[0017] The invention further provides a fabric comprising at least two different fibers wherein at least one of said fibers is any of the fibers described herein.

[0018] The invention further provides a process for producing a melt-spun elastic fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the load and unload cycle between 100% and 200% elongation, said process comprising: (a) melt spinning a thermoplastic elastomer polymer through a spinneret; and (b) winding the elastic fiber into bobbins at a winding speed which is no greater than 50% of the polymer melt velocity exiting the spinneret.

The present specification describes the features concerning the following items.

(Item 1) A melt-spun fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the load and unload cycle between 100% and 200% elongation.

(Item 2) The fiber of item 1 wherein the modulus of the fiber, on the 5th pull cycle, has a modulus that does not increase by more than 400% on the load cycle between 100% and 200% elongation.

(Item 3) The fiber of any of the items 1 to 2 wherein a Jersey knit fabric prepared from said fibers having superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength, as measured by ASTM D751, such that the load/thick at failure is at least 710 lbf/in (124 N/mm).

(Item 4) The fiber of any of the items 1 to 3 wherein the fiber is a monofilament fiber that is 30 to 300 microns in diameter.

(Item 5) The fiber of any of the items 1 to 4
wherein the denier of the fiber is from 40 to 90;
wherein the modulus of the fiber, on the 5th pull cycle, increases between 80 and 130% on the load cycle between 100% and 200% elongation;
wherein a Jersey knit fabric prepared from said fibers has a burst puncture strength, as measured by ASTM D751, such that the load/thick at failure for the fabric is between 710 and 1600 lbf/in (124 and 280 N/mm); and
wherein the fiber is monofilament and has a diameter of 80 to 100 microns

(Item 6) The fiber of any of the items 1 to 4
wherein the denier of the fiber is from 90 to 160;

wherein the modulus of the fiber, on the 5th pull cycle, increases between 50 and 120% on the load cycle between 100% and 200% elongation; and

wherein the fiber is monofilament and has a diameter of 100 to 150 microns.

(Item 7) The fiber of any of the items 1 to 4

wherein the denier of the fiber is from 300 to 400;

wherein the modulus of the fiber, on the 5th pull cycle, increases between 50 to 150% on the load cycle between 100% and 200% elongation; and

wherein the fiber is monofilament and has a diameter of 180 to 220 microns.

(Item 8) The fiber of any of the items 1 to 7 wherein a Jersey knit fabric prepared from said fibers have superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength as measured by ASTM D751, such that the energy to failure is at least 25 lbf-in. (2.8 N-m).

(Item 9) The fiber of any if the items 1 to 8 wherein a Jersey knit fabric prepared from said fibers have superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength, as measured by ASTM D751, such that the load at failure is at least 6 pounds (2.7 kg).

(Item 10) The fiber of any of the items 1 to 9 wherein said fiber is a thermoplastic polyurethane fiber.

(Item 11) The fiber of item 10 wherein said fiber is a polyester thermoplastic polyurethane, optionally crosslinked with a polyether crosslinking agent.

(Item 12) The fiber of any of the items 1 to 11 wherein the weight average molecular weight of the fiber is at least 500,000.

(Item 13) The fiber of any of the items 1 to 11 wherein the fiber is made from a polymer composition and wherein the weight average molecular weight of said polymer composition is from 500,000 to 1,500,000.

(Item 14)

A fabric comprising at least two different fibers wherein at least one of said fibers is the fiber of any of the items 1 to 13.

(Item 15) A process for producing a melt-spun fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the load and unload cycle between 100% and 200% elongation an elastic fiber, said process comprising:
melt spinning a thermoplastic elastomer polymer through a spinneret; and
winding the elastic fiber into bobbins and a winding speed which is no greater than 50% of the polymer melt velocity exiting the spinneret.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Various preferred features and embodiments will be described below by way of non-limiting illustration.

The Fibers and Fabrics

[0020] The fibers of this invention have a relatively constant modulus at room temperature in the load and unload cycle between 100% and 200% elongation. In some embodiments, the fiber of this invention has an elongation at break of at least 400%, or about 450 to 500%. The superlative fiber of this invention has a nearly perfect constant modulus at body temperature. This room temperature/body temperature constant compression is evidenced by the example provided herein.

[0021] The standard test procedure employed to obtain the values described here is one developed by DuPont for elastic yarns. The test subjects fibers to a series of 5 cycles. In each cycle, the fiber is stretched to 300% elongation, and relaxed using a constant extension rate (between the original gauge length and 300% elongation). The % set is measured after the 5^{th} cycle. Then, the fiber specimen is taken through a 6^{th} cycle and stretched to breaking. The instrument records the load at each extension, the highest load before breaking, and the breaking load in units of grams-force per denier as well as the breaking elongation and elongation at the maximum load. The test is normally conducted at room temperature (23ºC ± 2ºC; and 50% ± 5% humidity).

