(19) DANMARK

(10) **DK/EP 3100649 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***C 09 J 7/29 (2018.01)*** ***A 47 G 27/04 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2021-09-27**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-07-28**

(86) Europæisk ansøgning nr.: **16001181.3**

(86) Europæisk indleveringsdag: **2011-01-19**

(87) Den europæiske ansøgnings publiceringsdag: **2016-12-07**

(30) Prioritet: **2010-01-20 DE 102010005182**

(62) Stamansøgningsnr: **11000386.0**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **Selvklæbende folie**

(56) Fremdragne publikationer:
EP-A1- 1 944 345
EP-A1- 2 039 735
EP-A2- 0 816 459
WO-A1-2006/045435
WO-A2-2008/119003
DE-U1- 20 014 455
None

Self-adhesive film

The invention relates to the use of a self-adhesive film for bonding a covering, in particular a floor covering, a skirting board or a wall covering, for example in several parts, to a substrate, in particular a floor, a staircase or a wall, with a backing layer which is coated with a pressure-sensitive adhesive coating on an upper surface facing the covering and on a lower surface facing the substrate, according to the preamble of claim 1.

Coverings can be, for example, resilient coverings for floors or walls, which can be laid in individual elements abutting each other, or they can also be skirting boards. For processing reasons, resilient coverings and skirting boards have a more or less pronounced tendency to undergo dimensional changes, especially shrinkage, deformation and bulging. This can lead to undesirable gap formation, especially with coverings that are laid in individual elements, such as design floorings or PVC tiles. Dimensional changes to skirting boards can lead to hollow internal corners and/or joint gaps.

In general, self-adhesive films with a pressure-sensitive adhesive coating on both sides are nowadays used in different widths for the bonding of, for example, floor coverings and/or skirting boards, for example in the field of interior construction. Difficulties can arise in particular when coverings containing plasticisers are bonded using such self-adhesive films or tapes. The plasticisers or similar substances can diffuse from the material being bonded into the adhesive and/or the substrate and, due to this substance migration and the resulting material changes, increase the inherent tendency of the covering to undergo dimensional changes, for example in the case of a PVC design flooring consisting of individual covering elements joined together, so that, particularly over a long period, gaps can occur between the covering elements, and/or deformations such as bulges can occur in a covering of this type laid over a large area. Naturally this is undesirable.

Today, according to the state of the art, resilient coverings in individual elements, in particular design floorings and/or PVC tiles, are generally bonded to substrates using wet adhesives (dispersion and/or reactive two-component adhesives). For example, products from the company Uzin Utz AG are used, such as those marketed under the names Uzin KE 2000 S, Uzin KE 430 or Uzin KE 421.

PVC skirting boards, stair coverings or wall coverings are nowadays usually bonded with mostly solvent-based contact adhesives, e.g. Uzin GN 222, Uzin DK 700. Stair coverings and some wall coverings are also sometimes bonded with wet adhesives.

The use of wet adhesives and contact adhesives is relatively costly, furthermore high VOC emissions and/or strong odour emissions occur in some cases. Wet adhesives also often have insufficient initial adhesion, poor indentation performance during the curing phase and/or long waiting times before they can be walked on and until they are ready to withstand loads. Nor is it possible to avoid possible migration of plasticisers from the coverings.

Double-sided self-adhesive films/tapes are already in use today for bonding floor coverings or skirting boards, for example products from the company Uzin Utz AG with the product names SIGAN 1, SIGAN 2 or UZIN CONTACT. Although the processability of such self-adhesive films/tapes is greatly improved compared to the use of wet adhesives, and although they can usually withstand loads quickly after bonding, the problem of dimensional changes due to plasticiser migration from the coverings still arises or tends to be exacerbated by the self-adhesive materials used, i.e. dry adhesives, due to the increased migration that occurs as a result.

In the area of food packaging, for example, solutions are already employed in which, for example, barrier layers are used in films, where the barrier layers prevent the (excessive) migration of substances, e.g. plasticisers, or gases between individual layers. However, such barrier layers are often not sufficient to block plasticisers of the type and to the extent used in resilient coverings. Even if such film backings were to be designed as self-adhesive films, the described problem of increased dimensional

changes due to plasticiser migration would only be incompletely solved by laying the covering with dry adhesives. An excessive amount of plasticiser could still migrate from the covering into the adhesive and/or substrate, which could still cause the described dimensional changes.

