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METHOD OF TREATING FIBERS WITH A VINYL COPOLYMER AND A WERNER COMPLEX

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This invention relates to fibrous fabrics as used in draperies, curtains and the like and particularly to fabrics formed of glass fibers and it relates to the treatment of such fibers and fabrics to improve the characteristics thereof in use.

While description herein will be confined to fabrics of glass fibers, it will be understood that the concepts of this invention are also applicable for the described improvements in fabrics of natural fibers such as cotton, silk or wool, or synthetic organic fibers such as polyamides (nylon), polyesters (Dacron), polyvinyls (Vinyon), polyvinylidene chlorides (Saran) and the like, although the improvements in glass fibers and fabrics formed thereof are particularly noticeable. When used in fabrics, glass fibers are usually treated after fiber formation and preferably after heat treatment while in fabric form to relax and weave set the fibers, with a size composition, such as an organo-silicon compound, or a butadiene-acrylonitrile copolymer or the like, or a standard glass fiber size of the type formed of dextrinized starch, oil and gelatin, with or without various wetting agents and softening agents.

When such fibers and fabrics formed thereof become soiled, as by an oily soot or other greasy substance, the dirt clings tenaciously to the fiber surfaces and cleaning as by a normal rinsing operation is not effective. It becomes necessary then to resort to more drastic measures. The process for removing such dirt and soiling substance has often resulted in the removal also of the finish on the fibers so that the fibers themselves become subject to more rapid deterioration or destruction and they invariably lose many of their desirable characteristics, such as appearance, strength and abrasion resistance.

It is desirable, therefore, to provide a composition for use in the treatment of fibers of the type described which improves the surface characteristics of the fibers to enable the removal of soiling materials in a simple and expedient manner and which is neither harmful to the finish of the fibers or the characteristics of the fibers and the fabrics formed thereof and it is a related object to produce a composition of the type described and provide a method for application of same.

More specifically, it is an object of this invention to produce and to provide a method for producing a new and improved treatment for glass fibers and fabrics produced thereof, which enables the fibrous elements to be cleaned in response to a simple rinsing operation with aqueous medium without the removal of the glass fiber finish or deterioration of the fibrous fabric, which imparts a crispness to the fabric to improve its characteristics in a manner particularly desirable when used as curtains or draperies of the marquisette type, and which improves the characteristics of fabrics of glass fibers to enable fabrication into curtains, draperies and the like with high speed sewing machines ordinarily used in the manufacture of curtains, draperies and the like.

The improvements described are achieved by the treatment of such fibers and fabrics first with an aqueous composition containing a vinyl methyl ether-maleic anhydride

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copolymer in combination with a vinyl copolymer as represented by the composition marketed by E. F. Houghton Company under the trade name Rezsol 550, a maleic anhydride—vinyl acetate copolymer or a styrene—vinyl acetate copolymer, hereinafter referred to generally as the vinyl copolymer, and then treating the coated fibers after baking with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 and preferably between 12 and 18 carbon atoms, such as the acido groups of palmitic acid, stearic acid, oleic acid, linoleic acid and the like to form compounds which may be represented by stearato chromic chloride.

It is preferred to make use of the vinyl copolymer as a dispersion in aqueous medium in amounts ranging from 1–20 percent by weight solids. It is preferred, however, to make use of compositions in which the vinyl copolymer is present in concentrations of about 3–7 percent by weight. Best use is made of the vinyl methyl ether-maleic anhydride copolymer in amounts corresponding to about one-tenth the concentration of the vinyl copolymer or in concentrations in the treating composition of about 0.1–2.0 percent by weight.

Heating to eliminate the diluent and set the ingredients of the first treating composition on the glass fiber surfaces may be carried out at temperatures slightly above room temperature but it is preferred to make use of an elevated temperature, such as within the range of 300–340° F. The chrome complex compound which is soluble in aqueous medium should be applied in concentrations ranging from 0.5–5.0 percent by weight and preferably in concentrations in solution in amounts ranging from 2–3 percent by weight. The chrome complex compound will become insolubilized on the treated glass fiber surfaces upon drying but it is preferred to set the chrome complex compound on the glass fiber surfaces in a polymerized state by heat treatment at an elevated temperature, preferably within the range of 280–340° F.

