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(54) Abstract Title
Adhesive tape

(57) An adhesive tape such as, for example, a pressure-sensitive adhesive tape; comprises a substrate which includes a layer of polymer adjacent to a layer of fabric. An adhesive is provided at an outer surface of the substrate. The tape is characterized in that the polymer layer and the fabric layer of the substrate are bonded together independently of the outer surface adhesive. In one preferred embodiment the polymer layer is a film which is thermally bonded to the fabric layer. Alternatively, the polymer layer may be provided as a coating on the fabric layer applied by spraying or dipping.

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Adhesive Tape

The present invention relates to a tape, and in particular, to an adhesive tape such as, for example, a pressure-sensitive adhesive tape.

US patent no. 4 304 813 and European patent no. 0 466 342, the entire contents of which documents are incorporated herein by reference, disclose pressure-sensitive adhesive tapes having a substrate comprising a plastic film as a base or backing layer, and a fabric layer adjacent the film. A coating of pressure-sensitive adhesive is applied over an outer surface of the fabric layer and passes through the fabric to the film. The adhesive bonds the film and fabric layers together as a laminate.

By employing a fabric having a relatively open construction as described in the above-referenced documents, it is possible to produce a tape which is light-weight and has good distribution of the adhesive. The tapes disclosed in the above documents are also able to be readily torn by hand. Those tapes, however, have the disadvantage of relatively poor dimensional stability and are therefore easily distorted.

It is accordingly an aim of the invention to provide an improved adhesive tape which may exhibit the advantages of the prior art tapes described above without the same degree of susceptibility to distortion.

To this end, the present invention broadly provides an adhesive tape comprising a substrate including a layer of polymer material adjacent a layer of fabric, and an adhesive provided at an outer surface of said substrate, wherein the tape is characterized in that the polymer layer and the fabric layer of the substrate are independently bonded together without use of an adhesive.

The independent bonding of the polymer layer and the fabric layer in the substrate may be achieved by physical bonding, chemical bonding or a combination of both physical and chemical bonding. Desirably, however, the adhesive provided at the outer surface of the substrate may further enhance the bonding between the substrate layers.

In a first main embodiment of the invention the polymer layer of the adhesive tape substrate is in the form of a polymer coating applied to the fabric layer. The coating may be applied at just one or at both surfaces of the fabric layer (for example, by spraying or dipping) and the polymer coating preferably covers the full extent of fabric layer's surface. The polymer coating is furthermore preferably a thermoplastic polymer coating. The coating layer bonds physically with the fibres or filaments or yarns of the fabric layer. However, it may also bond chemically with compatible polymer fibres, filaments or yarns in the fabric layer.

In an alternative, second main embodiment, the polymer layer of the tape substrate is in the form of a film. The invention therefore preferably provides an adhesive tape comprising a substrate having a layer of polymer film and a layer of fabric adjacent to and in opposed face-to-face relation with the film, wherein the layer of polymer film and the layer of fabric are at least partially thermally bonded to one another. The heat bonding is effected between the opposed facing surfaces of the film and fabric layers. That is, the thermal bonding occurs at the interface between the layers.

In a preferred form of the invention the layer of fabric is thermally bonded to the film layer at a plurality of discrete locations over the interface between the fabric and the film. Desirably, the bond locations are relatively evenly distributed over the film-fabric interface area. Alternatively, the thermal bonding may be effected over substantially the entire area of contact between the fabric layer and the film layer.

In one form of the invention the adhesive properties of the tape are obtained from a coating of adhesive applied to an outer surface of the tape substrate. The outer surface of the substrate may be a surface of the fabric layer. On the other hand, however, the substrate may include a polymer layer on each side of the fabric layer. For example, the substrate may include a further layer of polymer film adjacent to and in opposed face-to-face relation with the other side of the fabric layer; i.e. such that the fabric layer is sandwiched between two film layers. The adhesive is then applied to an outer surface of one of the film layers.

The layer(s) of polymer film and the layer of fabric in the tape are typically in the form of substantially planar strips, each strip having two main (upper and lower) surfaces. The film and fabric layer strips typically have the same length and width dimensions (the thickness of the layers will typically differ, but may also be equal) and are superposed adjacent one another such that they are essentially coextensive.

In a preferred form of the invention the fabric is manufactured from yarn that includes at least some thermoplastic synthetic. Accordingly, the fabric may be manufactured purely from a thermoplastic synthetic yarn or, alternatively, the fabric may be manufactured from a combination or blend of different yarns which include a thermoplastic synthetic. The yarn in the fabric may also include a finish or component that promotes adhesion to the polymer layer; an example being a co-extruded yarn with one fibre type having low melt properties. For example, the yarn of the fabric preferably includes at least a proportion of PVC, polyurethane, polyester, polyethylene, polypropylene and/or polyamide. Upon heating, the thermoplastic softens and fuses to the polymer film. The yarn may also, however, include non-thermoplastic fibres or filaments such as rayon, viscose, or natural fibres such as cotton, flax, wool and/or silk.

