

1

2

3,066,383

**FINISH FOR STAPLE GLASS FIBERS AND YARNS
MANUFACTURED THEREOF**

Alfred Marzocchi, Pawtucket, R.I., and Gerald E. Ram-
mel, North Attleboro, and Clarence W. Charon, South
Attleboro, Mass., assignors to Owens-Corning Fiber-
glas Corporation, a corporation of Delaware
No Drawing. Filed Feb. 14, 1957, Ser. No. 640,094
7 Claims. (Cl. 28—39)

This invention is addressed to the manufacture of yarns formed of staple glass fibers and more particularly to a new and improved finish for application to staple glass fibers and yarns formed thereof.

In the manufacture of fabrics of glass fibers, such as textile fabrics formed of strands, yarns, threads and the like, it is important to provide a coating which serves as a finish on the glass fiber surfaces to provide abrasion resistance and flexural strength while at the same time imparting an attractive appearance, colorability, hand, feel, and good draping qualities to the glass fibers and fabrics formed thereof. Various materials have, to the present, been formulated into finishes applied to strands and yarns formed to continuous glass fibers to improve bond and processing characteristics from the standpoint of hand and feel, color retention characteristics, abrasion resistance, flexural strength, and the like. Very often these finishing compositions can be employed in the treatment of the glass fibers in forming to replace the usual size applied to the glass fiber surfaces. More often, they are applied to the glass fibers after sizing or after the size originally applied has been removed as by means of a wash or a heat cleaning process.

The characteristics demanded of a finish for continuous or textile fibers of glass differ somewhat from the properties which are important in the treatment of staple glass fibers in the formation of yarns and fabrics and the like. In staple glass fiber systems, where the discontinuous glass fibers are gathered into an endless sliver which is drafted lengthwise to achieve the desired interfelting and integrity for yarn formation, it is desirable to apply a composition onto the glass fiber surfaces that will permit the desired amount of relative endwise movement between the fibers in drafting to form the yarn but which will, at the same time, protect the glass fiber surfaces against deterioration by mutual abrasion, and which will impart sufficient drag to militate against separation of the sliver or uncontrolled dilution of the concentration of fibers in any cross section of the yarn that is formed during drafting. In addition, it is desirable that the composition applied to the glass fiber surfaces in yarn formation impart sufficient bonding between the fibers to provide a desired mass integrity for holding the fibers together in the yarn but without conflicting with the ability to draft the endless sliver in yarn formation.

These desirable characteristics of balance between lubricity and bonding in yarn formation must be compatible with the ability of the composition applied to the glass fiber surfaces to impart a desirable finish to the glass fibers and yarns while bonding the fibers in the twisted or plied yarns to minimize fuzziness and to impart integrity to the fibers in the yarn to maximize strength while imparting good hand, feel, color retention and wash-fastness characteristics.

The materials which, to the present, have appeared as the likely candidates for sizing and finishing staple glass fibers in the drafting of the slivers and in the formation of twisted and plied yarns have been the bodied oils, as represented by polymerized linseed oil and the like. However, these materials are difficult to control from the standpoint of the body and cure and, in general,

the cure is so slow as to introduce further complications into the processing steps. Still further, the bodied oils have been found to be somewhat insufficient from the standpoint of strength and abrasion resistance in the yarns that are formed.

It is an object of this invention to produce yarns of staple glass fibers having improved processing and performance characteristics, and it is a related object to provide a new and improved composition for use in the finishing of staple glass fibers.

More specifically, it is an object of this invention to provide a treating composition for use in application to staple glass fibers preferably after the fibers have been formed into an endless sliver but prior to drafting of the sliver to impart the desired balance between lubricity and bonding and to improve the processing characteristics of the sliver in yarn formation; which holds the fibrous elements together in the sliver and imparts a desired drag with respect to the relative endwise movements between the fibers while still permitting an amount of relative movement for drafting, twisting and plying the fibers in yarn formation; which protects the glass fibers as a size against destruction by mutual abrasion during relative movements of the glass fibers and further protects the glass fibers as a finish against destruction by abrasion of the finished yarn and fabric thereby to impart a desirable degree of abrasion resistance to the textile fabric formed of the staple fibers; which is capable of rapid and controlled advancement toward cure for holding the fibers together in the formed yarn to minimize fuzziness or separation of the fibers in the yarn and in the fabric formed thereof; which is capable also of functioning as a finish on the glass fiber yarns and fabrics to impart good color-ability and color retention under the conditions to which the fibers will be exposed in use, to impart good hand and feel, good softness and draping characteristics, and to impart an attractive appearance and life to the fabric that is formed of the treated yarns.

