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(54) **ARTIFICIAL TURF FOR LANDSCAPE APPLICATIONS AND PROCESS FOR MANUFACTURING ARTIFICIAL TURF FOR LANDSCAPE APPLICATIONS**

(57) An artificial turf for landscape applications is provided comprising a primary backing having a first surface and a second surface and artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, a material layer adhered to the second surface of the primary backing, wherein the artificial turf comprises a fibrous layer connected to the material layer adhered to the second surface of the primary backing, wherein the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers.

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Description

[0001] The application pertains to an artificial turf for landscape applications and to a process for manufacturing such an artificial turf for landscape applications.

[0002] Artificial turf is generally manufactured by tufting artificial turf fibers into a primary backing having a first surface and a second surface. Alternatively, artificial turf fibers may be connected to a primary backing by a weaving or a knitting process.

[0003] The primary backing generally is a woven fabric, in particular a polypropylene woven fabric (but can also be produced of polyethylene, polyamide or polyester for example), or may be a combination of two or more woven fabrics, possibly further including a further layer, such as for example a reinforcement layer and/or a nonwoven layer of polypropylene staple fibers.

[0004] The artificial turf fibers are generally composed of a thermoplastic polymer, and may for example be composed of a polyamide polymer, a polyester polymer or a polyolefin polymer, such as a polyethylene polymer or a polypropylene polymer, or a combination of different polymers combined in the artificial turf or even combined within the same turf fiber. The polymers can be virgin polymers or polymers which are, partly or completely, recuperated via a recycling step.

[0005] The primary backing comprising the artificial turf fibers extending from a first surface of the primary backing is generally coated on the second surface of the primary backing with a styrene-butadiene latex (SBR latex) to fixate the artificial turf fibers to the primary backing (tuft lock). The styrene-butadiene latex is generally applied as an aqueous emulsion, which has to be dried to evaporate the water. Alternatively, a polyurethane (PU) coating can be used to reduce energy consumption as there is no need to evaporate water from the polyurethane composition. To obtain sufficient tuft lock of the artificial turf fibers to the primary backing, generally about 900 g/m^2 of a SBR latex or a PU coating is applied.

[0006] At the end-of-life of artificial turfs, artificial turfs are often disposed into landfills or are fed into waste burning facilities. There is an increasing awareness that corporate social responsibility requires other solutions to be found for recycling or reusing artificial turfs at their end-of-life.

[0007] For that the artificial turf industry is working hard to find such solutions. Artificial turf comprising a SBR latex or a polyurethane coating, and artificial turf composed of polymers of different polymer families can for example be recycled into flower pots and other low-end applications.

[0008] Another solution is to manufacture artificial turf, which is composed of polymers of a single polymer family, for example composed of polyolefin polymers only, to simplify recycling of the artificial turf. Such a known "single polymer family" artificial turf is composed of polymers of a single polymer family and may comprise artificial turf fibers composed of a polyethylene and/or a polypropylene polymer and a woven primary backing composed of a polypropylene polymer. On the second surface of the backing a polyolefin coating is applied as a polyolefin dispersion, for example as available from the Dow Chemical Company under the tradename HYPOD 2000.

[0009] However, an artificial turf must comply with the requirements imposed by the intended application for the artificial turf. An artificial turf consisting of a primary backing having a first surface and a second surface and artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, a material layer consisting of a polyolefin coating adhered to the second surface of the primary backing may not fulfill the requirements of an artificial turf for landscape applications. An artificial turf for landscape applications should be capable to be installed with minimal efforts and should also be capable to be installed on sloping sub-surfaces. Artificial turf having a polyolefin coating adhered to the second surface of the primary backing may be problematic to be installed on sloping sub-surfaces due to sliding of the artificial turf over the sub-surface.

[0010] Therefore, there is a need for an artificial turf for landscape applications which can be recycled at the end-of-life, and which resolves or at least reduces, the disadvantages of the prior art.

[0011] The object of the invention is achieved by the artificial turf according to claim 1.

