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(54) **DISPOSABLE CLEANING CLOTHS AND ASSOCIATED METHODS**

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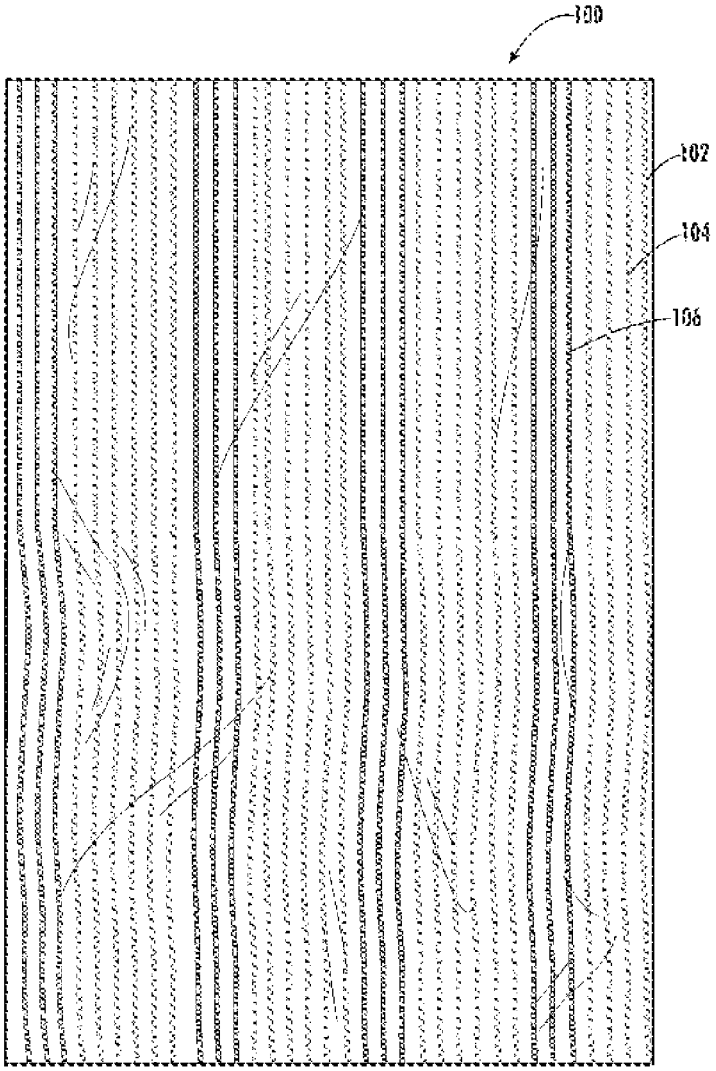
(57) **ABSTRACT**

A disposable cleaning cloth includes a low weight substrate having a first face and an opposed second face. The disposable cleaning cloth further includes microfiber yarn sewn to the low weight substrate in a plurality of parallel rows of straight stiches. The straight stitches are substantially flush with the first and second faces of the substrate. A method of making a disposable cleaning cloth includes providing a low weight substrate having a first face and an opposed second face. The method further includes sewing a microfiber yarn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate.



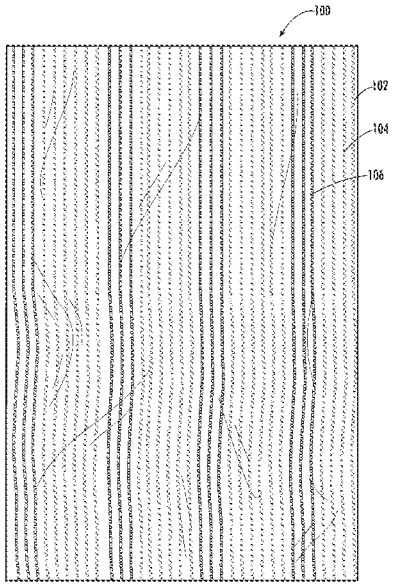


FIG. 1

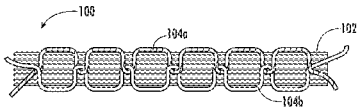


FIG. 2

DISPOSABLE CLEANING CLOTHS AND ASSOCIATED METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority benefit of U.S. Provisional Application No. 63/031,669, filed May 29, 2020, the disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] This disclosure generally relates to disposable cleaning cloths and methods for manufacturing the same, and more specifically relates to disposable cleaning cloths having a relatively low weight substrate with microfiber yarns sewn thereon.

[0003] Disposable cleaning wipe products have recently gained popularity. Such wipe products typically incorporate a nonwoven sheet that is saturated with a cleaning and sanitizing solution. Flat or textured nonwoven sheets have been used successfully, but such nonwoven sheets must have a relatively substantial weight to avoid falling apart during use.