The following will represent formulations used in the practice of this invention for the treatment of marquisette curtain material formed of glass fibers but it will be understood that improvements will also be secured in the use of such compositions in the manner described in the treatment of cotton, silk, nylon, Vinyon, Saran, Dacron and the like fibrous materials:

EXAMPLE 1

Coating composition No. 1

5.0 percent by weight vinyl copolymer (Rezsol 550—E. F. Houghton Company, 20% dispersion in aqueous medium)
0.5 percent by weight vinyl methyl ether-maleic anhydride copolymer
94.5 percent by weight water

EXAMPLE 2

Coating composition No. 2

2.0 percent by weight stearato chromic chloride
98.0 percent by weight water

In the preparation of the coating composition of Example 1, the water is added to dilute the dispersion of the vinyl copolymer with stirring, preferably with a Lightnin type mixer. The vinyl methyl ether-maleic anhydride copolymer solution is then incorporated with additional stirring.

In the event that a dye is to be introduced into the coating composition of Example 1, the order of preparation is preferably changed to use only about one-half of the amount of water for dilution of the dispersion of the vinyl copolymer. The dye is then incorporated in the remainder of the water and is added to the diluted dis-

portion of the vinyl copolymer. Finally, the vinyl methyl ether-maleic anhydride copolymer solution is incorporated, as before, with stirring.

When the finish is applied to glass fiber fabrics which have been weave set by heat treatment for a few seconds at a temperature in the range of 1050–1150° F., the fabric following heat treatment is sized with the composition of Example 1, as by a dip-squeeze process, and then subjected to heating in an oven at a temperature of about 320° F. After drying, the treated fabric is then coated with the composition of Example 2, as by a dip-squeeze process, followed by heat treatment at substantially the same temperature. A fabric which has been weave set in the manner described may be further treated to coat the fibers with a butadiene-acrylonitrile copolymer or an organo-silicon copolymer further to improve the feel and hand of the fabric and its ability to resist wrinkling.

By way of modification, it has been found that further improvements are secured, especially in resistance to soiling and to moisture pick-up, when glycerine or other similar liquid polyhydric alcohol, such as ethylene glycols and propylene glycols, are incorporated in limited amounts in the treating composition first applied to the glass fibers. When, for example, glycerine is incorporated in amounts ranging from 0.1–10.0 percent by weight in combination with the vinyl copolymer and the vinyl methyl ether-maleic anhydride copolymer in the treating composition, a fabric which has softer feel and better hand is secured. It is believed that the glycerine and the other polyhydric alcohols, when used, reacts to combine with the resin forming ingredients in a manner to cause reduction in the moisture pick-up of the treated fibers. When glycerine is present in amounts considerably in excess of 10 percent, the effect differs considerably and moisture pick-up becomes even more evident and tends to encourage the accumulation of dust and dirt rather than to inhibit it.

The following will represent the use of glycerine in a composition which may be used instead of that of Example 1 in the treatment of glass fibers:

EXAMPLE 3

5.0 percent by weight vinyl copolymer (Rezsol 550)
0.5 percent by weight vinyl methyl ether-maleic anhydride copolymer
94.0 percent by weight water
0.5 percent by weight glycerine

When treated in the manner described, soot and other greasy material can be easily and quickly removed from the fiber surfaces and from fabrics formed thereof merely by a rinse in water. Marquisette curtains embodying the finish of this invention acquire a desirable crispness and the appearance of the fabric is greatly improved. Unexpectedly, it has also been found that where it was difficult before to sew glass fiber fabrics with high speed machines in commercial practice, no difficulty of like character is experienced when the glass fibers have been treated in accordance with the practice of this invention.

Where dye colors are introduced into the treating composition of Example 1, such coloring materials may be selected of the conventional textile dyes and pigments and their concentration in the treating composition may be varied over a fairly wide extent, depending upon the intensity of color, the type of dye or pigment and the purpose for which the color is being introduced. Generally such components in amounts ranging from 1–10 percent are sufficient and pigments in amounts ranging from 3–15 percent ordinarily provide sufficient color for most purposes.

It will be understood that changes may be made in the details of formulation and application as well as in the treatment of the fibers to which the compositions are applied, without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In the method of treating fibrous structures to improve the characteristics thereof, the steps of coating the fibers with a composition containing a vinyl copolymer and a vinyl methyl ether-maleic anhydride copolymer, setting the coating materials on the fiber surfaces, and then treating the fibers with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

2. In the method of treating glass fibers to improve the characteristics thereof, the steps of coating the fibers with a composition containing the combination of a vinyl copolymer, a vinyl methyl ether-maleic anhydride copolymer, and a polyhydric alcohol, setting the materials on the glass fiber surfaces and then treating the coated glass fibers with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