[0012] An artificial turf for landscape applications comprising a primary backing having a first surface and a second surface and artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, a material layer adhered to the second surface of the primary backing characterized in that the artificial turf comprises a fibrous layer connected to the material layer adhered to the second surface of the primary backing, wherein the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers, enables to provide an artificial turf which can be recycled at the end-of-life and which prevents, or at least reduces, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed. As the artificial turf is essentially composed of one or more polyolefin polymers, the artificial turf can be recycled into higher-end applications as compared to artificial turf which is composed of polymers of different polymer families. The fibrous layer connected to the material layer adhered to the second surface of the primary backing comes into contact with the sub-surface, thereby preventing, or at least reducing, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed.

[0013] The artificial turf fibers may be connected to the primary backing by weaving, knitting or tufting. The process for manufacturing an artificial turf may comprise any

one of these three processes. It is however preferred for production efficiency that the artificial turf fibers are connected to the primary backing by tufting.

[0014] The term essentially composed of one or more polyolefin polymers is understood to mean that the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each individually composed of one or more polyolefin polymers for at least 90 wt.%, preferably for at least 95 wt.%, more preferably for at least 98 wt.%, respectively.

[0015] Although the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers, each of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer individually may comprise up to 10 wt.%, preferably up to 5 wt.%, more preferably up to 2 wt.%, based on the total weight of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer respectively, of additives, such as for example flame retardant materials, UV inhibitors, heat stabilizers, antimicrobial additives, antistatic agents, colouring agents or any combination thereof.

[0016] In an embodiment, one or more of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer may consist of one or more polyolefin polymers.

[0017] The one or more polyolefin polymers may be selected from the group consisting of polyethylene and/or polypropylene and/or copolymers thereof.

[0018] The one or more polyolefin polymers of which the material layer adhered to the second surface of the primary backing is essentially composed may be applied at a much lower weight as compared to a SBR latex or a PU coating, while providing sufficient tuft lock, fixating the artificial turf fibers in the primary backing. The lower weight of the material layer adhered to the second surface of the primary backing enables to reduce the amount of plastics in the artificial turf.

[0019] The material layer adhered to the second surface of the primary backing, which is essentially composed of one or more polyolefin polymers, may be applied as a polyolefin dispersion onto the second surface of the primary backing. The lower weight of the polyolefin dispersion reduces the amount of plastics in the artificial turf and enables to limit the price increase associated with the application of the polyolefin dispersion as compared to a SBR latex.

[0020] The material layer adhered to the second surface of the primary backing, which is essentially composed of one or more polyolefin polymers may be applied as a polyolefin coating powder or as a polyolefin film to the second surface of the primary backing and melted onto the second surface of the primary backing.

[0021] The material layer adhered to the second surface of the primary backing, which is essentially composed of one or more polyolefin polymers, may have a weight of 100 to 500 g/m^2, preferably 150 to 400 g/m^2, more preferably 200 to 300 g/m^2, enabling to provide an artificial turf for landscape applications at significantly reduced weight as compared to artificial turf comprising a SBR latex or a PU coating for providing sufficient tuft lock of the artificial turf fibers to the primary backing, thereby reducing raw material usage and reducing the amount of energy required for transport. The artificial turf can be installed easier due to the reduced weight of the artificial turf for landscape applications.

[0022] The fibrous layer connected to the material layer adhered to the second surface of the primary backing comes into contact with the sub-surface, thereby preventing, or at least reducing, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed.

[0023] The fibrous layer may be connected to the material layer adhered to the second surface of the primary backing by any suitable means. The fibrous layer may be connected to the material layer adhered to the second surface of the primary backing by an adhesive.

[0024] In an embodiment, the fibrous layer may be connected to the material layer adhered to the second surface of the primary backing by partially embedding the fibrous layer into the material layer adhered to the second surface of the primary backing, optionally under application of heat and/or pressure.

[0025] The fibrous layer connected to the material layer adhered to the second surface of the primary backing may be a woven fabric. The woven fabric may be a closed weave fabric, wherein warp threads are directly adjoining each other, which enables to prevent, or at least reduce to a large extend, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed. The closed weave fabric may, for example, be connected to the material layer adhered to the second surface of the primary backing by an adhesive, or may be partially embedded into the material layer adhered to the second surface of the primary backing.

