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RESIN COATED UNWOVEN FABRIC

Donald N. Reynolds, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware
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This invention relates to an improved pyroxylin coated fabric which is particularly useful as a bookcover material.

The term "bookcover material" designates the resin coated fabric or equivalent sheet material which is applied over the binder boards during bookbinding to become an integral part of the book and to form its outer protective cover.

Pyroxylin coated fabric has been one of the most widely used bookcover materials for many years. A typical conventional bookcover material of this type is made by a method which comprises coating one side of a light weight cotton sheeting with a pigmented and plasticized pyroxylin composition, and coating the other side with a size composition. A rather heavy coat of size is required when the bookcover material is one having a relatively light weight pyroxylin coating in order to obtain satisfactory embossing characteristics, especially grain retention.

Bookbinders have found that pyroxylin coated cotton sheeting cover materials generally possess a desirable combination of characteristics for their purpose, being relatively light in weight, low in cost, washable, embossable, printable with standard inks, compatible with standard adhesives and overprint lacquers, bulky and stiff enough to be handled in automatic assembly operations, and safe to leave in contact with the surfaces of other materials such as lacquered furniture for extended periods of time.

The quality of conventional pyroxylin coated fabric bookcover material has been quite satisfactory for books which normally receive relatively little use or abuse. However, there is definite need for improvement in the wear resistance or durability of this material when used to cover books which are likely to be subjected to severe or extended use, such as reference books, repeatedly used textbooks, and looseleaf notebooks. Under such conditions of use the durability limitations become apparent as excessive breakdown, cracking, and coating fall-out at the critical hinge and edge areas. Thus, there is particular need for improvement in flex resistance and in the coating-to-fabric adhesion.

Attempts have been made to improve on the mildew resistance of pyroxylin-coated bookcover materials by replacing the cotton sheeting with a woven synthetic fabric, such as a polyester fabric. But the resultant products were less wear resistant and more expensive than the conventional product. The results obtained by replacing the cotton sheeting with known nonwoven sheet materials of synthetic fibers were also unsatisfactory, particularly with respect to wear and tear resistance.

It is known that bookcover materials of superior durability have been made by coating fabrics with certain vinyl chloride resin compositions. But the improved durability of these cover materials is usually accompanied by higher cost, poor printability, incompatibility with binding adhesives and overprint lacquers, and/or plasticizer migration damage to furniture and other articles with which the covers are in contact.

It is therefore the primary object of this invention to provide a new and improved bookcover material.

A more specific object is to provide a resin coated fabric bookcover material which is more wear resistant and more mildew resistant than conventional pyroxylin

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coated fabric bookcover material, and which also has the desirable combination of bookbinding characteristics common to such material as described above.

A further object is the provision of a novel resin coated sheet material having utility outside of the bookbinding field.

Other important objects will be apparent from the description of the invention which follows.

The invention broadly comprises a particular type of nonwoven fabric coated with pyroxylin, the nonwoven fabric being one that contains, as the major fibrous component, continuous synthetic organic filaments having a loopy configuration and separate and random disposition within the fabric. The majority of the loops are disposed substantially in the plane of the fabric, and the filaments are bonded together at spaced points throughout the fabric.

"Coated with pyroxylin" signifies the result of impregnating and/or surface coating the fabric with a resinous composition in which pyroxylin is the principal film former. It does not imply that all, or even a major proportion, of the interstices or voids of the coated side of the fabric are filled or covered with pyroxylin even though such conditions are often preferred. However, it is usually best to have the pyroxylin relatively uniformly distributed along the length and width of the fabric.

A non woven fabric of the specified type is selected which has the necessary properties such as strength, weight, smoothness and density for the intended end use. For bookcover purposes, a light weight fabric is usually chosen, for example one that weighs about from 2 to 5 ounces per square yard. A fabric which has been dyed to substantially the same color as the pyroxylin coat to be applied to it is usually preferred.

The essential filaments of the fabric have a "loopy" configuration; that is, the average length of the individual filaments within any given circle is greater than the diameter of that circle, preferably at least 1.2 times the diameter. The majority of the loops are disposed substantially in the plane of the fabric and are to be distinguished from the acute transverse loops which result from needle-punching. Filament loops have either an amplitude of departure from a straight line of at least 0.6 inch associated with a radius of curvature of at least 0.2 inch, or a radius of curvature of over 0.5 inch.

