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(71) Applicant: **Cognis IP Management GmbH**
40589 Düsseldorf (DE)

(72) Inventors:
- **McCoy, Kay M.**
  Fort Mill
  SC 29715 (US)
- **Langley, Jeffrey T.**
  Lake Wylie
  SC 29710 (US)
- **Tuller, Frank Norman**
  Columbia
  SC 29205-3147 (US)

(54) **Textile fibers having soft hand characteristics and methods of making thereof**

(57) This invention relates to a fiber having a softer feel which comprises a fiber-forming polymer melt-blended with a bisamide additive of the formula:

$$RCNH(R'NH)_xR'NHCR'' \qquad (I)$$

wherein R and R'' can be the same or different and are straight or branched alkyl groups having from 7 to 19 carbon atoms, R' is a C_2-C_4 linear alkyl group, preferably ethylene, and x is an integer of from 0 to 5.

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Description

Background of the invention

[0001] There is a need in the textile industry to develop and provide a fiber having a softer feel. Traditionally, fibers formed from various polymers have been treated post-extrusion with various spin finish compositions. However, the use of traditional topical spin finishes has not met the need in the textile industry for the desired softer fibers. Some wax-based, topical spin finishes have resulted in softer fiber. However, these wax-based finishes have not been widely accepted or utilized by the industry due to the housekeeping problems caused by the solidification of wax on the machinery.

Brief summary of the invention

[0002] By way of the present invention, it has now been surprisingly found that the above-described need in the textile industry can be advantageously met by providing a fiber having a softer feel, which fiber comprises a fiber-forming polymer melt-blended with a bisamide additive.

[0003] More particularly, the fiber of the present invention comprises a fiber-forming polymer melt-blended with a bissteramide additive.

The fibers of the present invention advantageously possess a lower Stick Slip measurement than a corresponding fiber, which was not treated with the additive used in the present invention. The decrease in Stick Slip measurement of the fibers of the present invention is directly correlated to the softer feel of the fibers achieved by way of the invention.

[0004] Another aspect of the present invention is a process of making the fiber of the present invention by melt blending a fiber-forming polymer with a bisamide additive, preferably, a bisstearamide additive.

[0005] The fibers of the present invention have a wide variety of applications in the textile industry, particularly in those textile applications where fibers having a softer feel are valued.

Detailed description of the invention

[0006] Other than in the operating examples, or where otherwise indicated, all numbers expressing quantities of ingredients or reaction conditions used herein are to be understood as modified in all instances by the term "about."

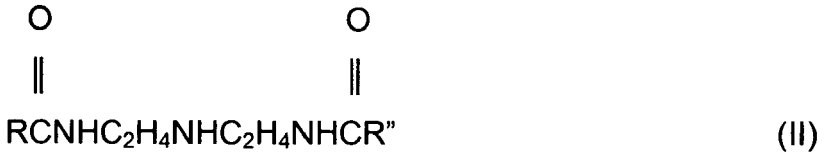
[0007] The present invention is directed to a fiber having a softer feel, which fiber comprises a fiber-forming polymer melt-blended with a bisamide additive of the formula:

$$RCNH(R'NH)_XR'NHCR'' \qquad (I)$$

wherein R and R" can be the same or different and are straight or branched alkyl groups having from 7 to 19 carbon atoms, R' is a C_2-C_4 linear alkyl group, preferably ethylene, and x is an integer of from 0 to 5.

Preferred compounds of formula I are those having the formula:

[0008]



$$RCNHC_2H_4NHC_2H_4NHCR'' \qquad (II)$$

in which R and R" have the meanings described above. Particularly preferred compounds of formula II are those containing at least one C_{18} acyl group ($R=C_{17}$), e.g., DETA bisstearamide (diethylenetriamine bisstearamide), DETA lauryl/stearyl amide and the like. Compounds in which R and R" contain from 11 to 15 carbon atoms are also of interest, such as

DETA bislaurylamide, DETA lauryl/palmityl amide and DETA bispalmitylamide, and the like.

[0009] The most preferred additive is N, N'-ethylene bisstearamide.

Fibers which can be formed by and the fiber-forming polymers which can be used in the present invention include nylon, e.g., Nylon 6 and Nylon 6,6, polyester, polypropylene, acrylic and the like. Any fiber formed by way of the present invention can advantageously achieve a desired softer feel, as compared to the corresponding non-treated fiber.

[0010] Particularly preferred is fiber formed from polypropylene by way of the present invention based on the textile industry's desire to utilize a polypropylene fiber. Such fiber advantageously possesses the feel of a nylon fiber. In addition, polypropylene is much cheaper than nylon. So it is quite an advantageous accomplishment of the present invention to provide a polypropylene fiber having the soft feel of nylon.

[0011] The fiber-forming polymer and additive of the present invention are mixed together and processed through an extruder. Typically, the extruder will operate at a temperature of from about 140 to about 220°C during the extrusion process.

