chain extender, optionally wherein the co-chain extender is selected from ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, 1,4-butanediol, 1,6-hexanediol, 1,3-butanediol, 1,5-pentanediol, neopen-tylglycol, 1,4-cyclohexanedimethanol, 2,2-bis[4-(2-hydroxyethoxy) phenyl]propane, hexameth-ylenediol, heptanediol, nonanediol, dodecanediol, 3-methyl-1,5-pentanediol, ethylenediamine, butanediamine, hexamethylenediamine, hydroxyethyl resorcinol and mixtures thereof.

6. The melt-spun fiber of any preceding claim, wherein the first diisocyanate component comprises or consists of an aromatic diisocyanate, optionally comprising 4,4'-diphenylmethane diisocyanate.

7. The melt-spun fiber of any preceding claim, wherein the thermoplastic polyurethane composition contains 50% to 80% by weight or 60% to 80% by weight or 70% to 80% by weight-of the polyol component, 5% to 25% by weight or 5% to 15% by weight or 5% to 10% of the chain extender component, and 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate component.

8. The melt-spun fiber of any preceding claim, wherein the second diisocyanate component comprises an aromatic diisocyanate, 4,4´-methylenebis(phenyl isocyanate), an aliphatic diisocyanate, or dicyclohexylmethane-4,4´-diisocyanate.

9. A melt-spun thermoplastic polyurethane fiber, comprising the reaction product of:

(a) a thermoplastic polyurethane composition, comprising the reaction product of:

i. a polyol component, wherein the polyol component comprises a co-polymer diol derived from caprolactone monomer and poly(tetramethylene ether glycol);

ii. a hydroxyl terminated chain extender component comprising ~~or consisting of~~ 1,4-bis(β-hydroxyethoxy)benzene; and

iii. a first diisocyanate component; and

(b) an isocyanate functional prepolymer crosslinking agent, wherein the isocyanate prepolymer crosslinking agent comprises or consists of the reaction product of poly(tetramethylene ether glycol) and a second diisocyanate component or neopentyl glycol adipate and a second diisocyanate component;

wherein the thermoplastic polyurethane fiber has a weight average molecular weight measured by gas permeation chromatography of 300,000 to 450,000.

10. The melt-spun thermoplastic polyurethane fiber of claim 9, wherein the co-polymer diol comprises the reaction product of 50% by weight caprolactone monomer polyol and 50% by weight poly(tetramethylene ether glycol).

11. The melt-spun thermoplastic polyurethane fiber of claim 9, wherein the first diisocyanate component comprises or consists of an aromatic diisocyanate, optionally comprising 4,4’-diphenylmethane diisocyanate.

12. The melt-spun thermoplastic polyurethane fiber of claim 9, wherein the thermoplastic polyurethane composition contains 50% to 80% by weight or 60% to 80% by weight or 70% to 80% by weight-of the polyol component, 5% to 25% by weight or 5% to 15% by weight or

5% to 10% of the chain extender component, and 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate component.

13. The melt-spun thermoplastic polyurethane fiber of claim 12, wherein the second diisocyanate component comprises an aromatic diisocyanate, 4,4´-methylenebis(phenyl isocyanate), an aliphatic diisocyanate, or dicyclohexylmethane-4,4´-diisocyanate.

14. A process for preparing a thermoplastic polyurethane fiber comprising the steps of:

(1) preparing a reactive thermoplastic polyurethane composition that is the reaction product of (a) a polyol component, wherein the polyol component comprises a co-polymer diol derived from caprolactone monomer and poly(tetramethylene ether glycol), (b) a chain extender component comprising 1,4-bis(β-hydroxyethoxy)benzene; and (c) a first diisocyanate;

(2) drying the reactive thermoplastic polyurethane composition;

(3) melting the reactive thermoplastic polyurethane composition in an extruder;

(4) adding an isocyanate functional prepolymer into the extruder; wherein the isocyanate prepolymer comprises or consists of the reaction product of poly(tetramethylene ether glycol) and a second diisocyanate component or neopentyl glycol adipate and a second diisocyanate component;

(5) mixing the reactive thermoplastic polyurethane composition and the isocyanate functional prepolymer in the extruder to form a crosslinked thermoplastic polyurethane polymer;

(6) feeding the crosslinked thermoplastic polyurethane polymer to at least one spinneret to produce a melt-spun fiber;

(7) cooling the melt-spun fiber; and

(8) winding the melt-spun fiber onto a bobbin.

15. The process of claim 14, wherein the co-polymer diol comprises the reaction product of 50% by weight caprolactone monomer polyol and 50% by weight poly(tetramethylene ether glycol).

16. The process of claim 14 or 15 wherein the thermoplastic polyurethane fiber has a weight average molecular weight measured by gas permeation chromatography of 300,000 to 450,000.

17. The process of claim 14, wherein the first diisocyanate component comprises or consists of an aromatic diisocyanate, optionally comprising 4,4'-diphenylmethane diisocyanate.

18. The process of any of claims 14 to 17, wherein the reactive thermoplastic polyurethane composition contains 50% to 80% by weight or 60% to 80% by weight or 70% to 80% by weight-of the polyol component, 5% to 25% by weight or 5% to 15% by weight or 5% to 10% of the chain extender component, and 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate component.

19. The process of claim 14, wherein the second diisocyanate component comprises an aromatic diisocyanate, 4,4´-methylenebis(phenyl isocyanate), an aliphatic diisocyanate, or dicyclohexylmethane-4,4´-diisocyanate.