German patent specification DE 197 16 996 C1 describes a method for producing a rubber-based, pressure-sensitive double-sided adhesive tape in which an additional barrier layer is applied by coextrusion to a backing material and then coated over the entire surface with hot-melt pressure-sensitive adhesive. The described hot-melt adhesives are known to absorb plasticisers and allow substance migration to a considerable extent, thus changing their physical properties very significantly. Hence, this design does not solve the problem of dimensional changes.

German disclosure document DE 1 544 777 relates to the bonding of plasticised materials with other plasticised or plasticiser-free materials, wherein a plasticiser-impermeable film, such as aluminium metal foil, is bonded between the materials in order to prevent the migration of plasticiser.

German disclosure document DE 100 40 966 Al describes a self-adhesive film for laying floor coverings and concerns the above-mentioned products of Uzin Utz AG, the applicant's parent company. The described self-adhesive film can optionally be designed in such a way that its backing layer has a portion which acts as an inhibiting layer to prevent the unhindered passage of additives and/or plasticisers. However, as the applicant's investigations have shown (see below), the corresponding reference sample 1 does not have properties able to completely solve the problem of dimensional changes.

The use of a self-adhesive film for bonding a floor covering, wherein the self-adhesive film has a backing layer which is coated with a pressure-sensitive adhesive coating on an upper surface facing the covering and on a lower surface facing the substrate and comprises a barrier layer of polymeric material, is disclosed in DE 200 14 455 U1.

It is the object of the present invention to provide for the use of a self-adhesive film which overcomes the disadvantages of the prior art, and in particular to provide for the use of a self-adhesive film which offers high dimensional stability in a constructively simple way, in particular high dimensional stability of plasticised coverings bonded with such self-adhesive film over extended periods of time.

This task is solved according to the invention by using a self-adhesive film with the features according to claim 1. Preferred embodiments of the invention are defined in the dependent claims.

The self-adhesive film according to the invention is used for the bonding of a covering, in particular a floor covering, a skirting board or a wall covering, for example a multi-part covering made up of individual elements, to a substrate, in particular a floor, a staircase or a wall. An application is conceivable in which, for example, multi-part PVC design flooring elements are bonded to a floor, or skirting boards are bonded at the base of walls in interior construction. The coverings to be bonded can therefore be, in particular, design floorings, which can have a high plasticiser content at least in their base layer. The self-adhesive film used according to the invention has a backing layer which is coated with a pressure-sensitive adhesive coating on an upper surface facing the covering and on a lower surface facing the substrate. According to the invention, the self-adhesive film has a barrier layer which is impermeable to plasticisers. Furthermore, the self-adhesive film used is designed according to the invention in such a way that the pressure-sensitive adhesive coating of at least one of the surfaces is capable of absorbing plasticisers to a limited extent and thus has a plasticiser absorbency of up to only 20 g/m^2 according to the invention.

The limited plasticiser absorbency can preferably be in the range of 2 g/m^2 to 20 g/m^2, in particular preferably in the range of 5 g/m^2 to 15 g/m^2.

The limited plasticiser absorbency according to the invention of up to only 20 g/m^2 of the pressure-sensitive adhesive coating on at least one of the surfaces is determined using a standardised covering with a certain plasticiser content and a certain plasticiser

release. The stated values refer to a covering which, regarding these parameters, corresponds for example to the covering sold under the product name SCALA 55 manufactured by Armstrong DLW GmbH as the bonding partner. To determine the plasticiser absorbency, the self-adhesive film with the pressure-sensitive adhesive coating to be tested is applied to the said covering with the corresponding standard values of plasticiser content and plasticiser release capacity. The sizes of the pieces used are of the order of approximately 100 cm^2. After a certain ageing process, e.g. 7 days at up to 70° C, a weight differential measurement is carried out to determine how much mass the covering in question releases to the pressure-sensitive adhesive coating of the tested self-adhesive film. In this way it is possible to determine the plasticiser absorbency according to the invention.

