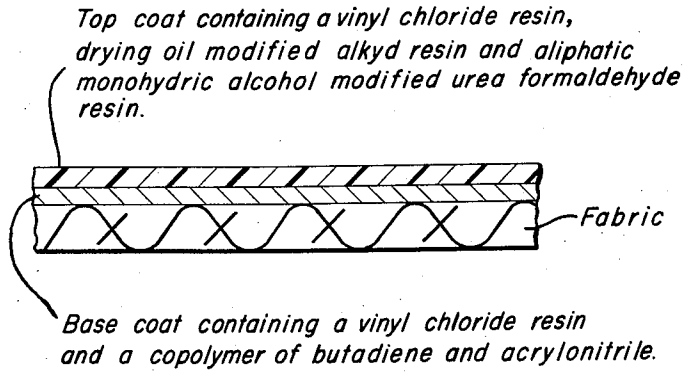
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COATED BOOK COVER MATERIAL

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COATED BOOK COVER MATERIAL

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1 Claim. (Cl. 117—76)

This invention relates to vinyl resin coated fabrics, and more especially to such materials which are printable and otherwise adapted for use as cover materials, particularly for bookbinding.

The term "book cover material" as used in this specification means the outer covering material which is applied to the binder boards during bookbinding.

For many years, pyroxylin coated fabric has been the prevailing resin coated book cover material, and for good reason. Bookbinders require a cover material having a special combination of properties which have heretofore been unattainable in any other material.

Ideally, a book cover material should be: printable with established book cover inks, which usually are based on drying-oil modified alkyd resins; adaptable to normal lithographic printing processes; receptive to conventional bindery adhesives and overprint lacquers; resistant to wear and cracking, especially at the fold lines; cleanable with mild cleaners, such as warm water and detergent; and harmless to surfaces which books are likely to be in contact with for extended periods, such as the covers of other books and the finishes on furniture.

Until the present invention, pyroxylin coated fabric has come the closest of any readily available material to meeting these specifications. However, certain limitations have been evident in this material, e.g., its tendency to show excessive wear and cracking at folds and edges after severe or extended use.

Vinyl resin coated fabrics, which have come into wide scale use in many applications in recent years, are known to possess many desirable qualities, such as good resistance to flexing and scuffing. Hence, the producers of book cover materials naturally turned their attention to vinyl resins in attempting to develop an improved book cover. However, the virtual absence of vinyl resin coated covers in the binderies up to the present time indicates the failure of previous efforts in this direction.

Typical limitations of prior art vinyl resin coated book cover materials have been poor printability with established book cover inks, that is, poor ink receptivity and coverage, excessive drying time, poor ink adhesion, and incompatibility with standard bindery adhesives and overprint lacquers. Further, the plasticizers employed in the prior art vinyl resin coated book cover materials tend to damage other book covers and furniture finishes, because of plasticizer migration, on extended contact therewith.

It is, therefore, an object of my present invention to provide a flexible vinyl resin coated book covering material which can be readily printed and decorated by conventional lithographic processes. A more specific object is the provision of an improved printable book cover material which is adaptable to normal bookbinding operations. Other objects will be apparent from the following description of the invention.

I have discovered a new combination of coating compositions which, when applied to a fabric substrate in accordance with the procedures described herein, results in

a high quality vinyl resin coated book cover material. The unique coating system for the fabric substrate of this invention comprises (A) a base coat composition containing as the essential film forming ingredients a butadiene-acrrylonitrile copolymer and a vinyl chloride containing resin compatible therewith, and (B) a top-coat composition containing as the essential film forming ingredients a drying-oil modified alkyd resin, a vinyl chloride containing resin compatible therewith, and an aliphatic monohydric alcohol modified urea-formaldehyde resin.

As used throughout the specification and claims, the term "vinyl chloride containing resin" means polyvinyl chloride and/or copolymers of vinyl chloride and another ethylenically unsaturated monomer, such as, e.g., vinyl acetate, vinylidene chloride, ethyl fumarate and methyl fumarate. In the case of copolymers, the vinyl chloride constitutes at least 50% of the polymer.

