LUBRICANT COMPOSITIONS USEFUL IN THE PRODUCTION OF SYNTHETIC FIBERS

Publication Classification

Abstract

Described herein are low add-on fiber lubricant compositions useful in the production of synthetic fibers. The compositions and methods described herein impart or enhance one or more properties of the fibers such as, for example, dry soil resistance, liquid repellency, or a combination thereof. Fibers produced with the lubricant compositions with the compositions described herein and articles comprising the treated fibers are also described herein. These compositions are composed of (a) a lubricant component, (b) a friction modifier, and (c) water.
LUBRICANT COMPOSITIONS USEFUL IN THE PRODUCTION OF SYNTHETIC FIBERS

CROSS REFERENCE TO RELATED APPLICATION

0001 This application claims priority upon U.S. Provisional Application Ser. Nos. 61/735,571, filed Dec. 5, 2012, and 61/775,768, filed Mar. 11, 2013. These applications are hereby incorporated by reference in their entireties for all of their teachings.

BACKGROUND

0002 Synthetic fibers have seen increased usage in recent years, in applications ranging from carpets and textiles to tire treads and food packaging. Many synthetic fibers are synthesized by melt extrusion; however, further processing is required following the exit of the newly-formed fibers from the spinneret. This processing may take the form of spinning, twisting, weaving, tufting, or the like. Mechanical stress and/or heating during processing can adversely affect the new fibers, for example, by causing fusion or breakage of the strands.

0003 The conversion of synthetic fibers into useful yarn for textile manufacture requires the use of a lubricant formulation known as a “fiber finish” or “spin finish.” The spin finish must control yarn-to-metal friction, as well as yarn-to-yarn friction, to protect newly spun fibers from fusion and breakage and, in the case of texturing, to ensure that proper twist is transferred to the yarn. Various spin finishes are known in the art and may include lubricants such as fatty acid esters, hydrocarbon oils, and/or vegetable oils; antistatic agents; and optional components such as antioxidants, preservatives, biocides, surfactants, defoamers, softeners, wetting agents, and other compounds known in the art. Spin finishes which incorporate emulsifiers, in order to render said spin finishes water-emulsifiable, are also known.

0004 In the past, spin finishes have been applied in the range of 0.7-1.3% owf. Typical spin finish can include as much as 15-100% by weight of the lubricant and antistatic components. Depending on the application method, typical concentrations of these components can be 18-20%, 28-30%, and/or 95-100%. The amounts of these components, and the total amount of spin finish used, are large enough to represent considerable expenses for fiber producers, in terms of both materials and cost. Further, the surfactants and oils in spin finishes cause fibers to soil and are detrimental to the performance of water and oil repellants applied after manufacture. Additionally, using large amounts of finishing compounds results in the fouling of equipment surfaces as components of the spin finishes are transferred to manufacturing plant machinery. Moreover, carpets and other textiles composed of synthetic fibers may be exposed, during the course of normal use, to a variety of substances that can stain and/or ultimately diminish the appearance of said carpets and textiles.

0005 For the reasons stated above, it would be desirable to possess a spin finish composition that incorporates smaller amounts of component compounds, that can be applied to fibers in lower amounts per unit yarn weight, and that enhances or imparts beneficial properties to the fibers and articles constructed therefrom. The compositions and methods described herein address these needs.

SUMMARY

0006 Described herein are low add-on fiber lubricant compositions useful in the production of synthetic fibers. The compositions and methods described herein impart or enhance one or more properties of the fibers such as, for example, dry soil resistance, liquid repellency, or a combination thereof. Fibers produced with the lubricant compositions with the compositions described herein and articles comprising the treated fibers are also described herein. These compositions are composed of (a) a lubricant component, (b) a friction modifier, and (c) water. Each component is described in detail below, as are methods of making and using the lubricant compositions.

0007 Additional advantages of the compositions, methods, and articles described herein will be set forth in part in the description that follows, and in part will be apparent from the description. The advantages of the compositions, methods, and articles described herein will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the compositions, methods, and articles described herein, as claimed.