[0026] The woven fabric may be an open weave fabric. An open weave fabric is understood to be a woven fabric wherein warp threads do not come into contact with each other, leaving interstices in the woven fabric. The open weave fabric may comprise interstitches having an area of at least 0.5 mm^2, preferably of at least 1 mm^2, more preferably of at least 1.5 mm^2, even preferably of at least 2 mm^2, enabling to prevent, or at least reduce, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed, at low weight of the artificial turf and/or to facilitate partial embedding of the open weave fabric into the material layer adhered to the second surface of the primary backing.

[0027] The fibrous layer connected to the material layer adhered to the second surface of the primary backing may be a scrim, in particular a laid scrim or a woven scrim.

[0028] As is known to the person skilled in the art, a scrim, no matter if laid or woven, is an open lattice structure comprising openings, wherein the lattice structure is composed of at least two sets of parallel threads, wherein the first group of parallel threads is oriented at an angle, generally at a 90° angle, to the second group of parallel threads. The first group of parallel threads may be connected to the second group of parallel threads by chemical bonding to form a laid scrim or the first group of parallel threads may be interwoven with the second group of parallel threads to form a woven scrim.

[0029] In an embodiment, the openings in the scrim have at least one dimension in the plane of the scrim being at least 0.5 mm, preferably at least 0.75 mm, more preferably at least 1.25 mm, even more preferably at least 2.5 mm, which enables to prevent, or at least reduce, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed, at low weight of the artificial turf and/or to facilitate partial embedding of the scrim into the material layer adhered to the second surface of the primary backing.

[0030] The fibrous layer connected to the material layer adhered to the second surface of the primary backing may be a nonwoven. The nonwoven may in principle be any type of nonwoven, such as for example staple fiber nonwovens produced by known processes, such as carding processes, wet-laid processes or air-laid processes, or any combination thereof. The nonwoven may also be a nonwoven composed of filaments produced by known spunbonding processes, wherein filaments are extruded from a spinneret and laid down on a conveyor belt and subsequently consolidated, also known as bonding.

[0031] The fibrous layer comprised in the artificial turf for landscape applications may have a weight of 30 to 200 g/m^2, preferably 40 to 150 g/m^2, more preferably 45 to 100 g/m^2, even more preferably 50 to 75 g/m^2, enabling to provide an artificial turf for landscape applications at significantly reduced weight as compared to artificial turf comprising a SBR latex or a PU coating for providing sufficient tuft lock of the artificial turf fibers to the primary backing, thereby reducing raw material usage and reducing the amount of energy required for transport. The artificial turf can be installed with less efforts due to the reduced weight of the artificial turf and due to a reduction in sliding of the artificial turf over the sub-surface onto which the artificial turf is installed, in particular on sloping sub-surfaces in landscape applications. The fibrous layer comprised in the artificial turf for landscape applications may also enable to improve the dimensional stability of the artificial turf, and/or prevent skewing of the artificial turf during installation, in particular on sloping sub-surfaces.

[0032] The artificial turf for landscape applications may have a dimensional stability in the range of -0.5% to 0.5%, as determined in accordance with EN13746 (2004), wherein a sample of 40 cm x 40 cm is cut out. After 48 hours of conditioning at 23°C $^+/_-$ 2°C and 50 $^+/_-$ 5% RH the dimensions of the sample are measured (original dimensions). The sample is subsequently subjected to the following treatments: for 24 hours in water, for 24 hours in a freezer at -18°C, for 72 hours in an oven at 70°C, and for 48 hours at conditioning at 23°C $^+/_-$ 2°C and 50 $^+/_-$ 5% RH. The dimensions of the sample are measured after each treatment. The dimensions of the artificial turf may deviate from the original dimensions in the range of -0.5% to 0.5% after each of the treatments. Preferably, the artificial turf has a dimensional stability in the range of -0.4% to 0.4%, more preferably in the range of -0.3% to 0.3%, most preferably in the range of -0.2% to 0.2%.

[0033] An artificial turf landscape can thus be provided comprising any of the artificial turf embodiments described herein above.

[0034] An object of the invention is to provide a process for manufacturing an artificial turf for landscape applications, which can be recycled at the end-of-life, and which resolves or at least reduces, the disadvantages of the prior art.

[0035] The object of the invention is achieved by the process for manufacturing an artificial turf for landscape applications according to claim 13.

