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(71) Applicant: **3M Innovative Properties Company**
St. Paul, Minnesota 55133-3427 (US)

(72) Inventor: **Schmidt, Axel**
1831 Diegem (BE)

(74) Representative: **Voortmans, Gilbert J.L.**
3M Europe S.A./N.V.
Hermeslaan 7
1831 Diegem (BE)

(54) **Adhesive tape splice**

(57) The present invention provides an adhesive tape splice joining an end of a first adhesive tape to an end of a second adhesive tape or another end of said first adhesive tape, each of said first and second adhesive tape having opposite major sides and at least one of said sides having an adhesive surface, said splice comprising a hardened composition bonding said end of said first adhesive tape to said end of said second adhesive tape or to said other end of said first adhesive tape.

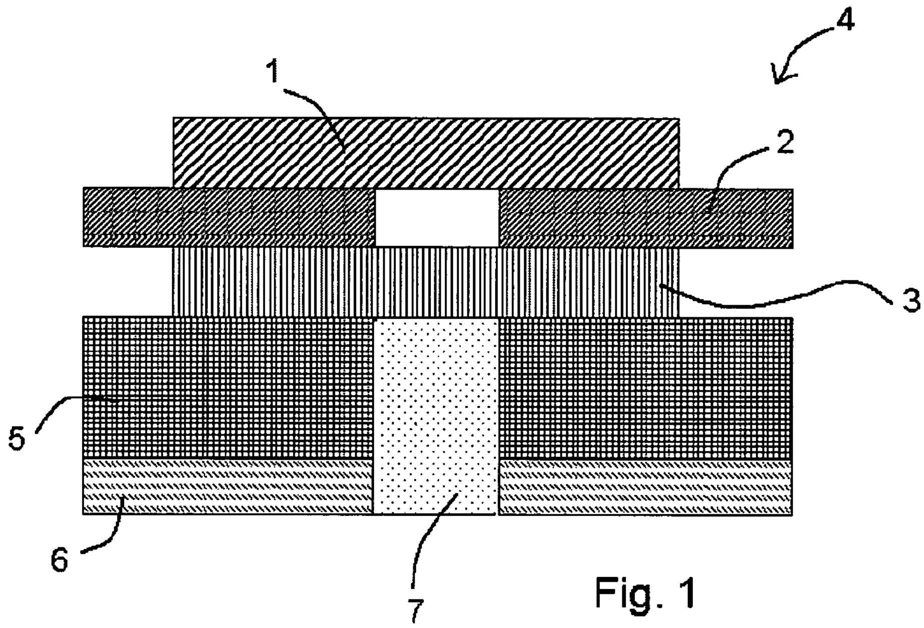

Fig. 1

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Description

1. Field of the invention

[0001] The present invention relates to an adhesive tape splice and in particular to an adhesive tape splice for splicing adhesive tapes that may be used for adhering articles such as rubber door seals to a motor vehicle. The invention further relates to a method of making the adhesive tape splice and to an adhesive tape comprising one or more of the adhesive tape splices. The invention in another aspect relates to the use of the adhesive tape for adhering an article to a motor vehicle.

2. Background of the invention.

[0002] Adhesive tapes are well known in the art and have found many applications including in the automotive field where they have been used to adhere an article to the body of a motor vehicle as well as in sealing applications. For example, adhesive tapes have been used to adhere an elastomeric or rubber seal to the frame of a car door or to the frame of the opening of the car door. Such rubber seals are provided to avoid moisture or water to penetrate into the interior of the car.

[0003] During their manufacturing, adhesive tapes need to be frequently spliced. Typically, when splicing adhesive tapes, the ends of a first and second adhesive tape are pushed against each other and spliced by adhering a pressure sensitive adhesive sheet to the release liners of the tapes being spliced. Unfortunately, these splices have presented a number of problems in the use and applications of adhesive tapes. In particular, the splice in the adhesive tape is a weak spot in the adhesive tape, which may cause the performance of the adhesive tape to deteriorate over time. Also, when the adhesive tape is used to adhere a rubber seal to the frame of a car door or opening of a car door, the splice may open (as the result of the elastomeric properties of the rubber) and cause water to penetrate in the adhesive tape and/or the interior of the car.

[0004] It was thus desirable to find alternative adhesive tape splices that have improved properties including for example improved mechanical properties and in particular improved weather resistance. Desirably, the adhesive tape splices can be easily and conveniently made in the manufacturing process of adhesive tapes.

3. Summary of the invention

[0005] The present invention provides an adhesive tape splice joining an end of a first adhesive tape to an end of a second adhesive tape or another end of said first adhesive tape, each of said first and second adhesive tape having opposite major sides and at least one of said sides having an adhesive surface, said splice comprising a hardened composition bonding said end of said first adhesive tape to said end of said second adhesive tape or to said other end of said first adhesive tape.

