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(54) **Process for the production of microfibrous non-woven fabric with felt appearance and surface characterized by absence of nap**

(57) Synthetic microfibrous non-woven fabric products with the appearance of woven materials, called "cloth", but with the felted appearance characteristic of

leather, having a surface totally lacking in hair or nap and with mechanical characteristics superior to those of natural leather (fig. 1).

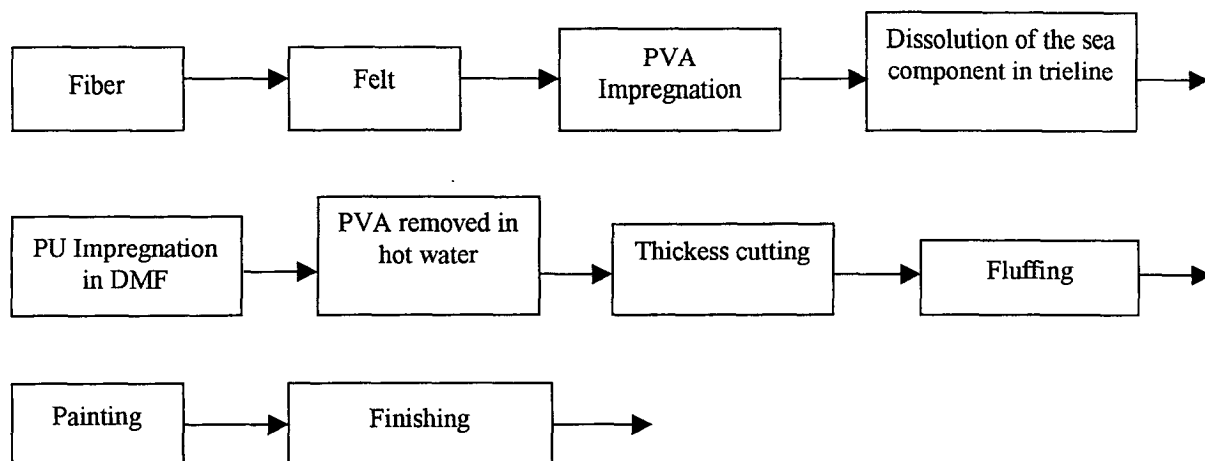


Fig. 1

Description

[0001] The present invention relates to new synthetic woven products, microfibrinous non-woven fabric having the appearance and the characteristics of high quality textiles, called "cloth" and of the synthetic leathers with surface completely clear of nap, and the methods for the production of the same.

[0002] In more detail, the present invention relates to synthetic microfibrinous non-woven fabric, with a surface appearance recalling that of cloth and felt, completely lacking in nap and writing ability, that is without surface microfiber, but with a pleasing appearance and unique in its kind. Moreover, the present invention refers to a preparation process for said product analogous to the process for the production of non-woven microfibrinous fabric of the suede-leather type. A traditional production process is known, and is currently exploited commercially, for the production of microfibrinous non-woven fabric of the suede-leather type, that is typically described in Italian Patents n. 823055, 839921, 858373, 873699, 905222, 921871 and in American patent US-A-3531368.

[0003] According to these patents, a fiber is prepared from two components, of the "islands in the sea" type, by feeding two polymers to a spinneret in such way that one (the "sea" component) completely surrounds the other constituted by several filaments that form the various "islands". In the two-component fiber, the "sea" component is generally constituted by polystyrene (PST) or other polymers that have such spinning characteristics as to surround the microfibers of the "island" component and is, in addition, easy soluble in the usual organic solvents.

[0004] The "island" component is typically polyethylene terephthalate (PET). a felt is prepared by means of agugliatura from the fiber thus obtained; the felt is impregnated with an aqueous polyvinyl alcohol solution (PVA), the "sea" component is dissolved in trichloroethylene ("trieline"), the felt is then impregnated with a polyurethane solution (PU) in dimethylformamide (DMF) and, finally, the PVA is eliminated. The product thus obtained is cut into two in the section, dyed in suitable jet of dye, and finished. A simplified block diagram of the process described above is shown in the attached figure.