Through the use, according to the invention, of a self-adhesive film with a combination of a plasticiser-impermeable barrier layer and limited plasticiser absorbency of up to only 20 g/m^2 of the pressure-sensitive adhesive coating of at least one of the surfaces of the self-adhesive film, it is possible, according to the invention, to achieve an improvement in the adhesive properties of such a self-adhesive film. In particular, this makes it possible to overcome the disadvantages of the prior art, in particular especially the large dimensional changes caused by plasticiser migration. This is because, according to the invention, not only is a barrier layer provided, but also the plasticiser absorbency is correspondingly limited, so that plasticiser cannot pass from the covering or substrate into the pressure-sensitive adhesive coating of the self-adhesive film according to the invention to such an extent that a large dimensional change can occur there due to a corresponding loss of plasticiser from the covering or substrate. The plasticiser can thus remain in the covering or substrate for longer or generally to a greater extent, so that the dimensional changes usually associated with plasticiser migration do not occur at all or are substantially less than when using self-adhesive films according to the prior art which do not have a barrier layer according to the invention and where the plasticiser absorbency of the pressure-sensitive adhesive coating of at least one of the surfaces is not reduced according to the invention.

In order to be able, in particular, to reliably control the dimensional change of the covering, according to a preferred embodiment, the self-adhesive film according to the invention has a pressure-sensitive adhesive coating on the upper surface that has limited plasticiser absorbency. The upper surface in particular is in direct contact with the covering, so that the dimensional changes of the covering can be controlled particularly effectively there.

The invention includes an embodiment of the self-adhesive film used according to the invention in which at least the pressure-sensitive adhesive coating of the upper surface consists of such a pressure-sensitive adhesive containing plasticiser in the range of 10% by weight to 70% by weight of dry substance, preferably plasticiser in the range of 10% by weight to 50% by weight of dry substance, more preferably plasticiser in the range of 15% by weight to 40% by weight of dry substance. With this defined plasticiser content in the dry substance of the pressure-sensitive adhesive coating of at least the upper surface, it can be ensured particularly effectively that, for example, the difference in plasticiser in the covering and in the pressure-sensitive adhesive coating of the corresponding surface of the self-adhesive film according to the invention is fairly small. This reduces the disparity in the percentages of plasticiser content by weight, which according to the invention may further advantageously reduce the undesired plasticiser migration.

It should be noted that, as explained above, the limited plasticiser absorbency and the plasticiser content of the pressure-sensitive adhesive coating of the upper surface can generally be adjusted according to the invention, but also that a suitable combination of values can be chosen for the pressure-sensitive adhesive coating of the lower surface of the self-adhesive film used according to the invention facing towards the substrate. Thus, a possible influence due to migration of plasticiser into or out of the substrate can also be easily controlled according to the invention.

The pressure-sensitive adhesive coating of at least one of the surfaces of the self-adhesive film according to the invention can expediently consist of a pressure-sensitive adhesive material which is selected from the non-closed group consisting of pressure-

sensitive adhesives based on acrylate, chloroprene rubber, polyurethane, styrene acrylate, vinyl acetate, vinyl acetate ethylene and/or mixtures thereof and/or copolymers thereof, generally in the form of a dispersion adhesive, solvent-based adhesive or hot-melt adhesive, with purely physical curing and/or chemical and/or physical post-crosslinking. Particularly preferred, according to the applicant's current state of knowledge, are pressure-sensitive adhesives based on acrylate, vinyl acetate, vinyl acetate-ethylene and/or mixtures thereof and/or copolymers thereof.

The backing layer of the self-adhesive film according to the invention can also have a multilayer structure, for example.

In particular, the barrier layer may preferably be part of the backing layer. The barrier layer can particularly preferably be disposed on at least one side of the backing layer, preferably on its upper side facing the covering.

The barrier layer can also preferably be disposed, for example, as an intermediate layer between a plurality of layers of the backing layer.

In general, the stability of the self-adhesive film according to the invention with regard to dimensional changes of the self-adhesive film itself, for example, can be selected by structuring the layers as appropriate.