In accordance with the practice of this invention, the desired improvement in a treating composition embodying the characteristics of a size and of a finish for use as a single treating composition for staple glass fibers in the formation of twisted and plied yarns and fabrics formed thereof can be accomplished by the formulation of a composition which contains a curable, oil modified resinous material in an intermediate stage of polymeric growth. As a resin forming material in a bodied and intermediate stage of polymeric growth, it is preferred to make use of an oil modified alkyd resin such as is formed by condensation reaction of a polybasic acid with a polyhydric alcohol but it is preferred to make use of the condensation polymerization product of a dibasic acid with a dihydric alcohol.

The dibasic acid may be selected of pythalic acid, sebacic acid, maleic acid or fumaric acid, and the dihydric alcohol can be selected of glycol, ethylene glycol, diethylene glycol, propylene glycol and the like. When, as is preferred, the composition of the alkyd or polyester resin is formed of saturated dibasic acids and dihydric alcohols, cure will occur chiefly through the oil used to modify the alkyd or polyester resin. For this purpose, it is desirable to make use of an oil containing unsaturated ethylenic groups as represented by linseed oil, soybean oil, China-wood oil, isoline, perilla oil, oiticia oil, and the like. Representative of the oil modified alkyd or polyester resins which can be employed in the practice of this invention are such materials as are marketed by Archer-Daniels Midland Company under the tradename "Aroplaz 1400" or "Aroplaz 1271" which are glycol-phthalic acid or anhydride resins modified with soybean, linseed or cocoanut oil. Epoxy resins, prefer-

ably similarly modified with oils and plasticizers, may be used.

The resinous component is not soluble in water and is therefore incorporated preferably as an emulsified phase in water in formulation of the treating composition. It will be understood, however, that solvent solutions of the oil modified resinous material may be employed. For application onto the staple glass fibers to provide the combination of a size and finish, it is desirable to formulate the treating composition with an amount of resin ranging from 4-25 percent by weight.

Use can be made of various surface active agents for emulsification and for producing a stable emulsion or dispersion of the oil modified resinous material in an aqueous system. For this purpose, use may be made of such surface active agents as aryl alkyl polyether alcohols, fatty acid esters of polyhydric alcohols, or other comparable emulsifying agents, preferably of the non-ionic type. When employed, the surface active agent or emulsifying agent may be employed in a concentration within the range of 0.1-1.0 percent by weight.

The treating composition can be further modified by the addition of a humectant as represented by sorbitan mono-oleate, sorbitan mono-palmitate, sorbitan monostearate, or the polyoxyethylene derivatives thereof, as well as other equivalent humectants. When employed, the humectant may be present in the treating composition in an amount within the range of 0.1-2.0 percent by weight. Humectants including ethylene oxide condensates such as carbowaxes, combinations of ethylene and propylene oxide condensates such as the Ucon oils, and ethylene oxide condensates of amides, amines and other active hydrogen compounds are used.

Further to improve the performance characteristics and to avoid the interference of static in yarn and fabric formation, it is desirable to formulate the treating composition with an anti-static agent as represented by cationic amine or amide compounds preferably in the form of fatty acid amines or amides, as represented by the material marketed by Nopco Chemical Company under the tradename "Konrite." The anti-static agents, when employed in the treating composition, can be present in an amount within the range of 0.1-2.0 percent by weight. Anti-static agents which are used also include ethylene oxide condensates and modified urea and epoxy resins containing quaternary ammonium groups.