[0005] All these processes lead to a product with the surface appearance of suede, characterized by the presence of microfibers -- generally between 0,1 and 5 millimeter in length -- on the surface that confers on the product its typical chamois appearance, and its "writing ability" i.e. the ability to show imprints left in the lay of the surface microfibers.

[0006] The product thus obtained has had good commercial success due to its appearance, and good textile characteristics, such as "hand", together with good mechanical properties. However, due to the complexity and the number of treatment stages necessary for its preparation,

the end product has a relatively high cost, which could be justified by the class of the natural products with which it is found in competition, such as optimum quality suede leather. On the other hand, it was not possible until now to obtain synthetic products, with the appearance of natural high-quality weaves, called "cloth" that, moreover, recall the felted appearance characteristic of leather and did not have the surface nap of the chamois leather described above but that, however, maintained the good textile and mechanical characteristics, at costs substantially lower than those of the synthetic suede leather mentioned above.

[0007] The material according to the present invention can be obtained by a process having the following stages:

- a) spinning of a twin-component fiber of the "islands in the sea" type in which the "islands" consist of a polymer chosen from those employed in textile applications, while the "sea" is a polymer that can be dissolved in organic solvents, or be removed by means of treatment with water, acidic or alkaline aqueous solutions, with non-polluting organic solvents, alone or in aqueous solution;
- b) preparation of a felt with the twin-component fiber;
- c) impregnation of the felt with an aqueous polyvinyl alcohol solution;
- d) removal of the "sea" component by means of treatment with solvents;
- e) impregnation with PU in organic solvents, or emulsion or aqueous dispersion;
- f) removal of the polyvinyl alcohol;
- g) splitting treatment;
- h) dyeing.

[0008] As can be seen from the comparison of the two processes, the difference consists in the lack of a product surface emery polishing stage in the process according to the invention. The elimination of the emery polishing stage, beyond the economic advantages intrinsic to the elimination of an operating stage, involves considerable progress from the environmental point of view in favor of the process according to the invention. The elimination of the emery polishing operation and disposal of resulting dust, considerably improves the environmental aspect of the process and reduces the investment and/or operating costs of the system. Moreover, always with respect to the process for the production of synthetic suede leather, the process according to the invention requires, for equal area of end product, uses a quantity of starting materials that could be up to 50% less by weight.

[0009] A further advantage of the product and process according to the present invention derives from the fact that the equipment needed for the production of the synthetic suede leather according to the known technology and that according to the invention is substantially the

same, with the exception of that required for the emery polishing. It is thus possible to switch from producing synthetic suede leather to producing the product according to the invention in little time, and without having to resort to particular know-how, simply by passing from the splitting stage to that of dyeing. Moreover, the preparation process of the product according to the invention can be carried out partially or totally in a clean way, using reagents or solvents described in the Application for Italian Patent MI2001 A000516 of the same applicant. The aforementioned process leads to a microfibrinous non-woven product, with surface characterized by the lack of microfiber emerging from the surface, thus without "writing ability", but with particular the "cloth" type appearance, pleasing to the eye, with good hand and physical-mechanical characteristics.

[0010] According to the present invention, the "island" component could be polyethylene terephthalate or a modified polyester, cationic polyester, nylon or other type of polyamide, from polyethylene, polypropylene or other types of polyolefin

[0011] The "sea" components could be nylon or other polyamides, modified polyesters and, in a generalized manner, other spinnable polymers with the essential characteristic of being soluble in "ecologically clean" or organic solvents, preferentially in acidic or alkaline aqueous solutions. The ratio between the "island" component and the "sea" component used in the twin-component spinning fiber must be between 20/80 and 80/20.

