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(54) **HIGH-WATER PERMEABILITY BASE CLOTH, ARTIFICIAL TURF CONTAINING SAME, AND PREPARATION METHOD**

(57) A high-permeability base fabric and a high-permeability durable artificial turf including the same are disclosed. The high-permeability base fabric is formed by interweaving warp yarns and weft yarns. The warp yarns and/or the weft yarns contain yarns A, and the thickness of the yarns A is 0.08-0.5mm; or include yarn B with thickness of 0.03-0.06mm. The high-permeability base fabric is obtained by weaving in regular or irregular arrangement. The high-permeability base fabric applied to the artificial turf has excellent water permeability and can meet the use requirements. The artificial turf designed by the invention does not need to be punched by an electric iron, which can effectively prevent the growth of natural weeds, simultaneously avoid the problems of abrasion of a back glue layer and the like caused by leakage of quartz sand during paving, has a simple preparation method, can save labour and cost, and is beneficial to market popularization and industrial production.

EP 4 411 041 A1

Description

TECHNICAL FIELD

[0001] The invention relates to the technical field of artificial turfs, in particular to a high-permeability base fabric, a preparation method of the high-permeability base fabric, an artificial turf containing the high-permeability base fabric and a preparation method of the artificial turf.

TECHNICAL FIELD

[0002] The first artificial turf in the world was born in Houston space dome stadium, USA, in April 1966, and since then, the artificial turf has been officially taken to the world stage. With the continuous development of artificial turf manufacturing technologies, the artificial turf is closer to natural turf in appearance and hand feeling, and is simpler than the natural turf in terms of paving and maintenance, low in maintenance cost and barely influenced by environment, weather and regions. With the continuous expansion of the application scene of the artificial turf, the artificial turf is accepted by more and more people and have been widely applied on football grounds, courtyards, roofs, office buildings and the like. The artificial turf is generally composed of three parts, which includes synthetic turf yarns in the shape of grass leaf, base fabric for implanting synthetic fibers and back adhesive layer for fixing. During use, the water permeability performance of the artificial turf besides the appearance and the mechanical properties of the bottom and the back of the artificial turf shall be considered.

[0003] Existing artificial turf product adopts the ferroelectrics punching method to ensure the water permeability rate of the product after the gum procedure in order to solve the water permeability problem. However, natural weeds can grow out from holes punched by the ferroelectrics in the long-term use, which causes troubles for the subsequent maintenance. Furthermore, for some artificial turf paving, sand may fill, and the sand may leak to the the below of the turf and in contact with the back adhesive layer through the hole. During long-term use, the presence of quartz sand intensifies the wear of the backing layer on the lawn. Thus resulting to poorly cover, and may finally led to the shedding of the turf yarns.

[0004] Therefore, there is a need to develop an artificial turf having excellent water permeability without punching holes, and to improve durability of the bottom and the back to meet the market demand.

BRIEF DESCRIPTIONS

[0005] A high-permeability base fabric and a high-permeability durable artificial turf including the same have been disclosed. The base fabric has excellent water permeability and can meet the use requirement. Meanwhile, the artificial turf designed by the invention does not need to be punched by an electric iron, so that the growth of natural weeds can be avoided, and the problems of gum layer abrasion and the like caused by quartz sand leakage during paving are avoided. The preparation method is simple, labour saving and cost efficient, and is beneficial to market popularization and industrial production.

[0006] In order to achieve the above objects, one of the objects of the present invention is to provide a high-permeability base fabric.

[0007] The high-permeability base fabric is formed by interweaving warp yarns and weft yarns. The warp yarns and/or the weft yarns include yarns A, and the thickness of the yarns A is 0.08-0.5mm.

[0008] The beneficial effects of adopting the above technical scheme at least include: when the thickness of the yarn is less than 0.08mm, the yarn cannot be spread at the crossing position of the warp and weft due to the fact that the yarn is too thin in the weaving process, holes are formed to meet the water permeability performance. When the thickness of the yarn is more than 0.5mm, stable production cannot be guaranteed when the yarn is cut and drawn, and the yarn cannot be woven due to the fact that the yarn is too thick in the follow-up process.

[0009] Further, the thickness of the yarn a is preferably 0.1 to 0.3mm.

[0010] Preferably, the warp and/or weft yarns comprise yarns B, and the thickness of the yarns B is 0.03-0.06mm.

[0011] Preferably, the warp yarn is yarn B and the weft yarn is yarn A.

[0012] Preferably, the warp yarn is yarn B, the weft yarn is yarns A and B, and the weft yarn is alternately arranged and woven in an ABAB mode or other regular or irregular modes.

[0013] Preferably, the weft yarn is yarn B and the warp yarn is yarn A.

[0014] Preferably, the weft yarn is yarn B, the warp yarn is yarns A and B, and the warp yarn is alternately arranged and woven in an ABAB mode or other regular or irregular modes.

[0015] Furthermore, the warp yarns have one thickness, the weft yarns have three thicknesses, and the weft yarns are arranged, combined and woven in a regular or irregular mode.

[0016] The weft yarns have one thickness, the warp yarns have three thicknesses, and the warp yarns are arranged,

combined and woven in a regular or irregular mode.

[0017] The warp yarns have two thicknesses, the weft yarns have three thicknesses, and the warp yarns and the weft yarns are arranged, combined and woven in a regular or irregular mode;

[0018] The weft yarns have two thicknesses, the warp yarns have three thicknesses, and the warp yarns and the weft yarns are arranged, combined and woven in a regular or irregular mode; by analogy, as long as suitable yarns with different thicknesses can be selected to be arranged, combined and woven in a regular or irregular mode, the weaving mode of forming effective holes among the yarns to improve the water permeability is within the scope of the invention.

[0019] Preferably, the warp and weft yarns are both yarn A.

[0020] Preferably, the width of the warp yarn is 0.5-3mm.

[0021] The width of the weft yarn is 0.5-4mm.

[0022] The weaving density of the warp yarns is 400-2400 yarns/m.

