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(54) **Method for manufacturing elastic ultrathin filament textured yarn**

(57) This invention discloses a method for manufacturing ultra-thin filament textured yarn having elastic characteristics. Ultra-thin filament textured yarn and thermoplastic filament are concurrently fed into a compressed air jet system to produce elastic ultra-thin filament. The two thermoplastic polymers of different heat shrinkage are entangled to get yarn having elastic char-

acteristics. The process of this invention is capable of Manufacturing elastic conjugated yarns with excellent dimensional stability, capable of being easily woven, suitable for the textile and sloopwork industries, and capable of producing textiles with good elasticity and high comfort.

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Description

Field of the invention

[0001] This invention relates to a novel ultra-thin filament textured yarn with elastic characteristics and its manufacturing method. Specifically, this invention relates to a novel elastic ultra-thin fiber textured yarn manufactured by concurrently feeding spun ultra-thin fiber textured yarn and spun thermoplastic fiber into a compression air jet system and passing the resulting product through feeding and winding rollers.

Description of the prior art

[0002] Taiwan Patent No. 127812 entitled "Manufacturing method of different shrinkage ultra-thin filament textured yarn" teaches a traditional method for manufacturing ultra-thin fiber. Ultra-thin filament textured yarn with boiling water shrinkage below 10% and high shrinkage low crimped gray yarn with boiling water shrinkage above 15% are compounded and processed to form a single yarn unit. Fabrics manufactured using yarns made with such a traditional method have thick feel and noticeable stiffness, which are appreciated by visual examination of the draped fabrics. However these fabrics lack elasticity and are not comfortable when worn.

[0003] In response to thick feel stiffness and lack of comfort associated with fabrics produced using traditional methods such as the method discussed above and in order to produce yarn with elastic covering characteristics, manufacturers often wrap the produced yarn around a Spandex (trade name for a type of polyurethane elastic yarn) periphery to form a single/dual wrapped yarn. Additionally, the produced yarn is knobbed with high speed air and wrapped around the periphery of a LYCRA Spandex to produce elastic covering yarn. Although such Spandex-based yarns have elasticity, production of the latter involve complex manufacturing procedures and high manufacturing cost. The following shortcomings are clear noticeable:

1. Higher manufacturing cost due to technical complexity associated with raw materials.
2. Process not applicable to high temperature dyeing and finishing; and easy coloring embrittlement results due to moist heat intolerance.
3. Intolerant to alkali (NaOH) decrement processing.
4. Uneasy tension control exist during the twisting of yarn and during finish processing, which is caused by unwanted elasticity and reduced product quality; and industrial processing efficiency is negatively influenced due to extreme process difficulties.

[0004] It is an object of this invention to solve the

shortcomings associated with Spandex-based yarns production and other traditional methods of producing yarns with elastic covering characteristics.

[0005] Another object of this invention is to produce high-class yarn with elastic function by false twisting thermoplastic filament with self-crimple elasticity characteristics into ultra-thin fiber via a compression air jet system.

[0006] Still another object of this invention is to simplify the process of manufacturing elastic complex yarns and to reduce the cost associated with producing elastic complex yarns.

[0007] Still further, another object of this invention is to manufacture elastic complex yarns with excellent size stability, capable of being easily woven, suitable for the textile and slopwork industries, and capable of producing textiles with good elasticity and high degree of comfort.

Summary of the invention

[0008] This invention discloses a method for manufacturing novel ultra-thin filament textured yarn with elastic characteristics. The process involves blending ultra-thin filament textured yarn with thermoplastic fiber having self-crimple characteristics.

[0009] The ultra-thin filament textured yarn of this invention is manufactured by heating, false twisting and spinning of continuous filament using traditional or conjugate spinning methods. The thermoplastic plastic of this invention is manufactured by spinning two thermoplastic polymers with different shrinkage. The ultra thin filament textured yarn and the thermoplastic filament are concurrently fed into a compression air jet and conjugated into the elastic ultra-thin filament yarn of this invention. Finally, the produced elastic ultra-thin filament processing yarn is fed through feeding rollers and subsequently wound with winding rollers.

Brief description of the drawings

[0010]

FIG 1 shows a conjugate false-twist processing flow sheet for manufacturing elastic ultra-thin filament processing yarn. The equipment symbols associated with the flow sheet 0.5 denier. The continuous filament yarn is subsequently false twisted and processed into ultra-thin filament textured yarn whose filament size is below 0.5 denier.

[0011] In contrast, the conjugate spinning method, which usually occurs after a false twisting process, uses two different polymers under traditional conditions and with traditional equipment to spin out continuous filament yarn whose filament size is below 0.5 denier. The continuous filament yarn is subsequently false twisted and processed into ultra-thin filament textured yarn

whose filament size is below 0.5 denier.

