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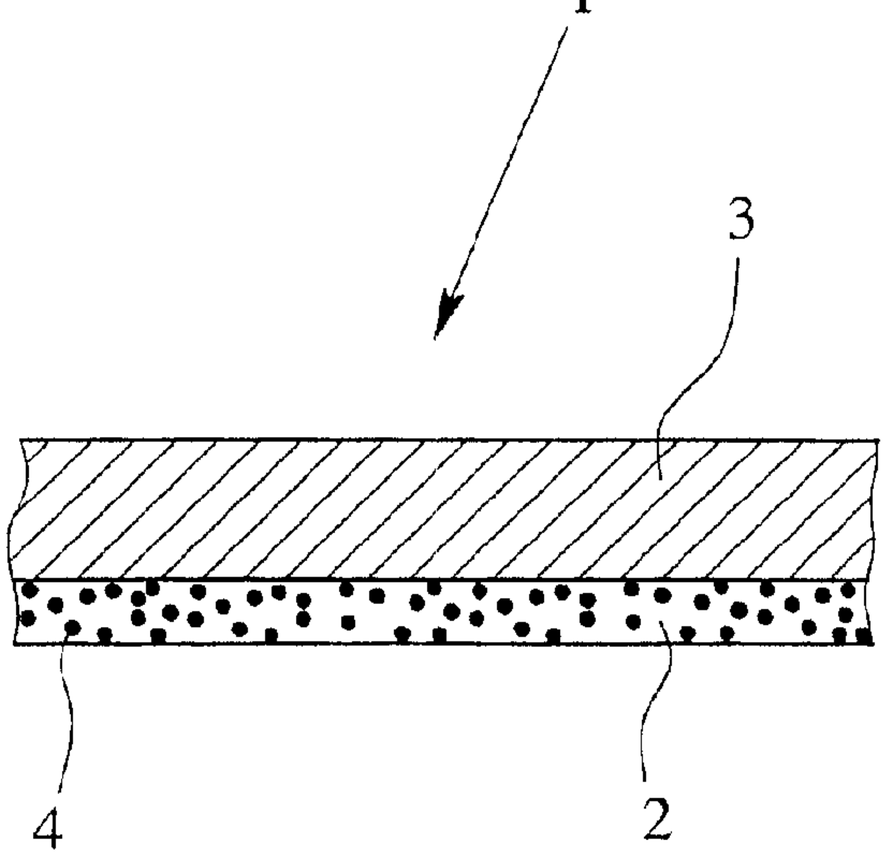
(54) **Titre : MATERIAU EN FEUILLES POUR LE SECTEUR DE LA CONSTRUCTION ET MATERIAU EN FEUILLES COMPOSITE**
(54) **Title: SHEET MATERIAL FOR THE BUILDING SECTOR AND COMPOSITE SHEET-MATERIAL ARRANGEMENT**



(57) **Abrégé/Abstract:**
The invention illustrates and describes a sheet material (1) for the building sector, having at least one functional layer (2) and, if appropriate, at least one further layer, in particular a carrier layer and/or reinforcing layer (3), the functional layer (2) having a resistance to water-vapour diffusion (Sd value) which is dependent on the ambient humidity. According to the invention, it is provided that the functional layer (2) has at least one material (4) which can be obtained from a renewable raw material, in particular at least one polymer based on a renewable raw material.

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(54) Title: SHEET MATERIAL FOR THE BUILDING SECTOR AND COMPOSITE SHEET-MATERIAL ARRANGEMENT