[0006] The adhesive tape splices may offer such advantages as better weathering resistances and good to excellent mechanical properties including for example strength of the bond created between the ends of the adhesive tape being spliced. Furthermore, such splices are easy and convenient to make and can be readily used in the manufacturing process of adhesive tapes.

[0007] In a further aspect, the present invention provides an adhesive tape having one or more of the adhesive tape splices.

[0008] In a still further aspect, the invention provides for a use of the adhesive tape to adhere an article to a motor vehicle body, e.g. the body of a car, bus or truck.

[0009] In another aspect, there is provided a method of making an adhesive tape splice comprising:

(i) providing a first and optionally second adhesive tape each having opposite major sides and at least one of said sides having an adhesive surface;
(ii) bringing one end of said first adhesive tape opposite one end of said second adhesive tape or bringing one of end of said first adhesive tape opposite another end of said first adhesive tape and leaving a gap between said ends;
(iii) filling said gap with a hardenable liquid composition; and
(iv) hardening said hardenable liquid composition.

[0010] By the term "hardenable liquid" is meant a liquid composition that can be solidified for example by exposing the liquid to heat or light. The term hardenable liquid thus include liquid compositions that can be solidified or hardened by polymerization as well as through a cross-linking or curing reaction.

4. Detailed description of the invention

Adhesive tape splice

[0011] The adhesive tape splice may splice opposite ends of an adhesive tape together but generally splices a first adhesive tape to a second adhesive tape. The first and second adhesive tapes will generally be of a similar nature and typically may have the same composition.
However, a splice in connection with the present invention may also be used to splice adhesive tapes of different composition to each other.

[0012] The adhesive tapes that can be spliced together have on at least one major side an adhesive surface. Typically, the adhesive tapes will be pressure sensitive adhesive tapes. However adhesive tapes having other types of adhesives may be spliced as well. For example, an adhesive tape comprising a heat-activatable adhesive may be spliced as well. With the term "heat-activatable adhesive" is meant an adhesive that needs to be 'activated' i.e. subject to a heat treatment so as to allow the adhesive to bond to a substrate. Generally such activation involves heating to a temperature of between 60 and 200°C. Further, the adhesive tapes may comprise an adhesive surface on only one major side or on both major sides. For example, in one embodiment, the adhesive tapes may comprise on one major side a pressure sensitive adhesive with the opposite major side not having an adhesive surface. In another embodiment, the adhesive tape may comprise a pressure sensitive adhesive on both major sides. In a still further embodiment, the adhesive tape may comprise a pressure sensitive adhesive on one major side and a heat-activatable adhesive at the opposite major side.

[0013] While any of the known adhesive tapes may be spliced in accordance with the present invention, the adhesive tapes for splicing in this invention are preferably pressure sensitive adhesive tapes, i.e. adhesive tapes that comprise on at least one major side a pressure sensitive adhesive.

[0014] A preferred pressure sensitive adhesive tape comprises a layer of acrylic-type pressure-sensitive adhesive. Preferably, the pressure-sensitive adhesive layer essentially consists of an acrylic-type pressure-sensitive adhesive. Notwithstanding the preference for acrylic type pressure sensitive adhesive, other pressure sensitive adhesives are contemplated as well and may be used. Such other pressure sensitive adhesives include for example those based on silicones or based on polyolefins as disclosed in Handbook of Pressure Sensitive Adhesive Technology (third edition) D.Satas, Ed. Satas and Associates, Warwick RI/USA, 1989 on pages 550-556 and 423-442 respectively.

[0015] Useful acrylic type pressure-sensitive adhesives include those known to the person skilled in the art. Particularly useful pressure-sensitive adhesives include ultraviolet- radiation polymerized acrylic pressure-sensitive adhesives. Preferably, these pressure-sensitive adhesives are prepared from a composition comprising at least one alkyl acrylate monomer, preferably a monofunctional unsaturated acrylate ester of a non-tertiary alcohol, the molecules of which preferably have from about 4 to about 14 carbon atoms. Such monomers include, e.g., isooctyl acrylate, 2-ethyl hexyl acrylate, isononyl acrylate, decyl acrylate, dodecyl acrylate, butyl acrylate, and hexyl acrylate. The alkyl acrylate monomers can be used to form homopolymers or they can be copolymerized with polar copolymerizable monomers. When copolymerized with strongly polar copolymerizable monomers, the alkyl acrylate monomer generally comprises at least about 75% of the polymerizable monomers. When copolymerized with moderately polar copolymerizable monomers, the alkyl acrylate monomer generally comprises at least about 60% of the monomers.