[0004] Thus, it would be desirable to provide improved constructions of disposable cleaning wipe or cloth products.

SUMMARY

[0005] Disposable cleaning cloths and methods for manufacturing disposable cleaning cloths are described.

[0006] In embodiments, a disposable cleaning cloth includes a low weight substrate having a first face and an opposed second face. The disposable cleaning cloth further includes microfiber yarn sewn to the low weight substrate in a plurality of parallel rows of straight stiches. The straight stitches are substantially flush with the first and second faces of the substrate.

[0007] In embodiments, a method of making a disposable cleaning cloth includes providing a low weight substrate having a first face and an opposed second face. The method further includes sewing a microfiber yarn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The detailed description is set forth with reference to the accompanying drawings. The use of the same reference numerals may indicate similar to identical items. Various embodiments may utilize elements and/or components other than those illustrated in the drawings, and some elements and/or components may not be present in various embodiments. Elements and/or components in the figures are not necessarily drawn to scale.

[0009] FIG. **1** is a photograph showing one embodiment of a disposable cleaning cloth, in accordance with the present disclosure

[0010] FIG. **2** is a cross-sectional illustration of one row of straight stitched yarn, in accordance with the present disclosure.

DETAILED DESCRIPTION

[0011] The present disclosure includes non-limiting embodiments of disposable cleaning cloths and methods for manufacturing the same. The embodiments are described in detail herein to enable one of ordinary skill in the art to practice the disposable cleaning cloths and associated methods of making, although it is to be understood that other embodiments may be utilized and that logical changes may be made without departing from the scope of the disclosure. Throughout the disclosure, depending on the context, singular and plural terminology may be used interchangeably.

[0012] Disposable cleaning cloths (also referred to interchangeably herein as "wipes") have been developed that utilize a relatively low weight substrate material, as compared to commercially available textured and flat nonwoven wipes. A microfiber yarn is sewn to the low weight substrate in parallel rows of straight stitches, in a pattern and amount effective to provide additional structural stability to the cloth. In certain embodiments, the yarn stitches also provide a textured surface to aid in cleaning effectiveness of debris particles, for both consumer and commercial cleaning applications. Thus, the disposable cleaning cloths described herein may be relatively lightweight, while providing superior cloth strength and cleaning ability in a disposable format.

[0013] The disposable cleaning cloths described herein may provide strong cleaning performance, high water/liquid absorbency, good dust and particle trapping, 99.9% microorganism removal, and/or not chemically bind quaternary ammonium chloride (QUAT) or chlorine bleach, as described below. Thus, these disposable cloths may provide an improved level of cleaning performance for a disposable cloth while being formed of lightweight materials.

[0014] Particularly in healthcare environments, such as hospitals, quaternary ammonium chlorides are frequently used with mops and cloths as disinfectants. However, these disinfectants are often absorbed by or bound to traditional microfibers, such as those contained in microfiber mops and cleaning cloths, when the microfibers are immersed in disinfectant solutions during cleaning, thereby reducing the concentration of any quaternary ammonium chloride-based disinfectant used with these microfibers, and reducing the killing effectiveness of the quaternary ammonium chloride-based disinfectant solution.

[0015] In some embodiments described herein, the disposable cleaning cloth does not chemically bind QUAT or chlorine bleach. For example, in some embodiments, the cleaning cloth, when immersed in a solution comprising QUAT or chlorine bleach and subsequently removed from the solution, does not substantially alter the concentration of the QUAT or chlorine bleach. As used herein, a cloth that does not substantially alter the concentration of the QUAT or chlorine bleach refers to a cloth that does not preferentially bind the QUAT or chlorine bleach, or to a cloth that is QUAT and chlorine bleach safe and compatible. That is, the concentration of any QUAT or chlorine bleach disinfectant solution used with the cloth does not substantially differ over time from the initial concentration of the liquid solution. For example, in some embodiments, the concentration of QUAT or chlorine bleach solution absorbed by the cloth differs by less than 5% from the concentration of any remaining solution.

[0016] Various embodiments of disposable cleaning cloths and methods for manufacture of the same are described below.

Disposable Cleaning Cloths

[0017] In one aspect, a disposable cleaning cloth is provided. As shown in FIG. **1**, the disposable cleaning cloth **100** includes a low weight substrate **102**, which has a first face and an opposed second face, and a microfiber yarn **104** sewn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate **102**. As used herein, the phrase "substantially flush with the first and second faces of the substrate" refers to the straight stitches lying flat or level along the respective surfaces of the substrate, such that no visible gap is present between the face and the stitch when the cloth is laid flat at rest. For example, the substantially flush straight stitches are not looped or otherwise stitched to form a gap between the yarn and the substrate. It has been discovered that the substantially flush straight stitches described herein provide a strong cleaning performance, including good dust and particle trapping, despite lying flush with the surface.