[0023] The weaving density of the weft yarns is 300-2400 yarns/m.

[0024] The beneficial effects of adopting the above technical scheme at least include: when the width of the warp yarn or the weft yarn is less than 0.5mm, the base fabric with stable size cannot be obtained by weaving. When the width of the warp yarn is more than 3mm or the width of the weft yarn is more than 4mm, the base fabric cannot be flat due to the folding phenomenon during weaving because the yarn is too wide. When the weaving density of the warp yarns is less than 400 yarns/m and the weaving density of the weft yarns is less than 300 yarns/m, the produced base fabric has poor dimensional stability and cannot meet the use requirement. When the weaving density of the warp yarn is greater than 2400 yarns/m and the weaving density of the weft yarn is greater than 2400 yarns/m, the warp yarn can be woven only by matching with thinner yarns, and the problem of dimensional stability also exists.

[0025] Further, the width of the warp yarn is 1-2mm.

[0026] The width of the weft yarn is 1-3mm.

[0027] The weaving density of the warp yarns is 600-1200 yarns/m.

[0028] The weaving density of the weft yarns is 400-1200 yarns/m.

[0029] Preferably, the yarn is one or more of black, green, white, blue, violet, orange, yellow and brown in colour.

[0030] The invention also provides a preparation method of the high-permeability base fabric, which includes the following steps.

(1) One or more of polyethylene resin, polypropylene resin, polyamide resin and polyethylene glycol terephthalate resin with color master batch and processing aid are uniformly mixed, and the mixture is extruded by a screw extruder, cut and drawed into yarns with required width and thickness, shaped and rolled for later use.

(2) Placing the warp and weft yarns on a knitting machine according to a pre-set knitting density and arrangement mode to obtain the required high-permeability base fabric.

[0031] The invention also provides a high-permeability durable artificial turf, which includes a base fabric, turf yarns and gum. The base fabric is a high-permeability base fabric. The turf yarns are tufted on the base fabric, and the back adhesive is coated on the back of the base fabric.

[0032] Preferably, the base fabric is a layer of the high-permeability base fabric.

[0033] The base cloth is the combination of one layer of the high-permeability base cloth and one layer of the mesh cloth.

[0034] The base fabric is formed by matching and combining the high-permeability base fabric and any non-woven fabric.

[0035] Preferably, the back glue includes raw glue, filler and foaming agent.

[0036] The raw glue is selected from one or more of styrene-butadiene glue, styrene-acrylic glue, ethylene-vinyl acetate glue, acrylic glue, epoxy glue and polyurethane glue.

[0037] The mass ratio of the raw glue to the filler is 8:2-2:8.

[0038] The foaming agent accounts for 0.3-0.7% of the total mass of the raw glue and the filler.

[0039] The density of the glue after foaming in the back gluing process is controlled to be 0.8-0.2 times of the density of the glue before foaming.

[0040] The beneficial effects of adopting the above technical scheme at least include: the purpose of adding the foaming agent in the glue is to enable the glue to be foamed more easily, the foam is more stable and finer, holes which are communicated sufficiently are formed in the glue layer after solidification, and the water permeability performance of the glue layer is improved.

[0041] When the ratio of the raw glue to the filler is more than 8, the water permeability performance of the whole lawn is affected due to too dense glue film after later-stage curing because of too much raw glue. When the addition amount of the foaming agent is less than 0.3%, the foaming performance of the glue is poor, and the ideal foaming density cannot be achieved. When the foaming density ratio is more than 0.8, no enough holes are formed in the adhesive layer, so that the water permeability performance is influenced. When the ratio of the raw glue to the filler is less than 2, the addition amount of the foaming agent is more than 0.7%, the foaming density ratio is less than 0.2, and the glue film

layer has more holes after later-stage curing, the good water permeability effect of the whole lawn can be ensured, but the mechanical property of the back glue layer of the lawn can be influenced due to excessive filler and low density.

[0042] Further, the mass ratio of the raw glue to the filler is 7.

[0043] The foaming agent accounts for 0.4-0.6% of the total mass of the raw glue and the filler.

[0044] The density of the glue after foaming in the back gluing process is controlled to be 0.3-0.7 times of the density of the glue before foaming.

[0045] Preferably, the foaming agent is selected from one or more of sodium dodecyl sulfate, sodium dodecyl benzene sulfonate, sodium dodecyl diphenyl ether disulfonate, sodium alpha-alkenyl sulfonate and sodium abietate.

[0046] The filler is selected from one or more of calcium carbonate, barium sulfate, mica powder, aluminum hydroxide, talcum powder and silicon dioxide.

[0047] Furthermore, the glue for the back glue can also include color paste and thickening agent in the formula. The color paste is selected from one or more of black color paste, red color paste, green color paste, orange color paste, blue color paste and purple color paste, the thickening agent is selected from one or more of polyacrylic acid, cellulose and polyurethane thickening agents, the color paste is added to color the back glue layer so as to meet the requirements of different customers on colors, and the thickening agent is added to adjust the viscosity of the glue so that the problem of glue bleeding is not easy to occur in the production of the back glue.

[0048] The fourth purpose of the invention is to provide a preparation method of a high-water-permeability durable artificial turf, which includes the following steps.

1) A wire drawing process: uniformly mixing polyethylene resin and/or polypropylene resin, color master batch and auxiliary agent to obtain a mixture, extruding and drawing the mixture by using a single-screw extruder, and processing the mixture into artificial turf yarns.

2) Tufting: tufting the twisted artificial turf yarns on a base fabric by a tufting machine according to a specified row spacing and a specified needle pitch to form an artificial turf semi-finished product.

3) A gum application: coating the glue on the bottom and the back of the semi-finished artificial turf, and curing in an oven to obtain the artificial turf.