[0036] A process for manufacturing an artificial turf for landscape applications comprising the steps of providing a primary backing having a first surface and a second surface and having artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, adhering a material layer to the second surface of the primary backing, and connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, wherein the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers enables to manufacture an artificial turf which can be recycled at the end-of-life and which prevents, or at least reduces, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed.

[0037] The process may include the step of connecting the artificial turf fibers to the primary backing by weaving, knitting or tufting. Preferably, the process includes the step of connecting the artificial turf fibers to the primary backing by tufting.

[0038] In the process, the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each individually composed of one or more polyolefin polymers for at least 90 wt.%, preferably for at least 95 wt.%, more preferably for at least 98 wt.%, respectively.

[0039] Although the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer in the process are each essentially composed of one or more polyolefin polymers, each of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer individually may comprise up to 10 wt.%, preferably up to 5 wt.%,

more preferably up to 2 wt.%, based on the total weight of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer respectively, of additives, such as for example flame retardant materials, UV inhibitors, heat stabilizers, antimicrobial additives, antistatic agents, colouring agents or any combination thereof.

[0040] In an embodiment, one or more of the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer in the process may consist of one or more polyolefin polymers.

[0041] In an embodiment of the process, the one or more polyolefin polymers may be selected from the group consisting of polyethylene and/or polypropylene and/or copolymers thereof.

[0042] The process may include the step of applying the material layer to the second surface of the primary backing as a polyolefin dispersion onto the second surface of the primary backing.

[0043] The process may include the step of applying the material layer to the second surface of the primary backing as a polyolefin coating powder or as a polyolefin film to the second surface of the primary backing and melting the polyolefin coating powder or the polyolefin film onto the second surface of the primary backing.

[0044] In an embodiment of the process, the material layer being adhered to the second surface of the primary backing, which is essentially composed of one or more polyolefin polymers, may have a weight of 100 to 500 g/m^2, preferably 150 to 400 g/m^2, more preferably 200 to 300 g/m^2, enabling to manufacture an artificial turf for landscape applications at significantly reduced weight as compared to artificial turf comprising a SBR latex or a PU coating for providing sufficient tuft lock of the artificial turf fibers to the primary backing, thereby reducing raw material usage.

[0045] The process may include the step of connecting the fibrous layer to the material layer adhered to the second surface of the primary backing by any suitable means. The step may include connecting the fibrous layer to the material layer adhered to the second surface of the primary backing by applying an adhesive between the fibrous layer and the material layer adhered to the second surface of the primary backing.

[0046] In an embodiment, the process may include the step of connecting the fibrous layer to the material layer adhered to the second surface of the primary backing by partially embedding the fibrous layer into the material layer adhered to the second surface of the primary backing, for example under application of heat and/or pressure.

[0047] In the step of connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, the fibrous layer may be a woven fabric. The woven fabric may be a closed weave fabric, wherein warp threads are directly adjoining each other, which enables to prevent, or at least reduce to a large extend, sliding of the artificial turf over the sub-surface onto which the artificial turf is installed.

[0048] The woven fabric may be an open weave fabric, preferably comprising interstitches having an area of at least 0.5 mm^2, preferably of at least 1 mm^2, more preferably of at least 1.5 mm^2, even preferably of at least 2 mm^2.

[0049] In the step of connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, the fibrous layer may be a scrim, in particular a laid scrim or a woven scrim. The scrim may comprise openings having at least one dimension in the plane of the scrim being at least 0.5 mm, preferably at least 0.75 mm, more preferably at least 1.25 mm, even more preferably at least 2.5 mm.

[0050] In the step of connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, the fibrous layer may be a nonwoven. The nonwoven may be any type of nonwoven, such as for example staple fiber nonwovens produced by known processes, such as carding processes, wet-laid processes or air-laid processes, or any combination thereof. The nonwoven may also be a nonwoven composed of filaments produced by known spunbonding processes, wherein filaments are extruded from a spinneret and laid down on a conveyor belt and subsequently consolidated, also known as bonding.