[0012] After elimination of the "sea" component, the felt can be impregnated with polyurethane in dimethylformamide or dimethylacetamide solution, analogous to what happens in the conventional systems described above, or, preferably, with polyurethane in emulsion or aqueous dispersion. If the process with polyurethane in emulsion or aqueous dispersion is followed, it is necessary that the bond between the polyurethane or the felt and the same polyurethane, can resist the polyvinyl alcohol extraction. To this purpose, analogous to what happens for polyvinyl alcohol in the extraction of the "sea" component, it will be necessary to fix the polyurethane so that it can resist the treatment of the felt in order to extract the polyvinyl alcohol. The polyurethane can be fixed by adding reticulating agents known to the art that are active, according to type, at ambient or relatively high temperatures (100°-120°C).

[0013] The operations that are executed in order to carry out the process of the present invention will be described in greater detail below, while examples of embodiments will allow the advantages of the same process to be appreciated.

[0014] A twin-component fiber is spun through a spinneret well known to the experts and it allows a composite fiber to be obtained in which one of the polymers is arranged around the elementary fibers of the other polymer. The fiber thus obtained is treated according to finishing methods known in the spinning technology of the; in particular the twin-component fiber, before being sub-

jected to stretching, must be between 10 and 13 denier, or better still between 11 and 12.5 denier. Stretching is executed with stretching ratios that vary generally from 2.5 to 3.4, with the "island" component between 0.08 and 0.5 denier.

[0015] In the present invention, it is preferable to use a twin-component fiber consisting of polyethylene terephthalate as the "island" component and a modified polyester as "sea" component, soluble in an alkaline aqueous solution.

[0016] With such twin-component fiber a felt is prepared through needle punching; the apparent density of the felt must preferably be in the range 0.1 to 0.5 g/cm³, better if it is between 0.15 and 0.3 g/cm³, with a thickness of between 2 and 4 millimeter, with the aim of obtaining a final non-woven fabric with good softness. The felt thus obtained is preferably impregnated with one aqueous polyvinyl alcohol solution (PVA), at a concentration of between 5% and 30%, preferably between 8% and 15%, and better still if between 10% and 13%, and at a temperature of between 60° and 90°C. After the piece is dried, the "sea" component is extracted either with organic solvents (example: polystyrene is extracted with trichloroethylene) or aqueous means (example: modified polyester is extracted with water + NaOH solution).

[0017] The non-woven fabric from which the "sea" component has been extracted is impregnated with polyurethane in dimethylformamide solution or dispersed in aqueous emulsion, at room temperature, with a concentration varying between 10% and 20% and is fed onto the piece through suitable dosing rollers. The polyols that constitute polyurethane (PU) can be of polyether type, polyester type and polyether-polyester type; the PU can be prepared using one or more such polyol types, that must have comprised a medium numerical molecular weight between 500 and 5000. The diisocyanates used for the synthesis of the PU could be aliphatic or aromatic; chain extenders used, on the other hand, are generally molecules of low molecular weight, that possess two or more active hydrogens that react with the isocyanic groups.

[0018] The synthesis of the PU is generally begun by preparing the prepolymer with terminal isocyan groups preliminarily, until the desired molecular weight is attained.

[0019] There then follows an extension reaction, carried out with diamine either of aliphatic or aromatic type, until the final molecular weight is established. In the case of the use of polyurethane in aqueous emulsion, a quantity of reticulating agent varying between 0.5% and 8% can be added to the aqueous polyurethane solution used for impregnation, with the aim of achieving the desired physical-mechanical and solvent resistance characteristics. Such crosslinking agents, which could be melamines, aziridines, carbodiimides, epoxides, zirconium compounds, or isocyan based, are active in the drying phase of the PU at a temperature that can varies

from 110°C to 180°C.

[0020] The polyurethane resin impregnated into the non-woven fabric is thermofixed to the same by drying, or is preliminarily coagulated and then dried; as an example, in the case of anionic type PU, coagulation can be carried out in an acidic aqueous solution, or, for a cationic PU, in an alkaline aqueous solution. In any case, the phase of fixing the PU on the microfiber must happen in the least possible time, to avoid the migration of the PU onto the surface of the non-woven fabric, with consequent worsening of the appearance and the physical-chemical characteristics.