[0016] The polar copolymerizable monomers can be selected from strongly polar copolymerizable monomers such as acrylic acid, itaconic acid, hydroxyalkyl acrylates, cyanoalkyl acrylates, acrylamides or substituted acrylamides, or from moderately polar copolymerizable monomers, such as N- vinyl pyrrolidone, acrylonitrile, vinyl chloride, or diallyl phthalate. When strongly polar monomers are used, they preferably comprise from about 1 to about 25 parts, preferably from about 4 to about 20 parts of the acrylic copolymer. When moderately polar monomers are used, they preferably comprise from about 20 to about 40 parts of the acrylic copolymer.

[0017] The composition comprising the polymerizable monomers may also contain a photoinitiator in order to induce polymerization of the monomers. Useful photoinitiators include benzoin ethers, such as benzoin methyl ether or benzoin isopropyl ether, substituted benzoin ethers, such as anisole methyl ether, substituted acetophenone derivatives, such as 2,2-diethoxyacetophenone and 2,2- dimethoxy-2-phenylacetophenone, substituted alpha-ketols, such as 2- methyl-2-hydroxypropiophenone, aromatic sulfonyl chlorides, such as 2-naphthalene sulfonyl chloride and photoactive oximes, such as 1-phenyl-1-propenedione-2(0-ethoxycarbonyl)-oxime.

[0018] The photopolymerizable composition may also contain a crosslinking agent to enhance heat-resistance. Preferred crosslinking agents for acrylic pressure-sensitive adhesives are multifunctional acrylates such as 1,6- hexanediol diacrylates as well as those disclosed in US-A-4,379, 201, such as trimethylolpropane triacrylate, pentaerythritol tetraacrylate, 1, 2-ethylene glycol diacrylate, and 1,2-dodecanediol diacrylate. Other useful crosslinking agents include substituted triazines, such as those disclosed in US-A-4,329,384, US-A-4,391, 687, US-A-4,330,590, e.g., 2,4- bis (trichloromethyl)-6-(3,4-dimethoxyphenyl)-s-triazine and other chromophore halogen-s-triazines. When used, the crosslinking agent is present in an amount of from about 0.01 to about 1 pph, wherein pph means (additional) parts per hundred parts of the total composition.

[0019] In a particular embodiment, the adhesive tape comprises an acrylic foam layer. The term foam layer as used in this invention not only includes layers obtained by foaming but any similar layer that includes voids as may be obtained for example by frothing a composition or including hollow spheres in the layer. For example, in one embodiment, the adhesive tape may comprise an acrylic cellular pressure-sensitive adhesive membrane as described in US-A-4,415,615. A cellular pressure-sensitive adhesive membrane is made by the steps of

(a) frothing a composition which is polymerizable to a pressure-sensitive adhesive state,
(b) coating the froth onto a backing, and
(c) polymerizing the coated froth *in situ* to a pressure-sensitive adhesive state to provide a pressure- sensitive adhesive membrane having a cellular structure.

[0020] Frothing can be conveniently accomplished by whipping a gas into the polymerizable composition. After coating the frothed composition onto a backing, the polymerization may be initiated by ultraviolet radiation as taught in US-A-4,181,752. Where such photopolymerization is desired, an inert frothing gas is preferably used as air tends to quench photopolymerization. Carbon dioxide and nitrogen are preferred frothing gases.

[0021] In another embodiment, the pressure sensitive adhesive layer may be a foam layer prepared from a monomer composition comprising hollow microspheres. Suitable microspheres include glass or polymeric microspheres. The microspheres should have an average diameter of 10 to 200 micrometers, and comprise from about 5 to about 65 volume percent of the core layer. The thickness of foam layers in preferred tapes of the present invention ranges from 0.3 mm to about 4.0 mm in thickness.

[0022] Preferred glass microspheres have average diameters of about 50 µm. When glass microspheres are used, the pressure sensitive adhesive layer should be at least 3 times as thick as their diameter, preferably at least 7 times.

[0023] Polymeric microspheres are also useful for some compositions such as those described in US-A-3,615,972, US-A-4,075,238, US-A-4,287,308, and US-A-4, 855,170. Such microspheres are available from Kema Nord Plastics under the trade name "Expancel" and from Matsumoto Yushi Seiyaku under the trade name "Micropearl". In expanded form, the microspheres have a specific density of approximately 0.02-0.036 g/cc. It is possible to include the unexpanded microspheres in the adhesive layer and subsequently heat them to cause expansion, but it is generally preferred to mix in the expanded microspheres. This process ensures that the hollow microspheres in the final layer are substantially surrounded by at least a thin layer of adhesive.

[0024] In a particular embodiment, the adhesive tape of the present invention may comprise more than one pressure-sensitive adhesive layer. Such further pressure sensitive adhesive layers may consist of a polymerized acrylic copolymer which may incorporate similar or dissimilar acrylic monomers in like or unlike thicknesses, having similar or different additives from those acrylic copolymers contained in another pressure- sensitive adhesive layer. For example, one layer may comprise a foam-like pressure-sensitive acrylic adhesive and a second layer is a non-foam-like pressure-sensitive acrylic adhesive. Still further, a foam-like pressure sensitive acrylic adhesive maybe provided on both opposite major sides with non-foam pressure sensitive acrylic adhesive layer.