[0049] In conclusion, the high-permeability base fabric designed by the invention is provided with the warp and weft yarns with proper width and thickness, and is woven according to a combination mode and a certain density, so that effective holes can be formed at the crossing positions of the warp and weft directions, and the water permeability of the base fabric is improved. Meanwhile, the high-permeability base cloth designed by the invention is applied to the artificial turf, so that the high-permeability artificial turf can be prepared, holes are not required to be punched by using an electric iron, and the problems of growth of natural weeds and leakage of quartz sand during pavement in later use are effectively solved.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0050] The technical solutions in the embodiments of the present invention are clearly and completely described below, and it is obvious that the described embodiments are only a part of the embodiments of the present invention, and not all of the embodiments. All other embodiments, which can be derived by a person skilled in the art from the embodiments given herein without making any creative efforts, shall fall within the protection scope of the present invention.

Embodiment 1

[0051] The preparation method of the high-permeability base fabric includes the following steps.

(1) Uniformly mixing 88 parts of polypropylene, 10 parts of color master batch and 2 parts of auxiliary agent according to the mass parts, extruding the mixture by a screw extruder, and then cutting and drawing.

The thickness of the weft yarn is 0.08mm, and the width of the weft yarn is 1.5mm.
The warp yarn is 0.04mm in thickness and 1.5mm in width, and is rolled for subsequent use after being shaped.

(2) Placing the warp and weft yarns on a knitting machine according to the knitting density of 780 threads/meter to obtain the required high-permeability base fabric.

[0052] The preparation method of the high-water-permeability durable artificial turf comprises the following steps:

1) Uniformly mixing 85 parts of polyethylene, 10 parts of color master and 5 parts of auxiliary agent according to

the mass parts, extruding and drawing the mixture by using a screw extruder, and processing the mixture into artificial turf yarns.

2) Tufting the twisted artificial turf yarns on a high-permeability base fabric by a tufting machine according to a specified row spacing and a specified needle pitch to form an artificial turf semi-finished product;

3) Mixing butylbenzene raw glue and calcium carbonate according to the mass ratio of 5:5, stirring and mixing glue, obtaining finished glue after 30min, continuously adding sodium dodecyl sulfate accounting for 0.5% of the total mass of the finished glue, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.5 times of the density before foaming, coating the foamed glue on the bottom and the back of the semi-finished artificial turf, and curing through an oven to obtain the high-water-permeability durable artificial turf.

Embodiment 2

[0053] Embodiment 2 is the same as embodiment 1 except that in step (1) the weft yarn is 0.1mm thick and 1.5mm wide.

Embodiment 3

[0054] Embodiment 3 is the same as embodiment 1 except that in step (1) the weft yarn is 0.2mm thick and 1.5mm wide.

Embodiment 4

[0055] Embodiment 4 is the same as embodiment 1 except that in step (1) the weft yarn is 0.3mm thick and 1.5mm wide.

Embodiment 5

[0056] Embodiment 5 is the same as embodiment 1 except that in step (1) the weft yarn is 0.4mm thick and 1.5mm wide.

Embodiment 6

[0057] Embodiment 6 is the same as embodiment 1 except that in step (1) the weft yarn has a thickness of 0.5mm and a width of 1.5mm.

Control example 1

[0058] Control example 1 is the same as embodiment 1 except that in step (1), the weft yarn has a thickness of 0.04mm and a width of 1.5mm.

Control example 2

[0059] Control example 2 is the same as embodiment 1 except that in step (1), the weft yarn has a thickness of 0.06mm and a width of 1.5mm.

[0060] control example 3The preparation method of the high-permeability base fabric comprises the following steps:

(1) Uniformly mixing 88 parts of polypropylene, 10 parts of color master and 2 parts of auxiliary agent according to the mass parts, extruding the mixture by a screw extruder, cutting and drawing the mixture into weft yarns with the thickness of 0.6mm and the width of 1.5mm and warp yarns with the thickness of 0.04mm and the width of 1.5mm, shaping and rolling the weft yarns for later use.

(2) Placing the warp and weft yarns on a knitting machine for knitting according to the knitting density of 780 threads/meter.

[0061] The thickness of the weft yarn is too thick, so that stable production cannot be guaranteed to obtain the high-permeability base fabric.

Control example 4

[0062] The preparation of the base fabric for the artificial turf comprises the following steps.

(1) Uniformly mixing 88 parts of polypropylene, 10 parts of color master and 2 parts of auxiliary agent according to

the mass parts, extruding the mixture by a screw extruder, cutting and drawing the mixture into weft yarns with the thickness of 0.04mm and the width of 1.5mm and warp yarns with the thickness of 0.04mm and the width of 1.5mm, shaping and rolling the weft yarns for later use;
(2) Placing the warp and weft yarns on a knitting machine according to the knitting density of 780 threads/meter to be knitted to obtain the required base fabric for the artificial turf.

[0063] The preparation of the artificial turf comprises the following steps:

1) Mixing 85 parts of polyethylene, 10 parts of color master batch and 5 parts of auxiliary agent uniformly according to the mass parts, extruding and drawing the mixture by using a screw extruder, and processing the mixture into artificial turf yarns;
2) Tufting the twisted artificial turf yarns on the base fabric by a tufting machine at a specified row spacing and needle pitch to form an artificial turf semi-finished product;
3) Mixing styrene-butadiene raw glue and calcium carbonate according to the ratio of 5:5, stirring and mixing the glue, obtaining finished glue after 30min, coating the finished glue on the bottom back of the semi-finished lawn, and curing in a drying oven to obtain the artificial turf;
4) Perforating the prepared artificial turf according to the specification of 10cm multiplied by 10 cm.

