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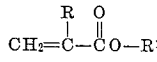
PROCESS FOR BINDING NONWOVEN TEXTILES

Domenick D. Gagliardi, East Greenwich, and Robert J. Cicione, Cranston, R.I., assignors to Commercial Solvents Corporation, New York, N.Y., a corporation of Maryland

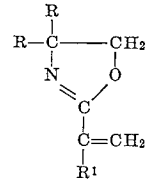
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ABSTRACT OF THE DISCLOSURE

A process for binding nonwoven textiles by impregnating a nonwoven textile with a liquid application medium containing a copolymer of an acrylic monomer of the formula



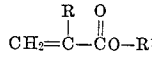
wherein R is hydrogen or methyl and R^1 is hydrogen or an alkyl radical having 1 up to about 6 carbon atoms and an oxazoline of the formula



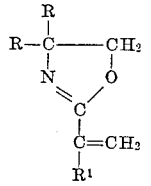
wherein R is a lower alkyl radical having 1 up to about 3 carbon atoms, a hydroxymethyl radical or the radical $—CH_2—OOC—R^1$ and R^1 is an alkyl radical having 1 up to about 25 carbon atoms, then drying and curing the impregnated textile. The weight ratio of acrylic monomer to vinyl oxazoline in the copolymer is in the range of from about 75:25 to about 95:5.

BACKGROUND OF THE INVENTION

This invention relates to a process for binding nonwoven textiles. In a particular aspect this invention relates to a process for binding nonwoven textile materials by impregnating a nonwoven textile with a liquid application medium comprising a copolymer of an acrylic monomer of the formula:



wherein R is hydrogen or methyl and R^1 is hydrogen or an alkyl radical having 1 up to about 6 carbon atoms, hereinafter referred to as "acrylic monomer," and an oxazoline of the formula:



wherein R is a lower alkyl radical having 1 up to about 3 carbon atoms, a hydroxymethyl radical or the radical $—CH_2—OOC—R^1$ and R^1 is an alkyl radical having 1 up to about 25 carbon atoms, hereinafter referred to as "vinyl oxazoline," the weight ratio of acrylic monomer to vinyl oxazoline in the said copolymer being in the

range of from about 75:25 to about 95:5, drying and curing the impregnated textile.

Nonwoven textile fabrics have found numerous uses, such as for example, as interlinings for dresses and coats. The preparation of nonwoven textile fabrics differs from the preparation of conventional textile fabrics in that no spinning or weaving is required. The nonwoven material is prepared by forming the textile fibers into a coherent sheet or "web" and then binding the fibers together to give the finished fabric. It is often necessary in order to impart adequate strength to the fabric to impregnate the textile material with a liquid solution or emulsion containing a binding agent. Binders which have been employed for this purpose include polyvinylacetate, polyvinylalcohols, vinylchloride copolymers, acrylic esters, such as ethyl acrylate, and acrylonitrile copolymers.

In general, most binding agents impart adequate strength to the nonwoven textiles. However, nonwoven fabrics treated with such binders often display serious drawbacks, such as, excessive stiffness and/or discoloration (scorch) on treatment with heat, such as that applied during normal pressing or ironing.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a process for binding nonwoven textiles.

It is a further object of the present invention to provide a process for binding nonwoven textiles without discoloration of the textile fabric on treatment with heat.

It is a still further object of the present invention to provide a process for binding nonwoven textiles without imparting excessive stiffness to the fabric.

Other objects and advantages of the present invention will be apparent from the specification and appended claims.

The process of the present invention comprises impregnating a nonwoven textile with a liquid application medium having dispersed therein a copolymer of an acrylic monomer and vinyl oxazoline, the weight ratio of acrylic monomer to vinyl oxazoline in said copolymer being in the range of from about 75:25 to about 95:5, drying and curing the textile.