The essential filaments also have a "separate" disposition within the fabric, which means that they are non-aggregated, non-rope, or free of clusters of parallel filaments. In other words, substantially none of the filaments are in juxtaposition with each other over any substantial proportion of their length. They do, of course, often touch at points where they cross.

The fabric filaments can be crimped or noncrimped. Noncrimped filaments are usually preferred for economical reasons. However, a crimped filament fabric is advantageous when a relatively supple or drapable pyroxylin coated product is desired. In a filament "crimp," the amplitude of the departure from a straight line is less than 3 times the radius of curvature, the latter always being less than 0.5 inch.

Crimp can be imparted to the filaments by known methods, for example as taught by Hebel in U.S. Patent 2,604,689, or by Kitson and Reese in Belgian Patent 566,145. The filaments can be crimped either during or after their formation into the fabric.

The filaments are bonded together at spaced points throughout the fabric as described in more detail below.

The major fibrous component of the fabric should be continuous filaments of a fiber-forming synthetic organic polymer. Melt-spinnable polymers are preferred since they can be formed into the required nonwoven fabric in a single continuous operation. Particularly preferred

are melt-spinnable polymers which form filaments which can be charged by corona discharge or other field charging means, or triboelectrically. Such polymers are exemplified by the following: polyesters, such as poly(ethylene terephthalate) and poly(hexahydro-p-xylylene terephthalate); polyamides, such as poly(hexamethylene adipamide), polycaproamide, and copolymers thereof; polyhydrocarbons, such as polypropylene and polyethylene; polyurethanes; polycarbonates; and polyacetals. Polyester filaments are usually best when the product is to be used as bookcover material since they are inherently well adapted to bookbinding processes, particularly with respect to organic solvent resistance, coating adhesion and dimensional stability in the presence of water.

Triboelectrically chargeable filaments become electrostatically charged when they are in intimate rubbing contact with a suitable solid surface, such as a surface comprised of aluminum, brass or chromic oxide.

The nonwoven fabric of the loopy and separate continuous filaments can be made by a process which comprises electrostatically charging a running multifilament yarn, preferably a no-twist yarn, composed of continuous synthetic organic filaments capable of holding an electrostatic charge to a potential sufficient to separate the filaments from one another, followed by collecting the charged and separated filaments on a receiver maintained at a potential differing from that of the filaments. The receiver can be a plate, screen, belt or the like, and is preferably in linear and/or circular motion during filament collection so as to control fabric properties such as shape, uniformity and thickness.

A method which is preferred for its simplicity and efficiency comprises electrically charging freshly melt-spun filaments and simultaneously orienting them and urging them towards the receiver by means of an aspirating jet. En route to the receiver, the filaments are conveniently triboelectrically charged as they are passed in rubbing contact with guides or the throat of the aspirating jet having a suitable surface for producing the desired charge, such as a surface of aluminum, brass or chromic oxide. The polarity of the induced charge is governed by the relation of composition of the filaments and the surface in rubbing contact therewith as indicated in the triboelectric series of materials [see, for example, V. E. Shashoua in *Journal of Polymer Science*, 33, p. 65 (1958)]. Alternatively, the electrical charging can be accomplished at similar locations by means of a field charging device.

As stated above, the filaments should be bonded together at spaced points (such as cross-over points) throughout the fabric. Such bonding gives the fabric strength and adapts it for the pyroxylin coating operation. Spaced bonding of the filaments in the fabric can be accomplished by various methods, such as one or more of the following: (1) spraying, atomizing or otherwise discharging a binder onto the filaments as soon as they have been charged, for example, charged fibrils or other polymer particles having a polarity opposite to that of the filaments; (2) dipping, spraying or otherwise applying binder particles or a dispersion or solution of binder to the fabric as formed or after its formation on the receiver; (3) co-spinning binder filaments along with the essential filaments, either from the same or an adjacent spinneret; (4) pressing and/or heating the as-formed fabric; (5) needle-punching the as-formed fabric, for example as taught by Lauterbach and Norton in U.S. Patent 2,908,064.

Preferred binders with which the filaments can be bonded together at their cross-over points include synthetic organic polymeric materials. The following are representative of the more useful polymeric binders: (1) polyester copolymers, such as an 80/20 copolymer of ethylene terephthalate and ethylene isophthalate, especially when used as a filamentary binder for poly(ethylene terephthalate) filaments; (2) polyamide copolymers, such as a 90/10 copolymer of hexamethylene adipamide and capro-

amide, especially when used as a filamentary binder for polyamide filaments; and (3) elastomeric acrylic copolymers, especially when applied from a dispersion, such as a copolymer of about 94-99% by weight of a methyl, ethyl, propyl or butyl ester of acrylic or methacrylic acid and 1-6% by weight of acrylic, methacrylic or itaconic acid, and preferably a terpolymer formed by copolymerizing about 80-90 parts ethyl acrylate, 4-20 parts methyl acrylate or methyl methacrylate and 1-6 parts acrylic or methacrylic acid, as taught in Example A of U.S. Patent 2,757,106. These copolymers are also useful when reacted with an oxide, hydroxide or basic salt of a polyvalent metal as described in the cited patent.