[0064] Water permeability performance test:
the water permeability of all samples was tested according to the method in FIFA Quality program for Football Turf-2015.
[0065] The sample to be tested is placed in an environment of 23 +/-2 °C for at least 4h before testing.
[0066] The sample to be tested is clamped by two metal or plastic circular rings with the inner diameters of 300mm +/-2 mm, and a supporting grid is arranged below the clamped sample to prevent the sample from being pressed and deformed by a large amount of water injection when water permeability test is carried out, and the maximum deformation from the outer side of the circular ring to the center of the circular ring is not more than 5mm. After clamping, the crack is sealed by sealant to prevent water leakage. Injecting 5L of water into the circular ring to wet a sample to be tested after the testing device is prepared, simultaneously checking whether the testing device has a water leakage phenomenon, if so, re-sealing the device, and performing the leakage detection process for at least 30min.
[0067] After the preparation work is finished, the testing device is ensured to be in a horizontal state before the testing is started, then a large amount of water is injected into the device, the water surface is ensured to exceed the bottom-back height of the sample to be tested by 70-90mm.When the water surface descends to a position 30mm away from the bottom-back height, timing is started, the time for the position from 30mm to 10mm is recorded, the time is accurate to 0.1 second, and if the permeation speed is low, the testing is stopped within 30min.
[0068] The test was repeated two more times according to the above method and the average of the last two results was taken.
[0069] The water penetration rate (Ic) was determined according to the following formula:

$$Ic = F\,wc / tc$$

wherein:

Fwc is the height (mm) of water level descent, typically 20mm.
tc is the time (h) taken for the water level to fall by a certain height.

[0070] The method for determinating the water permeability includes the following steps:
[0071] The conventional lawn produced in the industry at present needs to be punched by an electric iron after a gum-applying process in order to solve the water permeability problem. The water permeability performance of the lawn is tested according to a FIFA detection method, the water permeability rate is 8000-12000mm/h, the requirement can be basically met, but the water permeability rate needs to reach more than 15000mm/h in order to avoid the problem of a large amount of water accumulation when heavy rain and other scenes are met. Therefore, a lawn having a water permeability of 15000mm/h or more is considered to be a high-permeability lawn.

Durability testing

Initial pull-out force is tested.

[0072] An electronic universal material testing machine is used for testing according to a method in standard ISO4919, specifically, a newly prepared sample block to be tested of 20cm x 20cm is cut out, the sample block to be tested is placed in an environment with the relative humidity of (65 +/-4%) and the temperature of (20 +/-2) DEG for 24 hours, the sample block to be tested is placed on the electronic universal testing machine, a clamp is used for clamping a half-bunch of turf yarns in a direction perpendicular to the direction of the sample block, a machine is started, the maximum force value is recorded as the pulling force value of the turf yarns after the turf yarns are completely pulled out, and the pulling force value of each sample block is based on the average value of ten sample data.

Pull-out force after long-term use:

[0073] simulating the actual use condition of the lawn, carrying out rolling wear-resistant test on a newly prepared sample block to be tested of 40cm × 80cm by using a Lisport wear-resistant tester, filling 3kg of sand stone on the bottom back of the lawn, stopping the wear-resistant test after rolling for 3 ten thousand turns, pouring 100kg of water on the sample to be tested, carrying out rolling test for 3 ten thousand turns by using the Lisport wear-resistant tester after naturally permeating for 1 minute, continuously pouring 100kg of water on the sample to be tested after finishing wear resistance, naturally permeating for 1 minute, and sequentially carrying out water permeability and wear-resistant tests according to the method until the wear-resistant test is accumulated to reach 30 thousand turns. The pull-out force test was performed after the simulation according to the method in ISO 4919.

[0074] The covering condition of the back and the sole after long-term use:
after the sample is simulated for long-term use, the rubber layer covering condition of the bottom and the back is observed, the bottom and the back are well covered, no rubber layer falls off and is judged as a four star, the bottom and the back are covered generally, part of the rubber layer falls off and is judged as a four star, the bottom and the back are not well covered, and most of the rubber layer falls off and is judged as a four star.

[0075] The embodiments 1 to 6 and control examples 1, 2 and 4 were subjected to the relevant tests according to the above-mentioned water permeability test and durability performance test methods, and the results are shown in Table 1.

TABLE 1

Testing items	embo dimen t 1	embo dimen t 2	embod iment 3	embod iment 4	embod iment 5	embod iment 6	contro l exam ple 1	control examp le 2	control exampl e 4
thickness of weft yarns (mm)	0.08	0.1	0.2	0.3	0.4	0.5	0.04	0.06	0.04
waterpermeabil ity(mm/h)	15650	20760	27580	33950	40550	47360	3450	6950	11500
Initial pull-out force(N)	60.1	60.6	60.3	60.5	60.3	60.6	60.4	60.7	63.1
long-term use pull-out force (N)	55.2	58.3	58.4	58.1	55.6	50.7	40.3	42.2	28.9
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆	☆☆	☆☆	☆

[0076] It can be seen from embodiments 1 to 6 in table 1 that when the weft yarn thickness is 0.08-0.5mm, the prepared artificial turf has good water permeability effect, and when the artificial turf is subjected to the artificial turf actual use condition simulation test, since no holes are punched, the artificial turf has good water permeability performance, the bottom and back coverage condition and the mechanical property after the simulation test are good, and particularly when the weft yarn thickness is 0.1-0.3mm, the mechanical property after the simulation test is excellent. The decrease in mechanical properties of embodiments 5 and 6 compared to other embodiments in coverage and after long term use

is mainly due to the fact that the weft yarn is too thick, which results in too large pores in the base fabric and small leakage of quartz sand.

[0077] From the conditions of the control example 1 and the control example 2, the thickness of the weft yarn is less than 0.08mm, effective holes are not formed at the crossing positions of the warp yarn and the weft yarn, so that the water permeability performance is poor, and when the artificial turf is subjected to an artificial turf actual use condition simulation test, the aging of a back glue layer is aggravated due to long-term standing in a water accumulation state, so that the bottom and back coverage condition and the mechanical property after long-term use are not ideal. From the situation of control example 4, even though the lawn has a certain degree of water permeability, the holes punched by the electric soldering iron cause a large amount of quartz sand to leak to the bottom back, the bottom back is seriously abraded when in use, and the covering situation and the mechanical property are poor.

Embodiment 7

[0078] Embodiment 7 is the same as embodiment 1 except that in step (1), the weft yarn is 0.25mm thick and 1.5mm wide, and the warp yarn is 0.04mm thick and 1.5mm wide.