Although some improvements, over prior art vinyl resin coated book cover materials, in printability can be achieved with ingredients and proportions slightly outside the limits hereinafter specified, it is necessary to observe these limits in order to obtain the optimum balance of properties concerned with the product's printability, durability, and compatibility with bindery operations. To this extent, the limits defined hereinafter are critical.

The appended drawing is a cross-sectional illustration of the product of this invention.

The following examples are given to illustrate specific embodiments of this invention. All parts and percentages are by weight.

EXAMPLE I

A white book cover material is produced by base coating a continuous length of bleached cotton sheeting having a width of 40 inches and a weight of 3.7 ounces per square yard on one side with the following composition:

Base coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Aquesous dispersion of butadiene-acrylonitrile copolymer [1] (42% solids) (Goodyear "Chemigum" 235 CHS)	35.16	27.04
Titanium dioxide	6.45	11.67
Calcium carbonate	16.13	29.19
Potassium salt of polyacrylic resin, 15% solution in water (Monsanto "Lytron" 705)	9.68	2.62
Aqueous dispersion of vinyl chloride-vinylidene chloride copolymer [2] (52% solids)	32.58	29.48
	100.00	100.00

[1] Copolymer of about 55% butadiene and about 45% acrylonitrile.
[2] Copolymer of about 75% vinyl chloride and about 25% vinylidene chloride.

The aqueous solution of the potassium salt of polyacrylic resin is a water soluble thickening agent and is present as a processing aid, and it is not considered critical since other such water soluble thickening agents can be used, such as, e.g., sodium salt of carboxymethyl cellulose, starch, and others. The thickening agent can be omitted entirely in which case the amount of composition applied per coat is reduced. The titanium dioxide and calcium carbonate are fillers and are not essential ingredients.

The wet basis formula includes liquid components of the formula as first applied and the dry basis formula includes only non-volatile components.

The above base coat composition is applied to the base fabric by a conventional doctor knife coating process. Sufficient of the coating composition is applied to pro-

duce a dry coating weight of about 1.4 ounces per sq. yd. Volatile solvents in the wet film are evaporated by passing the web through a tenter frame oven at 260 to 280° F.

A coat of size is applied to the uncoated side of the base coated fabric, by means of a doctor knife, using the following composition:

Size coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Aqueous dispersion of polyvinyl acetate (55% solids) (Du Pont "Elvacet" 81-900)	19.79	32.25
China Clay	14.49	43.00
Starch	7.24	21.45
2.6% solution of sodium salt of carboxymethyl cellulose (high viscosity grade) in water	15.25	1.12
Water	42.49	
Animal Glue	0.74	2.18
	100.00	100.00

The above size coat is the invention of W. T. Kimball as described in U.S. Patent 2,650,170. Sufficient of the size composition is applied to the side of the base fabric opposite the base coat to deposit a dry weight of about 0.4 ounce per sq. yd.

The base-coated and back-sized fabric is next calendered in a conventional manner to improve the smoothness and continuity of the base coat by passing between smooth heated pressure rolls.

A topcoat composition having the following formula is next applied to the base-coated side of the calendered sheet.

Top coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Vinyl chloride-vinyl acetate copolymer, partially hydrolyzed, 30% solution in methyl ethyl ketone (Carbide & Carbon "Vinylite" VAGH [1])	69.19	43.48
Urea-formaldehyde resin, butanol modified, 60% solution in butanol	10.15	13.05
Alkyd resin, drying-oil modified [2]	8.26	17.38
Dipropylene glycol dibenzoate (Carbide & Carbon "Flexol" 77G)	2.07	4.36
Titanium dioxide	9.30	19.57
Silica (precipitated from a gel)	1.03	2.16
	100.00	100.00

[1] Copolymer of 91% vinyl chloride, 3% vinyl acetate, and 6% vinyl alcohol.

[2] The alkyd resin is the reaction product of phthalic anhydride and pentaerythritol modified with about 75% of linseed oil based on the weight of the modified alkyd resin.

Using the same doctor knife coating and drying apparatus and procedure described previously for the base coat, sufficient of the top coat composition is applied to deposit a dry coating weight of 0.4 ounce per sq. yd.

The topcoated surface is next embossed with a fine grain pattern by means of a conventional engraved-roll embossing apparatus. Embossing improves both the appearance and the abrasion resistance of the coated fabric.

