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(54) METHOD OF MAKING TOBACCO SMOKE FILTER ROD FROM FIBRILLATED FIBRES

(71) We, BRITISH-AMERICAN TOBACCO COMPANY LIMITED, a Company incorporated under the laws of Great Britain, of Westminster House, 7 Millbank, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns a method for making tobacco smoke filter rods from fibrillated polyolefin fibres.

To improve the firmness of tobacco-smoke filter rod composed of a tow of crimped continuous or fibrillated filaments of polyolefin, it is known to use a polymeric bonding agent. The non-volatile liquid organic plasticizers which are effective bonding agents for crimped cellulose-acetate tow cannot be used for bonding polyolefins, as they do not dissolve polyolefin fibres. Polyolefin tow can be bonded by mixing with another polyolefin, particularly polyethylene, and heating the rod to effect fusion. The bonding agent, for example polyethylene, may be incorporated during the melt-spinning operation. Polyolefin tow may alternatively be bonded by using a spray of, for example, a polymerizable unsaturated organic ester such as vinyl acetate, an acrylate ester or a vinyl ester. Generally the rod is heated to effect curing, and larger amounts of bonding agent are required.

It is an object of the present invention to provide a method for producing tobacco-smoke filter rods, composed of fibrillated polyolefin fibres, which has improved firmness without requiring the application of heat in a separate heat-curing stage and using low levels of bonding agent.

According to the invention, in a method for making tobacco-smoke filter rod from a tow comprising fibrillated polyolefin fibres, the fibres are spread and are treated with a cold-setting bonding or adhesive agent consisting substantially of a dispersion of a non-volatile polymeric or copolymeric unsaturated organic ester in a liquid carrier medium,

the dispersion having a viscosity in the range of 10 to 500 centipoise and a solids content in the range from 10 to 60%, preferably 45—55%, by weight, whereafter the treated fibres are formed into the rod. The viscosity of the dispersion is preferably within the range from 10 to 200 centipoise.

The fibres may be crimped polypropylene and suitable cold-setting bonding agents are for example polyvinyl acetate, a copolymer of ethylene and vinyl acetate or a heat-cured acrylic copolymer, such as a copolymer of vinyl acetate and 2-ethyl hexyl acrylate or of styrene and butyl acrylate.

For the application of the bonding-agent, use may advantageously be made of a spinning shear cone rotating at high speed and producing a curtain of minute droplets of the dispersion, the spread tow being passed over the cone so that the droplets are distributed on the tow. To ensure effective uniform distribution of the dispersion, the shear cone is preferably rotated at a somewhat higher speed than is usual for conventional plasticisers, namely at a speed of the order of 4000 r.p.m. Such a speed is particularly desirable, for achieving effective distribution and droplet size, if the viscosity of the bonding agent is high. The bonding agent may be thus applied at a rate of between 5% and 30%, preferably between 7% and 20%, by weight with reference to the fibre weight in the rod. Generally the dry weight of the bonding agent on the tow will be between 5% and 10% by weight only. A brush applicator or spraying means may be used as alternatives for applying the bonding agent.

For bringing the tow containing a uniform distribution of the bonding agent, to rod form, the tow may then be passed, in known manner, through a garniture in which it is formed into a continuous rod and may be wrapped. No application of heat, i.e. no separate heat-curing stage is necessary before, during or after the rod formation. The wrapper does not require a further application of adhesive for securing the fibre material to the wrapper, since the bonding

(12)

agent acts also as adhesive or glue for the rod. The rod is then cut into sections.

- 5 Suitably, the filter rods or sections may be allowed to cure for up to 24 hours in normal storage without heating. The rod has a hardness, after curing, in the range of 80%—95%, measure on the "Filtrona" (Trade Mark) Hardness & Resilience Tester, for a rod weight of 400—600 mg per 90 mm long rod.

10 Such a rod is eminently suitable for the production of firm cigarette filters.

- 15 The fibres of the tow need not consist solely of polyolefin material, but may contain of the order of 5 to 15% of other polymers or monomers which modify the characteristics of the fibre material with respect to its manufacture, for example the readiness with which it can be extruded or fibrillated. The presence of such additives does not detract from the effectiveness of the bonding agent.

- 20 The following Examples illustrate the application of the invention:—

25 **EXAMPLE 1**

- A tow of crimped fibrillated polypropylene fibres of total denier 40,000 was opened and spread in a conventional filter-tow opening machine and was passed over an applicator shear cone at a speed of 100 m/min. The cone was rotated at 3750 r.p.m. to give a level of application of bonding agent of 15% of the fibre-weight. The bonding agent was a copolymer of ethylene and vinyl acetate in the form of an emulsion of viscosity 100 centipoise and a solids content of 55%, the emulsion being prepared by dispersing the copolymer in water.