The fabric itself may be manufactured according to any one of a variety of known techniques including knitting, weaving and

laying. More preferably, however, the fabric is manufactured with a "warp knitted-weft insertion" construction. Desirably, the fabric has a relatively open construction to facilitate distribution of the adhesive, in the case that the adhesive is applied to the surface of the fabric facing away from the polymer film. The fabric may optionally be manufactured such that it includes tape yarns in the weft and/or warp.

In a preferred form of the invention the film layer is manufactured from a thermoplastic polymer. Accordingly, upon heating, the film softens and fuses to the yarns of the fabric layer. In a very preferred form of the invention, both the yarn of the fabric layer and the film layer include a thermoplastic polymer (most preferably, the same polymer) such that heating causes a softening of both the fabric yarns and the film enabling a fusion welding between the layers.

The heat bonding or welding between the polymer film layer and the fabric is preferably achieved using non-contacting heating elements, i.e. heating elements which do not actually come into contact with the film or fabric layers. For example, radiant heating elements may be used. Alternatively, electro-magnetic wave radiation, such as microwaves, may be used to heat the film and/or the fabric. The opposing surfaces of the film and the fabric are in contact as they reach the appropriate temperature for thermal bonding. The contact may be generally across the entire interface area of the film and fabric layers or may only be at discrete locations over the opposing surfaces.

After a film layer and a fabric layer are thermally bonded to one another to form a tape substrate, a coating of adhesive may be applied to the outer surface of the fabric, i.e. that surface which faces away from the film. In one form of this invention the adhesive is pressed into and through the fabric, for example by calendering as in US 4 304 813 and EP 0 466 342, to create a further bond or adhesion between the fabric and the

plastic film. The adhesive is preferably a rubber gum pressure-sensitive adhesive as typically known in the art.

Accordingly, the present invention is able to provide a pressure-sensitive adhesive tape in which the fabric layer is bonded to the plastic film base layer both by thermal bonding as well as by adhesive bonding, thus rendering the yarns of the fabric substantially more dimensionally stable within the tape and significantly reducing the tape's susceptibility to distortion. There is therefore less tendency for the fabric yarns in the tape to shift (particularly with more open fabrics) as a result of the superior bonding between the fabric layer and the film layer.

According to another broad aspect the present invention provides a method of manufacturing an adhesive tape, comprising the steps of:
- forming a tape substrate by arranging a layer of polymer material adjacent to a layer of fabric and bonding said layers together over at least a portion of a surface area of said fabric layer without use of an adhesive, and
- applying an adhesive to an outer surface of the tape substrate.

In a first main embodiment, the layer of polymer material is in the form of a polymer coating applied to the fabric layer, for example by spraying or dipping, as described previously. The polymer coating may be applied to just one or to both surfaces of the fabric layer, and preferably covers the entire surface area. Furthermore, the polymer material is preferably a thermoplastic, and the fabric also preferably includes at least a proportion of thermoplastic fibres, filaments or yarn, as also describe above.

In a second main embodiment of the invention, the step of forming the tape substrate, comprises the steps of:
- arranging a layer of polymer film adjacent to and in opposed face-to-face relation with the layer of fabric, and

- thermally bonding said layers of polymer film and fabric together over at least a portion of an interface area between said layers to form the tape substrate. The fabric layer may be arranged adjacent to and in opposed face-to-face relation with the fabric layer by extrusion of the polymer onto the fabric. Such an extrusion process may also facilitate simultaneous bonding to the fabric layer, as the extruded polymer material may be sufficiently soft to fuse immediately to the yarns of the fabric.

In the event that the substrate only includes one film layer and one fabric layer, then the adhesive is preferably applied to an outer surface of the fabric layer, namely the surface facing away from the film layer. However, the substrate may include a further layer of polymer film bonded to the other side of the fabric layer, in which case the adhesive is applied over an outer surface of one of the film layers.

In a preferred form of the invention the layer of polymer film and the layer of fabric are in the form of substantially coextensive sheets, which may be thermally bonded together in a calender. That is, the sheets may be heated and brought into intimate bonding contact between a pair of calender rollers. Accordingly, the method further includes the step of cutting or slitting said sheet layers into elongate strips after the thermal bonding step. The step of applying the coating of adhesive may be performed either before or after the step of cutting the sheet layers into strips.