Embodiment 8

[0079] Embodiment 8 the same as embodiment 1 except that step (1) was drawn into weft yarns of two thicknesses and warp yarns of one thickness, the weft yarns of two thicknesses being respectively 0.25mm thick, 1.5mm wide, 0.04mm thick and 1.5mm wide; one thickness warp yarn is 0.04mm in thickness and 1.5mm in width; and (2) alternately arranging and weaving the weft yarns with the two thicknesses to obtain the high-permeability base fabric.

Embodiment 9

[0080] Embodiment 9 is the same as embodiment 1 except that step (1) is drawn to form warp yarns having a thickness of 0.25mm and a width of 1.5mm and weft yarns having a thickness of 0.04mm and a width of 1.5mm.

Embodiment 10

[0081] Embodiment 10 the same as embodiment 1 except that step (1) was performed to draw warp yarns of two thicknesses of 0.25mm in thickness, 1.5mm in width, 0.04mm in thickness and 1.5mm in width, and weft yarns of one thickness of 0.04mm in width and 1.5mm in width; and step (2), alternately arranging and weaving the warps with the two thicknesses to form the high-permeability base fabric.

Embodiment 11

[0082] **Embodiment** 11 is the same as embodiment 1 except that step (1) is drawing warp yarns having a thickness of 0.25mm and a width of 1.5mm and weft yarns having a thickness of 0.25mm and a width of 1.5mm.

[0083] Embodiments 7 to 11 were subjected to the relevant tests according to the above-mentioned water permeability test and durability performance test methods, and the results are shown in Table 2.

TABLE 2

Testing items	embodimen t 7	embodimen t 8	embodimen t 9	embodiment 1 0	embodiment 1 1
thickness of weft yarns (mm)	0.25	0.25/0.04	0.04	0.04	0.25
thickness of warp yarns (mm)	0.04	0.04	0.25	0.25/0.04	0.25
water permeabilit y (mm/h)	30560	21220	31050	22350	32950
Initial pull-out force (N)	60.3	60.2	60.6	60.1	60.5
pull-out force after long-term use (N)	58.2	58.6	58.1	58.2	58.4

(continued)

Testing items	embodimen t 7	embodimen t 8	embodimen t 9	embodiment 1 0	embodiment 1 1
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆

[0084] As can be seen from the embodiments 7-11 in the table 2, when the selected warp and weft yarn is 0.08-0.5mm thick and is woven according to the arrangement and combination mode in the embodiments, the prepared artificial turf has excellent water permeability performance, and the bottom and back coverage condition and the mechanical property are good after the simulation test.

Embodiment 12

[0085] Embodiment 12 is the same as embodiment 1 except that step (1) is performed to draw warp yarns having a thickness of 0.04mm and a width of 0.5mm and weft yarns having a thickness of 0.25mm and a width of 2mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 2400 warps/m and 550 wefts/m to obtain the required high-permeability base fabric.

Embodiment 13

[0086] Embodiment 13 is the same as embodiment 1 except that in step (1) the yarn is drawn into warp yarn with thickness of 0.04mm and width of 1mm, and weft yarn with thickness of 0.25mm and width of 2mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 1200 warps/m and 550 wefts/m to obtain the required high-permeability base fabric.

Embodiment 14

[0087] Embodiment 14 is the same as embodiment 1 except that step (1) is performed to draw warp yarns having a thickness of 0.04mm and a width of 2mm, and weft yarns having a thickness of 0.25mm and a width of 2mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 600 warps/m and 550 wefts/m to obtain the required high-permeability base fabric.

Embodiment 15

[0088] Embodiment 15 is the same as embodiment 1 except that step (1) is performed to draw warp yarns with a thickness of 0.04mm and a width of 3mm and weft yarns with a thickness of 0.25mm and a width of 2mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 400 warps/m and 550 wefts/m to obtain the required high-permeability base fabric.

Embodiment 16

[0089] Embodiment 16 is the same as embodiment 1 except that in step (1) the yarn is drawn into warp yarn with a thickness of 0.25mm and a width of 2mm, and weft yarn with a thickness of 0.04mm and a width of 0.5mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 600 warp yarns/m and 2400 weft yarns/m to obtain the required high-permeability base fabric.

Embodiment 17

[0090] Embodiment 17 is the same as embodiment 1 except that step (1) is performed to draw warp yarns having a thickness of 0.25mm and a width of 2mm and weft yarns having a thickness of 0.04mm and a width of 1 mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 600 warps/m and 1200 wefts/m to obtain the required high-permeability base fabric.

Embodiment 18

[0091] Embodiment 18 is the same as embodiment 1 except that step (1) is performed to draw warp yarns having a thickness of 0.25mm and a width of 2mm and weft yarns having a thickness of 0.04mm and a width of 3mm; and the

warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 600 warps/m and 400 wefts/m to obtain the required high-permeability base fabric.

Embodiment 19

[0092] Embodiment 19 is the same as embodiment 1 except that step (1) is performed to draw warp yarns having a thickness of 0.25mm and a width of 2mm and weft yarns having a thickness of 0.04mm and a width of 4mm; and the warp and weft yarns in the step (2) are arranged on a knitting machine to be knitted according to the knitting density of 600 warps/m and 300 wefts/m to obtain the required high-permeability base fabric.

[0093] The embodiments 12 to 19 were subjected to the relevant tests according to the water permeability test and durability performance test methods described above, and the results are shown in Table 3.