DETAILED DESCRIPTION

The nonwoven textile binding agents used in the process of the present invention are copolymers of an acrylic monomer and vinyl oxazoline. These copolymers are known to the art and may be prepared by any suitable polymerization procedure, such as for example, emulsion polymerization, using vinyl oxazoline and acrylic monomers as starting materials. As indicated the weight ratio of acrylic monomer to vinyl oxazoline in the copolymer is in the range of from about 75:25 to about 95:5 and preferably in the range of from about 80:20 to about 95:5.

Examples of vinyl oxazolines used in the preparation of the copolymers include:

2-isopropenyl-4-hydroxymethyl-4-ethyl-2-oxazoline,
2-(1-hexadecylvinyl)-4,4-bis(stearoyloxymethyl)-2-oxazoline,
2-(1-eicosylvinyl)-4,4-bis(hydroxymethyl)-2-oxazoline,
2-isopropenyl-4,4-bis(hydroxymethyl)-2-oxazoline,
2-isopropenyl-4,4-bis(methyl)-2-oxazoline,
2-isobutenyl-4-hydroxymethyl-4-ethyl-2-oxazoline,
2-(1-heptylvinyl)-4,4-bis(hydroxymethyl)-2-oxazoline etc.

and the like. Vinyl oxazolines are known to the art and are prepared by the condensation of an oxazoline with

formaldehyde. The starting oxazoline material is also known to the art and is prepared by the condensation of an amino alcohol and an aliphatic monocarboxylic acid.

Examples of acrylic monomers used in the preparation of the copolymers include ethyl acrylate, methyl acrylate, methyl methacrylate, butyl acrylate, acrylic acid, methacrylic acid, etc. and the like with ethyl acrylate being preferred.

The copolymers used in the process of the present invention can be applied from any available form of liquid application medium such as, for example, from an aqueous emulsion or a solution in a suitable solvent as, for example, organic solvents. Suitable media are prepared by dispersing the copolymer in a liquid medium. When emulsions are to be formed an emulsifying agent also should be included. Emulsifying agents are well known to this art and any suitable agent can be employed. Examples of such suitable emulsifying agents include condensation products of octyl and nonylphenol with from 8 to 17 moles of ethylene oxide available under the names "Niw" and "Tergitol." Toward this end, when the copolymer of ethyl acrylate and vinyl oxazoline is prepared by an aqueous emulsion polymerization procedure, the aqueous emulsion polymerization product may be dispersed in the application medium without employment of additional emulsifier.

The amount of copolymer solids (dry basis) applied to the nonwoven textile may vary over a wide range and will depend among other things on the particular textile material and on the type of use intended for the final fabric. It is essential, of course, that the amount be sufficient to bind the textile fibers. Typically, from 1 to about 20% copolymer solids based on the weight of the fabric is applied.

The concentration of the copolymer in the application medium is not a critical feature of the present invention. Typically, the application medium applied on the textile contains from about 1 to about 25% of copolymer.

The process of the present invention can be carried out in any suitable procedure used for impregnating textiles with liquid textile-treating materials. Conventional impregnating, padding and like treating apparatus can be employed. Usually it is convenient to carry out the process by dipping, padding, spraying or immersing the textile in or with the application medium.

Following application the treated textile is dried, such as by air drying, to remove suspended solids and then cured at elevated temperatures. The temperature used to effect curing of the treated fabric will vary and will depend on such factors as the specific textile material being treated and the particular equipment employed. Of course, curing temperatures which cause discoloration or burning of the textile material should be avoided. Typically, a temperature in the range of from about 200 to about 325° F. is employed. The time used for curing may also be varied, generally in inverse proportion to the temperature. For example, when a temperature of 200° F. is employed, longer curing times are required than when a temperature of 300° F. is employed.

The process of the present invention is applicable to nonwoven textile materials of all types made from natural and synthetic fibers and blends thereof such as, for example, polyesters, nylon, viscose rayon, acetate rayon, wool, cotton, silk and the like.