According to the invention, the barrier layer is a polymer layer of polymeric material selected from the non-closed group: polyamide (aliphatic, aromatic), polyester (aliphatic, aromatic), polycarbonate, polyacrylic acid ester, polyacrylonitrile, polyamide imide, polybutyl acrylate, polyester amide, polyether imide, polyether ketone, polyether carbonate, polyethylene terephthalate, polyimide, polylactide, polymethyl methacrylate, polyacrylic ester amide, polyurethane or polyvinyl alcohol. The use of materials from the non-closed group: polyethylene, polypropylene, polyethylene propylene, polyolefins, polyoxymethylene, polyphenylvinyl, polystyrene, polyvinyl acetate, polyvinyl butyral, polyvinyl chloride or polyvinyl fluoride is also conceivable, depending on the application.

The backing layer of the self-adhesive film according to the invention may preferably comprise a polymeric material, preferably a polymeric material selected from the non-closed group: polyethylene, polypropylene, polyamide (aliphatic, aromatic), polyester (aliphatic, aromatic), polyethylene propylene, polyethylene terephthalate, polylactide, polymethyl methacrylate, polyolefins, polyvinyl butyral or polyvinyl chloride. The use of materials from the non-closed group: polycarbonate, polyacrylic acid ester, polyacrylonitrile, polyamide imide, polybutyl acrylate, polyester amide, polyether imide, polyether ketone, polyether carbonate, polyimide, polyacrylic ester amide, polyoxymethylene, polyphenylvinyl, polystyrene, polyurethane, polyvinyl acetate, polyvinyl alcohol or polyvinyl fluoride is also conceivable, depending on the application.

The barrier layer as a polymer layer has a thickness in the range of 1 µm to 100 µm, preferably in the range of 5 µm to 50 µm, more preferably a thickness in the range of 10 µm to 30 µm. Where a polymer layer is used as a barrier layer, this results in particular stability both in mechanical terms and in terms of the barrier effect against the passage of plasticisers.

Depending on the application, the self-adhesive film used according to the invention can expediently have a width in a range of 30 mm to 2000 mm, preferably in a range of 500 mm to 1500 mm and more preferably in a range of 600 mm to 1000 mm. When used for stairs, the width may particularly preferably be in a range of 100 mm to 500 mm, more preferably in a range of 150 mm to 350 mm, when used for skirting boards, the width may particularly preferably be in a range of 20 mm to 150 mm, more preferably in a range of 30 mm to 100 mm, and when used on floors or walls, the width may particularly preferably be at least 350 mm. These widths allow easy application when laying the self-adhesive film according to the invention preferably configured as described above. A suitable processing width can thus be determined depending on the application.

To enable the self-adhesive film according to the invention to be removed again with minimal residue, the lower surface may have a pressure-sensitive adhesive coating with a lower adhesive strength than the adhesive strength of the pressure-sensitive adhesive coating on the upper surface. However, it may also be expedient, for example when used for stairs or skirting boards, for the lower surface to have a pressure-sensitive adhesive coating with greater adhesive strength than the adhesive strength of the pressure-sensitive adhesive coating on the upper surface, in order to further improve adhesion there, for example on uneven substrates and/or under mechanical tread loads.

The adhesive strength can be determined by measuring the adhesive force in accordance with the DIN EN 1939 standard.

In order to improve the processability of the self-adhesive film according to the invention in a constructively simple way, at least the pressure-sensitive adhesive coating of the upper surface can be provided with a removable cover layer.

The self-adhesive film according to the invention can also be expediently wound onto a roll and sold as such.

The invention is explained in more detail below on the basis of self-adhesive film samples 1 and 2, not all of whose properties are in accordance with the invention.

As an example, two samples of a metallised self-adhesive film were examined in comparison with conventional self-adhesive films of the prior art with regard to plasticiser absorbency and dimensional changes.