[0025] The pressure sensitive adhesive layers may comprise further materials that may be blended with the pressure sensitive adhesive. Such materials include fillers, pigments, fibrous reinforcing agents, woven and non-woven fabrics, foaming agents, antioxidants, stabilizers, fire retardants, and viscosity adjusting agents.

[0026] An especially useful filler material is hydrophobic silica as disclosed in US-A-4,710,536 and US-A-4, 749,590. Thus, in an embodiment of the present invention, the pressure-sensitive adhesive layer further comprises from about 2 to about 15 pph of a hydrophobic silica having a surface area of at least 10 m^2/g.

[0027] In a preferred embodiment in connection with the present invention, the adhesive tape comprises a heat-activatable adhesive layer. Preferably the adhesive tape will also include a pressure sensitive adhesive layer as described above. Suitable heat-activatable adhesive layers include those based on thermoplastic polymers such as polyurethanes, polyesters and polyamides. Particularly useful are polyolefins.

[0028] Examples of useful heat-activatable polyolefin resins are polyolefin homopolymers, such as polyethylene, polypropylene, polyolefin/polyolefin copolymers, such as ethylene/propylene copolymers (often referred to as polyallomer) and blends thereof.

[0029] Suitable blends include blends of polyethylene and polypropylene at various ratios. Suitable copolymers may be atactic, isotactic, random, block or impact copolymers.

[0030] Preferred heat-activatable polyolefin resins effectively adhere to both thermoplastic and thermoset substrates. The adhesives achieve a high degree of compatible interfacial mixing with a thermoplastic substrate while molten, which upon cooling yields a high- strength bond. With a thermoset substrate, the molten adhesives achieve a superior wetting out of the substrate surface, again yielding a high bond strength when cooled.

[0031] A particularly useful polyolefin is a propylene/ethylene copolymer having an ethylene content of up to about 10% by weight.

[0032] Polyolefin polymers which have been toughened and made impact resistant by means of incorporation of elastomeric segments into the polymeric chain may also be useful. Suitable impact copolymers include impact copolymer based on polypropylene or on polyethylene, for example impact polypropylene copolymer containing an ethylene-propylene elastomeric phase.

[0033] In another embodiment, the olefin resin is a blend of polyethylene and polypropylene. Preferably, the polyethylene is used in an amount of 5 to 30% by weight, more preferably of 10 to 25% by weight, based on the total weight of the blend and the polypropylene is used in an amount of 95 to 7 % by weight, more preferably in an amount of 90 to 75 % by weight, based on the total weight of the blend.

[0034] The heat-activatable adhesive resin preferably exhibits one of the features selected from a melting point of about 120 to about 170°C (preferably of about 130 to about 165°C), a melt flow index of about 2 to 18 g/10 min (preferably of about 5 to 9 g/10 min), a tensile strength at break of about 25 to about 45 N/cm^2(preferably of about 30 to 40 N/cm^2), an e-modulus at 100% elongation of about 10 to about 20 N/cm^2 (preferably of about 12 to about 16 N/cm^2), and an elongation at break of about 200 to about 450% (preferably of about 230 to about 400%). More preferably, the heat-activatable adhesive resin exhibits at least two, more preferably at least three, and even more preferably all of the aforementioned features.

[0035] Suitable commercially available heat-activatable polyolefins include poylpropylene copolymers of the trade name Finapro™, such as those of the designation Finapro™ 5660, Finapro™ 8780, Finapro™ 5642, and Finapro™ 5712 (available from ATOFINA Petrochemichals), ethylene/propylene copolymers of the trade name Eltex P™, such as KS 414, KS 409, or KL 467 (available from Solvay Polymers), or those of the trade designation Novolen™, such as MC 3200 (available from Targor GmbH, Ludwigshafen, Germany).

[0036] The thickness of the heat-activatable adhesive layer when present is determined by the end-use of the adhesive tape typical thicknesses being in the range of about 30 to 300 µm.

[0037] If desired, the heat-activatable adhesive resin layer may also contain non-resinous ingredients, such as conventional additives. Such additives may include fillers, pigments, dyes, crosslinking agents, viscosity adjusting agents, dispersants, extrusion aids and mixtures thereof.

[0038] The adhesive tapes for splicing in connection with this invention typically will include a release liner protecting the adhesive surface of the adhesive tapes. Suitable release liners include those known in the art such as for example silicone based release liners.