DETAILED DESCRIPTION

0008 The compositions, methods, and articles described herein can be understood more readily by reference to the following detailed description. It is also to be understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to be limiting.

0009 It must be noted that, as used in the specification and in the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to “a lubricant” includes mixtures of two or more lubricants.

0010 The term “liquid repellency” is defined herein as the ability of an article to avoid penetration of a liquid into the article. The liquid can include water, solvents, or hydrophobic (i.e. oil-based) materials.

0011 The term “dry soil resistance” as used herein is the ability to prevent dry soils from sticking to a substrate such as a fiber. For example, the dry soil can be dirt tracked in by foot traffic.

0012 “Optional” or “optionally” means that the subsequently described event or circumstance can or cannot occur, and that the description includes instances where the event or circumstance occurs and instances where it does not. For example, the phrase “optionally includes a biocide” means that a biocide can or cannot be included.

0013 As used herein, the term “about” is used to provide flexibility to a numerical range endpoint by providing that a given value may be “a little above” or “a little below” the endpoint without affecting the desired result.

0014 “Admixing” or “admixtures” refers to a combination of two or components together so that there is no chemical reaction or physical interaction. The terms “admixing” and “admixtures” also include the chemical reaction or physical interaction between any of the components described herein upon mixing to produce the composition. The components can be admixed alone, in water, or in combination with one or more other solvents.
As used herein, “synthetic fiber” is a fiber that is optionally made from a polymeric material, the processing of which can include spinning and/or melt extrusion steps.

“Bulk continuous filament” or “BCF” refers to continuous strands of synthetic fibers. Multiple BCF strands are grouped together into fibers; these can be texturized and/or heat-set to impart desired properties.

As used herein, “lubricant” refers to a compound or composition used in the compositions described herein during fiber formation that has the effect of reducing metal-to-fiber and/or fiber-to-fiber friction during fiber processing.

As used herein, “antistatic” or “antistatic” refers to a compound or composition applied to a fiber that has the effect of dissipating the electric charges which frequently accumulate on synthetic fibers, textiles, and articles produced therefrom, or of reducing the generation of charge in said synthetic fibers, textiles, and articles.

As used herein, “friction modifier” refers to a polymer or mixture of polymers used in the compositions described herein to extend or enhance the lubricant effects of the lubricant component during fiber formation.

“Melt extrusion” refers to a process for forming a polymeric fiber. In melt extrusion, heated pellets of polymeric material are forced through an apparatus that includes a spinneret; filaments emerging from the spinneret are cooled and solidified into fibers.

A “spin finish” or “fiber finish” is an oil-based or aqueous solution, a solid, or an emulsion, applied to fibers to prevent damage such as fusion or breakage during further processing. A spin finish may be designed to impart qualities including, but not limited to, liquid repellency, antistatic properties, lubricity, heat resistance, and/or dry soil resistance. Spin finishes allow for high-speed processing of synthetic fibers and optionally enhance particular characteristics of the finished textiles and/or articles made from said fibers; spin finishes may include lubricants or smoothing agents, emulsifiers, antistatic agents, wetting agents, defoamers, softeners, water or other solvents, biocides, preservatives, antioxidants, and other additives.

“On weight of fiber” (“owf”) or “on weight of goods” (“owg”) refers to the amount of a compound, admixture, finishing compound, or other treatment applied to a fiber or article with respect to the total weight of the fiber or article. For example, a finish applied at 1% owf to 1 kg of fibers would be present in the batch of fibers in the total amount of 10 g.

As used herein, a plurality of items, structural elements, compositional elements, or materials may be presented in a common list for convenience. However, these lists should be construed as though each member of the list is individually identified as a separate and unique member. Thus, no individual member of such list should be construed as a de facto equivalent of any other member of the same list solely based on its presentation in a common group without indications to the contrary.