[0051] In the step of connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, the fibrous layer may have a weight of 30 to 200 g/m^2, preferably 40 to 150 g/m^2, more preferably 45 to 100 g/m^2, even more preferably 50 to 75 g/m^2, enabling to provide an artificial turf for landscape applications at significantly reduced weight as compared to artificial turf comprising a SBR latex or a PU coating for providing sufficient tuft lock of the artificial turf fibers to the primary backing, thereby reducing raw material usage.

Claims

1. An artificial turf for landscape applications comprising a primary backing having a first surface and a second surface and artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, a material layer adhered to the second surface of the primary backing **characterized in that** the artificial turf comprises a fibrous layer connected to the material layer adhered to the second surface of the primary backing, wherein the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers.

2. The artificial turf for landscape applications according to claim 1, wherein the one or more polyolefin

polymers are selected from the group consisting of polyethylene and/or polypropylene and/or copolymers thereof.

3. The artificial turf for landscape applications according to any one of the preceding claims, wherein the material layer adhered to the second surface of the primary backing is applied as a polyolefin dispersion onto the second surface of the primary backing, or is applied as a polyolefin coating powder or as a polyolefin film to the second surface of the primary backing and melted onto the second surface of the primary backing.

4. The artificial turf for landscape applications according to any one of the preceding claims, wherein the material layer adhered to the second surface of the primary backing has a weight of 100 to 500 g/m^2, preferably 150 to 400 g/m^2, more preferably 200 to 300 g/m^2.

5. The artificial turf for landscape applications according to any one of the preceding claims, wherein the fibrous layer is a woven fabric.

6. The artificial turf for landscape applications according to claim 5, wherein the woven fabric is a closed weave fabric.

7. The artificial turf for landscape applications according to claim 5, wherein the woven fabric is an open weave fabric.

8. The artificial turf for landscape applications according to claim 7, wherein the open weave fabric comprises interstitches having an area of at least 0.5 mm^2, preferably of at least 1 mm^2, more preferably of at least 1.5 mm^2, even preferably of at least 2 mm^2.

9. The artificial turf for landscape applications according to any one of claims 1 to 4, wherein the fibrous layer is a scrim comprising openings, the openings preferably having at least one dimension in the plane of the scrim of at least 0.5 mm, preferably of at least 0.75 mm, more preferably of at least 1.25 mm, even more preferably of at least 2.5 mm.

10. The artificial turf for landscape applications according to any one of claims 1 to 5, wherein the fibrous layer is a nonwoven.

11. The artificial turf for landscape applications according to any one of the preceding claims, wherein the fibrous layer has a weight of 30 to 200 g/m^2, preferably 40 to 150 g/m^2, more preferably 45 to 100 g/m^2, even more preferably 50 to 75 g/m^2.

12. An artificial turf landscape comprising the artificial turf according to any one of the preceding claims.

13. A process for manufacturing an artificial turf for landscape applications comprising the steps of providing a primary backing having a first surface and a second surface and having artificial turf fibers connected to the primary backing, the artificial turf fibers extending from the first surface of the primary backing, adhering a material layer to the second surface of the primary backing, and connecting a fibrous layer to the material layer adhered to the second surface of the primary backing, wherein the primary backing, the artificial turf fibers, the material layer adhered to the second surface of the primary backing and the fibrous layer are each essentially composed of one or more polyolefin polymers.

14. The process for manufacturing an artificial turf for landscape applications according to claim 13, comprising the step of applying the material layer to the second surface of the primary backing as a polyolefin dispersion onto the second surface of the primary backing, or as a polyolefin coating powder or as a polyolefin film and melting the polyolefin coating powder or the polyolefin film onto the second surface of the primary backing.

15. The process for manufacturing an artificial turf for landscape applications according to any one of claims 13 to 14, comprising the step of adhering a material layer to the second surface of the primary backing, the material layer having a weight of 100 to 500 g/m^2, preferably 150 to 400 g/m^2, more preferably 200 to 300 g/m^2.

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 4107

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2019/360160 A1 (MASHBURN LARRY E [US] ET AL) 28 November 2019 (2019-11-28) * paragraph [0001]; figure 2; example 1 *	1-3,5-8, 10,12-14 4,9,15	INV. D06N7/00 E01C13/08
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TECHNICAL FIELDS SEARCHED (IPC)
D06N E01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 November 2022	Menard, Claire

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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