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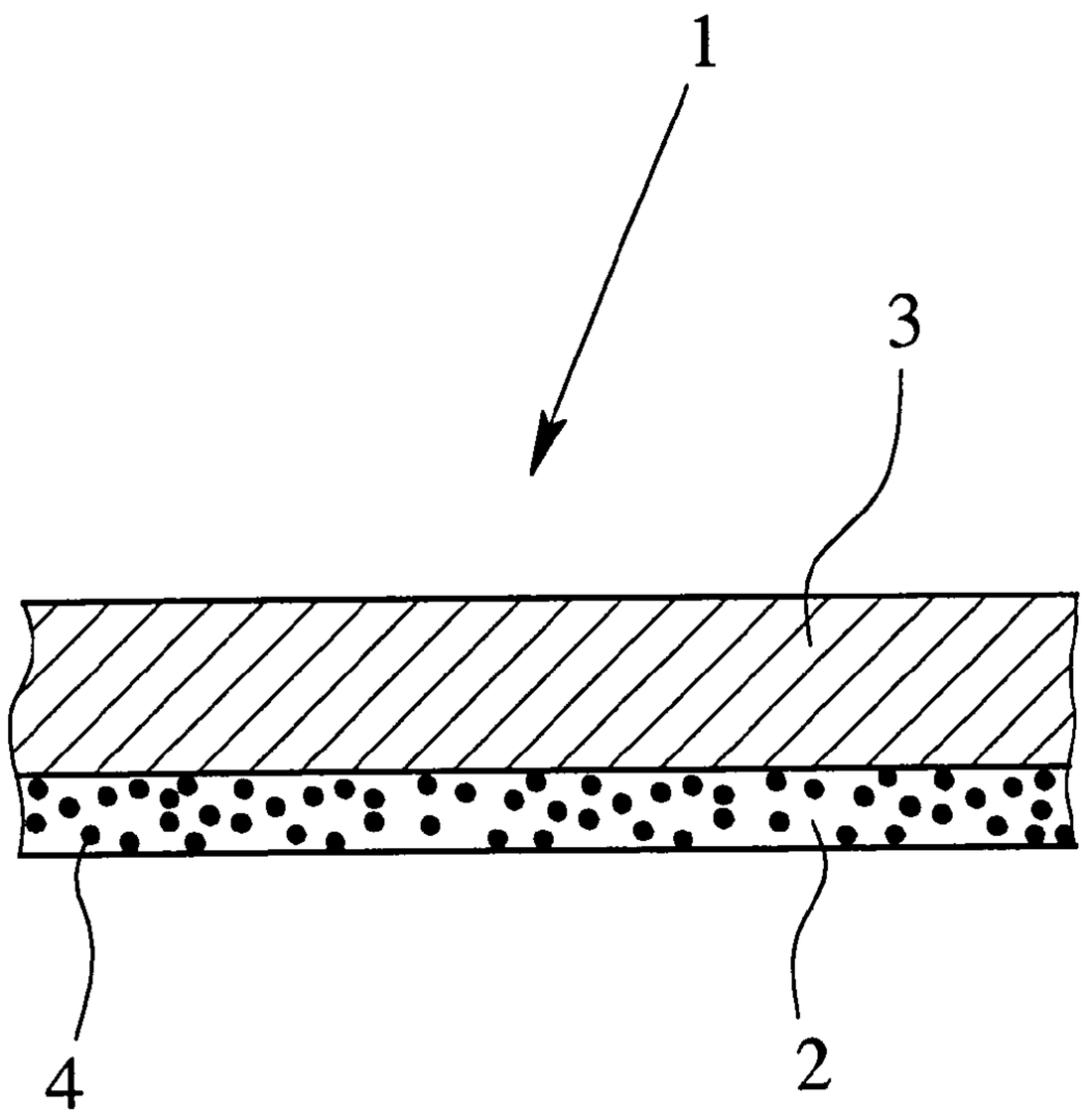

Fig. 1

(57) Abstract: The invention illustrates and describes a sheet material (1) for the building sector, having at least one functional layer (2) and, if appropriate, at least one further layer, in particular a carrier layer and/or reinforcing layer (3), the functional layer (2) having a resistance to water-vapour diffusion (S_d value) which is dependent on the ambient humidity. According to the invention, it is provided that the functional layer (2) has at least one material (4) which can be obtained from a renewable raw material, in particular at least one polymer based on a renewable raw material.

(57) Zusammenfassung: Dargestellt und beschrieben ist eine Folie (1) für den Baubereich, mit wenigstens einer Funktionsschicht (2) und ggf. wenigstens einer weiteren Schicht, insbesondere einer Träger- und/oder Verstärkungsschicht (3), wobei die Funktionsschicht (2) einen von der Umgebungsfeuchte abhängigen Wasserdampf-Diffusionswiderstand (S_d-Wert) aufweist. Erfindungsgemäß ist vorgesehen, daß die Funktionsschicht (2) wenigstens ein aus einem nachwachsenden Rohstoff erhältliches Material (4), insbesondere wenigstens ein Polymer auf der Basis eines nachwachsenden Rohstoffs, aufweist.

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SHEET MATERIAL FOR THE BUILDING SECTOR AND COMPOSITE SHEET-MATERIAL ARRANGEMENT

The invention relates to a film for construction, especially a vapor control layer, a counter ceiling web and an underform web, with at least one functional layer and optionally at least one other layer, especially a carrier layer and/or reinforcing layer, the functional layer having a water vapor diffusion resistance (s_d value) that is dependent on the ambient humidity. Moreover, this invention relates to a film combination with at least one film of the aforementioned type and optionally with at least one other film connected to the film and/or with at least one carrier connected to the film.

Heat insulation measures are known on buildings, parts and equipment in order to save energy on the one hand, on the other hand to protect the component against damage, for example by condensate formation when moisture penetrates by convection or by diffusion. Control of convection and diffusion processes therefore plays a decisive role in the construction domain. In particular, insulation can thus be improved and its function can be permanently maintained.

In particular, controlling water vapor diffusion can prevent moisture damage. If for this purpose vapor barriers with high diffusion resistance are used, the construction is indeed protected against penetrating moisture from diffusion processes, but has the disadvantage that drying processes to the inside are prevented or hindered. If vapor control layers with low diffusion resistance are used, redrying is possible, but there is the danger of overly great wetting as a result of diffusion processes.