[0012] The second material used to manufacture the elastic ultra-thin filament textured yarn of this invention is thermoplastic filament with self-crimple elastic characteristics. The thermoplastic filament is obtained by configuring two thermoplastic polymers of different shrinkages into a filament cross section by spinning with a conjugate spinneret having the desired proportionality. The different contraction stresses between the interfaces of the two thermoplastic polymers with different shrinkages form spring-like screw and generate self-crimple elasticity. See the manufacturing diagram shown in Fig. 2.

[0013] To form the ultra-thin filament textured yarn with elastic characteristics of this invention, thermoplastic filament with self-crimple elastic characteristics and continuous filament are first individually spun using traditional spinning methods or conjugate spinning methods. Specifically, the continuous filament is false twisted, spun, heated, subsequently false twisted and post processed into a ultra-thin filament textured yarn whose filament size is below 0.5 denier. The ultra-thin filament textured yarn produced from the continuous filament and the thermoplastic filament is conjugated to form an in-process textured yarn. The in-process yarn is passed through a weaving process, a dyeing process and a finishing process. The high in-process temperature is utilized to generate shrinkage difference within the thermoplastic filament thereby inducing elastic characteristics in the final product.

[0014] The manufacturing process steps of this invention are summarized as follows: ultra-thin filament textured yarn is manufactured by heating, false twisting and spinning of continuous filament using traditional or conjugate spinning methods; separately, thermoplastic filament with self-crimple characteristics is manufactured by spinning two thermoplastic polymers with different shrinkage, after first being melted and spun using a compound spinneret of desired proportion; the ultra filament textured yarn and the thermoplastic filament are concurrently fed into a compression air jet are conjugated into elastic ultra-thin filament processing yarn; and the resulting elastic ultra-thin filament processing yarn is passed through feeding rollers and wrapped with winding rollers.

[0015] Referring to FIG 1 for additional clarification of the manufacturing process steps of this invention, ultra-thin filament spinning cake 12 is relaxed via yarn guide (1), and passed through a first feeding roller (2). The resulting ultra-thin filament product is heated with a heater (3), passed over a cooling plate (4) and through a friction spindle (5). The ultra-thin filament product is then passed through a second feeding roller (7) to form the textured yarn. Steps 1-7 are the heating, extending, curl reshaping and cooling processes required to produce the ultra-thin textured yarn material of this invention.

[0016] Still referring to FIG 1 of the inventive process,

at the moment the ultra textured yarn is fed through the second feeding rollers (7), self-crimple thermoplastic filament 13 is incorporated into the ultra textured yarn through the yarn guide (6), and conjugated and entangled with the textured yarn and fed into a compression air jet system (8) with air nozzle supplied with a considerable amount of pressure.

[0017] The ultra-thin textured yarn and the thermoplastic filament are conjugated into an elastic ultra-thin filament processing yarn (10) and guided by a third feeding roller (9) down stream. Finally, the elastic yarn with feed rate controlled by the third feed roller (9) and the winding roller (11) is produced.

[0018] Still referring to FIG 1 of this invention, the friction spindle (5) is not restricted to anyone type. All well-known friction spindles such as friction disc, friction belt, and pin, etc. are applicable. The air nozzle of the compression air jet system (8) is not restricted to anyone type. All well-known nozzles, such as conventionally used nozzle and mixed fiber nozzle etc. are applicable. To achieve the maximum entanglement and conjugation, good relaxation of the thermoplastic filament into the ultra-thin textured yarn, the number of snarl of textured yarn shall be over 85 snarls/m.

[0019] The elastic ultra-thin filament textured yarn (10) of this invention can be woven into cloths and textiles of various shapes. Due to the elastic effect demonstrated prior to hot water treatment, there is no problem of tension control exists; therefore, various shapes can be obtained through knitter shuttle and shuttle less loom. The weaving and quality characteristics of this invention are superior to contemporaneous elastic yarn complexes. By manufacturing the elastic yarn with thermoplastic polymers interface having two different shrinkage, which forms spring-like screw due to the difference in shrinkage stress when exposed to high temperature during post processing, textiles produced using this invention demonstrated excellent elasticity and a high degree of comfort.