A bookbinding material produced in accordance with the above described procedure had the following properties:

Total weight (oz./sq. yd.)	5.9
Loop pliability (in.) Method 5200 [1]	1.8
Tensile strength, Method 5102 [1] (lb./in., warp/filler)	61/61
Tear strength, Method 5132 [1] (gms. warp/filler)	512/512

[1] Methods in Federal Spec. CCC-T-191*b*, "Textile Test Methods," dated May 15, 1951.

Plasticizer migration test: Samples of the product were placed in surface contact with lacquer type furniture finishes and pyroxylin coated book covers under a pressure of 8 ounces per sq. in. for 2 months at 100° F. No damage was apparent on any of the surfaces tested.

Blanking test: In the bookbinding art, small areas of a previously embossed cover material are often flattened to provide a smooth area for printing. The product of this example was successfully blanked by the conventional method.

Printability test: 2800 sheets of book cover size, measuring about 18 in. x 23 in., were cut from the product of this example. After the sheets were aged for 15 days in normal room atmosphere, they were printed on the embossed side in accordance with conventional lithographic practice on a Harrison Offset Press using a standard drying-oil-modified alkyd resin lithographic ink (Fuchs & Lang Red NY 32295 from General Printing Ink Co.) made in accordance with the disclosure in U.S. Patent 2,049,507. Ink receptivity and coverage were excellent. There was no tendency of the printing plate to "go blind" or to become non-receptive to the ink on any of the 2800 covers as often happens when printing prior art vinyl resin coated fabric bookbinding materials. Only the normal bindery drying time (less than 24 hours) was required to dry the ink.

Fifty additional sheets of the product of this example were printed in a conventional manner on a Miehle 2-color lithographic press with equally successful results.

Ink adhesion test: Ink adhesion on the above printed and dried sheets was excellent as determined by the commonly-known cellophane adhesive tape test. This test consists of applying a 5-inch strip of 1-inch wide cellophane adhesive tape to the printed surface and rubbing it down to insure good contact with the surface, then removing the tape suddenly and observing the amount of ink removed. No appreciable amount of ink was removed in any of the tests on the printed sheets made for the printability test.

Overprint lacquer test: Ten sheets from each of the two printing operations described above were coated by means of a conventional transfer roll with a standard bindery overprint lacquer (Pyroxylin Products Co. "Pyroxcote," based on cellulose nitrate). Drying time and adhesion were normal. The coated surface did not become tacky upon aging the samples at 100° F. for 2 months. Most prior art vinyl resin coated book covers fail this test.

Bookbinding assembly and adhesive test: Numerous books were assembled with the printed cover sheets made in accordance with the above specific example of this invention, employing standard bookbinding procedures. Bindery assembly qualities, including corner-forming and case making, were entirely satisfactory. Ordinary bindery adhesives (American Ahesives Co. #110, B-75, and A-25) were used, and no problems in cover or end-sheet adhesion were encountered.

Cleanability test: Several of the books from the above assembly test were soiled with dirty hands, and then their covers were washed with a cheesecloth dampened with warm water solution of a household detergent ("Tide"); others were wiped with a cloth dampened with dry-cleaners' naphtha. After 30 such soilings and cleaning cycles, the covers showed no apparent damage.

Wear and abuse test: Books assembled with the printed cover material of this invention, and books assembled with conventional printed pyroxylin cover material were submitted to a "tumble test" to compare resistance to wear and general abuse. This test consists of placing 10 books in a covered wooden box about the size of a casket, measuring 6 ft. long, with the inner surfaces roughened in a cross-hatched groove pattern. The ends are lined with a heavy duck fabric. The box is rotated end over end at 5½ r.p.m. for 1500 cycles. During each cycle the test books slide across 12 feet of the rough wooden interior and hit both ends of the box. Five books covered with the product of this invention and five covered with a prior art pyroxylin coated fabric were sub-

jected to the above wear and abuse test. The pyroxylin covered books showed considerable wear and cracking at folds and edges, whereas the books covered with the product of this invention showed no cracking and very little wear.