[0012] The amount of additive used in the fiber-forming process may range from about 0.25% to about 7% by weight, preferably from about 0.25% to about 2% by weight.

[0013] The fiber denier may be varied from about 300/144 to about 1540/70.

[0014] Accordingly, the present invention advantageously provides the ability to tailor the softness of the fiber by way of the combination of fiber diameter and additive content. Furthermore, the additive may additionally provide benefits with respect to texturing bulk performance.

[0015] In the fiber extrusion process carried out by way of the present invention, pellets of the polymer of interest are melted and conveyed through a heated extruder and then pumped through a spinneret to form a synthetic fiber. The bisamide additive, preferably a bisstearamide as described above, can be added and blended with the polymer at the point of extrusion. The additive can be metered as a concentrate into the throat of the extruder at a rate to equal 1% distribution in the final fiber. Alternatively, the additive can be blended with the polymer pellets from a 25% to 50% masterbatch at a ratio to result in a 1% distribution in the final fiber. The polymer with the additive blended therewith can then be processed through typical fiber extrusion conditions to achieve the fibers of the present invention.

[0016] The invention can be illustrated but not limited by the following examples.

Examples

[0017] DETA bisstearamide or N, N'-bisstearamide was blended with polypropylene (PP) resin at the point of extrusion. The blending step was completed either by pre-blending the masterbatch by weight percent with the bulk polymer in the hopper and mechanically mixing the two pellets or by meter feeding the masterbatch pellets into the bulk polymer stream at the throat of the extruder. The PP resin was varied from 14 MFI to 20 MFI. The experiments were carried out over an additive range of 0.25% to 7% by weight. The extrusion profile was 210, 215, 220, and 225°C. The spin beam temperature was 255°C. The fiber denier range was varied from 300/144 to 1540/70.

[0018] A relative ranking of the hand "feel" of the sample was made. A scale of from 1 to 5 was used wherein a rating of 1 was equivalent to a very soft hand and a rating of 5 was equivalent to a harsh, rough hand. The "Hand" or "feel" of the material was correlated to the Stick Slip (S/S) measurement of fiber friction.

[0019] Stick Slip behavior is observed in any sliding system in which the kinetic friction (F_k = force to maintain movement) is less than the static friction (F_s = force to begin movement). Surfaces will "stick" together until a sliding force of F_s is reached, then the surfaces will "slip" over one another at the lower F_k value. This intermittent motion will continually repeat itself at a constant sliding velocity. However, if the sliding velocity is continually increased, the system will eventually reach the point where $F_s = F_k$ and stick slip behavior will cease.

[0020] For the measurement in the Examples, the stick slip measurement was completed at a constant sliding velocity of 0.05 cm/min using a pre-tension of 10% of the total yarn denier. The yarn was attenuated around a guide wheel and twisted around itself three times. The stick slip measurement was completed using a Rothschild Friction Meter and yarn take-up device. The friction meter contains the electronics used to measure the ingoing and outgoing tension. The take-up device provides a precise yarn path with tensiometer mounting positions, a guide wheel and a yarn winding wheel that assures constant yarn speed. The two tensiometers used to measure the ingoing and outgoing tension are essentially differential condensers. The tensiometer measuring head consists of three prongs, the middle prong is the moveable measuring rod, which is mounted in a torsion spring that keeps it in a rest position. The two prongs on either side are screwed in yarn guides. The yarn is inserted on top of the measuring rod and during operation the rod is deflected by the moving yarn causing the capacity variations that are transmitted to the friction meter and recorded.

[0021] As shown in the Table 1 below, when compared to the control with no additive, the additive samples all exhibited a significantly lower S/S measurement. When the samples were felt, the samples of the present invention were readily identified as a much softer fiber with a significantly lower S/S value, as compared with the control samples.

