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(54) **Cool artificial turf**

(57) An artificial turf surface comprising fibrous ma-
terials, such as fibers, filaments and/or tapes, and if ap-
plicable infill materials, wherein the artificial turf surface
additionally comprises one or more additive(s) that reflect

(s) light, characterized in that the additive(s) is or are
incorporated in the fibrous material, preferably located
at the surface of the fibrous material.

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Description

[0001] The present invention pertains to artificial turfs, in particular to artificial turf surfaces.

[0002] Artificial turfs or synthetic turfs are known as grass-like man-made surfaces manufactured from synthetic materials. They are most often used in arenas for sports that were originally or are normally played on grass; however, it is now being used on residential lawns and commercial applications, as well.

[0003] The first artificial turfs developed and installed already in the early 60ies were a far harder surface than grass, and soon became known as an unforgiving playing surface, which was prone to cause more injuries.

[0004] In the early 21 st century, new artificial playing surfaces using sand and/or rubber infill were developed. These "next generation", of artificial grass surfaces are often virtually indistinguishable from grass when viewed from any distance, and are generally regarded as being about as safe to play on as a typical grass surface — perhaps even safer in cold conditions.

[0005] Many clubs have installed the new synthetic turf surfaces (most commonly as part of an all-weather training capability), while some clubs which have maintained grass surfaces are now re-considering artificial turf. With football clubs in Europe looking to reduce both maintenance costs and the number of winter matches that are cancelled due to frozen pitches, the issue has also been re-visited by that sport's governing bodies.

[0006] The most common type uses polyethylene "grass" about 5 centimeters long, which is lubricated and tufted into a woven backing fabric the rear of which is coated with a polyurethane or latex backing medium to lock the tufts in to place. The whole thing is then infilled to the client's specification with sand and rubber granules, which keeps the fibers upright and provides the right level of shock absorbency and deformability. The majority of the 15 or so turf manufacturers approved by FIFA use this technology. The other sort has a base of expanded polypropylene, a foamy material originally developed as a shock absorber for the car industry. The grass is also made of lubricated polyethylene fibers, but they are shorter and more densely packed than on an infilled pitch, and are also interspersed with short, curly, spring-like fibers that keep the blades upright. The finishing touch is an 8-millimeter filling of rubber granules.

[0007] Although artificial turfs are mostly applied in sport arenas, in the context of this invention the meaning of "artificial turf" is used in a broader sense, encompassing any applications and modification that comprise synthetic grass, i.e. grass that is made of a synthetic material, usually a polymer such as polyethylene, polypropylene and the like. Such additional applications comprise but are not limited to landscape applications and to green roofs on buildings.

[0008] The components used for artificial turf surfaces comprise - as mentioned above - fibers, filaments and tapes, and if applicable infill materials.

[0009] Whilst already having advantages over natural grass surfaces in cold areas or in the wintertime, the overall comfort of artificial turfs in hotter climates or seasons is still subject to improvement.

[0010] US 3,740,303 discloses an artificial playing surface that comprise a pile fabric with pile fibers having pigments and materials to stabilize against UV light. These stabilizers usually are sterically hindered amines that catch the radicals generated by the energy of the UV light.

[0011] US 2004/0214000 is directed to aggregate turf filler for use with the turf of athletic fields and landscape area, which comprise crushed silica sand particles. Such fillers may be colored to enhance the appearance of the surface.

[0012] US 5,958,527 discloses a synthetic grass turf with a unique multiple course resilient particulate infill. The infill consists of brightly colored sand and should serve the purpose to reduce the heat retention of the infill.

[0013] US 2003/0056432 discloses a synthetic grass surface with widely spaced rows of ribbons projecting from a flexible backing sheet which grass surface comprises thermal regulation means attached to the backing sheet in the spaces. The synthetic grass surface could comprise synthetic ribbons that could be made from heat reflecting material.