In this connection, the prior art discloses films with variable water vapor permeability. Vapor control layers are preferably used here with a water vapor diffusion resistance or variable s_d

value that is dependent on the ambient humidity and they can also be located around the rafters in an undulating manner for example in the roof area in addition to installation over or under the rafters.

DE 296 11 626 U discloses a barrier for prevention of air convection and emission of pollutants from components in the rooms of buildings, on the room side there being a polyamide film. The film can consist of polyamide 3, 4, 6, or 12 or of a mixed polyamide. At a film thickness of 50 microns the film under measurement conditions according to DIN 52650 in a dry region at an average relative humidity of roughly 30% has a water vapor diffusion resistance (s_d value) of 4.5 m and in a humid region at an average relative humidity of roughly 70% has a water vapor diffusion resistance (s_d) of 0.5 m of a diffusion-equivalent air layer thickness.

DE 102 39 985 B4 for construction engineering discloses suitable sealing strips 5 to 20 cm wide consisting of at least three flat layers, the middle layer consisting of a film of an ionomer that at the higher relative atmospheric humidity has a lower water vapor diffusion resistance than at a lower relative atmospheric humidity, the film at 72.5% relative atmospheric humidity having a s_d value from 0.1 to 5 m and at 25% relative atmospheric humidity having a s_d value from 1 to 10 m and the difference of the two values being 0.5 m or greater. The two outer layers that protect and carry the middle layer consist of the same or different material and have a s_d value that is below the lowest s_d value of the film. Moreover there can optionally be other layers of water vapor-permeable framing materials and/or process engineering auxiliary materials. Comonomers can be different synthetically based monomers.

DE 101 11 319 A1 discloses a material for a film for lining buildings or for covering

components such as walls, floors, rooves and ceilings in buildings or for a vapor control layer for heat insulation in buildings, at least some of the material consisting of polar materials and having a water vapor diffusion resistance (s_d value) that is dependent on the ambient humidity. At a relative humidity in the range from 20% to 60% or 30% to 50% the s_d value is 5 to 10 m diffusion-equivalent air layer thickness and at a relative humidity in the range from 50% to 95% the s_d value is less than 2 m or less than 1 m diffusion equivalent air layer thickness. Some of the material can consist of a polymer in which polar ingredients such as an ionomer resin with ethylene and methacrylic acid are contained. Moreover some of the material can consist of an ethylene-based polymer or copolymer material such as polyethylene or polypropylene to which acrylic acid is added.

DE 102 31 769 A1 describes a vapor control layer film with increased breaking elongation in the lengthwise and transverse direction and with variable water vapor permeability. The vapor control layer film consists of a copolyamide, by which increased breaking elongation in the lengthwise and transverse direction of the vapor control layer film will be achieved. The vapor control layer film at an ambient atmosphere [sic] of 100% and an ambient temperature of 0°C should have a water vapor diffusion resistance in the range from 4.5 to 8 g/(m^2d) and at a relative humidity of the atmosphere surrounding the vapor control layer film of 85% and an ambient temperature of 23°C should have a water vapor diffusion resistance in the range from 11 to 23 g/(m^2d).

The vapor control layers and films known from the prior art generally contain petrochemical-based polymers that must be disposed of with high energy expenditure and after their

use with great complexity. This is associated with high costs. In the petrochemical-based polymers only amide or ionic functionalities are used.

The object of this invention is to make available a film and a film combination of the initially named type that can be produced economically with low energy use and can be easily and economically disposed of after their use, and over the expected service life the function of the film or the film combination in the construction domain will be essentially ensured. Otherwise the object of this invention is to make available a film or film combination that is characterized by high elongation.

The aforementioned objects are achieved in a first embodiment of a film of the initially named type in that the functional layer has at least one material that can be obtained from a renewable raw material, especially at least one polymer based on a renewable raw material. In one alternative embodiment as claimed in the invention of a film of the initially named type, it is provided that the functional layer has at least one biodegradable material, especially a biodegradable polymer, and the biodegradable material according to DIN EN 13432:2000 can disintegrate, and upon aerobic composting of the degradable material after a composting interval of more than 12 weeks and at most 80 weeks that has been prolonged compared to DIN EN 13432:2000, a maximum 10% of the original dry weight of the biodegradable material can be found in the screen fraction of the composted material greater than 2 mm. Otherwise the aforementioned objects are achieved by a film combination with at least one film of the aforementioned type and optionally at least one other film and/or at least one carrier. Compostability in the sense of the invention relates simply to the biodegradable component(s) in the film or in the film combination.

The above described film and film combination can be produced with low energy use, and after expiration of the expected service life or after use can be easily and economically disposed of. For example, when using the film or film combination as claimed in the invention in the roof or facade domain, in ageing tests it was shown that it does not decompose over the expected service life of up to 20 - 30 years and essentially its functionality is maintained even when the film or film combination comes into contact with condensing water over a longer time. This can be attributed to the fact that the materials that can be obtained from renewable raw materials and that are used in the film or film combination or the biodegradable materials used have a limited water absorption capacity that is related otherwise to the absence of decomposing microorganisms. The film as claimed in the invention and the film combination moreover have variable water vapor permeability and high elongation, its having been surprisingly shown that functionalities other than amidic or ionic can also be used if polymers are used as the material of the functional layer.