The first sample of self-adhesive film had the following layer structure (from the top, i.e. facing the covering in the application, to the bottom, i.e. facing the substrate in the application):

Sample 1:

Cover layer: Protective paper siliconised on both sides
Upper pressure-sensitive adhesive coating: Acrylic pressure-sensitive adhesive
Barrier layer: Aluminium metal layer
Backing layer: Polyester material
Lower pressure-sensitive adhesive coating: Acrylic pressure-sensitive adhesive

The second sample of self-adhesive film had the following layer structure (from the top, i.e. facing the covering in the application, to the bottom, i.e. facing the substrate in the application):

Sample 2:
Cover layer: Protective paper siliconised on both sides
Upper pressure-sensitive adhesive coating: Acrylic pressure-sensitive adhesive
Backing layer a: Polyester material
Barrier layer: Aluminium metal layer
Backing layer b: Polyester material
Lower pressure-sensitive adhesive coating: Acrylic pressure-sensitive adhesive

The following products were examined as reference samples of the prior art: UZIN, SIGAN 1 (reference sample 1), THOMSIT, DT 100 (reference sample 2), BOSTIK, NIBOTAPE COMPLETE (reference sample 3), GPI 374614 (reference sample 4), UZIN, CONTACT (reference sample 5).

The plasticiser absorbency was determined in accordance with the method described above using a covering with the product name SCALA 55 from Armstrong DLW GmbH as the bonding partner. To determine plasticiser absorbency, the self-adhesive film with the pressure-sensitive adhesive coating to be tested is applied to the said covering with the corresponding standard values of plasticiser content and plasticiser release capacity. The sizes of the pieces used are of the order of approximately 100 cm^2. After an ageing process over 7 days at 70° C, the plasticiser absorbency of the samples is determined by differential weighing.

The dimensional changes were determined partly according to standard DIN EN 1903 and also according to an individual method of the applicant, in each case using the covering with product name SCALA 55 from Armstrong DLW GmbH as the bonding partner for the floor covering application, and in each case using the covering with product name WL 60 from Döllken as the bonding partner for the skirting board application. In the applicant's individual method, an ageing process was simulated and carried out over 7 days at a temperature of 70° C (see also the method above), and, in the measurement according to standard DIN EN 1903, an ageing process was simulated and carried out over four test cycles according to the standard.

The results are summarised in the following tables.

Floor covering application (covering SCALA 55, Armstrong DLW GmbH), Table 1:

	Product				
	Sample 1	Reference sample 1	Reference sample 2	Reference sample 3	Reference sample 4
Specific plasticiser absorbency in g/m^2	14.68	31.66	26.76	31.10	23.03
Dimensional changes according to DIN EN 1903	-0.10%	-0.24%	-0.18%	-	-
Dimensional changes according to	-0.27%	-0.62%	-0.48%	-0.68%	-0.41%

individual method					

The above table refers to the application of self-adhesive film in the field of floor covering laying using floor coverings.

The use of self-adhesive film according to the invention in skirting board applications was investigated in the same way.

Skirting board application (covering WL 60 from Döllken), Table 2:

	Product	
	Sample 2	Reference sample 5
Specific plasticiser absorbency in g/m^2 (measured with covering SCALA 55, Armstrong DLW GmbH)	15.28	40.92
Dimensional changes according to DIN EN 1903	-0.10%	-0.58%
Dimensional changes according to individual method	-0.26%	-0.58%

The examples and comparative tests according to the above tables show that when using a self-adhesive film with limited plasticiser absorbency, significantly better dimensional stabilities can be achieved compared to the use of self-adhesive films / skirting board tapes of the other prior art.

Patentkrav

1. Anvendelse af en selvklæbende folie, til fastklæbning af en belægning, en gulvbelægning, en sokkelliste eller en vægbelægning, også i flere dele, på et underlag, et gulv, en trappe eller en væg, med et bærerlag, som på en øvre overflade, der vender mod underlaget, og på en nedre overflade, der vender mod underlaget, er belagt med en hæfteklæberbelægning,
kendetegnet ved, at
den selvklæbende folie har et spærrelag, som er uigennemtrængeligt for blødgørere, hvor spærrelaget er et polymerlag af polymermateriale, udvalgt fra gruppen, polyamid (alifatisk, aromatisk), polyester (alifatisk, aromatisk), polycarbonat, polyacrylsyreester, polyacrylnitril, polyamidimid, polybutylacrylat, polyesteramid, polyetherimid, polyetherketon, polyethercarbonat, polyethylenterephthalat, polyimid, polylactid, polymethylmethacrylat, polyacrylesteramid, polyurethan eller polyvinylalkohol, og hvor polymerlaget har en tykkelse i området fra 1 µm til 100 µm, og at hæfteklæberbelægningen af mindst en af overfladerne i begrænset omfang kan optage blødgørere med en blødgøreroptagelsesevne på op til 20 g/m^2, bestemt i henhold til den i patentbeskrivelsen anførte fremgangsmåde, og at
i det mindste hæfteklæberbelægningen af den øvre overflade består af en sådan hæfteklæber, som indeholder blødgørere i området fra 10 vægt-% til 70 vægt-% i sin tørsubstans.