In a preferred form of the invention the thermal bonding includes heating either one or both of the polymer film layer and the fabric layer to a temperature at which a thermoplastic content thereof softens sufficiently to achieve a bonding or fusion between the layers. The heating step preferably includes the use of non-contacting heating elements such as radiant heaters or electromagnetic wave radiation heaters.

For assistance in arriving at an understanding of the invention, specific examples thereof are hereafter described way of illustration only. These examples may be read with reference to the preceding description but are no way intended to limit the generality of that description.

In one example of the invention a sheet of polyethylene film (thickness in the range of 20 to 40 μm) is superposed with a sheet of fabric. The sheet of fabric is a "warp knitted-weft inserted" fabric manufactured from yarns comprising a blend of polyester and polyethylene. For example, the weft yarns may be a blend of polyester and polyethylene. The fabric layer therefore includes at least a proportion of the same thermoplastic material (i.e. polyethylene) as the film layer.

The fabric and film sheets are brought into contact with one another between a pair of calender rollers, after and/or during heating of the sheets by radiant heating elements to such a temperature that the thermoplastic polyethylene component of the fabric and the film softens sufficiently to achieve heat bonding in the form of a fusion weld between the film and the fabric. The thermal bonding takes place over substantially the entire interface contact area between the fabric and film sheets.

After the thermal bonding of the fabric and film sheets, a coating of adhesive, such as a rubber gum pressure-sensitive adhesive, is then applied to the outer surface (i.e. the non-film facing surface) of the fabric. This application of the adhesive coating is preferably done by passing the now bonded sheets through a pair of calender rollers as described in US patent 4 304 813. The bonded and coated sheet is then cut or slit into elongate strips which are individually wound onto reels or spools to form the final adhesive tape product of the invention. The polymer layer of the tape substrate provides good release properties as the tape is peeled off the reel or spool during use.

In another example of the invention, a polyethylene polymer coating is deposited on both sides of a "weft knitted-warp inserted" fabric sheet by dipping that sheet in a bath of the polymer. The liquid polymer mechanically bonds with the fabric yarns but also, at least partially, forms fusion welds with a thermoplastic component of the fabric yarns which softens in contact with the molten polymer material. After the polymer coating process is finished and the substrate is complete, a pressure sensitive adhesive is applied to a surface of the substrate sheet, which is then slit and spooled as described previously.

As has previously been made clear, the invention allows for significant variation in the composition and construction of the fabric layer. The yarns making up the fabric may be a wide variety of combinations of synthetic, natural and artificial yarns. Furthermore, the yarns may be whole or partly mono- or multi-filament yarns, spun yarns (using rotor, ring, friction or any other known spinning technique), or in tape form including co-extended tape and filament yarns to which functional sizing is applied.

The composition blends of the yarns can essentially be in any percentages of yarn contribution provided that the fabric layer and the polymer layer of the tape of the invention are still capable of bonding in the required manner.

Claims

1. An adhesive tape comprising a substrate including a layer of polymer adjacent a layer of fabric, and an adhesive provided at an outer surface of the substrate, wherein the tape is characterized in that the polymer layer and the fabric layer of the substrate are independently bonded together without use of an adhesive.

2. An adhesive tape as claimed in claim 1, wherein the polymer layer of the substrate is in the form of a polymer coating applied to the fabric layer.

3. An adhesive tape as claimed in claim 2, wherein the polymer coating covers at least one surface of the fabric layer.

4. An adhesive tape as claimed in claim 3, wherein the polymer coating covers substantially the entire surface area of the fabric layer.

5. An adhesive tape as claimed in any one of claims 2 to 4, wherein the polymer coating is physically and/or chemically bonded with the fabric layer of the tape substrate.

6. An adhesive tape as claimed in claim 1, wherein the polymer layer of the tape substrate comprises a layer of polymer film, said film layer being adjacent to and in opposed face-to-face relation with the fabric layer.

7. An adhesive tape as claimed in claim 6, wherein the layer of polymer film and the layer of fabric are at least partially thermally bonded to one another.

8. An adhesive tape as claimed in claim 7, wherein the layer of polymer film and the layer of fabric

comprise substantially co-extensive planar strips and wherein the thermal bonding is effected at a contact interface between the layers.

9. An adhesive tape as claimed in claim 8, wherein the fabric and film layers are thermally bonded together at a plurality of discrete locations over said contact interface.

10. An adhesive tape as claimed in claim 9, wherein the bond locations are relatively evenly distributed over the interface between the film and fabric layers.

11. An adhesive tape as claimed in claim 8, wherein the thermal bonding is effected over substantially the entire contact interface between the fabric layer and the film layer.