- 40 This gave a level of dry weight of bonding agent on the tow web of approximately 8% referred to the weight of tow. In a conventional garniture, the web was brought to rod form and wrapped in a paper wrapper of 45 g/m² and was cut into sections. This paper, slightly heavier than usual, was used to obtain a satisfactory appearance of filter rod after cold-curing and to avoid warping in the paper. No lines of adhesive were required for anchoring the tow to the wrapper. After storage for 24 hours, without heating, the filter rods were found to have a hardness of 88% determined as indicated above.

- 55 In the following Examples, the procedure of Example 1 was followed except for the differences specified and the use of a shear cone rotating at a higher speed, of the order of 4000 r.p.m.

60 **EXAMPLE 2**

- A copolymer of ethylene and vinyl acetate dispersed in water was again employed as bonding agent, but the viscosity of the dispersion was 50 centipoise and its solids content 44%. The level of addition of bonding

agent on the tow was again 15%, the dry weight of the bonding agent in the finished rods being 6.6% referred to the weight of tow. The hardness of the filters produced was found to be 86% after 24 hours.

EXAMPLE 3

The bonding agent was a dispersion of a copolymer of vinyl acetate and 2-ethyl hexyl acrylate in water, having a viscosity of 100 centipoise and a solids content of 47%. The bonding agent was applied to the tow at a level of addition of 15%, giving a dry weight of polymer on the tow of 7%. The filters had a hardness of 86% after 24 hours.

EXAMPLE 4

A dispersion of a finely divided, less than 0.5 microns, copolymer of styrene and butyl acrylate in water having a viscosity of 52 centipoise and a solids content of 50% was applied to the tow in an amount sufficient to add 8% of dry polymer to the tow. The filters produced had a hardness of 86% after 24 hours.

EXAMPLE 5

A dispersion of polyvinyl acetate in water having a viscosity of 140 centipoise and a solids content of 45% was applied to the tow in an amount sufficient to deposit 7% of dry polymer on the tow. The filters produced had a hardness of 88% after 24 hours.

An apparatus suitable for carrying out the method of this invention is shown in the accompanying schematic drawing. The tow 1 is fed to a tow processing unit 2 in which it is opened and then passed to a coating unit 3 in which the fibres of the tow are coated with the bonding agent. The coating unit preferably comprises a shear cone 4 which rotates at a speed high enough to produce a curtain of minute droplets which are distributed on to the tow, the dispersion being fed by means of a delivery tube 5. Alternatively the spray cone may be replaced by a brush means which applies the bonding agent to the tow.

The apparatus also includes a wrapper 6 fed from a spool 7 and the coated tow and the wrapper are fed together through a garniture 8 in which they are formed into a continuous rod. The formed rod is then passed through a cut-off unit 9 in which the rod is cut into sections of predetermined length and delivered to a storage bin 10 where the rod lengths may be allowed to cure and harden, before being used, for example, as cigarette filters.

WHAT WE CLAIM IS:—

1. A method of making tobacco-smoke filter rod from a tow comprising fibrillated polyolefin fibres, wherein the fibres are

12 agent acts also as adhesive or glue for the rod. The rod is then cut into sections.

Suitably, the filter rods or sections may be allowed to cure for up to 24 hours in normal storage without heating. The rod has a hardness, after curing, in the range of 80%—95%, measure on the "Filtrona" (Trade Mark) Hardness & Resilience Tester, for a rod weight of 400—600 mg per 90 mm long rod.

Such a rod is eminently suitable for the production of firm cigarette filters.

The fibres of the tow need not consist solely of polyolefin material, but may contain of the order of 5 to 15% of other polymers or monomers which modify the characteristics of the fibre material with respect to its manufacture, for example the readiness with which it can be extruded or fibrillated. The presence of such additives does not detract from the effectiveness of the bonding agent.

The following Examples illustrate the application of the invention:—

EXAMPLE 1

A tow of crimped fibrillated polypropylene fibres of total denier 40,000 was opened and spread in a conventional filter-tow opening machine and was passed over an applicator shear cone at a speed of 100 m/min. The cone was rotated at 3750 r.p.m. to give a level of application of bonding agent of 15% of the fibre-weight. The bonding agent was a copolymer of ethylene and vinyl acetate in the form of an emulsion of viscosity 100 centipoise and a solids content of 55%, the emulsion being prepared by dispersing the copolymer in water.