Although the fundamental ingredient used in the process of the present invention is the copolymer of acrylic monomer and vinyl oxazoline, numerous other materials may be added to the application medium. The application medium may contain such additives as thermosetting agents, curing catalysts, softening agents, shrinkproofing agents, flameproofing agents and the like. Materials in these groups are well known to those skilled in the art and would be applied to obtain the special effect indicated by the function of the agent. Alternatively, such materials can be applied to the textile material either before or after application of the binding composition of the present invention.

The invention will be understood more fully by reference to the following specific examples. It is understood that the examples are presented for purposes of illustration only, and are not intended as a limitation of the invention. In the following examples all parts are by weight.

EXAMPLE 1

(A) An aqueous textile treating bath was prepared by mixing 10 parts of a 20% aqueous emulsion of a copolymer of ethyl acrylate and 2-isopropenyl-4-hydroxymethyl-4-ethyl-2-oxazoline in 90 parts of water. The copolymer was prepared by polymerizing 90 parts of ethyl acrylate with 10 parts of 2-isopropenyl-4-hydroxymethyl-4-ethyl-2-oxazoline in an aqueous emulsion polymerization medium. Nonwoven webs of polyester fleece were impregnated with this application medium, dried in air at 250° F. for 10 minutes and then heated an additional 5 minutes at 300° F.

(B) A second treating bath was prepared following the above procedure with the exception that the copolymer was prepared using 80 parts of ethyl acrylate and 20 parts of 2 - isopropenyl - 4 - hydroxymethyl-4-ethyl-2-oxazoline. Nonwoven webs of polyester fleece were treated as above.

(C) A third textile treating bath was prepared by mixing 10 parts of a 50% aqueous emulsion of ethyl acrylate polymer sold under the name HYCAR 1571 in 90 parts of water. Nonwoven webs of polyester fleece were treated as above.

Samples of the fabrics obtained from parts A, B and C of this example were tested for burst strength according to the Mullen Burst Strength test (ASTMD–1117–59) and for scorch by heating at 365° F. for one minute. The hand of samples of the fabric was also determined. Samples of the fabrics were washed prior to testing. Other samples were dry cleaned prior to testing. Additional samples were tested without prior washing or dry cleaning. The results of the tests on the fabrics are given in Table 1.

TABLE 1

		Burst strength (lbs. per sq. inch)			Scorch effect		
Sample	Hand	Initial	Dry cleaned	Washed	Initial	Dry cleaned	Washed
A	Firm, pliable	38	47	42	No discoloration.	No discoloration.	Slight discoloration.
B	Firm	41	40	37	do	do	Do.
C	Stiff	39	32.5	37	Yellow brown	Deep yellow	Brown.

The effectiveness of the process of the present invention is shown by the above tests. It is apparent from these tests that improved burst strength, resistance to scorch and hand are obtained with the ethyl acrylate-vinyl oxazoline copolymer binding agent of the present invention.

EXAMPLE 2

Aqueous textile treating baths were prepared exactly as set forth in Example 1. The baths were applied to webs of nonwoven nylon fleece. Burst strength, scorch effect and hand were determined as in Example 1. The results are given in Table 2. In the example the treating bath used to treat sample D was identical to the treating bath used to treat sample A. Likewise the treating bath used to treat sample E was identical to the treating bath used to treat sample B and the treating bath used to treat sample F was identical to the treating bath used to treat sample C.

TABLE 2

Sample	Hand	Burst strength (lbs. per sq. inch)			Scorch effect		
		Initial	Dry cleaned	Washed	Initial	Dry cleaned	Washed
D	Soft, firm	61	49	52	No discoloration.	Light yellow	Slight discoloration.
E	Soft	50	48	45	do	do	Do.
F	do	46	52	35	Yellow	Yellow brown.	Brown.