The film as claimed in the invention consists of a functional layer that itself can be for example a film or a correspondingly coated carrier, and optionally a carrier layer or reinforcing layer that is connected to the functional layer. The film can be present as a flat product, especially web-like as rolled goods, and can have a bendability or deformability that is high enough for processing in the construction domain.

It goes without saying that the material that can be obtained from a renewable raw material according to DIN 13432:2000 with a correspondingly prolonged test duration can be biodegradable, as has been described above. Otherwise it goes without saying that the functional layer can have at least one material that can be obtained from a renewable raw material and in addition optionally

another biodegradable material.

The functional layer can have at least one polymer based on a renewable raw material and/or at least one biodegradable polymer or also a mixture of different polymers based on renewable raw materials and/or different biodegradable polymers. Otherwise the functional layer can contain a mixture of biodegradable polymers and/or polymers based on renewable raw materials with conventional synthesized polymers. Preferably the polymers indicated below can be used:

Polymer Type	Monomer or Base	Manufacturer	Trade Name
Polyesters	Butylene Adipate Terephthalate	BASF	Ecoflex
	Butylene Succinate Adipate	Showa	Bionolle
	Butylene Succinate Terephthalate	Novamont	Eastar Bio
	Butylene Succinate Adipate	IReChem	EnPol
Polyhydroxyalkanoates	Hydroxyalkanoate	PHB (Metabolix)	Metabolix
	Hydroxybutyrate-Hydroxyhexanoate		Nodax
Polylactides	Aliphatic Polyesters Based on Lactic Acid	Narureworks (Cargill)	
Polyester Urethanes	Aliphatic Polyester Urethane	Simadzu	PEU-Enfresin
Polysaccharides	Starch-Based	BIOP (BioPolymer Technologies)	Biopar
Polysaccharides	Mixture of Corn Starch Base and Ecoflex	BASF	Ecovio

Additives for polymers can be conventional ones, such as pigments, dyes, fillers and reinforcing substances, reinforcing fibers, stabilizers, lubricants or the like, preferably the additives

can be renewable raw materials and/or substances that are biodegradable according to DIN EN 13432:2000 with a prolonged composting interval of more than 12 weeks and at most 80 weeks.

Since the film as claimed in the invention and film combination are preferably long-lived products for construction, a test interval that has been prolonged compared to DIN EN 13432:2000 of more than 12 weeks can be easily tolerated. Preferably the prolonged composting interval should be at most 60 weeks, furthermore preferably at most 48 weeks, especially at most 18 weeks. In this connection the water vapor permeability of the functional layer and/or of the film or film combination after at least 5 years in use in construction, preferably after at least 10 years, furthermore preferably after 20 years, should be roughly 30 to 70%, preferably roughly 50%, of the water vapor permeability or the s_d value in the new state of the film. Furthermore, the tearing force of the functional layer and/or of the film or film combination after at least 5 years of use in construction, preferably after at least 10 years, especially after 20 years, should be roughly 10 to 50 N/5 cm. This ensures that operation of the film as claimed in the invention or film combination should be essentially preserved over the entire service life or useful life.

The proportion of the material that can be obtained from renewable raw materials in the functional layer and/or the proportion of biodegradable material in the functional layer can be greater than 40% by weight, preferably greater than 60% by weight,, furthermore preferably greater than 80% by weight, and especially greater than 95% by weight. The proportion of the material that can be obtained from renewable raw materials in the film or in the film combination and/or the proportion of biodegradable material in the film or in the film combination in this connection can be greater than 10% by weight, preferably greater than 30% by weight, furthermore preferably

greater than 60% by weight, and especially greater than 95% by weight. In this way, production of the film as claimed in the invention with low energy use and its simple and economical disposal after the useful life has expired is ensured.

In order to ensure adequate processability and function of the film as claimed in the invention over the expected service life, the minimum elongation of the functional layer and/or of the film or film combination according to DIN EN 2311 should be greater than 5% by weight, preferably greater than 20%, furthermore preferably greater than 50%, and especially greater than 100%. The maximum elongation of the functional layer and/or of the film or the film combination according to DIN 12311 can be less than 1000%, preferably less than 600%, furthermore preferably less than 200%.

In order to ensure that the film as claimed in the invention or the film combination is not decomposed even upon contact with condensed water over the expected service life and essentially preserves its function, the water absorption of the functional layer and/or of the film or the film combination according to DIN 53714 at 50% relative humidity and saturation can be between 0.45 to 40%, preferably between 1.0 to 30%, furthermore preferably between 1.5 to 20%, especially between 2 to 8% or between 10 to 40%.