Method of splicing

[0039] To splice two adhesive tapes together or to splice opposite ends of an adhesive tape, the ends of the adhesive tape(s) are arranged opposite to each other while leaving a gap between them. The size of this gap, i.e. the distance between the ends of the adhesive tapes being spliced can vary widely but is generally between 0.1 and 5 mm, preferably between 0.2 and 2 mm. Generally, the adhesive tapes are arranged on a temporary support or alternatively on a release liner so as to cover the gap on one major side.

[0040] The gap may then be filled with a liquid composition that can be hardened. Generally, the liquid composition is a composition that can be hardened upon exposure to heat or to irradiation with light such as for example UV light or visible light. Alternatively, the liquid composition may harden upon exposure to an electron beam radiation. The liquid composition may harden as a result of a polymerization reaction occurring and/or a crosslinking or curing reaction.

[0041] Preferably, the liquid composition will have a viscosity selected such that the gap can be readily filled although the viscosity should generally not be too low as this may cause the liquid to leak out of the gap before it can be hardened in the gap. Typically the viscosity should be between 1 000 and 20 000 mPa.s, preferably between 1 000 and 5 000 mPa.s.

[0042] Conveniently, the liquid composition will be of a similar or like nature as the adhesive tapes that are being spliced together as this will generally provide for a stronger bond between the respective ends of the adhesive tapes being spliced. Thus, when the adhesive tape comprises an acrylic pressure sensitive adhesive, it will generally be preferred to use a hardenable liquid that is based on acrylic monomers.

[0043] Thus, in a preferred embodiment for splicing acrylic pressure sensitive adhesive tapes as described above, the liquid composition may comprise one or more mono-functional acrylic monomers described above in connection with acrylic pressure sensitive adhesives. The liquid composition preferably also comprises one or more poly-functional monomers, i.e. cross-linkers as described above. When the liquid composition is intended to be hardened by an exposure to UV light or visible light, the composition should generally also include a photoinitiator as for example described above. The liquid composition may have a composition such that when hardened, a pressure sensitive adhesive results but such is not required and the liquid composition may also be selected such and/or hardened to a level that the resulting hardened composition does not have adhesive characteristics. Generally, when a large amount of cross linking agents is included in the liquid composition, the resulting hardened composition will not have adhesive characteristics.

[0044] The viscosity of the liquid composition may be adjusted by adding a thickening agent to the liquid composition such as for example an acrylic polymer or alternatively, the liquid may be exposed for a short time to irradiation or an electron beam so as to cause a slight polymerization or cross-linking for example up to a conversion level of not more than 20%, preferably not more than 10%.

[0045] Alternative liquid compositions that can be used for splicing include curable epoxy resin compositions and cross-linkable polyurethane compositions. However, because of their potential sensitivity to hydrolysis, polyurethane compositions will not be preferred where the splice may be subjected to water or moisture as for example in car door seals.

[0046] The hardenable liquid composition will generally be free of or substantially free of solvents. By the term substantially free of is meant that the amount of solvents is generally not more than 10% by weight, preferably not mote than 5% by weight and most preferably not more than 1% by weight.

[0047] When the adhesive tapes that are being spliced include release liners, it will generally be preferred to also join the release liners in the splice. This may conveniently be done by adhering an adhesive tape to the major side of the release liners that is opposite to the side of the release liner that is facing the adhesive surface of the adhesive tape. This provides the advantage that when the release liner is being removed by automatic equipment, the liner can be removed without interruption when a splice occurs in the adhesive tape.

[0048] Use of a spliced adhesive tape

[0049] The spliced adhesive tape can be used in sealing applications or can be used to adhere one article to another. In a particular embodiment, the spliced adhesive tape is used to adhere an article to a motor vehicle body, e.g. the body of a car, bus or truck. Examples of articles that may be adhered to the body of a motor vehicle include for example emblems, side protection strips, interior panels and trim.

[0050] In another embodiment, the spliced adhesive tape is used in a sealing application. For example, the spliced adhesive tape is particularly suitable for adhering a rubber gasket to the frame of a door or the frame of a door opening of a motor vehicle such as for example a car, bus or truck. Particularly suitable spliced adhesive tapes for adhering a rubber gasket are adhesive tapes that comprise on one major side a pressure sensitive adhesive and on the opposite major side a heat-activatable adhesive such as for example a heat-activatable polyolefin resin. The heat-activatable adhesive is typically used to adhere the adhesive tape to the rubber gasket and the pressure sensitive adhesive, e.g. an acrylic based one, is used to adhere to the frame of the door or door opening.

[0051] The invention is further described with reference to the following specific examples without however intending to limit the invention thereto.

Example 1

<u>Preparing the adhesive tape parts to be spliced</u>

[0052] A 40 cm long section of 10 mm wide dual functional adhesive tape, available as # 5402-F Tape from 3M Company (St. Paul, MN/USA) was cut cleanly into two 20 cm lengths using a razor blade. This tape bore an acrylic-based pressure-sensitive adhesive (PSA) on one side and a heat-activated polyolefin film on the other side. This tape is commonly used to adhere rubber door seals onto automobile doors. The heat-activated side of the tape is heat-bonded to a rubber gasket and the pressure-sensitive adhesive side of the tape is bonded to the car door. The pressure-sensitive adhesive side of the tape was protected by a polymeric film-based release liner.