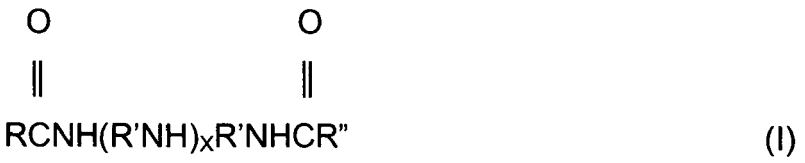
Table 1

Sample ID	Denier Per Filament	Stick Slip S/S cN 0.05cm/min	Hand Rating	F/M Friction cN 300 m/min	F/F Friction cN 0.05 cm/min	Static Volts
Control 2	18	71	5	66	121	-16
*1973@1%	18	23	1	70	93	7
*1848@1%	18	33	1	69	101	15
1433@1%	18	66	5	61	115	-10
1433@3%	18	54	4	67	108	-11
1433@5%	18	48	3	71	109	-12
1433@7%	18	24	1	73	86	-11
Control	22	53	5	58	127	-112
**1973@0.25%	22	52	5	56	148	-171
**1973@0.375 %	22	32	4	58	100	-122
**1973@0.75%	22	36	4	58	124	-95
**1973@1.0%	22	36	3	57	111	-100
**1973@1.5%	22	26	3	60	111	-42
Control tex.	2	10	5	22	26	227
*1973@3% tex.	2	2	1	23	25	151
*1973@5% tex.	2	4	2	23	20	190
1433 flake allowed for adequate blending with the PP pellets allowing a loading of 1, 3, 5 and 7%. At 9% the 1433 caused screw slippage and was not further processed. *Standapol™ F 1848, DETA bisstearamide, was provided in powder form from Cognis Brazil.						

[0022] The powder did not allow for adequate blending with the PP pellets.
Blended and Starve Fed by hand to control percentage at 1 to 2%. At greater than 1.5% caused screw slippage.
[0023] *CF 1973, N, N'-ethylene bisstearamide, was in the form of a small bead.
The small bead did not allow for adequate blending with the PP pellets.
Blended and Starve Fed by hand to control percentage at 1 to 2%. At greater than 1.5% caused screw slippage.
[0024] **CF1973 in a 25% masterbatch of 20MFI PE. This masterbatch was blended to give the final percentages in the yarn.
[0025] Standapol™ 1433 is a poly(alkyl vinyl ether), which can be obtained from Cognis Corporation.
[0026] The results of the Examples clearly demonstrated that the additive unexpectedly allowed for large denier per filament PP to advantageously possess the soft-hand feel of smaller denier PP and nylon fiber. The additive further advantageously and surprisingly did not cause any significant negative changes in the polypropylene fiber strength characteristics.

Claims

1. A fiber having a softer feel which comprises a fiber-forming polymer melt-blended with a bisamide additive of the formula:

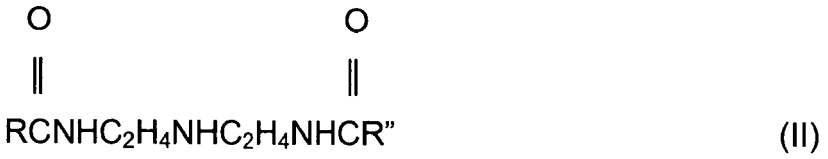


(I)

wherein R and R" can be the same or different and are straight or branched alkyl groups having from 7 to 19 carbon atoms, R' is a C_2-C_4 linear alkyl group, preferably ethylene, and x is an integer of from 0 to 5.

2. The fiber of claim 2 wherein the additive is N, N'-ethylene bisstearamide.

3. The fiber of claim 1 wherein the additive is of the formula:



(II)

wherein said formula contains at least one C_{18} acyl group (R=C_{17}).

4. The fiber of claim 3 wherein the additive is DETA bisstearamide.

5. The fiber of claim 3 wherein R and R" of the additive formula contain from 11 to 15 carbon atoms.

6. The fiber of claim 1 wherein the fiber-forming polymer is selected from the group of polymers consisting of nylon, polypropylene, polyester and acrylic.

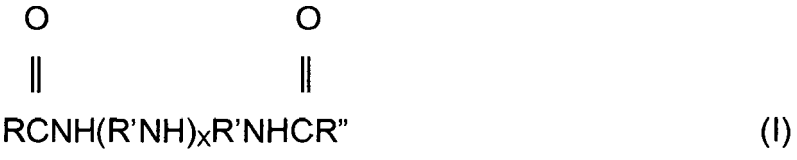
7. The fiber of claim 6 wherein the fiber-forming polymer is polypropylene.

8. The fiber of claim 1 wherein the additive is present in an amount of from about 0.25% to about 7% by weight.

9. The fiber of claim 8 wherein the additive is present in an amount of from about 0.25% to about 2%.

10. The fiber of claim 1, which fiber has a denier ranging from about 300/144 to about 1540/70.

11. A process of making a fiber having a softer feel, which process comprises melt-blending a fiber-forming polymer with a bisamide additive of the formula:



(I)

wherein R and R" can be the same or different and are straight or branched alkyl groups having from 7 to 19 carbon atoms, R' is a C_2-C_4 linear alkyl group, preferably ethylene, and x is an integer of from 0 to 5.

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EUROPEAN SEARCH REPORT

Application Number
EP 06 01 9578

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	WO 98/53127 A (HENKEL CORP [US]) 26 November 1998 (1998-11-26) * examples 1,3,4 *	1,3-11	D01F6/62
X	EP 1 548 161 A (TORAY INDUSTRIES [JP]) 29 June 2005 (2005-06-29) * examples *	1,2,6, 8-11	
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TECHNICAL FIELDS SEARCHED (IPC)

D01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 January 2007	Fiocco, Marco

CATEGORY OF CITED DOCUMENTS

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