12. An adhesive tape as claimed in any one of claims 6 to 11, wherein the substrate includes a further layer of polymer film disposed adjacent to and in opposed face-to-face relation with said layer of fabric.

13. An adhesive tape as claimed in any one of the preceding claims, wherein the fabric layer is manufactured from a yarn that includes at least some thermoplastic synthetic, preferably selected from the group comprising polyester, polyethylene, polypropylene and polyamide.

14. An adhesive tape as claimed in any one of the preceding claims, wherein the layer of polymer comprises a thermoplastic polymer, preferably selected from the group comprising PVC, polyurethane, polyester, polyethylene, polypropylene and polyamide.

15. An adhesive tape as claimed in any one of the preceding claims,
wherein the fabric layer is manufactured with a "warp knitted-weft insertion" construction, and wherein the fabric has a relatively open construction.

16. An adhesive tape as claimed in any one of the preceding claims,
wherein the adhesive is provided at a surface of said fabric layer and wherein the adhesive provides a further bond between the layer of fabric and the layer of polymer.

17. A method of manufacturing an adhesive tape comprising the steps of:
- forming a tape substrate by arranging a layer of polymer material adjacent to a layer of fabric and bonding said layers together over at least a portion of a surface area of said fabric layer without use of an adhesive, and
- applying an adhesive to an outer surface of the substrate.

18. A method as claimed in claim 17,
wherein the step of arranging the layer of polymer material adjacent to the layer of fabric includes coating the fabric layer with a liquid polymer, for example by spraying or dipping.

19. A method as claimed in claim 18,
wherein the bonding between the polymer layer and the fabric layer occurs as the polymer coating dries or sets.

20. A method as claimed in claim 18 or claim 19,
wherein the polymer coating is applied over at least one surface of the fabric layer.

21. A method as claimed in claim 20,
wherein the polymer coating is applied over substantially the entire surface area of the fabric layer.

22. A method as claimed in claim 17, wherein the step of forming the substrate comprises the steps of:
- arranging a layer of polymer film adjacent to and in opposed face-to-face relation with the layer of fabric material, and
- thermally bonding said layers of polymer film and fabric material together over at least a portion of an interface area between said layers.

23. A method as claimed in claim 22, wherein the step of thermally bonding said layers includes:
- heating either one or both of the polymer film layer and the fabric layer to a temperature at which a thermoplastic content thereof softens sufficiently to achieve a bonding or fusion between the layers when they are in contact, and
- bringing the layers into bonding contact beween a pair of calender rollers.

24. A method as claimed in claim 23, wherein the heating step includes the use of at least one heating element which does not make contact with either of the polymer film and fabric layers.

25. A method as claimed in any one of claims 22 to 24, wherein the step of forming the substrate includes arranging a further layer of polymer film adjacent to and in opposed face-to-face relation with the fabric layer and thermally bonding said film and fabric layers together.

26. A method as claimed in any one of claims 17 to 25, wherein the layer of polymer and the layer of fabric are substantially coextensive and wherein the substrate is in the form of a sheet, the method further comprising the step of:
- cutting or slitting said substrate sheet into elongate strips.

Application No: GB 0010392.9 13 **Examiner:** R.J.MIRAMS
Claims searched: 1 to 26 **Date of search:** 17 October 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B2E

Int Cl (Ed.7): B32B 27/12. CO9J 7/02.

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2124514A	(Venture Tape) whole document	at least 1, 6 to 8, 11 to 15, 17, 22, 23 and 25
X	EP1000992A1	(Sliontec) e.g. page 3 lines 23 to 26 and page 4 lines 8 to 25 & WO99/61541A1	at least 1 to 5, 14 and 16 to 21
X	EP0848048A2	(Japan Polychem) e.g. page 10 line 56 to page 11 line 7	at least 1 to 8, 11 to 15, 17 to 22 and 25
X	EP0569862A2	(Nitto Denko) whole document	at least 1, 6 to 8, 11, 13 to 17 and 22
X	EP0102331A1	(Bray) whole document	at least 1 to 8, 11, 14, 17, 22 and 23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Application No: GB 0010392.9 14 **Examiner:** R.J.MIRAMS
Claims searched: 1 to 26 **Date of search:** 17 October 2000

Category	Identity of document and relevant passage		Relevant to claims
X	WO97/24222A2	(MMM) whole document	at least 1 to 5, 13 to 15 and 17 to 19
X	US5246773A	(Mamish) whole document	at least 1 to 5, 13, 14 and 16 to 21
X	US5227225A	(Mamish) whole document	at least 1 to 5, 13, 14 and 16 to 21
X	US4636427A	(Ohno) whole document	at least 1 to 5, 12 to 15 and 17 to 21

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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A Document indicating technological background and/or state of the art.
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