EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 31.05.2006 Bulletin 2006/22
(21) Application number: 01970731.4
(22) Date of filing: 10.09.2001

(54) MOLD AND MILDEW INHIBITING WICKING MATERIAL
MODER- UND SCHIMMELHEMMENDES DOCHTMATERIAL
MATERIAU DE MECHE INHIBANT LES MOISISSURES

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

(43) Date of publication of application: 11.06.2003 Bulletin 2003/24

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WO-A-99/19523
GB-A- 1 086 564
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Description

Field of the Invention

[0001]  The present invention is related generally to breathable wicking materials, including building materials. More specifically, the present invention is related to building materials such as wallboard, paneling, insulation, wallpaper, paint, sheathing, siding, etc.


Background of the Invention

[0003]  Buildings, including those residential, commercial, and industrial, have walls, ceilings, and floors which serve to maintain a desired environment. Together, the walls, ceiling, and floors may be considered as part of the building envelope. The building envelope serves to maintain the desired temperature and humidity for both humans and machines. In particular, the building envelope serves to maintain inside humidity within desirable limits. Above a high limit, high humidity can cause problems such as condensing moisture within machinery and electronics, human discomfort, building material rot, and growth of mold and mildew. Below low limits, low moisture may cause problems, including static electricity generation, cracking of wood furniture, and human discomfort.

[0004]  Building envelopes serve to maintain the humidity within desired limits for the above-mentioned reasons. Moisture, in particular, presents a difficult problem in building design and construction. In colder climates, and/or colder seasons, the lower outside relative humidity can lead to problems where the higher inside relative humidity serves as a driving force for the diffusion of water vapor from areas of high relative humidity inside a building, to areas of low relative humidity outside of the building. In particular, the high relative humidity on one side of the wall, and low humidity on the opposite side of the wall, provide a driving force for the diffusion of water vapor into the wall. The outside of the wall, or the cold side, serves as a condensing region for water vapor.

[0005]  In warm, humid regions, a higher outside relative humidity relative to an air-conditioned, inside humidity, which is lower, may lead to diffusion of water vapor from outside to inside. This can lead to condensation and pooling of water within the building envelope, for example, within a wall. Outside water may also present a problem. Precipitation, after penetrating into the building envelope, may remain for long periods. Standing or puddling water may present a problem by causing building material rot. Water or high humidity may also lead to mold or mildew growth, which may present a problem to human health.

[0006]  Some modern building practices may exacerbate the problems. In times of labor shortages and/or high building demand, structures may be built in less than optimal ways. In particular, the building envelope may be built without the desired integrity. Modern building codes may also worsen the problems. In one example, energy conservation goals may inspire ever-tighter building envelopes. While this may be desirable with respect to heat loss, it may not be as desirable with respect to preventing the diffusion of water vapor out of the building. In particular, tight building envelopes may lead water to remain within the building, and/or building envelope, for very long time periods as the tighter building envelope may inhibit the escape of water vapor from the structure. This may lead to the aforementioned problems of rot, and bacterial, mold, and mildew growth. What would be desirable, therefore, are building materials and methods for reducing the degree of problems caused by condensing moisture in or near building envelopes. Building materials and methods for reducing the harm caused by water penetration into building structures would also be desirable.

Summary of the Invention

[0007]  The present invention provides a breathable wicking material as defined in claim 1. The wicking material may be a building material. The channels provide a plurality of vapor channels for wicking moisture from areas of high concentration to areas of low concentration. The channels also allow air passage through the building material. In one embodiment, the fibers are disposed within the building material, oriented transversely to the surfaces of the building material. In another embodiment, the fibers are randomly oriented within the building material. The building material is termed breathable, as air and moisture can pass through the material, rather than moisture being trapped within impermeable building materials.

[0008]  Fibers suitable for use in the current invention preferably have a higher surface-to-volume ratio than round fibers of the equivalent volume. Examples of suitable fibers include doughnut or annular shaped fibers, and fibers having internal channels extending therethrough. Biocidal materials can also be included with fibers according to the present invention. Biocidal materials include antifungal agents, antimicrobial agents, antibacterial agents, and/or anti-mildew agents. Biocides can be coated over the fibers prior to incorporating the fibers into the building materials.

[0009]  Fibers according to the present invention can be incorporated into outer siding, sheathing, insulation material, wallboard, gypsum, plaster, wallpaper paste, paint, wallpaper, ceiling tile, etc. Having fibers coated with biocide can provide a means for inhibiting growth of mold and other undesirable life which is activated upon addition of moisture. Thus, a biocide may reside on a fiber surface as a coating for a long time period, until moisture is wicked into the area of the fiber having the biocide. The biocide may then be activated by the moisture at the same point in time at which the growth of mold is possible due to the presence of the moisture.
Detailed Description of the Preferred Embodiments

[0011] Figure 1 illustrates a building envelope or wall 20 extending from an outside air space 24 to an inside air space 40. Figure 1 is a top, cross-sectional view, looking down through a section of wall including a stud 22. Wall 20 extends from a siding layer 26, through a sheathing layer 27, an insulation layer 28, and continuing through a vapor barrier 30, which is disposed immediately inside wallboard 32. In the embodiment illustrated, wallboard 32 is covered by a paint layer 34, which is in turn covered by a wallpaper paste layer 36, which affixes a wallpaper layer 38. As is discussed below, many of the layers within wall 20 can benefit from inclusion of fibers according to the present invention.

[0012] Figure 2 illustrates several triangular, hollow fibers 60. Fibers 60 include generally an external surface 64, and an internal surface 66 within a plurality of internal channels 62. Inspection of Figure 3 shows that fibers 60 have a higher surface-to-volume ratio than round fibers having an equivalent volume.