The functional layer and/or the film or film combination can have a thickness between 1 to 1000 microns, preferably between 2 to 500 microns, furthermore preferably between 5 to 100 microns. This ensures sufficiently high water vapor permeability. The weight per unit area of the functional layer and/or of the film or film combination can be 1 to 1000 g/m^2, preferably 2 to 500 g/m^2, furthermore preferably 5 to 100 g/m^2. In order to ensure sufficiently high load capacity of the

film the tearing force of the functional layer and/or of the film or film combination can have a value from 10 to 1500 N/5 cm, preferably 50 to 800 N/5 cm, furthermore preferably 80 to 500 N/5 cm.

In order to be able to use the film as claimed in the invention or the film combination in construction, the functional layer and/or the film or the film combination for a static water column of at least 10 cm, preferably of at least 1 m, furthermore preferably of at least 1.5 m, should be watertight.

As has already been pointed out, the functional layer itself can be composed of different layers. Here the same or different layers can be located next to one another and/or on top of one another. For a multilayer structure, different functionalities can be combined in the functional layer. Fundamentally it is of course also possible for the functional layer to have a single-layer structure.

The film as claimed in the invention as a further layer, preferably as a carrier layer for the functional layer, can have a textile layer, a fabric layer, a nonwoven layer or an optionally perforated further film. Here the further layer consists preferably of at least one material that can be obtained from renewable raw materials, especially from a polymer based on renewable raw materials, and/or has at least one biodegradable material, especially a biodegradable polymer, the biodegradable material according to DIN EN 13432:2000 being able to disintegrate, and upon aerobic composting of the degradable material after a composting interval of more than 12 weeks and at most 80 weeks, preferably at most 60 weeks, furthermore preferably of at most 48 weeks, especially of at most 18 weeks, which interval has been prolonged relative to DIN EN 13432:2000, a maximum 10% of the original dry weight of the biodegradable material can be found in the screen fraction of the composted material greater than 2 mm. This ensures that the film or film

combination as claimed in the invention can be produced with low energy use and/or can be disposed of easily and economically.

The water vapor permeability of the further layer can be less than the water vapor permeability of the functional layer in order not to influence the water vapor permeability of the film or the film combination.

The film as claimed in the invention can be easily and economically produced by cast film extrusion, blown film extrusion, pouring and drying of emulsions or dispersions. Otherwise the film can be obtained by cementing or bonding of at least one functional layer with at least one further layer or by extrusion coating or paste coating of at least one carrier layer with at least one functional layer or by spraying at least one functional layer onto at least one carrier layer. Films or film combinations with several identical or different layers that can be located next to one another and/or on top of one another can be produced.

The film as claimed in the invention or the film combination as claimed in the invention can be used as a vapor control layer with installation over the rafters running inside or outside or with installation in a loop shape over the rafters, the term "rafters" being defined as all longitudinal construction elements in the roof and facade region, preferably of wood materials. The film as claimed in the invention or the film combination can be made as a vapor control layer barrier, the film or film combination acting as a vapor control layer in a humid climate and as a vapor barrier in a dry climate. Otherwise the film and film combination can be made as a vapor control layer counter ceiling web, i.e. diffusion-open counter ceiling web in a humid climate, and a vapor control layer in a dry climate. Installation of the film as claimed in the invention and the film combination

as claimed in the invention made as an counter ceiling web is possible over the rafters outside or inside or in a loop shape over the rafters. In all cases installation in a sheeted roof region or in the facade region is possible. Furthermore, the film or film combination can also be used on concrete rooves, in wood post or lattice-type constructions in the base region. Preferred values for the water vapor permeability of the film as claimed in the invention or of the film combination are listed in the Table shown in Figure 1.

Exemplary Embodiment 1

A cast film with a weight per unit area of 100 g/m^2 is extruded from a polyester with the trade name Ecoflex from BASF. At a relative humidity of 60% at 23°C, a s_d value of 1.1 m is measured. In a dry region the s_d value at a relative humidity of 25% is 3.5 m. The film that has been obtained in this way can be used as a variable vapor control layer with looped installation around the rafters or as a vapor control layer over the rafters inside.

Exemplary Embodiment 2

A nonwoven with a weight per unit area of 100 g/m^2 of needled hemp fibers is extrusion-coated with a film with a weight per unit area of 80 g/m^2 from a polyester with the trade name Ecoflex from BASF. At a relative humidity of 70% at 23°C a s_d value of 0.8 m is measured. In a dry region the s_d value at a relative humidity of 30% is 2.5 m.

One embodiment of a film as claimed in the invention is shown in the drawings and is detailed below.

Figure 1 shows a schematic cross sectional view of the film as claimed in the invention for construction and

Figure 2 shows a tabulation of s_d values in [m] for different applications of the film as claimed in the invention or the film combination and for different types of installation.

Figure 1 shows an extract from a cross sectional view of the film 1 as claimed in the invention for construction that can be used for example as a vapor control layer, underform web or counter ceiling web. The film 1 has a functional layer 2 with a water vapor diffusion resistance (s_d value) that is dependent on the ambient humidity and a carrier or reinforcing layer 3 that is connected to the functional layer 2.