This gave a level of dry weight of bonding agent on the tow web of approximately 8% referred to the weight of tow. In a conventional garniture, the web was brought to rod form and wrapped in a paper wrapper of 45 g/m² and was cut into sections. This paper, slightly heavier than usual, was used to obtain a satisfactory appearance of filter rod after cold-curing and to avoid warping in the paper. No lines of adhesive were required for anchoring the tow to the wrapper. After storage for 24 hours, without heating, the filter rods were found to have a hardness of 88% determined as indicated above.

In the following Examples, the procedure of Example 1 was followed except for the differences specified and the use of a shear cone rotating at a higher speed, of the order of 4000 r.p.m.

EXAMPLE 2

A copolymer of ethylene and vinyl acetate dispersed in water was again employed as bonding agent, but the viscosity of the dispersion was 50 centipoise and its solids content 44%. The level of addition of bonding

agent on the tow was again 15%, the dry weight of the bonding agent in the finished rods being 6.6% referred to the weight of tow. The hardness of the filters produced was found to be 86% after 24 hours.

EXAMPLE 3

The bonding agent was a dispersion of a copolymer of vinyl acetate and 2-ethyl hexyl acrylate in water, having a viscosity of 100 centipoise and a solids content of 47%. The bonding agent was applied to the tow at a level of addition of 15%, giving a dry weight of polymer on the tow of 7%. The filters had a hardness of 86% after 24 hours.

EXAMPLE 4

A dispersion of a finely divided, less than 0.5 microns, copolymer of styrene and butyl acrylate in water having a viscosity of 52 centipoise and a solids content of 50% was applied to the tow in an amount sufficient to add 8% of dry polymer to the tow. The filters produced had a hardness of 86% after 24 hours.

EXAMPLE 5

A dispersion of polyvinyl acetate in water having a viscosity of 140 centipoise and a solids content of 45% was applied to the tow in an amount sufficient to deposit 7% of dry polymer on the tow. The filters produced had a hardness of 88% after 24 hours.

An apparatus suitable for carrying out the method of this invention is shown in the accompanying schematic drawing. The tow 1 is fed to a tow processing unit 2 in which it is opened and then passed to a coating unit 3 in which the fibres of the tow are coated with the bonding agent. The coating unit preferably comprises a shear cone 4 which rotates at a speed high enough to produce a curtain of minute droplets which are distributed on to the tow, the dispersion being fed by means of a delivery tube 5. Alternatively the spray cone may be replaced by a brush means which applies the bonding agent to the tow.

The apparatus also includes a wrapper 6 fed from a spool 7 and the coated tow and the wrapper are fed together through a garniture 8 in which they are formed into a continuous rod. The formed rod is then passed through a cut-off unit 9 in which the rod is cut into sections of predetermined length and delivered to a storage bin 10 where the rod lengths may be allowed to cure and harden, before being used, for example, as cigarette filters.

WHAT WE CLAIM IS:—

1. A method of making tobacco-smoke filter rod from a tow comprising fibrillated polyolefin fibres, wherein the fibres are



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- spread and are treated with a cold-setting bonding agent consisting substantially of a dispersion of a non-volatile polymeric or copolymeric unsaturated organic ester in a liquid carrier medium, the dispersion having a viscosity in the range of 10 to 500 centipoise and a solid content in the range of 10 to 60% by weight, whereafter the treated fibres are formed into the rod.
2. A method according to Claim 1, wherein the fibres are crimped fibres.
3. A method according to Claim 1 or 2, wherein the fibres are polypropylene fibres.
4. A method according to any one of Claims 1 to 3, wherein the dispersion has a solids content in the range of 45 to 55% by weight.
5. A method according to any one of Claims 1 to 4, wherein the bonding agent is a copolymer of ethylene and vinyl acetate.
6. A method according to any one of Claims 1 to 4, wherein the bonding agent is polyvinyl acetate.
7. A method according to any one of Claims 1 to 4, wherein the bonding agent is a copolymer of vinyl acetate and 2-ethyl hexyl acrylate.
8. A method according to any one of Claims 1 to 4, wherein the bonding agent is a copolymer of styrene and butyl acrylate.
9. A method according to any one of Claims 1 to 8, wherein the dispersion is applied to the tow in the form of a curtain of droplets by means of a spinning shear cone.
10. A method according to Claim 9, wherein the shear cone is rotated at a speed of the order of 4,000 r.p.m.
11. A method according to any one of Claims 1 to 10, wherein the treated tow is brought to rod form by means of a garniture.
12. A method according to any one of Claims 1 to 11, wherein a wrapping is applied to the rod without the employment of adhesive other than the bonding agent applied to the tow.
13. A method of making tobacco-smoke filter rod substantially as hereinbefore described with reference to any of the Examples.
14. Tobacco-smoke filter rod produced by a method as claimed in any one of the preceding claims.

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