Concentrations, amounts, and other numerical data may be expressed or presented herein in a range format. It is to be understood that such a range format is used merely for convenience and brevity and thus should be interpreted flexibly to include not only the numerical values explicitly recited as the limits of the range, but also to include all the individual numerical values or sub-ranges encompassed within that range as if each numerical value and sub-range was explicitly recited. As an illustration, a numerical range of “about 1 to about 5” should be interpreted to include not only the explicitly recited values of about 1 to about 5, but also to include individual values and sub-ranges within the indicated range. Thus, included in this numerical range are individual values such as 2, 3, and 4, and sub ranges such as from 1-3, from 2-4, and from 3-5, etc., as well as 1, 2, 3, 4, and 5, individually. The same principle applies to ranges reciting only one numerical value as a minimum or a maximum. Furthermore, such an interpretation should apply regardless of the breadth of the range or the characteristics being described.

Disclosed are materials and components that can be used for, can be used in conjunction with, can be used in preparation for, or are products of the disclosed compositions and methods. These and other materials are disclosed herein, and it is understood that when combinations, subsets, interactions, groups, etc. of these materials are disclosed, that while specific reference of each various individual and collective combination and permutation of these compounds may not be explicitly disclosed, each is specifically contemplated and described herein. For example, if a friction modifier is disclosed and discussed and a number of different lubricant compounds and/or compositions are discussed, each and every combination and permutation of friction modifier and lubricant that is possible is specifically contemplated unless specifically indicated to the contrary. For example, if a class of molecules A, B, and C are disclosed, as well as a class of molecules D, E, and F; and an example of a combination A+B is disclosed, then even if each is not individually recited, each is individually and collectively contemplated. Thus, in this example, each of the combinations A+E, A+F, B+D, B+E, B+F, C+D, C+E, and C+F, are specifically contemplated and should be considered disclosed from disclosure of A, B, and C; D, E, and F; and the example combination of A+B. Likewise, any subset or combination of these is also specifically contemplated and disclosed. Thus, for example, the sub-group of A+E, B+F, and C+E is specifically contemplated and should be considered disclosed from disclosure of A, B, and C; D, E, and F; and the example combination of A+B. This concept applies to all aspects of this disclosure including, but not limited to, steps in methods of making and using the disclosed compositions. Thus, if there are a variety of additional steps that can be performed with any specific embodiment or combination of embodiments of the disclosed methods, and that each such combination is specifically contemplated and should be considered disclosed.

Throughout this application, where publications are referenced, the disclosures of these publications in their entireties are hereby incorporated by reference into this application in order to more fully describe the state of the art to which this invention pertains.

Described herein are low add-on fiber lubricant compositions useful in the production of synthetic fibers. The compositions generally include (a) a lubricant component, (b) a friction modifier, and (c) water. In some aspects, these compositions can also include silicone components useful in forming emulsions. Optional additives that are known in the art may also be included. Each component is described in detail below, as are methods of making and using the lubricant compositions.

The lubricant component is not limited and known lubricant components can be used. Examples of lubricants useful herein include, but are not limited to, mineral oils; linear and/or branched carboxylic acid esters and ethers; fatty alcohol esters and ethers; coconut oil fatty acid triglycerides;
and their derivatives; silicones; polyalkylene glycols; sorbitan esters/ethers; alkyl polyglucosides; and alkoxylated alky- laminines. In one aspect, the lubricant comprises PEG 400 monolaurate, isobutyl stearate, n-hexyl laurate, tall oil fatty acid 2-ethylhexyl ester, dimethylpolysiloxane, or any combination thereof. Other useful lubricants include, but are not limited to, those disclosed in U.S. Pat. No. 6,491,839, which is herein incorporated by reference.

[0029] In one aspect, the amount of lubricant in the compositions disclosed herein can be from about 0.1% to about 10% by weight, from about 0.5% to about 5% by weight, from about 0.5% to about 4% by weight, or from about 0.5% to about 2% by weight of the total composition.

[0030] The friction modifiers useful herein comprise watersoluble, high average molecular weight polymers. In one aspect, the polymers can be polyethylene oxide or polypropylene oxide polymers, or copolymers of polyethylene and propylene oxide, or other polyalkylene oxides. In another aspect, the polymers can be polyacrylamide polymers. In a further aspect, the polyacrylamide polymers have a molecular weight greater than 100,000 Da and are identified by the CAS number 25085-02-3.