TABLE 3

testing items	embodiment12	embodiment13	embodiment14	embodiment15	embodiment16	embodiment17	embodiment18	embodiment19
warp yarn width (mm)	0.5	1	2	3	2	2	2	2
weft yarn width (mm)	2	2	2	2	0.5	1	3	4
warp yarn density (threads/ meter)	2400	1200	600	400	600	600	600	600
weft yarn density (threads/ meter)	550	550	550	550	2400	1200	400	300
water permeability(mm/h)	35780	34550	32950	32180	37200	35900	31120	30400
Initial pull-out force(N)	60.3	60.2	60.6	60.2	60.5	60.3	60.4	60.1
pull-out force after long-term use (N)	58.1	58.6	58.3	58.4	58.2	58.5	58.1	58.0
Bottom coverage after long-term use	☆☆☆	☆ ☆☆	☆ ☆☆	☆☆☆	☆☆☆	☆ ☆☆	☆☆☆	☆☆☆

[0094] As can be seen from embodiments 12-15 in Table 3, when the selected width of the warp yarn is 0.5-3mm and the weaving density of the warp yarn is 400-2400 yarns/m, the prepared high-permeability durable artificial turf has excellent water permeability, and the bottom and back coverage conditions and the mechanical properties are good after simulation tests. Particularly, when the width of the warp is 1-2mm and the weaving density of the warp is 600-1200 threads/meter, the prepared artificial turf can ensure excellent water permeability performance and mechanical performance after simulation test and has better dimensional stability.

[0095] As can be seen from embodiments 16-19 in Table 3, when the selected weft width is 0.5-4mm and the weft weaving density is 300-2400 pieces/m, the prepared high-permeability durable artificial turf has excellent water permeability, and the bottom and back coverage condition and the mechanical property are good after simulation test. Especially when the width of the warp is 1-3mm and the weaving density of the warp is 400-1200 threads/meter, the prepared artificial turf not only can ensure excellent water permeability performance and mechanical performance after simulation test, but also has better dimensional stability.

Embodiment 20

[0096] Embodiment 20 same as embodiment 1 except that step (1) was performed drawing weft yarns having a thickness of 0.25mm and a width of 1.5mm, warp yarns having a thickness of 0.04mm and a width of 1.5mm;

and step 3), mixing the styrene-butadiene raw glue and calcium carbonate according to the mass ratio of 8:2, stirring and mixing the glue.

Embodiment 21

[0097] Embodiment 21 is the same as embodiment 1 except that step (1) is drawn into weft yarns 0.25mm in thickness and 1.5mm in width, and warp yarns 0.04mm in thickness and 1.5mm in width;
and step 3), mixing the butylbenzene raw glue and calcium carbonate according to the mass ratio of 7:3, stirring and mixing the glue.

Embodiment 22

[0098] Embodiment 22 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm;
and step 3), mixing the butylbenzene raw glue and calcium carbonate according to the mass ratio of 3: and 7, stirring and mixing the glue.

Embodiment 23

[0099] Embodiment 23 is the same as embodiment 1 except that step (1) is performed to draw weft yarns with a thickness of 0.25mm and a width of 1.5mm, and warp yarns with a thickness of 0.04mm and a width of 1.5mm;
and step 3), mixing the butylbenzene raw glue and calcium carbonate according to the mass ratio of 2:8, stirring and mixing the glue.

Control example 5

[0100] Control example 5 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm.
[0101] In the step 3), mixing the butylbenzene raw glue and calcium carbonate according to the mass ratio of 9:1, stirring and mixing the glue.

Control example 6

[0102] The control example 6 is the same as embodiment 1 except that step (1) was performed to draw weft yarns of 0.25mm in thickness and 1.5mm in width and warp yarns of 0.04mm in thickness and 1.5mm in width;
and step 3), mixing the butylbenzene raw glue and calcium carbonate according to the mass ratio of 1:9, stirring and mixing the glue.
[0103] **The** embodiments 20 to 23 and control examples 5 to 6 were subjected to the related tests according to the above-mentioned water permeability test and durability performance test methods, and the results are shown in Table 4.

TABLE 4

Testing items	contr ol exam ple 5	embodi ment 20	embodi ment 21	embodi ment 7	embodi ment 22	embodi ment 23	contr ol exam ple 6
ratio of raw glue to filler	9/1	8/2	7/3	5/5	3/7	2/8	1/9
The density ratio of adhesive after foaming to before foaming	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Addition amount of foaming agent(%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
water permeability(mm/h)	1060 0	17500	23100	30560	35250	41560	5052 0
Initial pull-out force(N)	61.2	61.1	60.3	60.3	60.6	55.5	45.9
pull-out force after long-term use (N)	45.5	56.5	58.0	58.2	58.2	50.1	35.6

(continued)

Testing items	control example 5	embodiment 20	embodiment 21	embodiment 7	embodiment 22	embodiment 23	control example 6
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆

[0104] It can be seen from embodiments 20-23 in table 4 that the artificial turf prepared by the method has good water permeability when the ratio of the raw glue to the filler is between 8 and 2, and the simulation test shows that the artificial turf has good bottom and back coverage and good mechanical properties.

[0105] It can be seen from Control example 5 that, when the ratio of the raw glue to the filler is greater than 8, the glue film is too dense after the later curing due to the excessive raw glue, which affects the water permeability of the whole lawn, and further affects the mechanical properties of the lawn after the simulation test. It can be seen from comparative example 6 that when the ratio of the raw glue to the filler is less than 2.

Embodiment 24

[0106] Embodiment 24 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm.

[0107] and step 3), adding lauryl sodium sulfate accounting for 0.3 percent of the total mass of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.8 times of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in a drying oven to obtain the high-permeability durable artificial turf.

Embodiment 25

[0108] Embodiment 25 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm; and step 3), adding lauryl sodium sulfate accounting for 0.4% of the total amount of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.7 times of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in an oven to obtain the high-permeability durable artificial turf.

Embodiment 26

[0109] Embodiment 26 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm; and step 3), adding lauryl sodium sulfate accounting for 0.6% of the total amount of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.3 times of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in an oven to obtain the high-permeability durable artificial turf.

Embodiment 27

[0110] Embodiment 27 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm; and step 3), adding lauryl sodium sulfate accounting for 0.7% of the total amount of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.2 times of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in an oven to obtain the high-permeability durable artificial turf.