EXAMPLE II

A book cover material having substantially the same properties as the product of Example I is made in accordance with the same procedure by using the following base coat in place of that in Example I:

Base coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Aqueous dispersion of butadiene-acrylonitrile copolymer (Same as Example I)	12.69	9.42
Titanium dioxide	6.68	11.67
Calcium carbonate	16.71	29.19
Potassium salt of polyacrylic resin, 15% water solution	10.00	2.62
Aqueous dispersion of vinyl chloride-vinylidene chloride copolymer (Same as Example I)	53.92	47.10
	100.00	100.00

EXAMPLE III

A book cover material having substantially the same properties as that of Example I is made according to the teaching of Example I, the only exception being that the following base coat composition is used:

Base coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Aqueous dispersion of butadiene-acrylonitrile copolymer (Same as Example I)	57.09	45.22
Titanium dioxide	6.19	11.67
Calcium carbonate	15.48	29.19
Potassium salt of polyacrylic resin, 15% water solution	9.26	2.62
Aqueous dispersion of vinyl chloride-vinylidene chloride copolymer (Same as Example I)	11.98	11.30
	100.00	100.00

EXAMPLE IV

A book cover material having substantially the same properties as that produced in accordance with Example I is produced in the same manner as described in Example I, except the following topcoat composition is used:

Top coat composition

	Percent By Wt.	
	Wet Basis	Dry Basis
Vinyl chloride-vinyl acetate copolymer, 30% solution in methyl ethyl ketone ("Vinylite" VAGH), (Same as Example I)	73.89	50.00
60% solution of a butanol modified urea-formaldehyde resin in butanol	10.15	13.90
Alkyd resin (Same as Example I)	3.56	8.10
Dipropylene glycol dibenzoate	2.07	4.70
Titanium dioxide	9.30	21.00
Silica (precipitated from a gel)	1.03	2.30
	100.00	100.00

As illustrated in the above specific embodiments of my invention and tests thereon, I have thus produced a flexible, printable covering material particularly well adapted for use as the outer cover of binder boards employed in binding books. My new book cover material has unexpectedly overcome the deficiencies of prior art vinyl chloride resin coated cover products, such as poor printability, non-adaptability to assembly line adhesive techniques, and harmful plasticizer migration. My invention furthermore has overcome the deficiencies of pyroxylin coated book cover materials, such as edge wear and cracking at the folds, without sacrificing any of the desirable properties.

Various grades and types of fabrics may be used in practicing this invention. The fabric may be woven or non-woven, composed of natural or synthetic fibers, tightly woven or loosely woven.

An essential film-forming material present in both the base coat and the topcoat is a vinyl chloride containing resin. In the base coat the vinyl chloride containing resin must be compatible with the butadiene-acrylonitrile copolymer to such an extent that a stable aqueous dispersion of the two essential film formers can be produced. In the top coat the vinyl chloride containing resin must be compatible with the drying-oil-modified alkyd resin to such a degree that a stable homogeneous solution can be produced from these two essential film formers in a common solvent or mixture of solvents.

While the examples illustrate the preferred vinyl chloride containing resins for both the base coat and topcoat, others which are useful in practicing this invention include the homopolymers of vinyl chloride, copolymers of vinyl chloride with another ethylenically unsaturated monomer such as, e.g., lower alkyl fumarates, vinyl fluoride, and acrylic acid. The vinyl resin in the base coat and topcoat may be the same or they may be different.

The aliphatic monhydric alcohol modified urea-formaldehyde resins useful in this invention are those produced in accordance with the teaching of U.S. Patent 2,191,957, issued to D. E. Edgar et al., February 27, 1940. The materials serve as a stabilizer for the vinyl chloride containing resin to inhibit degradation upon prolonged exposure to actinic rays.

The term "copolymer of butadiene and acrylonitrile" as used throughout the specifications and amended claim embraces the material of the type disclosed in U.S. Patent 1,973.000.