[0021] When the fixing is achieved by drying, the use of warm air ovens at very high temperatures between 150° and 200°C, or of a steamer that adds the effect of microwaves to the action of the steam, is advisable.

[0022] Once the PU is fixed, the PVA must be removed from the non-woven fabric and this is done in a vibro-washer with warm water, at a temperature of between 85° and 95°C. The final piece is dried in warm air oven and subjected to the successive working phases of, respectively, cutting in two along the section, dyeing and the finishing. The operating conditions of these productive stages reflect those used in the production of non-woven fabrics where organic solvents are used.

[0023] In the process according to the present invention, compared to the traditional methods of production of microfibrinous non-woven fabrics cited, no emery polishing operation is carried out on the product, so as to avoid the appearance of microfiber in surface. This allows felts of reduced thickness to be used with, leading to a reduction of between 20% and 50% in the production cost.

EXAMPLE 1

[0024] A fiber staple is prepared formed from microfibers of PET (polyethylene terphthalate) (0,13 to 0,15 denier) in a polystyrene matrix, with the following characteristics:

- 1- denier: 3.9
- 2- length: 51 millimeter
- 3- curl: approximately 4 cm
- 4- Stretching ratio: 3.5:1

[0025] In particular the fiber is formed from 57 parts by weight of PET and 43 parts by weight of PST. If observed in section, the fiber reveals the presence of 16 microfibers of PET embedded in the PST matrix. With the fiber staple, a raw felt is prepared that is subjected to needle punching to form an needle punched felt with density 0.217 g/cc. The agugliato felt is made to shrink in warm water at a temperature of 90°C to yield a density of 0.331 g/cc; this is then dipped in a 12% polyvinyl alcohol solution at a temperature of around 70°C and is then thermofixed in an oven at 150°C for 10 minutes. The piece impregnated with PVA is dipped in trichlo-

roethylene to dissolve the "sea" component. The piece is impregnated with solution of PU in dimethylformamide at a concentration of about 12%. The polyurethane is fixed to the microfibrinous structure due to coagulation in water and dimethylformamide solution, then there is a drying of the piece phase. The following phase involves the cutting into two parts in the direction of the thickness. The material thus obtained is subjected to dyeing in jets with dispersed coloring, then subjected to traditional finishing treatments of the textile industry.

EXAMPLE 2

[0026] A fiber staple is prepared from microfibers formed of PET (polyethylene terphthalate) (0,13 to 0,15 denier) in a modified polyester matrix (TLAS), with the following characteristics:

- 1- denier: 3.9
- 2- length: 51 millimeter
- 3- curl: approximately 4 cm
- 4- Stretch ratio: 3.5:1

[0027] In particular, the fiber is formed from 57 parts by weight of PET and 43 pmts by weight of TLAS. If observed in section, the fiber reveals the presence of 16 microfibers of PET embedded in the PST matrix. With the fiber staple, a raw felt is prepared that is subjected to needle punching to form an needle punched felt with density 0.217 g/cc. The agugliato felt is made to shrink in warm water at a temperature of 90°C to yield a density of 0.331 g/cc; this is then dipped in a 12% high saponification polyvinyl alcohol solution (H.S.PVA) at a temperature of about 70°C and is then thermofixed in an oven at 150°C for 30 minutes. The piece impregnated with PVA is dipped in a 10% solution of NaOH at a temperature of 60°C to dissolve the "sea" component.

[0028] The piece is impregnated with a solution of PU in dimethylformamide at a concentration of about 12%. The polyurethane is fixed to the microfibrinous structure due to coagulation in water and dimethylformamide solution, followed by a drying of the piece phase. The following phase involves the cutting into two parts in the direction of the thickness. The material thus obtained is subjected to dyeing in jet with dispersed coloring, subjected to traditional finishing treatments of the textile industry.

Claims

1. Synthetic microfibrinous non-woven fabric products with the appearance of the woven materials, called "cloth", but with the felted appearance characteristic of leather, having a surface totally lacking in hair or nap and with mechanical characteristics superior to those of natural leather.