[0053] The two adhesive tape sections to be spliced were arranged on the polyester support film so that PSA side of the adhesive tape was facing upwards.

<u>Preparation of a UV curable acrylic syrup</u>

[0054] An acrylic syrup comprising a mixture of polymer and monomer was prepared by first combining 87.5 parts by weight isooctyl acrylate (IOA), 12.5 parts by weight acrylic acid (AA), 0.25 parts by weight photoinitiator (2,2-dimethoxy-2-phenyl acetophenone, available as IRGACURE™ 651 from Ciba-Geigy), 0.055 parts hexanedioldiacrylate (HDDA), 4.0 parts by weight hydrophobic fumed silica (available as AEROSIL™ 972R from Degussa) and 8 parts by weight hollow glass microspheres (available as K-15 3M™ Scotchlite™ glass bubbles from 3M Company). The mixture thus prepared was polymerized in the absence of oxygen under UV lamps to a conversion of ca. 6 % by weight. The acrylic syrup comprising a mixture of polymer and monomer had a Brookfield viscosity of approx. 400 mPa s measured according to ASTM D4016-02.

<u>Preparing and curing the splice</u>

[0055] About 1 ml of acrylic syrup thus prepared was taken up in a pipette and introduced into the 1-2 mm space between tape ends, thus filling the gap between the two tape pieces.

[0056] The construction thus prepared was placed under a UV lamp, commercially available as OSRAM Ultra Vita Lux, 0928, 230 V AC, 300W, for 1 minute. The syrup was fully cured and converted to a pressure-sensitive adhesive mass.

[0057] The two sections of release liner were then connected to one another, with single-sided adhesive tape on each side of the release liner so as to obtain splice 4 as shown in Figure 1. As can be seen from figure 1, the pressure sensitive adhesive layer 5 and heat activatable adhesive layer 6 of the respective ends of the adhesive tapes have been joined to each other by the hardened acrylic syrup 7 while the ends of the release liner 2 have been joined by adhesive tapes 1 and 3.

[0058] This spliced construction of Example 1 was subjected to a tensile and elongation test according to DIN (Deutsche Industrie Norm) 53455 using a commercially available tensile tester (Model. 1435 from ZWICK GmbH). Tests were conducted at a crosshead speed of 300 mm / min. Elongation at break was recorded in percent as well as tensile strength at break (N/mm^2). The adhesive tape broke in the tape itself and not in the splice area, indicating that that the splice area had more cohesive strength than the tape itself.

[0059] A rubber seal was fixed to a car door using dual functional adhesive tape # 5402-F which contained three splices of the type described in Example 1. Water was unable to penetrate the closed car door in areas where a tape splice was present.

[0060] Test results are summarized in Table 1.

Comparative Example 1

[0061] Two sections of 3M tape # 5402-F bearing release liner on the pressure-sensitive adhesive side were employed as in Example 1. The two tape ends were arranged in an abutting fashion with the tape ends touching one another.

[0062] The two sections of release liner were then connected to one another, with single-sided adhesive tape on each side of the release liner to yield the splice 4 shown if Figure 2. In this figure 2, like layers have been designated with the same numerals as used in figure 1. As can be seen from a comparison of figure 1 and 2, the splice 4 of figure 2 does not include the acrylic syrup 7 and the adhesive layers 5 and 6 are abutting each other.

[0063] The spliced liner was removed before testing the tape construction. It was found that the abutting tape ends had developed a light adhesion to one another due to their inherent pressure-sensitive adhesive character. This construction was also subjected to the tensile and elongation test as described above. Results showed that little stress could be tolerated by the adhesive bond formed between the two abutting ends of the adhesive tape.

[0064] Rubber seals were mounted on car doors using the tape of Comparative Example 1 that has been stored in a continuous roll, adhered to and supported by the spliced liner. When a long section of this dual functional adhesive tape, bearing three sections where the two tape ends were lightly adhered together only by means of their inherent adhesive character, was used to put a rubber seal on a car door, the resulting seal in the door was not resistant to water penetration. Test results are summarized in Table 1.

Example 2

<u>Preparation of the tapes to be spliced</u>

[0065] A 40 cm long section of 10 mm wide acrylic pressure-sensitive adhesive tape bearing a film liner on one side and having a thickness of 1.2 mm, available as 5385-F Acrylic Foam Tape available from 3M Company (St. Paul, MN/USA) was cut cleanly into two 20 cm lengths using a razor blade. This tape has pressure-sensitive adhesive character on both exposed surfaces

[0066] The two pieces of adhesive tape bearing liner were arranged in a centered fashion on top of a 4 cm long section of 10 mm wide polyester support film having a thickness of 110 µm in such a manner that the adhesive tape liner was facing downwards and was adjacent to the polyester support film. The ends of the two adhesive tape pieces to be spliced together, respectively, were separated by a space of about 1-2 mm.