[0018] The low weight substrate may be any suitable low weight substrate, and may have a weight of 70 g/m^2 or less. In certain embodiments, the low weight substrate has a weight of about 10 g/m^2 to about 50 g/m^2, such as about 30 g/m^2 to about 45 g/m^2. As used herein, the term "about" when used with reference to a numerical value, refers to an amount that is plus or minus up to 3 percent of the stated numerical value.

[0019] In certain embodiments, the low weight substrate has a paper or fabric construction. The paper or fabric construction may display suitable fluid absorbency. For example, the low weight substrate may have an absorbency of from about 400% to about 800% its weight. For example, the low weight substrate may be a cotton cellulose or rayon cellulose paper. In other embodiments, the low weight substrate is a nonwoven fabric. For example, the nonwoven fabric may be formed of suitable materials, such as polyester, polypropylene, nylon, acrylic, cotton, rayon, and blends of any of these materials. For example, the nonwoven fabric may be formed via suitable nonwoven fabrication methods, such as spun-bonding, needle-punching, and hydro-entanglement. In one embodiment, the low weight substrate is a needle-punched nonwoven polyester configuration.

[0020] In certain embodiments, the disposable cleaning cloths described herein contain a single nonwoven fabric or paper layer forming the low weight substrate. In other embodiments, the low weight substrate may be formed of multiple layers.

[0021] The microfiber yarn may be formed of suitable microfibers in any suitable configuration. For example, the microfibers may be sized with a relatively small diameter and deliver good water absorbency. For example, the microfibers may have a size of about 0.36 to about 1 denier, such as about 0.52 denier. The microfibers may be formed of suitable materials, such as polyesters, polypropylene, nylon, and blends of any of these materials.

[0022] A microfiber yarn is formed of a plurality of microfibers, i.e., microfiber filaments. For example, the microfiber yarn may be formed of from about 250 to about 350 microfiber filaments, such as from about 275 to about 300 filaments. In certain embodiments, the microfiber yarn has a denier of from about 100 to about 200.

[0023] FIG. **2** illustrates a cross-section of a single row of straight stitches of yarn **104** in the substrate **102** of a disposable cleaning cloth **100**. As shown, in certain embodiments of the yarn, the straight stitch yarn pattern is formed by an upper yarn **104***a* and a lower yarn **104***b*. The upper yarn **104***a* is sewn along the first, upper surface of the substrate **102**, while the lower yarn **104***b* is sewn along the opposed, lower surface of the substrate **102**. Such straight stitch patterns are formed by standard sewing machines. As described herein, both the upper and lower yarns may be a microfiber yarn. In certain embodiments, the upper and lower yarns are identical. In other embodiments, the upper and lower yarns are different microfiber yarns. For example, the upper and lower yarns may have different denier or different material.

[0024] As described herein, the microfiber yarn **104** is sewn to the substrate **102** in a plurality of parallel rows of stiches. For example, the parallel rows may be straight lines, or other patterns, such as serpentine or zig-zag shaped. For example, the parallel rows may be substantially continuous over the width and length of the cleaning cloth. The stitches may be sewn in a suitable stitch density per area to provide the desired strength reinforcement to the substrate and to provide the desired cleaning performance. For example, the parallel rows of stitches may be spaced from one another by about 0.5 mm to about 5 mm, such as from about 1 mm to about 3 mm. In certain embodiments, the straight stitches of the microfiber yarn are present in an amount of about 50 to about 500 stitches per square inch, such as about 100 to about 300 stiches per square inch, such as from 150 to about 250 stiches per square inch, or about 150 to about 200 stiches per square inch, such as about 180 or 200 stiches per square inch.

[0025] In certain embodiments, as shown in FIG. **1**, a cleaning cloth **100** includes a fiber yarn **106** sewn to the low weight substrate **102** in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate, the fiber yarn stiches being substantially parallel to the microfiber yarn **104** stiches. For example, the fiber yarn may not be a microfiber yarn, but may be a yarn formed of larger filaments, such as filaments having a size of greater than 1 denier. In certain embodiments, one, two, three or more of the fiber yarns are provided between sets of parallel rows of straight microfiber yarn stitches (e.g., sets of two, three, four, five, six, seven, eight, nine, ten or more rows). For example, the interspersed fiber yarns **106** may provide enhanced strength and stiffness for the cleaning cloth.

Methods of Manufacture

[0026] In another aspect, methods of making a disposable cleaning cloth **100** are provided. These methods may be used to make cleaning cloths having any of the features, or any combination of the features, described herein. In one embodiment, a method includes providing a low weight substrate **102** having a first face and an opposed second face, and sewing a microfiber yarn **104** to the low weight substrate **102** in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate.