[0031] In one aspect, the friction modifier is a polyethylene oxide polymer available under the trade designation POLYOX™ from the Dow Chemical Company, Midland, Mich. In another aspect, the POLYOX™ resin is POLYOX™ WSR Coagulant, POLYOX™ WSR-1105, POLYOX™ WSR N-750, POLYOX™ WSR-301, or a mixture thereof.

[0032] In one aspect, the amount of friction modifier in the compositions disclosed herein can be from about 0.05% to about 10% by weight, from about 0.1% to about 5% by weight, from about 0.1% to about 1.25% by weight, from about 0.1% to about 0.75% by weight, from about 0.1% to about 0.5% by weight, from about 0.1% to about 0.35% by weight, or from about 0.1% to about 0.3% by weight of the total composition. In another aspect, the average molecular weight of the friction modifier is from about 300,000 to about 10,000,000 Da, from about 300,000 to about 5,000,000 Da, or may be about 300,000 Da, about 900,000 Da, about 4,000,000 Da, or about 5,000,000 Da.

[0033] In one aspect, the lubricant is in an amount of 0.5% to 3% by weight of the composition, and the friction modifier is in the amount of 0.05% to 0.50% by weight of the composition. In another aspect, the lubricant is a fatty acid ester or ether in an amount of 0.5% to 3% by weight of the composition, and the friction modifier is a polyethylene oxide (e.g., POLYOX™ polymer) in the amount of 0.05% to 0.50% by weight of the composition.

[0034] Silicone emulsions and emulsion-forming components may also be included in the compositions described herein. The silicones useful herein include, but are not limited to, StarSil™ LAS-24 (an amino functional polydimethylsiloxane), available from StarChem, LLC (Wellford, S.C.), and KF-8017 (dimethicone/aminopropyl dimethicone), available from Shin-etsu Silicones (Japan). In one aspect, the silicone is an amino silicone emulsion.

[0035] In one aspect, the amount of optional silicone in the compositions disclosed herein can be from about 1% to about 10% by weight, from about 2% to about 8% by weight, or about 5% by weight of the total composition.

[0036] The compositions described herein can include other components such as, for example, preservatives, biocides/antimicrobial agents, softeners, defoamers, antistatic agents, emulsifiers, wetting agents, UV stabilizers, antioxidants, and the like.

[0037] Although the compositions described herein do not require the use of an antistatic agent, in certain aspects the compositions can include one or more antistatic agents. Not wishing to be bound by theory, antistatic agents operate by increasing charge dissipation. Antistatic agents can be cationic, anionic, zwitterionic and/or amphoteric, or nonionic. Cationic antistatic agents can include imidazolines and quaternary amines; anionic antistatic agents can include sulfates or phosphates such alcohol phosphate esters. In one aspect, the antistatic agent is decyl alcohol POE(6) phosphate. Other useful antistatic agents include, but are not limited to, those disclosed in U.S. Pat. No. 6,491,839, which are incorporated by reference in their entirety.

[0038] In one aspect, the amount of optional antistatic agent in the compositions disclosed herein can be from about 0.05 to about 10% by weight, from about 0.5 to about 5% by weight, or from about 0.5% to about 1.5% by weight of the total composition.

[0039] In another aspect, a biocide, preservative, or antimicrobial agent may be included in the compositions disclosed herein. In one aspect, the amount of optional biocide, preservative, or antimicrobial agent in the compositions disclosed herein can be from about 0.05 to about 5% by weight, from about 0.05% to 1.25% by weight, or from about 0.1% to 0.5% by weight of the total composition.