In order to ensure production of the film 1 with low energy use and simple and economical disposal after the useful life has expired, in the film shown in Figure 1 it is provided that the functional layer 2 has a material 4 that can be obtained from a renewable raw material and is preferably biodegradable, and the biodegradable polymer according to DIN 13432:2000 can disintegrate with aerobic composting and a prolonged composting interval of more than 12 weeks and at most 80 weeks.

Claims

1. Film (1) for construction, with at least one functional layer (2), the functional layer (2) having a water vapor diffusion resistance (s_d value) that is dependent on the ambient humidity, characterized in that the functional layer (2) has at least one material (4) that is obtained from a renewable raw material, the at least one material (4) comprising at least one polymer based on a renewable raw material.

2. Film as claimed in claim 1, wherein the functional layer (2) has at least one biodegradable material (4) comprising a biodegradable polymer, and the biodegradable material (4) according to DIN EN 13432:2000 is capable of disintegration, and upon aerobic composting of the degradable material (4) after a composting interval of more than 12 weeks and at most 80 weeks that has been prolonged compared to DIN EN 13432:2000 a maximum 10% of the original dry weight of the biodegradable material (4) is found in the screen fraction of the composted material greater than 2 mm.

3. Film as claimed in claim 2, wherein the prolonged composting interval is at most 60 weeks.

4. Film as claimed in any one of claims 1 to 3, wherein the water vapor permeability of the functional layer (2) after at least 5 years in use in construction is between 30 to 70% of the water vapor permeability in the new state of the functional layer.

5. Film as claimed in any one of claims 1 to 4, wherein the tearing force of the functional layer (2) after at least 5 years of use in construction is at least 10 to 50 N/5 cm.

6. Film as claimed in claim 5 wherein the tearing force of the functional layer (2) after at least 10 years of use in construction is at least 10 to 50 N/5 cm.

7. Film as claimed in claim 6 wherein the tearing force of the functional layer (2) after at least 20 years of use in construction is at least 10 to 50 N/5 cm.

8. Film as claimed in any one of claims 1 to 7 wherein the proportion of the material (4) that is obtained from renewable raw materials in the functional layer (2) and/or the propor9tion of biodegradable material (4) in the functional layer (2) is greater than 40% by weight.

9. Film as claimed in any one of claims 1 to 7 wherein the proportion of the material (4) that is obtained from renewable raw materials in the film and/or the proportion of biodegradable material (4) in the film is greater than 10% by weight.

10. Film as claimed in any one of claims 1 to 7 wherein the minimum elongation of the functional layer (2) according to DIN EN 12311 is greater than 5%.

11. Film as claimed in any one of claims 1 to 10 wherein the maximum elongation of the functional layer (2) according to DIN 12311 is less than 1000%.

12. Film as claimed in any one of claims 1 to 11 wherein the water absorption of the functional layer (2) according to DIN 53714 at 50% relative humidity and saturation is between 0.45 to 40%.

13. Film as claimed in any one of claims 1 to 12 wherein the thickness of the functional layer (2) is between 1 to 1000 microns.

14. Film as claimed in claim 13 wherein the thickness of the functional layer (2) is between 2 to 500 microns.

15. Film as claimed in claim 14 wherein the thickness of the functional layer (2) is between 5 to 100 microns.

16. Film as claimed in any one of claims 1 to 15 wherein the weight per unit area of the functional layer (2) is 1 to 1000 g/m^2.

17. Film as claimed in any one of claims 1 to 16 wherein the tearing force of the functional layer (2) is 10 to 1500 N/5 cm.

18. Film as claimed in any one of claims 1 to 17 wherein the functional layer (2) for a static water column of at least 10 cm.

19. Film as claimed in any one of claims 1 to 18 wherein the functional layer (2) has several layers.

20. Film as claimed in any one of claims 1 to 19 wherein one further layer in form of a carrier layer and/or a reinforcing layer (3) is provided.

21. Film as claimed in claim 20, wherein the further layer is a textile layer, a fabric layer, a nonwoven layer or a further film.

22. Film as claimed in either one of claims 20 or 21 wherein the further layer has at least one material that is obtained from renewable raw materials.

23. Film as claimed in claim 22 wherein the at least one material of the further layer is a polymer based on renewable raw materials.

24. Film as claimed in any one of claims 20 to 22 wherein the further layer has at least one biodegradable material.

25. Film as claimed in claim 24, whereby the biodegradable material according to DIN EN 1342:2000 being able to disintegrate, and upon aerobic composting of the degradable material after a composting interval of more than 12 weeks and at most 80 weeks, which interval has been prolonged relative to DIN EN 13432:2000, a maximum of 10% of the original dry weight of the biodegradable material is found in the screen fraction of the composted material greater than 2 mm.

26. Film as claimed in any one of claims 20 to 25, wherein the water vapor permeability of the further layer is less than the water vapor permeability of the functional layer (2).

27. Film as claimed in any one of claims 1 to 26 wherein the film is produced by cast film extrusion, blown film extrusion, pouring and drying of emulsions or dispersions.