The best amount of binder to employ usually falls within the range of about 3-50% by weight of bonded fabric, although more binder sometimes gives good results.

In addition to the essential continuous filaments, the fabric can contain a minor proportion of any other material known to be useful in fibrous sheet structures, such as fibers of paper-making length and any of the known staple fibers including crimped and uncrimped, organic and inorganic, natural and synthetic fibers.

A more detailed description of the bonded non-woven fabrics described above which are useful in practicing this invention, as well as methods of making them, is given by Guandique and Katz in copending patent application S.N. 859,640, filed December 15, 1959, now Patent No. 3,117,055, and by Kinney in copending patent application S.N. 859,614, filed December 15, 1959, now abandoned. The disclosures of these two applications are incorporated herein by reference. In Serial No. 859,640 the following disclosure appears:

"Non-woven fabrics of this invention contain between about 3% and about 50% by weight of a synthetic organic polymer binder material dispersed uniformly throughout the fabric which adheres fibers together at fiber cross-over points. The binder polymer must have a modulus (M_i), expressed in grams per denier, such that

$$\text{Percent binder} \times \sqrt[3]{M_i \text{ of binder}} < 40$$

where the percent binder is based on the total weight of the fabric, including the binder. The modulus (M_i) of the binder is between about 0.002 and about 25 grams per denier.

When making bookcover material and the like, a size coat can be applied to the back side of the fabric, either before or after applying the pyroxylin coat. By "back" side is meant the side which is ultimately adhered to the binder boards. As indicated previously, it is conventional practice to size the back side of pyroxylin coated bookcover material. Unexpectedly, however, bookcover materials are obtainable in accordance with this invention which have no size coat at all, even in the light weight grades, and yet have satisfactory stiffness, capacity for adhesive assembly and retention of embossed patterns. Such properties are controllable in the present materials through selection of the type and proportion of binder and/or conditions used for bonding the filaments.

The nonwoven fabric is impregnated and/or coated with a resinous composition in which pyroxylin (i.e., cellulose nitrate) is the principal film former, preferably with a dispersion of pyroxylin, pigment and plasticizer in a volatile organic liquid solvent for the pyroxylin. A minor proportion of another film former can also be present in the pyroxylin coating, such as a drying oil, a natural or synthetic resin, or an oil-modified resin. Pyroxylin coating compositions are so well known in the art as to make an extensive description in this regard unnecessary. A useful aqueous dispersion pyroxylin coating composition is described in U.S. Patent 2,792,314.

Castor oil, castor oil phthalate, castor oil modified glyceryl sebacate, polypropylene glycol sebacate, and blown vegetable oils such as cottonseed, soya, castor and corn oil are among the well known plasticizers which can be incorporated into the pyroxylin coat. Because of the

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surprisingly good coating-to-fabric adhesion obtained in the product of this invention, less than the usual amount of plasticizer is needed to achieve satisfactory resistance to damage by repeated flexing. The fact that less plasticizer is required in flex resistant qualities of bookcover material means that improvements can be realized in properties related to control of plasticizer migration, such as furniture mar resistance and capacity to be printed, blank-embossed and stamped with gold leaf.

In accordance with known practice for making sheet material comprising a fabric coated with a pigmented and plasticized pyroxylin composition, a preferred coating system includes a final protective coat, for example a coat of a non-pigmented and non-plasticized pyroxylin composition or a synthetic interpolymide composition as described in U.S. Patent 2,416,041.

The pyroxylin coating can be applied to one or both sides of the nonwoven substrate by any known coating method, including doctor knifing, dipping, extruding, brushing and rolling. For bookbinding applications it is preferred to apply the coating to only one side of the substrate, and in the amount of about 2-10 ounces per square yard total dry coating weight. It is also preferred to provide the coated product with an embossed pattern, such as one simulating a fine-grain leather, by such a well known method as passing it under pressure between a heated engraved metal roll and a paper-covered roll.