[0067] The two adhesive tapes were then secured to the polyester support film with a single-sided pressure-sensitive adhesive tape #851 splicing tape (from 3M Company, St. Paul, MN/USA).

[0068] The acrylic syrup described in Example 1 was introduced onto the gap between the two tape ends and cured completely using UV radiation as described in Example 1.

[0069] The splice of Example 2 was tested qualitatively by first removing the spliced construction from the polyester support film, grasping the each of the two adhesive tape pieces separately by the non-spliced ends and trying to pull the two tape pieces apart from one another. The adhesive tape ends were adhered strongly together and the spliced adhesive tape stretched before it broke. The splice remained in tact and the sample broke in the non-spliced area.

[0070] Test results are summarized in Table 1.

Example 3

[0071] Example 2 was repeated with the exception that a different acrylic foam tape was spliced. This tape was # 4222, a white acrylic foam tape having pressures-sensitive adhesive characteristics on both surfaces, having a width of 10 mm and a thickness of 0.8 mm, available from 3M Company, St. Paul MN/USA.
[0072] Tensile tests on spliced adhesive tapes of Example 3 showed that the spliced area was stronger than the acrylic foam tape itself. Test results are summarized in Table 1.

Table 1

Example	3M tape employed	Tape type	Splice type	Elongation at break, %	Tensile strength at break, N/mm^2	Splice resistance to water penetration
1	5402	Dual functional	UV curable Syrup	130*	0.48 *	YES
C1	5402	Dual functional	Liner splice only	None	None	NO
2	5385	PSA	UV curable Syrup	--- *	---- *	YES
3	4222	PSA	UV curable Syrup	300*	0.50*	YES

* Samples broke in the tape itself and not in the spliced area

Claims

1. Adhesive tape splice joining an end of a first adhesive tape to an end of a second adhesive tape or another end of said first adhesive tape, each of said first and second adhesive tape having opposite major sides and at least one of said sides having an adhesive surface, said splice comprising a hardened composition bonding said end of said first adhesive tape to said end of said second adhesive tape or to said other end of said first adhesive tape.

2. Adhesive tape splice wherein the first and second adhesive tape are of a same composition.

3. Adhesive tape splice according to any of claims 1 or 2 wherein said ends of said first and second adhesive tape are separated by a distance of between 0.1 and 2 mm and said hardened composition fills the gap defined between the ends of said first and second adhesive tape.

4. Adhesive tape splice according to any of the previous claims wherein said hardened composition is a composition obtainable by exposing a liquid to irradiation or electron beam.

5. Adhesive tape splice according to claim 4 wherein said liquid comprises a polymerizable and/or cross-linkable composition.

6. Adhesive tape splice according to claim 5 wherein said liquid comprises one or more acrylic monomers.

7. Adhesive tape splice according to any of the previous claims wherein said hardened composition is a pressure sensitive adhesive.

8. Adhesive tape splice according to any of the previous claims wherein said first and second adhesive tape comprise an acrylic foam layer.

9. Adhesive tape splice according to any of the previous claims wherein said both major sides of said first and second adhesive tape have a pressure sensitive adhesive surface.

10. Adhesive tape splice according to any of claims 1 to 8 where one of said major sides of said first and second adhesive tape has a pressure sensitive adhesive surface and the opposite side comprises a heat-activatable ad-

hesive layer.

11. Adhesive tape splice according to any of the previous claims wherein the adhesive surface of each of said first and second adhesive tape is protected with a release liner, the end of the release liner of the first adhesive tape being spliced to the end of the release liner of the second adhesive tape by a sheet of pressure sensitive adhesive tape adhered to the major side of the release liners that is opposite to the major side of the release liners facing the adhesive surface of the first and second adhesive tape.

12. Adhesive tape comprising one or more adhesive tape splices as defined in any of claims 1 to 11.

13. Use of an adhesive tape as defined in claim 12 for adhering an article to the body of a motor vehicle.

14. Use according to claim 13 wherein said article comprises a rubber seal and wherein said article is being adhered to the frame of a door or the frame of a door opening.

15. Method of making an adhesive tape splice comprising:

(i) providing a first and optionally second adhesive tape each having opposite major sides and at least one of said sides having an adhesive surface;
(ii) bringing one end of said first adhesive tape opposite one end of said second adhesive tape or bringing one of end of said first adhesive tape opposite another end of said first adhesive tape and leaving a gap between said ends;
(iii) filling said gap with a hardenable liquid composition; and
(iv) hardening said hardenable liquid composition.