The preferred drying oil modified alkyd resin is a linseed oil modified alkyd resin. The present invention includes within its scope many modifications of the drying oil modified alkyd resin. The drying oil or drying oil acid should preferably range from about 50% to 80% by weight of resin. Other drying oils (or acid) such as, e.g., China-wood or soya are useful in preparing the resins employed in the topcoat composition. In place of phthalic acid other polybasic acids such as terephthalic, adipic, succinic, sebacic and similar acids may be employed. In place of pentaerythritol other polyhydric alcohols are useful, such as, e.g., glycol, diethylene glycol and glycerine. The preparation of this type of resin is well known in the art and various specific ingredients mentioned above are intended only to be used as a guide to those skilled in the art, as to the general type of resin useful in this invention.

Modifying agents known in the art of coating fabrics may be added to the coating compositions of this invention within its intended scope, such as fillers, pigments, stabilizers, and the like.

Useful products can be made in accordance with this invention within the following ranges:

	Percent by weight
Base coat:	
Vinyl chloride containing resin	85–15
Copolymer of butadiene and acrylonitrile	15–85
Topcoat:	
Vinyl chloride containing resin	80–50
Drying oil modified alkyd resin	15–30
Aliphatic monhydric alcohol modified urea-formaldehyde resin	5–20

The above percentage figures are based on the combined weight of the above listed film formers in the base coat and top coat, respectively.

When less copolymer of butadiene and acrylonitrile is present in the base coat it is too hard, fragile, and brittle; when more is used it is too soft and pliable. The copolymer contributes suppleness to the base coat and when conventional vinyl resin plasticizers ordinarily used for this purpose are employed, they result in harmful plasticizer migration, interference with ink receptivity and poor adhesion of printing inks applied to the surface layer.

The presence of a dry-oil-modified alkyd resin in the vinyl resin topcoat is essential to the product's printability, especially with respect to ink adhesion. The desirable book cover qualities are achieved within the above ranges. Printing ink adhesion becomes very poor when a less ratio of drying oil modified alkyd resin is used. When a greater ratio is employed, an objectionable tacky or sticky surface is encountered.

Although the size coat composition is not a feature of this invention, it is preferred to use a size coat such as the one described in Example I, to achieve such properties as stiffness, curl resistance, and adhesive receptivity to the uncoated side of the fabric.

In addition to the knife coating method used in the described embodiments of this invention, other coating methods known in the art of coating fabrics may be used for applying the coating compositions.

No particular limits are placed on the amount of coating or the number of coats to be applied to the fabric, but I prefer to use one coat of each composition, which deposits from about .5 to 1.0 ounce of dry coating per square yard.

The printable coating system of this invention may be applied to various woven and non-woven fabrics made from natural and synthetic fibers, and other flexible substrates such as paper.

While usefulness as a book cover material has been emphasized in describing this invention, it will be understood in the art of coated fabrics that the product of this invention is readily adaptable for other uses which require that the surface be printable with a drying-oil-alkyd type of ink, or requiring other desirable qualities characteristic of the product, such as, e.g., luggage, cases for photographic products, optical cases, typewriter covers and numerous other products which require flexible printed coverings.

While there are above disclosed but a limited number of embodiments of the structure, process and product of the invention herein presented, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is desired therefore that only such limitations be imposed on the appended claims as are stated therein, or required by the prior art.

I claim:

A book cover comprising a woven fabric base coated on one side with a continuous base coating comprising (1) 15–85 percent by weight of a copolymer of butadiene and acrylonitrile, and (2) 85 to 15 percent by weight of a polymer selected from the group consisting of polyvinyl chloride, a copolymer of vinyl chloride and vinyl acetate, a copolymer of vinyl chloride and vinylidene chloride, a copolymer of vinyl chloride and ethyl fumarate, and a copolymer of vinyl chloride and methyl fumarate, and a permanently bonded continuous surface coating superposed over said base coating, said surface coating comprising (*a*) 80 to 50 percent by weight of a polymer selected from the group consisting of polyvinyl chloride, a copolymer of vinyl chloride and vinyl acetate, a copolymer of vinyl chloride and vinylidene chloride, a copolymer of vinyl chloride and ethyl fumarate, and a copolymer of vinyl chloride and methyl fumarate, (*b*) 15 to 30 percent by weight of a drying oil modified alkyd resin, and (*c*) 5 to 20 percent by weight of an aliphatic monohydric alcohol modified urea-formaldehyde resin, said percentage figures being based on the combined weight of the named film formers in the base coating and surface coating, respectively.

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