[0022] In some embodiments, the fiber of the invention has a round cross-section. Referring to FIG. 2, it can be seen that a 70 denier fiber according to the invention is substantially round in cross sectional shape. FIG. 1 shows a typical and industry standard 70 denier ribbon-like high elongation SEF which has a different and larger cross

What is claimed is:

1. A melt-spun fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the load and unload cycle between 100% and 200% elongation, wherein the fiber is a polyester thermoplastic polyurethane corsslinked with a polyether crosslinking agent, and wherein the fiber has a weight average of at least 500,000.

2. The fiber of claim 1 wherein the modulus of the fiber, on the 5^{th} pull cycle, has a modulus that does not increase by more than 400% on the load cycle between 100% and 200% elongation;

3. The fiber of any of the claims 1 to 2 wherein a Jersey knit fabric prepared from said fibers having superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength, as measured by ASTM D751, such that the load/thick at failure is at least 710 lbf/in (124 N/mm).

4. The fiber of any of the claims 1 to 3 wherein the fiber is a monofilament fiber that is 30 to 300 microns in diameter.

5. The fiber of any of the claims 1 to 4

wherein the denier of the fiber is from 40 to 90;

wherein the modulus of the fiber, on the 5^{th} pull cycle, increases between 80 and 130% on the load cycle between 100% and 200% elongation;

wherein a Jersey knit fabric prepared from said fibers has a burst puncture strength, as measured by ASTM D751, such that the load/thick at failure for the fabric is between 710 and 1600 lbf/in (124 and 280 N/mm); and

wherein the fiber is monofilament and has a diameter of 80 to 100 microns.

6. The fiber of any of the claims 1 to 4

wherein the denier of the fiber is from 90 to 160;

wherein the modulus of the fiber, on the 5th pull cycle, increases between 50 and 120% on the load cycle between 100% and 200% elongation; and

wherein the fiber is monofilament and has a diameter of 100 to 150 microns.

7. The fiber of any of the claims 1 to 4

wherein the denier of the fiber is from 300 to 400;

wherein the modulus of the fiber, on the 5th pull cycle, increases between 50 and 150% on the load cycle between 100% and 200% elongation; and

wherein the fiber is monofilament and has a diameter of 180 to 220 microns.

8. The fiber of any if the claims 1 to 7 wherein a Jersey knit fabric prepared from said fibers have superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength, as measured by ASTM D751, such that the energy to failure is at least 25 lbf-in. (2.8 N-m).

9. The fiber of any if the claims 1 to 8 wherein a Jersey knit fabric prepared from said fibers have superior burst puncture strength, wherein superior burst puncture strength means the fibers of said fabric, when said fibers have an average denier of about 70, have a burst puncture strength, as measured by ASTM D751, such that the load at failure is at least 6 pounds (2.7 kg).

10. The fiber of any of the claims 1 to 9 wherein said fiber is ~~a thermoplastic polyurethane fiber~~ made from a polymer composition and wherein the weight average molecular weight of said polymer composition is from 500,000 to 1,500,000.

11. ~~The fiber of claim 10 wherein said fiber is a polyester thermoplastic polyurethane, optionally crosslinked with a polyether crosslinking agent~~ A fabric comprising at least two different fibers wherein at least one of said fibers is the fiber of any of the claims in 1 to 10.

12. ~~The fiber of any of the claims 1 to 11~~ A process for producing a melt-spun fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the

load and unload cycle between 100% and 200% elongation on elastic fiber, said process comprising:

(a) Melt spinning a thermoplastic elastomer polymer through a spinneret; and

(b) winding the elastic fiber into bobbins ad a winding speed which is no greater than 50% of the polymer melt velocity exiting the spinneret,

wherein the fiber is a polyester thermoplastic polyurethane crosslinked with a polyether crosslinking agent, and wherein the weight average molecular weight of the fiber is at least 500,000.

13. The fiber of any of the claims 1 to 11 wherein the fiber is made from a polymer composition and wherein the weight average molecular weight of said polymer composition is from 500,000 to 1,500,000.

14. A fabric comprising at least two different fibers wherein at least one of said fibers is the fiber of any of the claims 1 to 13.

15. A process for producing a melt-spun fiber having an ultimate elongation of at least 400% and having a relatively flat modulus in the load and unload cycle between 100% and 200% elongation an elastic fiber, said process comprising:

(a) melt spinning a thermoplastic elastomer polymer through a spinneret; and

(b) winding the elastic fiber into bobbins at a winding speed which is no greater than 50% of the polymer melt velocity exiting the spinneret.