Control example 7

[0111] Control example 7 is the same as embodiment 1 except that step (1) is performed to draw weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm; and step 3), continuously adding sodium dodecyl sulfate accounting for 0.1% of the total amount of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.9 times of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in an oven to obtain the artificial turf.

Control example 8

[0112] Control example 8 the same as example except that step (1) was wire-drawn into weft yarns having a thickness of 0.25mm and a width of 1.5mm, and warp yarns having a thickness of 0.04mm and a width of 1.5mm;

and step 3), continuously adding sodium dodecyl sulfate accounting for 0.9% of the total amount of the finished glue as a foaming agent, continuously stirring for 10min to obtain the finished glue, utilizing a foaming machine to adjust process parameters to foam the finished glue, controlling the density after foaming to be 0.1 time of the density before foaming, coating the foamed glue on the bottom back of the semi-finished lawn, and curing in an oven to obtain the artificial turf.

embodiments 24 to 27 and control examples 7 to 8 were subjected to the relevant tests according to the above-mentioned water permeability test and durability performance test methods, and the results are shown in Table 5.

TABLE 5

testing items	control example7	embodiment 24	embodiment 25	embodiment 7	embodiment 26	embodiment 27	control example 8
Ratio of raw glue to filler	5/5	5/5	5/5	5/5	5/5	5/5	5/5
The density ratio of adhesive after foaming to before foaming	0.9	0.8	0.7	0.5	0.3	0.2	0.1
Addition amount of foaming agent(%)	0.1	0.3	0.4	0.5	0.6	0.7	0.9
water permeability(mm/h)	12350	18650	24250	30560	34560	40360	4892 0
Initial pull-out force(N)	61.5	61.8	60.0	60.3	60.6	55.5	45.9
long-term use pull-out force (N)	48.2	56.3	58.3	58.2	58.5	51.0	33.7
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆

[0113] It can be seen from embodiments 24-27 in table 5 that when the density ratio of the glue after foaming to the glue before foaming is 0.8-0.2 and the addition of the foaming agent is 0.3-0.7%, the artificial turf prepared by the method has good water permeability, the coverage of the back and the sole after the simulation test and the mechanical properties are good, and particularly when the density ratio is 0.7-0.3 and the addition of the foaming agent is 0.4-0.6%, the performances after the simulation test are excellent.

[0114] It can be seen from Control example 7 that when the density ratio of the glue after foaming to the glue before foaming is greater than 0.8 and the addition of the foaming agent is less than 0.3%, the gum layer is relatively dense and has no sufficient holes, resulting in poor water permeability and poor mechanical properties after lawn simulation tests. It can be seen from Control example 8 that when the density ratio of the glue after foaming to the glue before foaming is less than 0.2 and the addition of the foaming agent is greater than 0.7%, the holes of the back adhesive layer are too many due to too much foaming, and the lawn has excellent water permeability, but the mechanical property of the back adhesive layer is poor.

Embodiment 28

[0115] Embodiment 28 is the same as Embodiment 7 except that the warp yarn thickness in step (1) is 0.03mm.

Embodiment 29

[0116] Embodiment 29 is the same as Embodiment 7 except that the warp yarn thickness in step (1) is 0.06mm.

[0117] The embodiments 28 to 29 were subjected to the relevant tests according to the water permeability test and durability test methods described above, and the results are shown in Table 6.

TABLE 6

testing items	embodime nt28	embodiment 7	embodiment29
thickness of warp yarns(mm)	0.03	0.04	0.06
thickness of weft yarns(mm)	0.25	0.25	0.25
water permeability(mm/h)	30360	30560	31020
Initial pull-out force(N)	60.1	60.3	60.3
long-term use pull-out force(N)	58.4	58.2	58.9
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆

[0118] As can be seen from the embodiments in Table 6, the prepared artificial turf has good water permeability effect, and when the artificial turf is subjected to the simulation test of the actual use condition of the artificial turf, the artificial turf has good water permeability performance due to no holes, and the artificial turf has good bottom and back coverage conditions and good mechanical properties after the simulation test.

embodiment 30

[0119] embodiment 30 is the same as Embodiment 7 except that in step 3), the raw glue is styrene-acrylic glue.

embodiment 31

[0120] embodiment 31 is the same as Embodiment 7 except that the raw glue in step 3) is acrylic glue.

Embodiment 32

[0121] The embodiment 32 is the same as the embodiment 7 except that the raw glue in the step 3) is styrene-butadiene glue and styrene-acrylic glue, and the mass ratio is 1.

Embodiment 33

[0122] Embodiment 33 is the same as Embodiment 7 except that in step 3), the raw glue is styrene-butadiene glue, and the filler is aluminum hydroxide.

Embodiment 34

[0123] Embodiment 34 is the same as Embodiment 7 except that in step 3), the raw glue is styrene-butadiene glue, and the filler is mica powder.

[0124] The embodiments 30 to 34 were subjected to the relevant tests according to the water permeability test and durability performance test methods described above, and the results are shown in Table 7.

TABLE 7

testing items	embodimen t30	embodime nt31	embodimen t32	embodime nt33	embodime nt34
raw glue	Styrene acrylic adhesive	Acrylic adhesive	Sbr+ Styrene acrylic adhesive	Sbr	Sbr
filler	calcium carbonate	calcium carbonate	calcium carbonate	Aluminum hydroxide	MICA
water permeability (mm/h)	30540	30450	30490	30650	30590
Initial pull-out force(N)	60.9	62.1	60.7	61.7	59.5
long-term use pull-out force(N)	58.0	57.6	58.3	58.5	57.4
Bottom coverage after long-term use	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆

[0125] As can be seen from the embodiments in Table 7, the artificial turf prepared by the method has good water permeability when the raw glue and the filler are changed, and the simulation test shows that the bottom and back coverage and the mechanical property are good.

[0126] The embodiments in the present description are described in a progressive manner, each embodiment focuses on differences from other embodiments, and the same and similar parts among the embodiments can be referred by each other.