3. In the method of treating fibers and fabrics formed thereof to improve their characteristics, the steps of coating the fibers with a composition containing 1–20 percent by weight of a vinyl copolymer selected from the group consisting of maleic anhydride-vinyl acetate copolymer and a styrene-vinyl acetate copolymer and 0.1–2.0 percent by weight of a vinyl methyl ether-maleic anhydride copolymer, setting the materials on the fiber surfaces, and then treating the fibers with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

4. In the method of treating fibers and fabrics formed thereof to improve their characteristics, the steps of coating the fibers with a composition containing 1–20 percent by weight of a vinyl copolymer selected from the group consisting of maleic anhydride-vinyl acetate copolymer and a styrene-vinyl acetate copolymer, 0.1–2.0 percent by weight of a vinyl methyl ether-maleic anhydride copolymer and 0.1–10 percent by weight of a polyhydric alcohol, setting the materials on the fiber surfaces, and then treating the fibers with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

5. In the method of treating fibers and fabrics formed thereof to improve their characteristics, the steps of coating the fibers with a composition containing 1–20 percent by weight of a vinyl copolymer, 0.1–2.0 percent by weight of a vinyl methyl ether-maleic anhydride copolymer, and 0.1–10 percent by weight glycerine, setting the materials on the fiber surfaces, and then treating the fibers with a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

6. In the method of treating glass fibers and fabrics formed thereof to improve their characteristics, the steps of coating the fibers with a composition containing from 1–20 percent by weight of a vinyl copolymer selected from the group consisting of maleic anhydride-vinyl acetate copolymer and a styrene-vinyl acetate copolymer and 0.1–2.0 percent by weight of a vinyl methyl ether-maleic anhydride copolymer, setting the materials on the glass fiber surfaces and then treating the coated fibers with a composition containing 0.5–5.0 percent by weight of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

7. In the method of treating glass fibers and fabrics formed thereof to improve their characteristics, the steps of coating the glass fibers with a composition containing in combination a vinyl copolymer and a vinyl methyl ether-maleic anhydride copolymer present in the ratio of 1–20 parts by weight of the former to 0.1–2.0 parts by weight of the latter, heating the treated fibers at a temperature within the range of 280–340° F. to set the mate-

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rials on the glass fiber surfaces and then coating the fibers with a composition containing 0.5–5.0 percent by weight of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms.

8. In the method of treating glass fibers and fabrics formed thereof to improve their characteristics, the steps of coating the glass fibers with a composition containing in combination a vinyl copolymer and a vinyl methyl ether-maleic anhydride copolymer present in the ratio of 1–20 parts by weight of the former to 0.1–2.0 parts by weight of the latter, heating the treated fibers at a temperature within the range of 280–340° F. to set the materials on the glass fiber surfaces, coating the fibers with a composition containing 0.5–5.0 percent by weight of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms, and heating the fibers treated with the Werner complex compound at a temperature within the range of 280–340° F. to set the complex compound on the glass fiber surfaces.

9. Glass fibers having a surface coating of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms and an underlying coating of a composition formed by the combination of a vinyl copolymer and a vinyl methyl ether-maleic anhydride copolymer.

10. Glass fibers having a surface coating of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms and an underlying coating of a composition formed by the combination of a vinyl copoly-

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mer, a vinyl methyl ether-maleic anhydride copolymer, and a liquid polyhydric alcohol.

11. Glass fibers having a surface coating of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms and an underlying coating of a composition formed by the combination of a vinyl copolymer selected from the group consisting of maleic anhydride-vinyl acetate copolymer and a styrene-vinyl acetate copolymer and a vinyl methyl ether-maleic anhydride copolymer, in which the materials are present in the ratio of 1–20 parts by weight vinyl copolymer to 0.1–2.0 parts by weight polyvinyl methyl ether-maleic anhydride.

12. Glass fibers having a surface coating of a Werner complex compound in which the acido group coordinated with the trivalent nuclear chromium atom contains at least 10 carbon atoms and an underlying coating of a composition formed by the combination of a vinyl copolymer selected from the group consisting of maleic anhydride-vinyl acetate copolymer and a styrene-vinyl acetate copolymer, a vinyl methyl ether-maleic anhydride copolymer and a liquid polyhydric alcohol, in which the materials are present in the ratio of 1–20 parts by weight vinyl copolymer to 0.1–2.0 parts by weight polyvinyl methyl ether-maleic anhydride, and 0.1–10.0 percent by weight of a liquid polyhydric alcohol.

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