The following formulations are representative of treating compositions which can be employed in the practice of this invention:

Example 1

10.0 percent by weight of a soybean oil modified phthalic acid-glycol resin
1.0 percent by weight of a cationic amide anti-static agent (Konrite A anti-static oil—marketed by Nopco Chemical Company)
0.5 percent by weight of an emulsifying agent (Triton X-100)
0.5 percent by weight sorbitan mono-oleate
88.0 percent by weight water

Example 2

20.0 percent by weight oil modified alkyd resin (Aroplaz 1400—Archer-Daniels Midland Company)
3.0 percent by weight fatty acid ester of polyhydric alcohol emulsifying agent
77.0 percent by weight water

Example 3

5.0 percent by weight oil modified alkyd resin
0.5 percent by weight anionic emulsifying agent
3.0 percent by weight anti-static agent
91.5 percent by weight water

Example 4

10.0 percent by weight oil modified alkyd resin (Aroplaz 1271—Archer-Daniels Midland Company)
1.0 percent by weight anti-static oil (Konrite A)
0.5 percent by weight aryl alkyl polyhydric alcohol (Triton X-100)
0.5 percent by weight sorbitan mono-palmitate
88.0 percent by weight water

The materials may be incorporated by conventional procedures in the manufacture of the aqueous emulsion to form a stable treating composition. Application may be made to the glass fibers as they are rained down from above for collection onto a rotating drum to form the sliver or else the treating composition may be applied to the sliver prior to drafting as by the process described in the copending application Serial No. 344,362, filed on March 24, 1953, now U.S. Patent No. 2,780,909.

The drawn slivers should be air dried prior to twisting or plying to form yarns. After yarn formation, the resinous component of the size composition should be advanced to a cured stage by heating as to a temperature within the range of 250-400° F. for a time sufficient to advance the oil modified resin to the cured stage. Lower temperatures can be used and when a catalyst is employed, air curing may be utilized.

It will be understood that modifications may be made with respect to the materials, their formulation and method of application without departing from the spirit of the invention, especially as defined in the following claims.

We claim:

1. A yarn comprising staple glass fibers and a coating on the glass fiber surfaces embodying a resinous film-forming component consisting essentially of an unsaturated oil modified alkyd resin and containing an emulsifying agent and in which the materials are present in the ratio of 4-25 parts by weight of the alkyd resin to 0.1 to 1.0 part by weight of the emulsifying agent.

2. A glass fiber yarn as claimed in claim 1 in which the unsaturated oil modified alkyd resin is formed by the condensation reaction of a dibasic alcohol with a di-basic acid.

3. A glass fiber yarn comprising staple glass fibers and a size composition on the glass fiber surfaces comprising an aqueous system in which the resinous film-forming component consists essentially of an unsaturated oil modified alkyd resin present in an amount within the range of 4-25 percent by weight of the size composition and which contains an emulsifying agent present in an amount within the range of 0.1 to 1.0 percent by weight of the size composition, and an anti-static agent present in an amount within the range of 0.1 to 1.0 percent by weight.

4. A yarn comprising staple glass fibers and a coating on the glass fiber surfaces the resinous component of which consists essentially of an oil modifying alkyd resin and which contains an emulsifying agent, an anti-static agent and a humectant in which the materials are present in the ratio of 4-25 parts by weight of the alkyd resin, 0.1 to 1.0 part by weight of the emulsifying agent, 0.1 to 1.0 part by weight of the anti-static agent and 0.1 to 1.0 of the humectant.

5. A glass fiber yarn as claimed in claim 4 in which the anti-static agent is an oil amide.

6. A glass fiber yarn comprising staple glass fibers and a size composition on the glass fiber surfaces comprising an aqueous system in which the resinous film-forming component consists essentially of an unsaturated oil modified alkyd resin present in an amount within the range of 4-25 percent by weight of the size composition and which contains an emulsifying agent present in an amount within the range of 0.1 to 1.0 percent by weight of the size composition and a humectant present in an

5

amount within the range of 0.1 to 1.0 percent by weight of the size composition.

7. A glass fiber yarn as claimed in claim 4 in which the humectant is a sorbitan ester of a fatty acid.

References Cited in the file of this patent

UNITED STATES PATENTS

2,168,286 Eustis et al. ----- Aug. 1, 1939

5

2,245,824
2,289,222
2,392,805
2,504,845
2,694,021
2,712,509
2,780,909
2,795,926
2,961,821

6

Roesch ----- June 17, 1941
Spanagel ----- July 7, 1942
Biefeld ----- Jan. 15, 1946
Keyes ----- Apr. 18, 1950
Griffin ----- Nov. 9, 1954
Biefeld ----- July 5, 1955
Biefeld et al. ----- Feb. 12, 1957
Drummond ----- June 18, 1957
Marzocchi et al. ----- Nov. 29, 1960