[0013] Figure 3 illustrates an end view of numerous round, annular fibers 80, having a central hole or lumen 88 within a body 84. Fibers 80 include an external surface 82 and an internal surface 86. Inspection of fibers 80 shows that round, solid fibers have a higher surface-to-volume ratio than round fibers of an equivalent volume.

[0014] Figure 4A illustrates a transverse, cross-sectional view through a building material 100. Building material 100 has several fibers 104 disposed transversely through building material 100 relative to an outside surface 102 and an inside surface 103. Figure 4B represents a building material 110 having several randomly oriented fibers 112 disposed therein. Fibers 112 may be seen to be randomly oriented with respect to an outside surface 114 and an inside surface 116. Fibers 112 may be seen to disposed between outside surface 114 and inside surface 116. Building material 100 or 110 can include, for example, gypsum board, paneling, sheetrock, plaster, a paste layer, a paint layer, a wallpaper layer, ceiling tile, or any other building material or layer.

[0015] Referring again to Figure 1, the present invention includes incorporation of the fibers previously disclosed into the building materials and equivalents illustrated in Figure 1. Fibers according to the present invention can have high surface-to-volume ratios and have hollow channels extending along or through the fibers which enables the fibers to wick more moisture along their length. A preferred fiber for use in the present invention is the Triad™ fiber, commercially available from Honeywell, Inc. In the illustrative embodiment, the fibers may be incorporated into siding 26, sheathing 27, insulation layer 28, and wallboard layer 32. The wallboard may be, for example, gypsum, plaster, or sheetrock. The fibers may also be incorporated into paint layer 34, wallpaper paste layer 36, and wallpaper layer 38. Fibers may be oriented transversely to the surfaces of the layers in some embodiments, while other embodiments have the fibers randomly oriented relative to the surfaces.

[0016] Fibers according to the present invention can serve to wick moisture from areas of high concentration to areas of low concentration. Fibers according to the present invention wick moisture from areas where it is already found, to areas of lower concentration. In areas that have been properly waterproofed or sealed, fibers according to the present invention may, in fact, wick little moisture. For example, in situations where barrier integrity has been breached, fibers according to the present invention may wick moisture from areas of high concentration, or even liquid water, from these high concentration areas out to lower concentration areas, where the moisture may be vented or evaporated. In particular, drips or other discreet point sources of water may be dissipated away either linearly and transversely from the point source to the other side of the barrier, or radially and vertically away from the point source in all three dimensions, such that a potential source of rot and mold growth is dissipated away from the point source.

[0017] In one example, fibers are incorporated into wallboard 32, such as fibers incorporated into gypsum. If water vapor extends through wallboard 32 to barrier 30 and condenses, fibers within wallboard 32 can act to dissipate the water throughout wallboard 32. In another example, fibers incorporated into sheathing 27 can wick moisture trapped within the space, such as between insulation 28 and sheathing 27. While moisture at the inside of sheathing 27 is to be prevented, once the moisture is at this location, wicking the moisture through sheathing 27 may be desirable. Sheathing 27 can be formed of various building materials well known to those skilled in the art.

[0018] It is contemplated that that biocidal materials, for example, antibacterial, antifungal or antimicrobial compounds, may be incorporated into various layers such as wallpaper layer 38 or wallpaper paste 36. Bio-
Claims

1. A breathable wicking material comprising a plurality of fibers (80) characterized in that the fibers (80) are situated in a material (100); and that the fibers (80) are hollow fibers having one or more hollow passages which form channels (88) continuously open from one end to the other end of the fiber.

2. The material of claim 1, characterized in that some of the channels (88) are continuous passages from one surface (102) to another surface of the material (100).

3. The material of claim 2, characterized in that the channels (88) are for conveying vapor from one end to the other end of the respective fibers (80).

4. The material of claim 3, characterized in that the fibers (80) are similarly oriented in the material (100).

5. The material of claim 3, characterized in that the fibers (80) are oriented transverse to surfaces (102) of the material (100).

6. The material of claim 3, characterized in that internal surfaces (86) of the hollow passages are coated with at least one agent from a group consisting of antifungal agents, antimicrobial agents, antibacterial agents, and the like.

7. The material of claim 5, characterized in that the material (100) is a building material.

Patentansprüche

1. Atmungsaktives, feuchtigkeitstransportierendes Material, das eine Vielzahl von Fasern (80) umfasst, und dadurch gekennzeichnet ist, dass die Fasern (80) in einem Material (100) angeordnet sind; und dass die Fasern (80) Hohlfasern sind, die einen oder mehrere hohle Passagen aufweisen, die Kanäle (88) bilden, die von einem Ende zum anderen Ende der Faser durchgängig offen sind.

2. Material nach Anspruch 1, dadurch gekennzeichnet, dass einige der Kanäle (88) durchgängige Passagen von einer Oberfläche (102) zum anderen Oberfläche des Materials (100) sind.


4. Material nach Anspruch 3, dadurch gekennzeich-
net, dass die Fasern (80) in dem Material (100) gleichartig ausgerichtet sind.

5. Material nach Anspruch 3, dadurch gekennzeichnet, dass die Fasern (80) quer zu den Oberflächen (102) des Materials (100) angeordnet sind.

6. Material nach Anspruch 3, dadurch gekennzeichnet, dass die inneren Oberflächen (86) der hohlen Passagen mit mindestens einem Mittel beschichtet sind, das ausgewählt wird aus der Gruppe, die aus Mitteln gegen Pilze, Mitteln gegen Mikroben, Mitteln gegen Bakterien und dergleichen besteht.

7. Material nach Anspruch 5, dadurch gekennzeichnet, dass das Material (100) ein Baumaterial ist.