The present invention provides a worthwhile advance in the pyroxylin-coated-fabric art. Books which are bound with this novel coated fabric exhibit less cracking, fall-out and wearing away of the coating at the hinges, corners and edges on extended use than books bound with conventional pyroxylin coated fabric. This is believed to be due largely to the achievement of the superior flex resistance and coating-to-fabric adhesion. Moreover, the novel coated fabric is at least equal to conventional pyroxylin coated bookcover material in other important bookbinding characteristics as listed previously.

The product's specific advantages also include:

Superior resistance to mildew and rot.
Superior scrub resistance, as explained below in Example 1.
Satisfactory flex resistance even when somewhat less than the usual amount of plasticizer is present in the coating.
Superior retention of embossed patterns in non-sized lightly coated products.
Improved tensile strength, tear resistance, elongation characteristics and dimensional stability.

This invention provides durable coated fabrics and the like which are uniquely suited for use as bookcover materials, particularly for the binding of books which are to be used repeatedly or over a relatively long period of time. Utility is also found in such products as wall coverings, window shades, handbags, upholstery, and coverings and case covers for typewriters, photographic equipment, phonographs, binoculars and spectacles.

The following examples are given for the purpose of illustrating the invention; all quantities shown are on a weight basis unless otherwise indicated.

EXAMPLE 1

A piece of consolidated nonwoven fabric weighing 2.5 ounces per square yard is prepared which is composed of poly(ethylene terephthalate) continuous filaments having a loopy configuration, about 50 crimps per inch, and separate and random disposition within the fabric, the filaments being bonded together at spaced points throughout the fabric with cospun filaments of an 80/20 copolymer of ethylene terephthalate and ethylene isophthalate. The majority of the loops are substantially in the plane of the fabric. The weight ratio of the poly(ethylene terephthalate) filaments to the copolymer binder filaments in the fabric is 91:9.

The nonwoven fabric is prepared as follows. Using an apparatus similar to that described in Example 2 of

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the aforementioned Kinney application S.N. 859,614, poly(ethylene terephthalate) having a relative viscosity of 34 is melt-spun into filaments from a 68-hole spinneret (7 mil hole diameter) while the 80/20 ethylene terephthalate/isophthalate copolymer is cospun into filaments from an adjacent 34-hole spinneret. Nine grams of copolymer filaments are spun for each 91 grams of the former. The freshly spun filaments are passed in rubbing contact with chromic oxide guide bars to give them an induced electrical charge. An aspirating air jet operating with 50 p.s.i.g. pressure is employed to attenuate and quench the filaments, advance them to an aluminum plate receiver and lay them down on the receiver in separate and random fashion in the form of a loosely constructed nonwoven fabric or batt. The receiver is moved sufficiently to yield a batt of uniform thickness.

Next, the batt is placed between two sheets of paper in a press and consolidated into a denser and stronger nonwoven fabric under a pressure of 150 p.s.i. while heated to 60° C. The consolidated fabric is removed from between the paper sheets, placed in the press between two pieces of 60 mesh wire screen, and embossed under a pressure of 150 p.s.i. while heated to 210° C. The latter operation completes the crimping and the bonding of the filaments. The fabric can be dyed as desired, for example with a red dye.

The resultant nonwoven fabric is doctor knife coated on one side with a sufficient number of coats of the following composition to yield a total dry coating weight of 4.7 ounces per square yard:

Colored Pyroxylin Composition

	Parts by weight
Pyroxylin -----	15.4
Red and white pigments -----	15.1
Castor oil -----	15.5
Ethyl acetate -----	27.0
Ethyl alcohol -----	27.0
	100.0

Each coat is dried in a heat zone before the next one is applied. After the first coat is dried the coated fabric is passed through the nip of a standard smoothing calendar comprising a smooth steel roll heated to about 120° C. and a paper-covered roll. With the pyroxylin coat facing the steel roll, a total pressure of about 10 tons is exerted on the material as it passes between the rolls.

A clear pyroxylin coat having a dry weight of 0.2 ounce per square yard is applied over the colored pyroxylin layer by means of a doctor knife from an 11% solution of pyroxylin in an 80-20 mixture of ethyl acetate and ethyl alcohol. Drying is carried out in a heat zone.

Employing a conventional embossing roll, the front side of the product is embossed in an attractive leather-like grain. As the product leaves the embossing apparatus, it is cooled on a cold drum and wound up on a storage reel.

A coat of size, such as that described in Example 1 of U.S. Patent 2,919,206, can be applied to the uncoated side of the fabric if desired, but it is not necessary.