[0027] In certain embodiments, the sewing is performed on a multiline sewing machine.

[0028] In certain embodiments, the method also includes sewing a fiber yarn **106** to the low weight substrate **102** in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and

second faces of the substrate **102**, the fiber yarn **106** stiches being substantially parallel to the microfiber yarn **104** stiches.

EXAMPLES

[0029] Sample cleaning cloths were manufactured in accordance with the present disclosure. In particular, disposable cleaning cloths having a single layer of nonwoven, needle-punched polyester substrate with a weight in the range of 30 g/m^2-45 g/m^2 with polyester microfiber upper and lower yarns sewn to the substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate, were manufactured. The cloths were tested for cleaning performance and water absorbency.

[0030] Specifically, the cloths were used in standardized tests to clean chocolate powder, milk, and cream in a simulated spill on tile and ranked based on strokes required to clean the spill. Generally, the cloths performed substantially as well as commercially available cleaning cloths. The cloths displayed an average water absorbency of 640% of the cloth weight.

[0031] Thus, it has been discovered that lightweight disposable cleaning cloths can be manufactured using relatively low weight and low cost materials, but that provide high cloth strength and cleaning performance. Additionally, it was found that competitive cleaning performance could be achieved using flat or flush stitches on the face of the substrate, instead of raised or looped stitches, allowing for reduced materials to be used in fabrication.

[0032] While the disclosure has been described with reference to a number of embodiments, it will be understood by those skilled in the art that the disclosure is not limited to such disclosed embodiments. Rather, the disclosure can be modified to incorporate any number of variations, alterations, substitutions, or equivalent arrangements not described herein, but which are commensurate with the spirit and scope of the disclosure. Conditional language used herein, such as "can," "could," "might," or "may," unless specifically stated otherwise, or otherwise understood within the context as used, generally is intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements or functional capabilities. Additionally, while various embodiments of the disclosure have been described, it is to be understood that aspects of the disclosure may include only some of the described embodiments. Accordingly, the disclosure is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

What is claimed is:

1. A disposable cleaning cloth, comprising:

a low weight substrate having a first face and an opposed second face; and

microfiber yarn sewn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate.

2. The disposable cleaning cloth of claim **1**, wherein the low weight substrate has a weight of 70 g/m^2 or less.

3. The disposable cleaning cloth of claim **1**, wherein the low weight substrate comprises a nonwoven fabric.

4. The disposable cleaning cloth of claim **3**, wherein the nonwoven fabric comprises nonwoven polyester, polypropylene, nylon, acrylic, cotton, rayon, or blend of any of these materials.

5. The disposable cleaning cloth of claim **1**, wherein the microfiber yarn comprises microfibers of polyester, polypropylene, nylon, or a blend of any of these materials.

6. The disposable cleaning cloth of claim **5**, wherein the microfibers each have a denier of from about 0.36 to about 1.

7. The disposable claim cloth of claim **1**, wherein the microfiber yarn has a denier of from about 100 to about 200.

8. The disposable cleaning cloth of claim **1**, wherein the microfiber yarn is formed of from about 250 to about 350 microfiber filaments.

9. The disposable cleaning cloth of claim **1**, wherein the straight stitches of the microfiber yarn are present in about 150 to about 250 stiches per square inch.

10. The disposable cleaning cloth of claim **1**, further comprising a fiber yarn sewn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate, the fiber yarn stiches being substantially parallel to the microfiber yarn stiches.

11. A method of making a disposable cleaning cloth, comprising:

providing a low weight substrate having a first face and an opposed second face; and

sewing a microfiber yarn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate.

12. The method of claim **11**, wherein the low weight substrate has a weight of 70 g/m^2 or less.

13. The method of claim **11**, wherein the low weight substrate comprises a nonwoven fabric.

14. The method of claim **13**, wherein the nonwoven fabric is a nonwoven polyester, polypropylene, nylon, acrylic, cotton, rayon, or blend of any of these materials.

15. The method of claim **11**, wherein the microfiber yarn comprises microfibers of polyester, polypropylene, nylon, or a blend of any of these materials.

16. The method of claim **15**, wherein the microfibers each have a denier of from about 0.36 to about 1.

17. The method of claim **11**, wherein the microfiber yarn has a denier of from about 100 to about 200.

18. The method of claim **11**, wherein the microfiber yarn is formed of from about 250 to about 350 microfiber filaments.

19. The method of claim **11**, wherein the straight stitches of the microfiber yarn are sewn in about 150 to about 250 stiches per square inch.

20. The method of claim **11**, further comprising sewing a fiber yarn to the low weight substrate in a plurality of parallel rows of straight stiches, such that the straight stitches are substantially flush with the first and second faces of the substrate, the fiber yarn stiches being substantially parallel to the microfiber yarn stiches.

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