EXAMPLE 3

Aqueous textile treating baths were prepared exactly as set forth in Example 1. The baths were applied to webs of nonwoven rayon fleece. Burst strength, scorch effect and hand were determined as in Example 1. The results are given in Table 3. In this example, the treating bath used to treat sample G was identical to the treating bath used to treat sample A. Likewise the treating bath used to treat sample H was identical to the treating bath used to treat sample B and the treating bath used to treat sample I was identical to the treating bath used to treat sample C.

TABLE 3

Sample	Hand	Burst strength (lbs. per sq. inch)			Scorch effect		
		Initial	Dry cleaned	Washed	Initial	Dry cleaned	Washed
G	Soft	37	38	35	Light yellow	Light yellow	Slight discoloration.
H	do	34.5	33	29	do	do	Light yellow.
I	Stiff	33	35	36	Deep yellow	Yellow brown	Brown.

EXAMPLE 4

The procedure of part A of Example 1 is repeated in all essential details with the exception that 2-(1-hexyl-vinyl) - 4,4 - bis(hydroxymethyl) - 2 - oxazoline is substituted for 2 - isopropenyl - 4 - hydroxymethyl - 4 - ethyl-2-oxazoline in the copolymer to bind the nonwoven textile material.

EXAMPLE 5

The procedure of part A of Example 1 is repeated in all essential details with the exception that 2-(1-hexadecylvinyl) - 4,4 - bis(stearoyloxymethyl) - 2 - oxazoline is substituted for 2 - isopropenyl - 4 - hydroxymethyl - 4-ethyl-2-oxazoline in the copolymer to bind the nonwoven textile material.

EXAMPLE 6

The procedure of part A of Example 1 is repeated in all essential details with the exception that methyl methacrylate is substituted for ethyl acrylate in the copolymer to bind the nonwoven textile material.

EXAMPLE 7

The procedure of part A of Example 1 is repeated in all essential details with the exception that methyl acrylate is substituted for ethyl acrylate in the copolymer to bind the nonwoven textile material.

EXAMPLE 8

The procedure of part A of Example 1 is repeated in all essential details with the exception that butyl acrylate is substituted for ethyl acrylate in the copolymer to bind the nonwoven textile material.

EXAMPLE 9

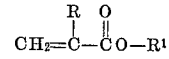
The procedure of part A of Example 1 is repeated in all essential details with the exception that acrylic acid is substituted for ethyl acrylate in the copolymer to bind the nonwoven textile material.

EXAMPLE 10

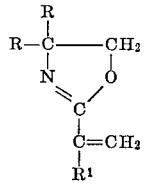
The procedure of part A of Example 1 is repeated in all essential details with the exception that methacrylic acid is substituted for ethyl acrylate in the copolymer to bind the nonwoven textile material.

What is claimed is:

1. A process for binding nonwoven textiles which comprises impregnating a nonwoven textile with a liquid application medium comprising a copolymer of an acrylic monomer of the formula:



wherein R is hydrogen or methyl and R^1 is hydrogen or an alkyl radical having 1 up to about 6 carbon atoms and an oxazoline of the formula:



wherein R is a lower alkyl radical having 1 up to about 3 carbon atoms, a hydroxymethyl radical or the radical $—CH_2—OOC—R^1$ and R^1 is an alkyl radical having 1 up to about 25 carbon atoms, the weight ratio of acrylic monomer to oxazoline being in the range of from about 75:25 to about 95:5, drying and curing the thus impregnated textile.

2. The process of claim **1** wherein the weight ratio of ethyl acrylate to oxazoline is in the range of from about 80:20 to about 95:5.

3. The process of claim **1** wherein the oxazoline is 2-isopropenyl-4-hydroxymethyl-4-ethyl-2-oxazoline.

4. The process of claim **1** wherein the liquid application medium is water.

5. The process of claim **1** wherein the acrylic monomer is ethyl acrylate.

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WILLIAM D. MARTIN, Primary Examiner

H. J. GWINNELL, Assistant Examiner

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