ANTIMICROBIAL FABRIC ASSEMBLIES

[0001] This application claims the benefit of U.S. Provisional Application number 62/318,059, filed April 4, 2016, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] In some examples, the disclosure relates to protective fabric materials that can be used in clothing, gloves, boots, furniture, transportation seating, and other applications where fabric is commonly used.

SUMMARY

[0003] In some examples, the disclosure is directed to antimicrobial fabric assemblies and methods for making and using the same. The fabric assemblies may include fabric substrates (e.g., woven, non-woven, or knitted fabric substrates) including a plurality of guard plates affixed to and separated by gaps on the surface of the fabric substrate. The guard plates may be formed by curing a polymer material following deposition of the polymer material, e.g., via screen printing, on the fabric substrate. The fabric assembly includes one or more antimicrobial agents contained in or on at least one of the substrate or plurality of guard plates. The antimicrobial agent may be configured to reduce the fabric assembly's surface population of at least one of bacteria, virus, mold, fungus, or algae.

[0004] According to a first aspect of the present disclosure, there is provided a fabric assembly including a flexible substrate including a top surface; a plurality of guard plates affixed to the top surface of the flexible substrate and arrayed in a pattern such that a plurality of continuous gaps are defined between adjacent plates; and a silver-zeolite or silver-glass antimicrobial agent contained in the plurality of guard plates at 2% to 7% by weight, and wherein the antimicrobial agent is selected to reduce the fabric assembly's surface population of at least one of bacteria, virus, mold, fungus, or algae.

[0004a] According to a second aspect of the present disclosure, there is provided a method including forming the above fabric assembly.

[0005] According to a third aspect of the present disclosure, there is provided a method including depositing a plurality of guard plates affixed to a top surface of a flexible substrate

and arrayed in a pattern such that a plurality of continuous gaps are defined between adjacent plates, wherein the fabric assembly includes a-silver zeolite or silver-glass antimicrobial agent contained in the plurality of guard plates at 2% to 7% by weight, and wherein the antimicrobial agent is selected to reduce the fabric assembly's surface population of at least one of bacteria, virus, mold, fungus, or algae

[0006] The details of one or more examples are set forth in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

[0007] FIGS. 1(a)-1(s) are conceptual diagrams illustrating example antimicrobial fabric assemblies in accordance with this disclosure.

[0008] FIGS. 2(a)-2(d) are conceptual diagrams illustrating various example cross sections for example guard plates.

[0009] FIG. 3 is a plan view illustration of an example fabric assembly showing example plate shapes, plate patterns, and variations in gap widths.

[0010] FIG. 4 is a plot illustrating experimental results from testing of an example antimicrobial fabric assembly in accordance with an example of the disclosure.

[0010a] FIG. 5 is a conceptual diagram illustrating the ion exchange mechanism of silver zeolite that enables and controls the release of Ag+ ions into a microbe rich environment.

[0010b] FIG. 6 is a conceptual diagram illustrating how ordinary glass is modified to make a porous silver glass.

[0010c] FIG. 7 is a schematic diagram illustrating an example process with which components of plates, gaps, and flexible substrate are combined into a fabric assembly.

DETAILED DESCRIPTION

[0011] The disclosure is not limited by the embodiments that are described herein. These embodiments serve only to exemplify aspects of the disclosure.

CLAIMS

1. A fabric assembly comprising:

a flexible substrate including a top surface;

a plurality of guard plates affixed to the top surface of the flexible substrate and arrayed in a pattern such that a plurality of continuous gaps are defined between adjacent plates; and

a silver-zeolite or silver-glass antimicrobial agent contained in the plurality of guard plates at 2% to 7% by weight, and

wherein the antimicrobial agent is selected to reduce the fabric assembly's surface population of at least one of bacteria, virus, mold, fungus, or algae.

2. The fabric assembly of claim 1, wherein the plurality of guard plates are formed of a material that wears away such that fresh antimicrobial agent contained in the guard plates is exposed at a surface of the guard plates as the material wears away to make the fabric assembly antimicrobial regenerative.

3. The fabric assembly of claim 1, wherein the antimicrobial agent is also contained in the substrate.

4. The fabric assembly of claim 1, wherein the antimicrobial agent is also on the plurality of guard plates.

5. The fabric assembly of claim 1, wherein the antimicrobial agent is also on the substrate.

6. The fabric assembly of claim 1, wherein the antimicrobial agent is not contained in the substrate or on the substrate except for the guard plates.

7. The fabric assembly of claim 1, wherein the antimicrobial agent is selected to reduce the fabric assembly's surface population of the virus.

8. The fabric assembly of claim 1, wherein the fabric assembly forms a garment for a healthcare worker.

9. The fabric assembly of claim 1, wherein the antimicrobial agent is a silver-zeolite.

10. The fabric assembly of claim 1, wherein the antimicrobial agent is a silver-glass.

11. The fabric assembly of claim 1, wherein the plurality of guard plates comprise epoxy resin.

12. The fabric assembly of claim 11, wherein the epoxy resin is heat curable.

13. The fabric assembly of claim 11, wherein the plurality of guard plates further comprise a rubbery moiety mixed with the epoxy resin.

14. The fabric assembly of claim 13, wherein the rubbery moiety causes softening of the plurality of guard plates.

15. The fabric assembly of claim 13, wherein the rubbery moiety causes a reduction in abrasion resistance of the plurality of guard plates.

16. The fabric assembly of claim 1, wherein the flexible substrate comprises a woven fabric.

17. The fabric assembly of claim 1, wherein the flexible substrate comprises a non-woven fabric.

18. A method comprising forming the fabric assembly of any of claims 1-17.

19. A method comprising depositing a plurality of guard plates affixed to a top surface of a flexible substrate and arrayed in a pattern such that a plurality of continuous gaps are defined between adjacent plates, wherein the fabric assembly includes a-silver zeolite or silver-glass antimicrobial agent contained in the plurality of guard plates at 2% to 7% by weight, and wherein the antimicrobial agent is selected to reduce the fabric assembly's surface population of at least one of bacteria, virus, mold, fungus, or algae.