[0040] In another aspect, the inclusion of a UV stabilizer or an antioxidant may be advantageous. Not wishing to be bound by theory, all components in spin finishes are susceptible to oxidation under certain conditions. The reaction that occurs is known as autoxidation and produces undesirable byproducts. The addition of UV stabilizers and antioxidants can prevent the breakdown of the finish components under these conditions. Examples of antioxidants typically used for this purpose include, but are not limited to, dialkyl thiadipropionates, aryl and alky phosphites, metal salts of diacids, and hindered phenols. UV stabilizers can be used to control photodegradation, which occurs when the finish is exposed to light. Examples of UV stabilizers useful herein include, but are not limited to, benzenophene compounds and hindered amines. In one aspect, the antioxidant and UV stabilizer can be added at 0.05 to 4.0% by weight, or 0.05 to 2.0% by weight.

[0041] In one aspect, the compositions are prepared by first admixing the lubricant component, the optional antistatic agent, and the friction modifier until uniform. Next, this mixture is then added slowly to water and stirred. Finally, any remaining ingredients are added and the mixture is stirred until uniform. Emulsion-forming techniques known in the art may also be employed as appropriate. Thus, the compositions described herein can be produced as homogeneous solutions in water or as emulsions. Non-limiting procedures for making the compositions described herein are provided in the Examples.

[0042] The compositions described herein can be used to produce synthetic fibers using techniques known in the art. In one aspect, a polymer is fed into a screw extruder and heated to melt. The molten polymer is pumped, under pressure, through a filter and then through the capillary of a spinnerette plate. Freshly extruded filaments are put through a descending spinning tower. Filaments are gathered into yarn and, upon emerging from the spinning tower, coated with a lubricant composition described herein, using a finish applicator.
Useful finish applicators include, but are not limited to, a trough through which the fibers pass, a "kiss" roll rotating in a trough over which the fibers pass, or a metered pump with discharge orifices over which the fibers pass.

In one aspect, the amount of composition that is present in the fiber can be from about 0.05 to about 0.5% owf, from about 0.1 to about 0.4% owf, or from about 0.1% or about 0.2% owf.

Also contemplated are articles having the fibers produced with the compositions described herein, or by any of the methods, described herein. Examples of articles include, but are not limited to, bedding (e.g. blankets, sheets, pillowcases, futon covers, comforter covers, comforter wadding), clothes (e.g. suits, uniforms, shirts, blouses, trousers, skirts, sweaters, socks, panty hose, shoe linings, shoe sole inserts), curtains, carpet, rugs, yarn, and covers for upholstered items (e.g. home or office furnishings, auto or boat seats, restaurant seats, furniture in medical offices and hospitals).

In one aspect, the article is composed of synthetic fibers. In one aspect, the synthetic fiber includes, but is not limited to, a monofilament polyester fiber, a multifilament polyester fiber, a polyamide fiber, a polyolefin fiber, a poly(benzimidazole) fiber, a carbon fiber, a glass, yarn fiber, a synthetic fiber containing free amino groups, or a combination or derivative thereof. In a further aspect, the derivative may be nylon covered with polypropylene. Fibers containing free amino groups can be obtained by a variety of methods, including, but not limited to, the condensation reaction of hexamethylenediamine with adipic acid, hexamethylene diamine with sebacic acid, 4-aminodecanoic acid, caprolactam, and dodecylcaprolactam. Fibers formed from polyurethanes, including type 6 and type 6,6 nylons, can be treated by the compositions and methods described herein. Semisynthetic fibers such as rayon can also be contacted with any of the compositions described herein. In one aspect, the fibers are Antron® (N6.6) manufactured by Invista, Anson® (N6) manufactured by Shaw, Sorona® (PTT) manufactured by DuPont, and Everstrand® (PET) manufactured by Mohawk.

The fibers produced with the compositions and methods described herein can be twisted, woven, tufted, and sewn into various forms of textile materials including, but not limited to, rugs, carpets, and yarns. In one aspect, the fibers being treated by the compositions and methods disclosed herein may be spun at speeds of from about 1400 meters/min to about 3500 meters/min.

