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.

6. ~~The melt-spun fiber of claim 5,~~, 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.

~~7~~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.

~~8. The melt-spun fiber of claim 7, wherein the first diisocyanate component comprises or consists of 4,4'-diphenylmethane diisocyanate.~~

~~9~~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.

~~10. The melt-spun fiber of any preceding claim, wherein the thermoplastic polyurethane composition contains 5% to 25% by weight or 5% to 15% by weight or 5% to 10% of the chain extender component.~~

~~11. The melt-spun fiber of any preceding claim, wherein the thermoplastic polyurethane composition contains 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate.~~

~~12~~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.

~~13. The melt-spun fiber of claim 12, wherein the second diisocyanate component comprises or consists of 4,4´ methylenebis(phenyl isocyanate).~~

~~14. The melt-spun fiber of any of claims 1 or 11, wherein the second diisocyanate component comprises an aliphatic diisocyanate.~~

~~15. The melt-spun fiber of claim 14, wherein the second diisocyanate component comprises or consists of dicyclohexylmethane 4,4´ diisocyanate.~~

~~16~~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.

~~17~~10. The melt-spun thermoplastic polyurethane fiber of claim ~~16~~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).

~~18~~11. The melt-spun thermoplastic polyurethane fiber of claim ~~16 or 17~~9, wherein the first diisocyanate component comprises or consists of an aromatic diisocyanate~~.~~, optionally comprising 4,4'-diphenylmethane diisocyanate.

~~19~~12. The melt-spun thermoplastic polyurethane fiber of claim ~~18, wherein the first diisocyanate component comprises or consists of 4,4'-diphenylmethane diisocyanate.~~

~~20. The melt-spun thermoplastic polyurethane fiber of any of claims 16 to 19~~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.

~~21~~13. The melt-spun thermoplastic polyurethane fiber of ~~any of claims 16 to 20, wherein the thermoplastic polyurethane composition contains 5% to 25% by weight or 5% to 15% by weight or 5% to 10% of the chain extender component.~~

~~22. The melt-spun thermoplastic polyurethane fiber of any of claims 16 to 21, wherein the thermoplastic polyurethane composition contains 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate.~~

~~23. The melt-spun thermoplastic polyurethane fiber of any of claims 16 to 22~~claim 12, wherein the second diisocyanate component comprises an aromatic diisocyanate~~.~~

~~24. The melt-spun thermoplastic polyurethane fiber of claim 23, wherein the second diisocyanate component comprises or consists of,~~ 4,4´-methylenebis(phenyl isocyanate~~).~~

~~25. The melt-spun thermoplastic polyurethane fiber of any of claims 16 to 22, wherein the second diisocyanate component comprises~~), an aliphatic diisocyanate~~.~~

~~26. The melt-spun thermoplastic polyurethane fiber of claim 25, wherein the second diisocyanate component comprises or consists of~~ , or dicyclohexylmethane-4,4´-diisocyanate.

~~27~~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.

~~28~~15. The process of claim ~~27~~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).

~~29~~16. The process of claim ~~27~~14 or ~~28~~15 wherein the thermoplastic polyurethane fiber has a weight average molecular weight measured by gas permeation chromatography of 300,000 to 450,000.

~~30~~17. The process of ~~any of claims 27 to 29~~claim 14, wherein the first diisocyanate component comprises or consists of an aromatic diisocyanate~~.~~

~~31. The process of claim 30, wherein the first diisocyanate component comprises or consists of~~, optionally comprising 4,4'-diphenylmethane diisocyanate.

~~32~~18. The process of any of claims ~~27~~14 to ~~31~~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.

~~33. The process of any of claims 27 to 32, wherein the reactive thermoplastic polyurethane composition contains 5% to 25% by weight or 5% to 15% by weight or 5% to 10% of the chain extender component.~~

~~34. The process of any of claims 27 to 33, wherein the reactive thermoplastic polyurethane composition contains 15% to 30% by weight or 15% to 25% by weight, or 15% to 20% by weight of the first diisocyanate.~~

~~35. The process of any of claims 27 to 34~~ 19. The process of claim 14, wherein the second diisocyanate component comprises an aromatic diisocyanate~~.~~

~~36. The process of claim 35, wherein the second diisocyanate component comprises or consists of~~, 4,4´-methylenebis(phenyl isocyanate~~).~~

~~37. The process of any of claims 27 tp 34, wherein the second diisocyanate component comprises~~), an aliphatic diisocyanate~~.~~

~~38. The process of claim 37, wherein the second diisocyanate component comprises or consists of~~ , or dicyclohexylmethane-4,4´-diisocyanate.