28. Film as claimed in any one of claims 1 to 27, wherein the film is obtained by cementing or bonding of at least of one functional layer (2) with at least one further layer or by extrusion coating or paste coating of at least one carrier layer (4) with at least one functional layer (2) or by spraying at least one functional layer (2) onto at least one carrier layer (4).

29. Film combination with at least one film (1) as claimed in any one of claims 1 to 28.

30. Film combination as claimed in claim 29, with at least one further film connected to the film (1) and/or with at least one carrier connected to the film (1).

31. Film combination as claimed in either one of claims 29 or 30, wherein the proportion of the material (4) that is obtained from renewable raw materials in the film combination and/or the proportion of biodegradable material (4) in the film combination is greater than 10% by weight.

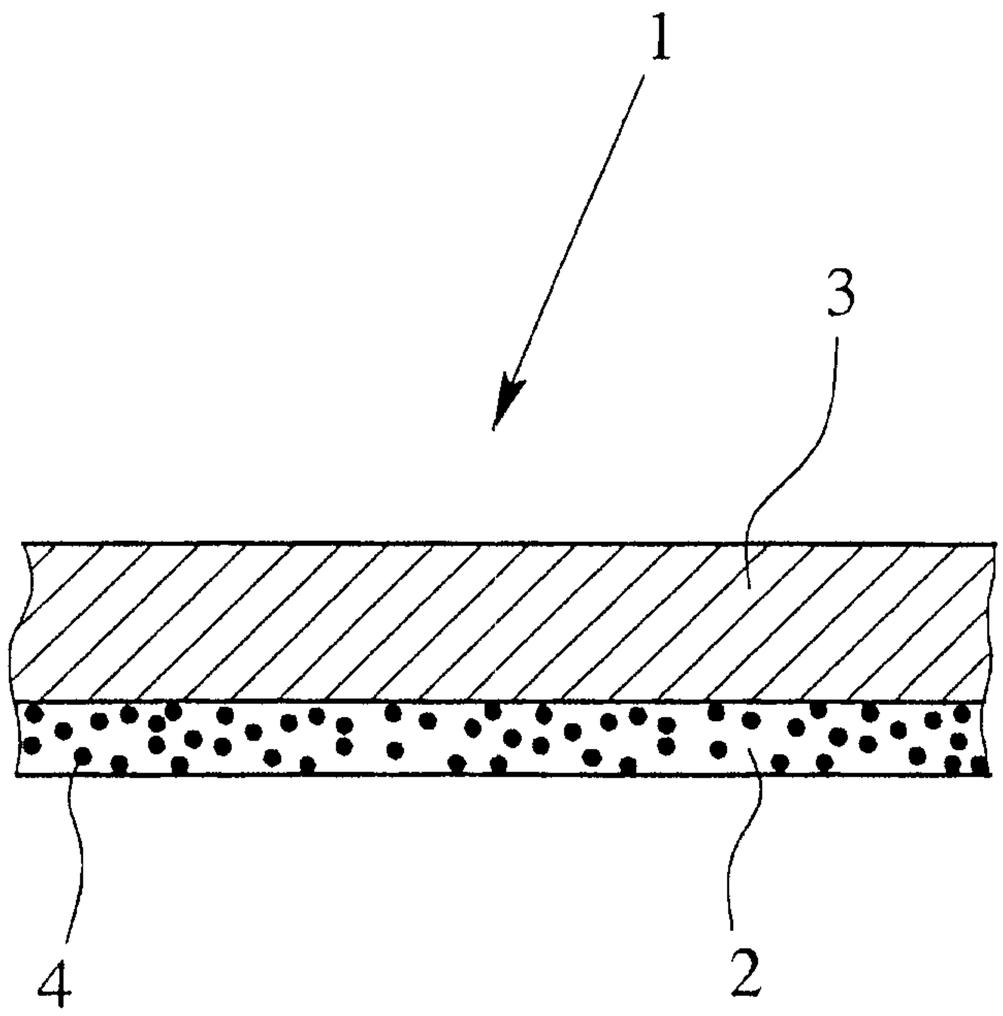
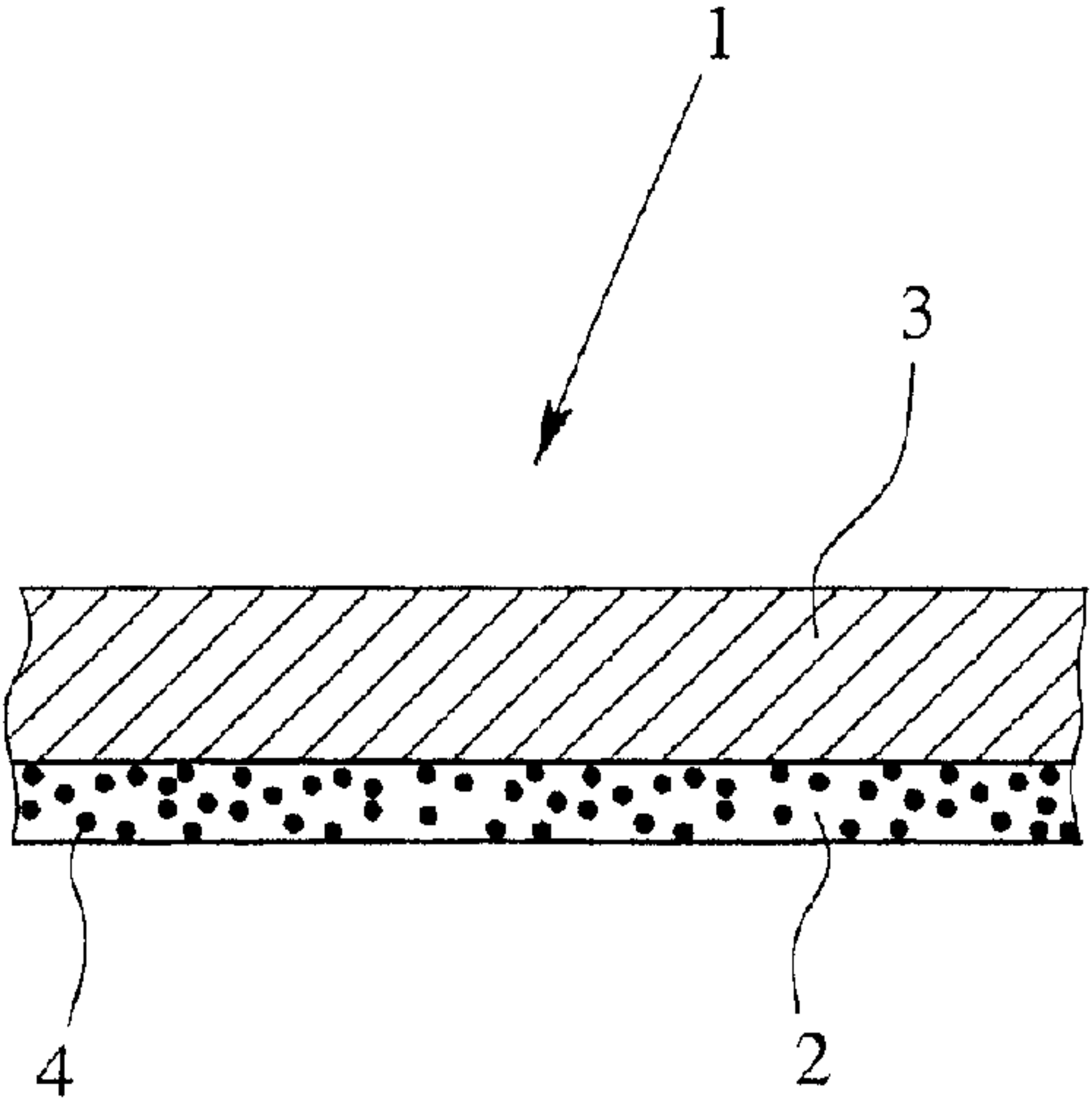