[0014] It is thus an objective of the invention to provide an artificial turf that offers comfort and safety both under hot and cold conditions and which can easily and reliably be manufactured and installed.

[0015] This objective is being achieved by an artificial turf surface comprising fibrous materials, such as fibers, filaments and/or tapes, and if applicable infill materials, wherein the artificial turf surface additionally comprises one or more additive(s) that reflect(s) light, characterized in that the additive(s) is or are incorporated in the fibrous material, preferably located at the surface of the fibrous material.

[0016] In contrast to the prior art, the present invention restricts the presence of the additives and/or pigments to be incorporated into the fibrous material with a preferred location at the surface of the fibrous material, possibly with kind of a concentration gradient from the inner to the outer portions of the fibrous material, i.e. the concentration becoming higher in those portions that are closer to the surface. That leaves the other properties of the fibrous material substantially unchanged, which is important for the suitability of the artificial turf for e.g. ball rolling etc.

[0017] Typically, an artificial turf assembly includes a pile fabric with a flexible sheet backing and rows of upstanding synthetic ribbons tufted through the flexible backing, representing grass blades, extending upwardly from an upper surface of the backing. The term "fibrous material" thus predominately encompasses those fibers filaments and tapes that form the sheet backing and the synthetic ribbons, among them the synthetic ribbons are preferred as location for the additives and/or pigments.

[0018] The light reflectance obtained by the addition of the additives and/or pigments is at least 10 % higher in spectral reflectance and/or IR reflectance measurements compared to artificial turf surfaces without these additives and/or pigments.

[0019] The terms additives and pigments are being used likewise in the description of the invention.

[0020] For this invention the term "light" is used in its physical meaning and encompasses a wavelength range of the total solar reflectance, which is the sum of ultraviolet, visible and near infra-red reflectance. The higher the solar reflectance the cooler the object will stay. Preferably, reflectance is applied in the range from about 380 nm to about 1 mm, i.e. the spectrum of both the visible light (from about 380 nm to about 780 nm) and the infrared light (from about 700 nm to about 1 mm). Particularly preferred is the reflectance of the heat radiation in the infrared spectrum as IR makes up 52% of the spectrum and thus a significant portion of the sun's energy.

[0021] For this reason additives and/or pigments with an increased reflectance in the so-called near infrared (NIR) range, i.e. in the wavelength range from about 700 nm to about 3000 nm, even more preferred from 800 nm to 2500 nm, are preferred.

[0022] Preferably, the light reflectance is at least as high as that of a natural grass turf surface, preferably 10 %, even more preferred 20 %, higher than that of a natural grass turf surface.

[0023] The additives or pigments thus have the property to reflect heat generated by sunlight and other light or heat sources in at least the same order of magnitude as Chlorophyll - the green pigment in natural turf - does, whilst pigments currently used in artificial turf have a higher IR absorption.

[0024] Preferably, the additive(s) or pigment(s) is or are incorporated in the fibrous material, even more preferably it is or are located at or near the surface of the fibrous material.

[0025] Any pigment that is capable to reflect light, preferably infra red light, can be used as additive. It is, however, preferred to apply as additives those pigments that are selected from a group containing metal oxides, mixed metal oxides, cobalt compounds and chromium compounds such as titanium dioxide, aluminium platelet pigments and chromium oxide.

[0026] Among suitable additives the so-called spinels (mixed oxides such as $MgAl_2O_4$, after which this class of minerals is named) are particularly preferred. Further preferred are additives and/or pigments of the class metal-oxide titanates based on antimony, chromium, tin and cobalt. These pigments are all non toxic and have both FDA and EEC purity approvals in the quantities used.

[0027] IR reflective inorganic pigments such as C.I. Pigment Black 30, a spinel formulated primarily with nickel, manganese, chrome and iron, and C.I. Pigment Green 17, a chromium green black hematite, are known to the skilled person.

[0028] It is preferred that the fibrous material is made of a synthetic polymer, even more preferred if the polymer is selected from a group containing polyethylene, polypropylene, plastomer blends, nylon and copolymers and/or blends thereof.