2. Anvendelse af den selvklæbende folie ifølge krav 1, **kendetegnet ved, at** den begrænsede blødgøreroptagelsesevne ligger i området fra 2 g/m^2 til 20 g/m^2, fortrinsvis i området fra 5 g/m^2 til 15 g/m^2.

3. Anvendelse af den selvklæbende folie ifølge krav 1 eller 2, **kendetegnet ved, at** hæfteklæberbelægningen af den øvre overflade i begrænset omfang er i stand til at optage blødgørere.

4. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 3, **kendetegnet ved, at** i det mindste hæfteklæberbelægningen af den øvre overflade består af en sådan hæfteklæber, som indeholder blødgørere i området fra 15 vægt-% til 40 vægt-% i sin tørsubstans.

5. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 4, **kendetegnet ved, at** hæfteklæberbelægningen af i det mindste den øvre overflade består af hæfteklæbermateriale udvalgt fra den følgende gruppe, hæfteklæbestoffer baseret på acrylat, cloropren-kautsjuk, polyurethan, styrenacrylat, vinylacetat, vinylacetat-ethylen og/eller blandinger deraf og/eller copolymerisater deraf, fortrinsvis foreliggende som dispersions-klæbestoffer, opløsningsmiddelbaserede klæbestoffer eller smelteklæbestoffer, og i den forbindelse udstyret rent fysisk hærdende og/eller kemisk og/eller fysisk post-krydsbindende.

6. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 5, kendetegnet ved, **at** bærerlaget består af flere lag.

7. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 6, kendetegnet ved, **at** spærrelaget er en del af bærerlaget.

8. Anvendelse af den selvklæbende folie ifølge krav 7, **kendetegnet ved, at** spærrelaget er anbragt på mindst en side af bærerlaget, fortrinsvis på en øvre side, som vender mod belægningen.

9. Anvendelse af den selvklæbende folie ifølge krav 7, **kendetegnet ved, at** spærrelaget er anbragt som mellemlag mellem flere lag af bærerlaget.

10. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 9, **kendetegnet ved, at** bærerlaget består af et polymermateriale, fortrinsvis af et polymermateriale fra gruppen polyethylen, polypropylen, polyamid (alifatisk, aromatisk), polyester (alifatisk, aromatisk), polyethylenpropylen, polyethylenterephthalat, polylactid, polymethylmethacrylat, polyolefin, polyvinylbutyral eller polyvinylchlorid.

11. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 10, **kendetegnet ved, at** spærrelaget er polymerlaget med en tykkelse i området fra 5 µm op til 50 µm, foretrukket med en tykkelse i området fra 10 µm op til 30 µm.

12. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 11, **kendetegnet ved, at** dens bredde ligger i et område fra 30 mm til 2000 mm, fortrinsvis i et område fra 500 mm til 1500 mm, og mere fortrinsvis ligger i et område

fra 600 mm til 1000 mm, hvor dens bredde ved anvendelse til trapper særligt foretrukket ligger i et område fra 100 mm til 500 mm, især foretrukket ligger i et område fra 150 mm til 350 mm, ved anvendelse til sokkellister særligt foretrukket ligger i et område fra 20 mm til 150 mm, især foretrukket ligger i et område fra 30 mm til 100 mm og ved anvendelse på gulve eller vægge særligt foretrukket udgør mindst 350 mm.

13. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 12, **kendetegnet ved, at** den nedre overflade har en hæfteklæberbelægning med mindre hæftestyrke end hæftestyrken på hæfteklæberbelægningen på den øvre overflade.

14. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 13, **kendetegnet ved, at** i det mindste hæfteklæberbelægningen på den øvre overflade er forsynet med et aftageligt afdækningslag.

15. Anvendelse af den selvklæbende folie ifølge et af kravene 1 til 14, **kendetegnet ved, at** den selvklæbende folie er viklet til en rulle.