EXAMPLES

The following examples are put forth so as to provide those of ordinary skill in the art with a complete disclosure and description of how the compositions and methods described and claimed herein are made and evaluated, and are intended to be purely exemplary and are not intended to limit the scope of what the inventors regard as their invention. Efforts have been made to ensure accuracy with respect to numbers (e.g. amounts, temperature, etc.) but some errors and deviations should be accounted for. Unless indicated otherwise, parts are by weight, temperature is in °C or is at ambient temperature, and pressure is at or near atmospheric.

There are numerous variations and combinations of reaction conditions, e.g. component concentrations, desired solvents, solvent mixtures, temperatures, pressures, and other reaction ranges and conditions that can be used to optimize the produce purity and yield obtained from the described process.

Only reasonable and routine experimentation will be required to optimize such process conditions.

Preparation of Low Add-On Lubricant Compositions as Aqueous Solutions

2. Charge mixture with POLYOX™ WSR Coagulant and continue stirring until the resin is thoroughly dispersed.
3. Add the blend created in step 2 slowly to water at 130°F (54.4°C) and stir until the mixture is uniform (about 1 hour).
4. Charge with biocide and mix to disperse.

<table>
<thead>
<tr>
<th>Component</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG 400 Monolaurate</td>
<td>2.0%</td>
</tr>
<tr>
<td>Decyl Alcohol POE(6) Phosphate</td>
<td>1.0%</td>
</tr>
<tr>
<td>POLYOX™ WSR Coagulant</td>
<td>0.25%</td>
</tr>
<tr>
<td>Water</td>
<td>96.65%</td>
</tr>
<tr>
<td>Biocide</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Preparation of Low Add-On Lubricant Compositions as Silicone-Based Emulsions

1. Charge PEG400 monolaurate and decyl alcohol POE(6) phosphate in a suitable vessel. Stir until uniform.
2. Charge mixture with POLYOX™ WSR Coagulant and continue stirring until the resin is thoroughly dispersed.
3. Add the blend created in step 2 slowly to water at 130°F (54.4°C) and stir until the mixture is uniform (about 1 hour).
4. With stirring, cool to <90°F (32.2°C). Add the silicone emulsion (available as Starsoft SIL-V (amino silicone emulsion) from ArrowStar, LLC, Dalton, Ga.) and stir until uniform.
5. Charge with biocide and mix to disperse.

<table>
<thead>
<tr>
<th>Component</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG 400 Monolaurate</td>
<td>1.0%</td>
</tr>
<tr>
<td>Decyl Alcohol POE(6) Phosphate</td>
<td>0.5%</td>
</tr>
<tr>
<td>POLYOX™ WSR Coagulant</td>
<td>0.25%</td>
</tr>
<tr>
<td>Water</td>
<td>93.15%</td>
</tr>
</tbody>
</table>
TABLE 2-continued

<table>
<thead>
<tr>
<th>Component</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amino Silicone Emulsion</td>
<td>5%</td>
</tr>
<tr>
<td>Biocide</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Preparation of Control Formulation

A control lubricant formulation representing the current state of the art was prepared in the same manner as the aqueous lubricant compositions of the present invention. The components of this formulation are provided in Table 3.

TABLE 3

<table>
<thead>
<tr>
<th>Component</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG 400 Monolaureate</td>
<td>10.5%</td>
</tr>
<tr>
<td>Nonyl Phenol POE(9)</td>
<td>5.5%</td>
</tr>
<tr>
<td>Coconut Olein, RBD</td>
<td>1.0%</td>
</tr>
<tr>
<td>Decyl Alcohol POE(6) Phosphate</td>
<td>2.5%</td>
</tr>
<tr>
<td>Carbowax #400</td>
<td>1.0%</td>
</tr>
<tr>
<td>Water</td>
<td>79.5%</td>
</tr>
</tbody>
</table>

Application of Low Add-On Lubricant Compositions to Carpet Fibers

Cut pile solution dyed nylon carpet was tufted with both a standard lubricant package (Table 3) and the aqueous-based low add-on lubricant (VBL) (Table 1). The treated carpet had superior antisoling properties and water repellency as compared to the control.