The durable red-colored rich-textured product of this example is especially useful as a bookcover material, particularly for encyclopedias and other books which receive repeated and extended use. It is also useful for covering the carrying cases for typewriters, cameras and the like. Because the product of this example has superior resistance to damage by repeated flexing and excellent coating-to-fabric adhesion, books bound with it retain their new appearance much longer than those bound with conventional pyroxylin coated bookcover material.

The surprisingly superior durability of the product of this example is demonstrated by the familiar "hand scrub test." This severe test, which is a rather reliable measure of how well a bookcover material or other coated fabric

will withstand wear and abuse, is performed by firmly grasping the ends of a 2 inch by 6 inch sample between the thumbs and forefingers and vigorously rubbing the coated surface back and forth upon itself under mild pressure. A comparable weight of conventional pyroxylin coated cotton sheeting bookcover material shows considerable apparent coating damage (e.g., cracking, delamination and fall-out) after 10-20 of such back-and-forth rubs. The product of this example, however, shows no apparent coating damage after 40 or more such rubs.

EXAMPLE 2

A pyroxylin coated fabric having substantially equal utility as a bookcover material is obtained when Example 1 is repeated except the crimped filaments in the fabric are replaced with non-crimped filaments. The filaments in the product are substantially free of crimps.

EXAMPLE 3

A running length of soft and drapable nonwoven fabric is prepared which is composed of 1.4 denier poly(ethylene terephthalate) continuous filaments having a loopy configuration, about 80-90 crimps per inch, and separate and random disposition within the fabric, the filaments being bonded together at spaced points throughout the fabric with an elastomeric acrylic terpolymer of ethyl acrylate, methyl acrylate and acrylic acid as described below. The weight ratio of the poly(ethylene terephthalate) filaments to the terpolymer binder in the fabric is 60:40.

The nonwoven fabric is prepared by using an apparatus similar to the one used in Example 1 to spin poly(ethylene terephthalate) filaments from a 30-hole spinneret at a rate of 10 grams per minute. Following the teaching of Example 1, the filaments are given an induced electrical charge, passed into an aspirating air jet, and collected on a receiver in the form of a loosely constructed nonwoven fabric of uniform thickness.

Next, the fabric is placed between two 60 mesh wire screens in a press and consolidated into a relatively strong and dense nonwoven fabric under a pressure of 100 p.s.i. while heated to 50° C. When removed from the press, the consolidated fabric is saturated with water containing a wetting agent and placed in a steam chamber for 10 seconds to cause shrinkage and crimping of the filaments.

Binder is applied to the fabric by immersing it in a 46% aqueous dispersion of a copolymer of about 92% ethyl acrylate, 6% methyl acrylate and 2% acrylic acid. Enough of the binder is applied so that after the impregnated fabric is dried in a heat zone, the filament:copolymer weight ratio is 60:40.

The impregnated fabric is placed in a press between two 50-mesh wire screens, and embossed under a pressure of 200 p.s.i. for one minute while heated to 210° C., after which it is placed in a 175° C. oven for 5 minutes. The crimping and the bonding of the filaments in the fabric is now complete.

The resultant fabric has a weight of 3.2 oz./yd.², a tensile strength of 7.5 lbs./in./oz./yd.², a density of 0.37 gm./cm.³ and a drape stiffness of 0.69.

The fabric is coated on one side in the manner of Example 1 with a sufficient number of coats of the colored pyroxylin composition described in Example 1 to yield a total dry coating weight of 2.5 ounces per square yard.

A product having properties and utility similar to the product of Example 1 is obtained when the durable coated fabric thus produced is given a clear pyroxylin coat and embossed in the manner described in Example 1.

EXAMPLE 4

A product similar in utility to the one obtained in Example 3 but somewhat less flexible is produced by repeating that example except for the following differences:

(a) The filaments of the fabric are substantially free of crimps, and the fabric is less supple.

(b) Binder is applied to the fabric by immersing it in a

46% aqueous dispersion of a copolymer of about 83% ethyl acrylate, 15% methyl methacrylate and 2% methacrylic acid.

(c) After the heat and pressure consolidation steps, the side of the fabric which will receive the pyroxylin coating is doctor-knife coated with one coat of the following composition:

Base Coat Composition

	Parts by weight
10 Acrylic copolymer ¹ -----	13.52
Polyvinyl acetate ² -----	37.73
Thickener ³ -----	0.56
Water -----	48.19
15	100.00

¹ The same copolymer as in the binder, added as an aqueous dispersion containing 46% of the copolymer.