[0127] The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to the above-described embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

Claims

1. A high-permeability base fabric formed by interweaving warp yarns and weft yarns, the warp yarns and/or the weft yarns comprising yarns A, and a thickness of each yarn A ranges from 0.08 to 0.5mm.

2. The high-permeability base fabric according to claim 1, wherein each the warp and/or the weft yarn comprise yarn B, and the thickness of the yarn B ranges from 0.03 to 0.06mm.

3. The high-permeability base fabric according to claim 2, wherein the warp yarns are yarn B and the weft yarns are yarn A.

4. The high-permeability base fabric according to claim 2, wherein the warp yarns are yarn B, the weft yarns are yarns A and B, and the weft yarns are woven in an alternating arrangement in a form of ABAB.

5. The high-permeability base fabric according to claim 2, wherein the weft yarns are yarn B and the warp yarns are yarn A.

6. The high-permeability base fabric according to claim 2, wherein the weft yarns are yarn B, the warp yarns are yarns A and B, and the warp yarns are woven in an alternating arrangement in the form of ABAB.

7. The high-permeability base fabric of claim 1, wherein the warp and weft yarns are both yarn A.

8. The high-permeability base fabric of claim 1, wherein each warp yarn has a width of 0.5-3mm; the width of each weft yarn is 0.5-4mm; a weaving density of the warp yarns is 400-2400 yarns/m; and the weaving density of the weft yarns is 300-2400 yarns/m.

9. The high-permeability base fabric of any one of claims 1 to 8, wherein the yarns are one or more of black, green, white, blue, violet, orange, yellow and brown in colour.

10. The method for preparing a high-permeability base fabric according to claim 9, comprising:

(1) uniformly mixing one or more of polyethylene resin, polypropylene resin, polyamide resin and polyethylene glycol terephthalate resin with color master batches and a processing aid, extruding the mixture by a screw extruder, cutting and drawing the mixture into yarns with required wide thickness, shaping and rolling the yarns for subsequent use;
(2) placing the warp yarns and weft yarns on a knitting machine according to a pre-set knitting density and arrangement mode to obtain the high-permeability base fabric.

11. A high-permeability durable artificial turf, comprising a base fabric, turf yarns and a back adhesive; wherein the base fabric comprises the high-permeability base fabric according to any one of claims 1 to 9; the turf yarns are tufted on the base fabric, and the back adhesive is coated on a back of the base fabric.

12. The high-permeability and durable artificial turf as claimed in claim 11, wherein said base fabric is a layer of said high-permeability base fabric;or the base fabric is the combination of one layer of the high-permeability base fabric and one layer of the mesh fabric; or the base fabric is formed by combining the high-permeability base fabric and any non-woven fabric.

13. The high-permeability and durable artificial turf as claimed in claim 11, wherein the back adhesive is composed of raw glue, filler and foaming agent; the raw glue is selected from one or more of styrene-butadiene glue, styrene-acrylic glue, ethylene-vinyl acetate glue, acrylic glue, epoxy glue and polyurethane glue; a mass ratio of the raw glue to the filler is 8:2-2:8; the foaming agent accounts for 0.3 to 0.7 percent of a total mass of the raw glue and the filler; and the density of the glue after foaming in the back gluing process is controlled to be 0.8-0.2 times of the density of the glue before foaming.

14. A method of preparing the high-permeability and durable artificial turf according to claim 12 or 13, comprising:

1) wire drawing: uniformly mixing polyethylene resin and/or polypropylene resin, color master batch and auxiliary agent to obtain a mixture, extruding and drawing the mixture by a single-screw extruder, and processing the mixture into artificial turf yarns;
2) tufting: tufting twisted artificial turf yarns on a base fabric by a tufting machine according to a specified row spacing and a specified needle pitch to form an artificial turf semi-finished product; and
3) gluing: coating the glue on the bottom and the back of the semi-finished artificial turf product, and curing in an oven to obtain the artificial turf.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/102105

A. CLASSIFICATION OF SUBJECT MATTER

D03D15/54(2021.01)i; E01C13/08(2006.01)i; D03D13/00(2006.01)i; D01D5/42(2006.01)i; D03D15/283(2021.01)i; D03D15/37(2021.01)i; D05C17/02(2006.01)i; D06N7/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:D03D,E01C,D01D,D05C,D06N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT, CNKI, ENTXTC, ENTXT, DWPI, WPABS: 人造草坪, 底布, 簇绒, 胶, artificial turf, base fabric, tuft, gum.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 115948839 A (COCREATION GRASS CO., LTD) 11 April 2023 (2023-04-11) description, specific embodiments	1-14
X	CN 114086403 A (JIANGSU ZONGHENG PLASTIC INDUSTRY CO., LTD.) 25 February 2022 (2022-02-25) description, specific embodiments, and figures 1-4	1-14
X	CN 214143130 U (ALL VICTORY GRASS (GUANGZHOU) CO., LTD.) 07 September 2021 (2021-09-07) description, specific embodiments, and figures 1-2	1-14
A	CN 206157525 U (JIANGSU FURUN CARPET CO., LTD.) 10 May 2017 (2017-05-10) entire document	1-14
A	CN 208748478 U (JIANGSU VIVATURF CO., LTD.) 16 April 2019 (2019-04-16) entire document	1-14
A	JP H02190501 A (SEKISUI CHEMICAL CO., LTD.) 26 July 1990 (1990-07-26) entire document	1-14

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 October 2023	**24 October 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/102105

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP H10237814 A (SEKISUI CHEMICAL CO., LTD.) 08 September 1998 (1998-09-08) entire document	1-14

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/102105

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 115948839 A	11 April 2023	None	
CN 114086403 A	25 February 2022	None	
CN 214143130 U	07 September 2021	None	
CN 206157525 U	10 May 2017	None	
CN 208748478 U	16 April 2019	None	
JP H02190501 A	26 July 1990	JP 2510272 B2	26 June 1996
JP H10237814 A	08 September 1998	JP 3665444 B2	29 June 2005

Form PCT/ISA/210 (patent family annex) (July 2022)