16. Method according to claim 15 wherein said ends are separated from each other by a distance of between 0.1 and 2 mm.

17. Method according to claim 15 wherein said hardenable liquid composition comprises a polymerizable and/or cross-linkable composition.

18. Method according to claim 15 wherein said hardenable liquid composition comprises a precursor of a pressure sensitive adhesive.

19. Method according to claim 15 wherein said hardenable liquid composition comprises one or more acrylic monomers.

20. Method according to claim 15 wherein said hardenable liquid composition is hardened by exposing the hardenable liquid composition to irradiation or electron beam.

21. Method according to claim 15 wherein said first and second adhesive tape are the same.

22. Method according to claim 15 wherein said core comprises an acrylic foam layer.

23. Method according to claim 15 wherein said adhesive surface comprises a pressure sensitive adhesive.

24. Method according to claim 15 wherein each of said first and second adhesive tape have on one major side of the core a pressure sensitive adhesive and on the major side opposite thereto a heat-activatable adhesive.

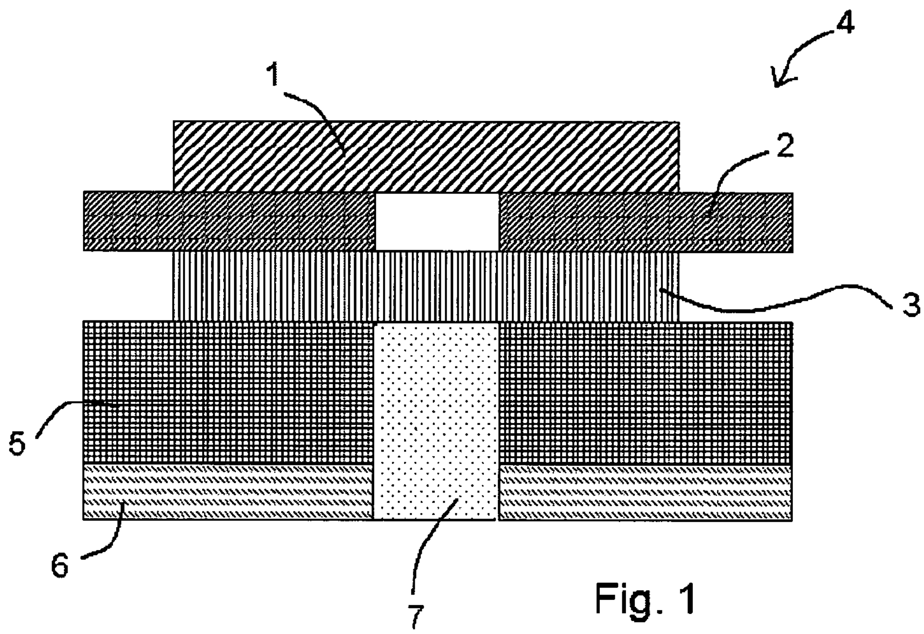

Fig. 1

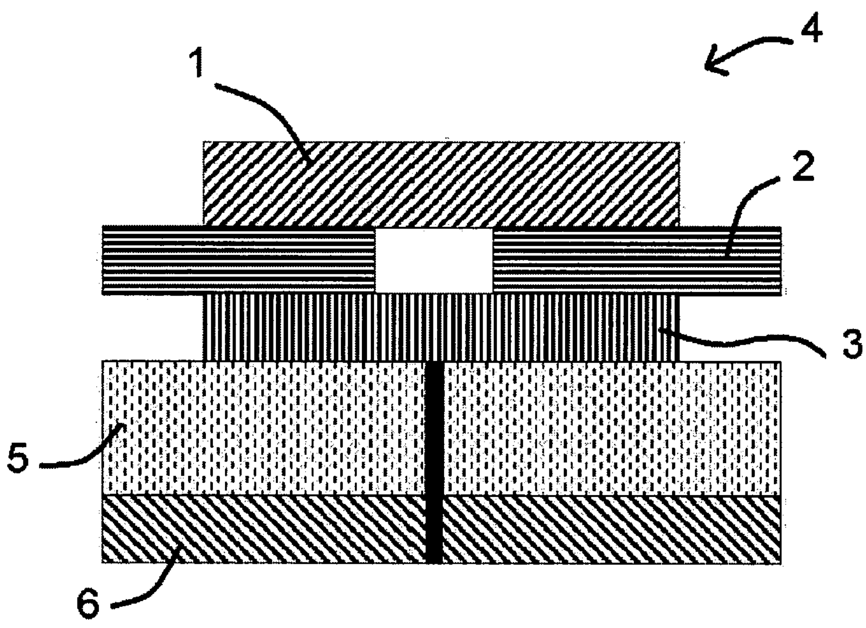

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 8391

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	11 March 2004	Hannam, M

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CATEGORY OF CITED DOCUMENTS

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