2. Synthetic microfibrinous non-woven fabric products according to Claim 1, **characterized by** the micro-fibers being polyesters chosen from polyethyleneterephthalate, polytriethyleneterephthalate, polybutyleneterephthalate, modified polyesters, or their mixtures. 5
3. Synthetic microfibrinous non-woven fabric products according to Claim 1, **characterized by** the micro-fibers consisting of nylon 6, other polyamides, polyethylene, polypropylene or other polyolefin or their mixtures. 10
4. Synthetic microfibrinous non-woven fabric products according to Claim 1, **characterized by** the micro-fibers that compose the non-woven fabric being between 0.001 denier and 0.4 denier. 15
5. Synthetic microfibrinous non-woven fabric products according to Claim 1, **characterized by** the micro-fibers being circular in section. 20
6. Synthetic microfibrinous non-woven fabric products according to Claim 1, **characterized by** the micro-fibers not being circular in section. 25
7. Procedure for the preparation of synthetic microfibrinous non-woven fabric products with the appearance of woven material called "cloth", but with the felted appearance characteristic of leather, prepared by impregnation of microporose microfiber and polyurethane, **characterized by** having at least one surface totally lacking in hair or nap and having mechanical characteristics superior to those of natural leather. 30
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8. Procedure for the preparation of non-woven woven microfibrinous synthetic products with the appearance of the woven materials called "cloth", but with the felted appearance characteristic of leather, **characterized by** said process differing from the procedure for the production of artificial suede leather by not using an emery polishing of the product stage. 40
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9. Procedure for the preparation of products like those from Claim 8, comprising the following stages:
 - a) preparation of one fiber twin-component of the "islands in the sea" type; 50
 - b) preparation of a felt with the twin-component fiber;
 - c) impregnation of the felt with an aqueous polyvinyl alcohol solution;
 - d) removal of the "sea" component by means of treatment with solvents; 55
 - e) impregnation with PU in organic solvents, or aqueous emulsion or dispersion;

- f) removal of the polyvinyl alcohol;
- g) splitting treatment;
- h) dyeing.

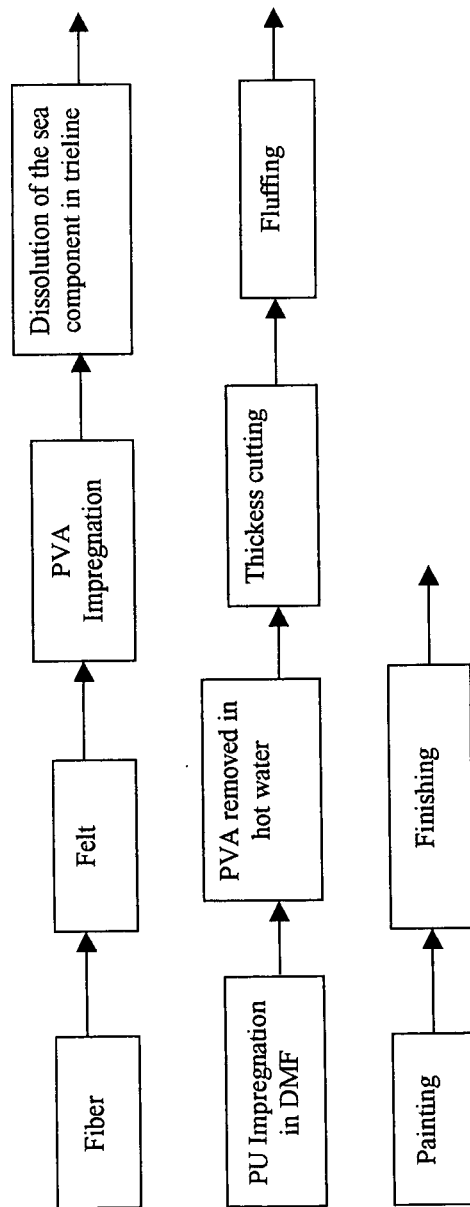


Fig. 1