[0020] By way of examples of exploitation/comparison and explanation, the evaluation method, the manufacturing processes, conditions and process components, though not limited to the exploitations, of the present invention may be as follows:

Explanation of Elasticity Evaluation Method

Workbench: INSTRON-6021 universal tensile testing machine

[0021]

Method:

- a. Tailor 2.5cm x 30cm test piece under the condition of room temperature without tension (Containing clamping section 10cm).
- b. Test rate for 1.667mm / Sec Return speed for

10.0mm/ Sec

c. Test piece pre-load 12g

d. Fixed tension of 1000g

Calculation:

elastic extension (fixed pull 1000g)

$$= (A2-A1) \div A1 \times 100\%$$

A1: Test piece length before stretching

A2: Test piece length applying fixed tension 1000g

(Example of Exploitation)

[0022] 360d/48f polyester/modified polyester conjugate spinning ultra-thin filament cake 12 is relaxed via yarn guide (1), and passed through a first feeding roller (2). The ultra-thin filament product is heated to 160°C with a heater (3) (having a temperature range between 100-220°C). The resulting product is passed over a cooling plate (4), false twisted by passing through a friction spindle (5) and extended to 2.28 times with the second feeding roller (7) (having a drawing ratio of between 1.3-4.0), to form the textured yarn. At the moment the ultra-thin textured yarn is fed through the second feeding roller (7), 75d/24f polyester conjugate spinning ultra-thin filament having self crimple 13 is incorporated into the second feeding roller (7) via yarn guide (6) at speed of 500 m/minute (the second feeding roller speed range is between 300-900 rn/minute). The resulting product is combined with the textured yarn and fed into the air jet compression system (8) with air nozzle having air pressure of about 5.0kg/m², at the guiding end of the yarn. The ultra-thin textured yarn and the thermoplastic filament are entangled to conjugate into an elastic ultra-thin filament textured yarn (10) and guided by a third feeding roller (9) down stream. A 225d/72f elastic ultra-thin elastic yarn with feed rate controlled by the third feed roller (9) and the winding roller (11) is produced consistent with the process flow chart shown in FIG 1.

[0023] Said textured yarn is used as weft, and 75d/36f textured yarn as warp, weaved and alkali decrement reduced by 25%. Post finish such as abrading, dyeing to produce cloth of enhanced thickness, drape, soft and ultra-fine touching (hand), particularity, peach skin feeling and elastic elongation (fixed tension 1000g) that reaches 23.1% were performed. Clothing produced using this exploitation maintained a high degree of comfort when worn.

(Example of Comparison)

[0024] In this example, conditions are similar to the processing conditions above. However, the self-crimple elastic thermoplastic filament 13 is replaced with 45%

high shrinkage low crimped gray yarn having boiling water shrinkage and dimensions of 75d / 36f to produce 225d / 84f different shrinkage ultra-thin filament textured yarn. Similar to the above exploitation, the processed yarn is used as filling, wrapped, weaved and reduced. Post finish such as abrading, dyeing to produce cloth of enhanced thickness, drape,, soft and ultra-fine touching (hand), particularity, peach skin feeling and elastic elongation (fixed tension 1000g) that reaches only 5.8 % were performed. Thus, clothing produced using this example possessed many shortcomings and lack the needed comfort when worn.

[0025] Comparing the example of exploitation with the example of comparison, it is clear that the elastic ultra-fine filament textured yarn in this invention can be obtained by properly conjugating thermoplastic filament having self-crimple elasticity with ultra-fine false twisted textured yarn, said textured yarn not only exhibits the original characteristic of the ultra-fine filament, but also unique elasticity to improve the deficiency of the conventional ultra-fine false twisted textured yarn.

Industrial applicability

[0026] The elastic ultra-fine filament textured yarn in this invention will exhibit the self-crimple elastic characteristic till the textured yarn is subject to the heat treatment condition of dyeing and finishing, i.e. the textured yarn has excellent dimensional stability, can be easily woven into clothing and fabric, is very useful in the textile and slopwork industries, has industrial applicability in itself.

The present invention comprises the following preferred embodiments:

[0027]

1. A method for manufacturing elastic ultra-thin filament textured yarn comprising the steps of

- (a) Heating, false twisting to the continuous filament using spinning methods to produce ultra-thin filament textured yarn;
- (b) Spinning two thermoplastic polymers with different shrinkage in proportion via conjugate spinneret into thermoplastic filament having self crimple;
- (c) Concurrently feeding said ultra-thin filament textured yarn and said thermoplastic filament having self crimple into a compressed air jet system to produce elastic ultra-thin filament textured yarn;
- (d) Feeding said elastic ultra-thin filament textured yarn into filament feeding roller, and
- (e) winding said elastic ultra-thin filament textured yarn with winding roller.

2. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 1, wherein the spinning method used to spin said filament is conventional spinning.

3. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 1, wherein the spinning method used to spin said filament is conjugate spinning.

4. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 2, wherein said elastic ultra-thin filament textured yarn and said thermoplastic filament having self crimple are concurrently fed into a compressed air jet system and conjugated to get elastic ultra-thin filament textured yarn.

5. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 4, wherein said elastic ultra-thin filament textured yarn is fed with a false twister into a yarn guide end.

6. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 5, wherein said elastic ultra-thin filament textured yarn is compressed and conjugated with high pressure gas supplied from air nozzle.

7. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 6, wherein said filament is false twisted and processed into ultra-thin filament textured yarn with filament below 0.5 denier.

8. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 7, further comprising of high in-process temperature to generate shrinkage difference within the thermoplastic filament and to induce elasticity.

9. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 3, wherein said elastic ultra-thin filament textured yarn and said thermoplastic filament having self crimple are concurrently fed into a compressed air jet system and conjugated to get elastic ultra-thin filament textured yarn.

10. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 9, wherein said elastic ultra-thin filament textured yarn is compressed and conjugated with high pressure gas supplied from air nozzle.

11. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 10, wherein said elastic ultra-thin filament textured yarn

is compressed and conjugated with high pressure gas supplied from air nozzle.

12. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 11, wherein said filament is false twisted and processed into ultra-thin filament textured yarn with filament below 0.5 denier.

13. The method for manufacturing elastic ultra-thin filament textured yarn according to embodiment 12, further comprising of high in-process temperature to generate shrinkage difference within the thermoplastic filament and to induce elasticity.

Claims

1. A method for manufacturing elastic ultra-thin filament textured yarn comprising the steps of

- (a) Heating, false twisting to the continuous filament using spinning methods to produce ultra-thin filament textured yarn;
- (b) Spinning two thermoplastic polymers with different shrinkage in proportion via conjugate spinneret into thermoplastic filament having self crimple;
- (c) Concurrently feeding said ultra-thin filament textured yarn and said thermoplastic filament having self crimple into a compressed air jet system to produce elastic ultra-thin filament textured yarn;
- (d) Feeding said elastic ultra-thin filament textured yarn into filament feeding roller, and
- (e) winding said elastic ultra-thin filament textured yarn with winding roller.

2. The method for manufacturing elastic ultra-thin filament textured yarn according to claim 1, wherein the spinning method used to spin said filament is conventional spinning.

3. The method for manufacturing elastic ultra-thin filament textured yarn according to claim 1, wherein the spinning method used to spin said filament is conjugate spinning.

4. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, wherein said elastic ultra-thin filament textured yarn and said thermoplastic filament having self crimple are concurrently fed into a compressed air jet system and conjugated to get elastic ultra-thin filament textured yarn.

5. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the

preceding claims, wherein said elastic ultra-thin filament textured yarn is fed with a false twister into a yarn guide end.

6. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, wherein said elastic ultra-thin filament textured yarn is compressed and conjugated with high pressure gas supplied from air nozzle. 5
7. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, wherein said filament is false twisted and. processed into ultra-thin filament textured yarn with filament below 0.5 denier. 10 15
8. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, further comprising of high in-process temperature to generate shrinkage difference within the thermoplastic filament and to induce elasticity. 20
9. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, wherein said elastic ultra-thin filament textured yarn and said thermoplastic filament having self crimple are concurrently fed into a compressed air jet system and conjugated to get elastic ultra-thin filament textured yarn. 25 30
10. The method for manufacturing elastic ultra-thin filament textured yarn according to one or more of the preceding claims, wherein said elastic ultra-thin filament textured yarn is compressed and conjugated with high pressure gas supplied from air nozzle, and/or wherein said elastic ultra-thin filament textured yarn is compressed and conjugated with high pressure gas supplied from air nozzle, and/or wherein said filament is false twisted and. processed into ultra-thin filament textured yarn with filament below 0.5 denier, and/or further comprising of high in-process temperature to generate shrinkage difference within the thermoplastic filament and to induce elasticity. 35 40 45

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EUROPEAN SEARCH REPORT

Application Number
EP 03 00 9266

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 1 277 861 A (NAN YA PLASTICS CORP) 22 January 2003 (2003-01-22) * the whole document *	1-4,6-9	D02G3/32 D02G3/18 D02G1/18
A	US 6 038 847 A (JEN ZO-CHUN) 21 March 2000 (2000-03-21) * claims 1,2; example 1 *	1,4,6-10	
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 06, 30 April 1998 (1998-04-30) & JP 10 053927 A (TORAY TEXTILE KK), 24 February 1998 (1998-02-24) * abstract *	1	
A	"Composite yarn for manufacture of textiles and knit fabric, with predetermined priming shrinkage percentage and dry heat shrinkage percentage comprises polyester conjugate multifilament and polyester multifilament components" DERWENT, XP002193681 * abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D02G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 October 2003	Examiner D'Souza, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 00 9266

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-10-2003

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82