² Added as an aqueous dispersion containing 50% polyvinyl acetate ("Elvacet" 81-900).

³ A copolymer which greatly increases the viscosity of the composition when the composition is made alkaline, specifically, a copolymer of methyl methacrylate, ethyl acrylate and acrylic acid, the acrylic acid units constituting 35% of the copolymer ("Acrysol" ASE-60), added as an aqueous dispersion containing 28% of the copolymer, and followed by the addition of sufficient ammonium hydroxide to render the composition alkaline.

The base coat is applied in sufficient thickness to yield a dry coating weight of 1.0 ounce per square yard. It is force dried in a heat zone.

(d) The other or "back" side of the fabric is coated with 0.5 ounce per square yard (dry weight) of the same composition in a single doctor-knife application.

EXAMPLE 5

A running length of soft and drapable nonwoven fabric is prepared which is composed of 1.6 denier poly(hexamethylene adipamide) continuous filaments having a loopy configuration, about 40-50 crimps per inch, and separate and random disposition within the fabric, the filaments being bonded together at spaced points throughout the fabric with cospun filaments of a 90/10 copolymer of hexamethylene adipamide and caproamide. The weight ratio of the poly(hexamethylene adipamide) filaments to the copolymer binder filaments in the fabric is 90:10.

The non-woven fabric is prepared in a similar manner to that of Example 1, except for the modifications indicated hereafter. Poly(hexamethylene adipamide) having a relative viscosity of 39 is melt-spun into filaments from a 34-hole spinneret (9 mil hole diameter) while the 90/10 copolymer having a relative viscosity of 45 is cospun into filaments from an adjacent 2-hole spinneret. The guide bars in this example are of polished aluminum instead of chromic oxide, and the air is supplied to the jet at 25 p.s.i.g.

The loosely constructed nonwoven fabric formed on the receiver is rendered more resistant to tearing and delamination in a consolidation operation in which it is placed in a press between two 50-mesh stainless steel screens and embossed under a pressure of 50 p.s.i. for one minute while heated to 200° C. The resultant fabric has a weight of 4 oz./yd.² and a tensile strength of 10.8 lbs./in./oz./yd.².

A product having properties and utility similar to the product of Example 1 is obtained by coating the nonwoven fabric just produced with colored pyroxylin composition and clear pyroxylin followed by embossing in accordance with the teaching of Example 1. The back side of the product, unless it receives a suitable protective coating, is less resistant to attack by organic solvents and is less dimensionally stable in the presence of water and water-borne adhesives than is the back side of the product of Example 1. The product can be adhered or fastened to binder boards and other surfaces by mechanical methods, by means of pressure sensitive adhesive applied to the other surfaces, or by means of hot-press activation of thermoplastic "heat-seal" adhesives.

I claim:

1. An article useful for book binding comprising a

non-woven fabric coated with pyroxylin, said non-woven fabric consisting essentially of continuous synthetic organic filaments having a random disposition and loopy configuration within the plane of the fabric and containing between about 3% and about 50% by weight of a synthetic organic polymer binder which is dispersed throughout the fabric and bonds the fibers at spaced points, the binder having an initial tensile modulus (M_i) of between about 0.002 and about 25 grams per denier and being present in an amount such that

$$\text{Percent binder} \times \sqrt[3]{M_i (\text{binder})} < 40$$

the fabric having a weight of about 2 to 5 oz./sq. yd. and the coating having a weight of about 2 to 10 ounces per square yard.

2. The article of claim 1 in which said filaments are polyethylene terephthalate.

3. The article of claim 1 in which the filaments are polyhexamethylene adipamide.

4. The article of claim 1 in which the binder is a copolymer of ethylene terephthalate and ethylene isophthalate.

5. The article of claim 1 in which the binder is a copolymer of hexamethylene adipamide and caproamide.

6. The article of claim 1 wherein the binder is a co-

polymer of about 94-99% by weight of an ester selected from the group consisting of methyl, ethyl, propyl and butyl esters of acrylic and methacrylic acids and about 1 to 6% by weight of an acid selected from the group consisting of acrylic, methacrylic and itaconic acids.

7. The article of claim 6 in which the copolymer is a terpolymer of about 80-90% by weight ethyl acrylate, 4-20% by weight of an ester selected from the group consisting of methyl acrylate and methyl methacrylate, and 1-6% by weight of an acid selected from the group consisting of acrylic acid and methacrylic acid.

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