[0029] The pigments are added in an amount that ranges from about 0.5% to about 4% wt.-% in relation to the polymer.

[0030] Artificial turfs having a surface according to the invention exhibit a considerably reduced surface temperature. A temperature decrease by 15 °C can easily be achieved.

[0031] This invention is especially an advantage for sport fields and landscape applications to increase the player's and users comfort and safety aspects.

[0032] Another important claim for this invention is energy savings. Where artificial turf is used as a kind of insulation material to prevent - heat build up - of that what has been covered by it. For example green roofs on buildings etc. to reduce energy cost for climate control systems.

[0033] As a consequence this invention pertains also to the use of the artificial turf surface for sport fields and landscape applications and to the use of the artificial turf as heat insulation in green roofs on buildings.

[0034] The invention is further elucidated by the following non-limiting example(s).

[0035] Hemispherical spectral reflectance measurements were performed in accordance with ASTM Standard Test Method E903 (1996). The measurements were performed with a Perkin-Elmer Lambda 950 Spectrophotometer utilizing an integrating sphere (Fig A1.3 of E903 [1996]). Total reflectance measurements were obtained in the solar spectrum from 2500 nm to 300 nm at an incident angle of 80°. The measurements employ a detector-baffled, wall-mounted-integrating sphere that precludes the necessity of employing a reference standard except to define the instrument's 100% line. The measurements are properly denoted as being 'hemispherical spectral reflectance'.

[0036] Total solar p reflectance was obtained by integrating the spectral data against Air Mass 1.5 (ASTM G159-98) direct solar spectrum utilizing 105 weighted ordinates.

[0037] The NIR region from 724 nm to 2494 nm was obtained by integrating the spectral data against Air Mass 1.5 (ASTM G159-98) direct solar spectrum utilizing 66 weighted ordinates.

[0038] The measured artificial grass specimens were cut from larger specimens that were used for a temperature study.

[0039] With all test methods, there typically is a level of uncertainty for the test data due to the acceptable operating tolerances of the instrumentation and variation caused by the test method. The estimated tolerances are expected to be less than plus or minus 2% for most materials tested to ASTM E903.

Table

Specimen Code	% Solar Reflectance	% NIR Reflectance
Live Grass	33.7	52.8
25/23 - 888 Tex Olive Green	16.2	24.0
25/24 - 888 Tex Sports Green	16.8	25.1
52/53 - 888 Tex Sports Green	22.6	38.7
52/54 - 888 Tex Olive Green	33.9	55.0
29/42 8 x 138 Tex Sports Green	12.9	19.6
29/77 8 x 138 Tex Olive Green	16.0	23.5
07XO44 8 x 138 Tex IR Sports Green	31.4	47.6
07XO45 8 x 138 Tex IR Olive Green	30.5	48.4

Claims

1. A fibrous material, such as fibers, filaments and/or tapes, **characterized in that** the fibrous material comprises one or more additive(s) that reflect(s) infrared light in a wavelength range from about 700 nm to about 1 mm, selected from the group consisting of spinels and metal-oxide titanates based on antimony, chromium, tin and cobalt.
2. The fibrous material according to claim 1 **characterized in that** the additive(s) is or are located at the surface of the fibrous material.
3. The fibrous material according to claim 1 or 2 **characterized in that** the additive(s) is or are added in an amount from about 0.5 wt.% to about 4 wt.% in relation to the polymer.
4. The fibrous material according to any of claims 1 to 3, wherein the fibrous material is selected from a group containing polyethylene, polypropylene, plastomer blends, nylon, and copolymers and blends thereof.



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 2941

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 2003/056432 A1 (PREVOST JEAN [CA]) 27 March 2003 (2003-03-27) * paragraph [0043] *	1-4	INV. E01C13/08
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 December 2012	Examiner Gallego, Adoración
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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