Fig. 1

Sd Values [m]		General					Preferred					Especially Preferred				
Application	Installation	Dry 20-55% min.	Dry 20-55% max.	Wet 60-95% min.	Wet 60-95% max.	Quotient Dry-Wet	Dry 20-55% min.	Dry 20-55% max.	Wet 60-95% min.	Wet 60-95% max.	Quotient Dry-Wet	Dry 20-55% min.	Dry 20-55% max.	Wet 60-95% min.	Wet 60-95% max.	Quotient Dry-Wet
Vapor Control Layer	Over the Rafters Outside	3	50	0.5	20	>1,5	4	25	1	15	>2	5.5	12	2	9	>2,5
Vapor Control Layer	Over the Rafters Inside	2	30	0.1	3	>1,5	2	15	0.5	7	>2	2	8	1	4	>2,5
Vapor Control Layer	Over the Rafters in a Loop Shape	1	10	0	1.2	>1,5	1	5	0	0.8	>2	1	1.8	0	0.6	>2,5
Vapor Control Layer Counter Ceiling Web	All	1	75	0.02	0.5	>2	1,5	30	0.02	0.5	>3	2	8	0.02	0.5	>3
Counter Ceiling Web	Over the Rafters Outside + in a Loop Shape	0.3	10	0	0.8	>1,5	0.3	5	0	0.5	>2	0.4	2	0	0.3	>2,5
Counter Ceiling Web	Over the Rafters Inside	1	15	0	2	>1,5	0.5	8	1	1	>2	0.7	3	0.2	0.7	>2,5
Vapor Barrier	Over the Rafters Outside or Inside	120	1000	100	Infinite	>1,2	150	500	100	Infinite	>1,5	150	300	100	Infinite	>1,5
Vapor Control Layer Barrier		100	Infinite	2	95	>3	100	Infinite	5	60	>4	100	Infinite	10	40	>5

Fig. 2


1
3
4
2