Treated carpet samples were evaluated for soiling using AATCC Test Method 123. Soiling is rated on a scale of 1 to 5, with 1 representing the highest soiling and 5 representing no change in appearance; a higher value in this test represents superior performance.

Carpet samples were topically sprayed with a soil resistance-imparting compound, ARROSHEILD® EVO at 2% owg and again evaluated by the AATCC Test Method 123.

The water repellency of treated carpet samples was also evaluated using the DuPont and 3M methods. In each of these cases, a larger number corresponds to better water repellency.

Results of all soil resistance and water repellency tests are presented in Table 4.

TABLE 4

<table>
<thead>
<tr>
<th>Soil Resistance</th>
<th>Water Repellency</th>
</tr>
</thead>
<tbody>
<tr>
<td>AATCC Method</td>
<td>ARROSHEILD®</td>
</tr>
<tr>
<td>(method #)</td>
<td>EVO Treated</td>
</tr>
<tr>
<td>VBL</td>
<td>3-4</td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
</tr>
</tbody>
</table>

Throughout this application, various publications are referenced. The disclosures of these publications in their entireties are hereby incorporated by reference into this application in order to more fully describe the compounds, compositions and methods described herein.

Various modifications and variations can be made to the materials, methods, and articles described herein. Other aspects of the materials, methods, and articles described herein will be apparent from consideration of the specification and practice of the materials, methods, and articles disclosed herein. It is intended that the specification and examples be considered as exemplary.

What is claimed:

1. A composition comprising (a) a lubricant in the amount of 0.1% to 10% by weight of the composition, (b) a friction modifier in the amount of 0.05% to 10% by weight of the composition, and (c) water.

2. The composition of claim 1, wherein the lubricant component comprises, a mineral oil; a carboxylic acid ester or ether; a fatty alcohol ester or ether; a coconut oil fatty acid triglyceride or derivative thereof; a silicone; a sorbitan ester or ether; an alkyl polyglycoside; an alkoxylated alkylamine or any combination thereof.

3. The composition of claim 1, wherein the friction modifier comprises a polyacrylamide.

4. The composition of claim 1, wherein the friction modifier comprises a polyalkylene oxide.

5. The composition of claim 4, wherein the polyalkylene oxide polymer is a polyethylene oxide having an average molecular weight of 300,000 to 10,000,000 Daltons.

6. The composition of claim 1, wherein the composition further comprises an antistatic agent.

7. The composition of claim 6, wherein the antistatic agent comprises an alcohol phosphate ether.

8. The composition of claim 6, wherein the antistatic agent is in an amount of 0.05% to 10% by weight of the composition.

9. The composition of claim 1, wherein the lubricant is in an amount of 0.5% to 3% by weight of the composition, and the friction modifier is in the amount of 0.05% to 0.50% by weight of the composition.

10. The composition of claim 1, wherein the composition further comprises a preservative, an antimicrobial agent, an antioxidant, a defoamer, an emulsifier, a softener, a wetting agent, a UV stabilizer, or any combination thereof.

11. The composition of claim 1, wherein the composition further comprises an antioxidant, a UV stabilizer, or a combination thereof.

12. The composition of claim 1, wherein the composition is a homogeneous solution.

13. The composition of claim 1, wherein the composition is an emulsion.

14. A fiber comprising the composition of claim 1, wherein the amount of composition applied to the fiber is 0.05% to 0.50% on weight fiber.

15. The fiber of claim 14, wherein the fiber comprises a monofilament polyester fiber, a multifilament polyester fiber, a polyamide fiber, a polyolefin fiber, a polybenzimidazole fiber, a carbon fiber, a glass yarn fiber, or a combination thereof.

16. A fiber produced by the process comprising applying the composition of claim 1 to the fiber.

17. An article comprising the fiber of claim 14.

18. The article of claim 17, wherein the fiber is in a rug, carpet, yarn, bedding, clothes, curtains, or a covering for an upholstered article.
19. A method for imparting soil resistance, water repellency, or a combination thereof, to a fiber, comprising applying the composition of claim 1 to the fiber.