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- **PATENT ABSTRACTS OF JAPAN vol. 096, no. 012, 26 December 1996 & JP 08 207499 A (TAKAMIZAWA YUKIO;TSUZUKI YAKUMO), 13 August 1996,**

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Description

Field of the invention

[0001] The present invention relates to an application film, and more particularly to an application film which can be advantageously utilized as an intermediate transfer member in the application of a marking member in a film or tape form to an adherend. Utilization of the application film according to the present invention, by virtue of its good balance between softness, rubber elasticity, and stiffness, enables the marking member to be satisfactorily applied to an adherend, particularly an adherend having irregularities or a severe three dimensional area, with good workability and without creating damage to the marking member. Therefore, the application film of the present invention can be advantageously utilized in the application of, for example, a marking film having a predetermined shape or decoration or the like to an adherend, such as an automobile or a motorcycle, or any other adherend.

Prior Art

[0002] Various application members for use in the application of a marking member to an adherend have hitherto been proposed in the art and actually put to practical use. For example, Japanese Unexamined Patent Publication (Kokai) No. 6-51702 discloses an application tape wherein a decorative pressure-sensitive adhesive sheet, having a predetermined shape, laminated on a release material is peeled off from the release material and transferred onto a contemplated adherend, wherein the backing for the tape has the following properties: 2% modulus load at a tensile speed of 0.2 m/min 3 to 4 kg/15 mm-width; and elongation at break not less than 50%. Since the backing for this tape has specific properties, the pressure-sensitive adhesive sheet can be satisfactorily transferred onto the application tape and, when applied to an adherend having a three dimensional area and irregularities, enables working to be easily performed with high efficiency. Further, in this case, advantageously, neither wrinkle nor introduction of air bubbles occurs.

[0003] Japanese Unexamined Patent Publication (Kokai) No. 7-138540 discloses an application film, for use in the application of a marking sheet, comprising a backing of a thermoplastic resin; and a pressure-sensitive adhesive layer provided on one side of the backing, the backing having higher softness and rubber elasticity than the marking sheet. Preferably, the backing for the application film is made of a soft vinyl chloride resin, and the film preferably has the following properties: 10% modulus load 1.5 to 2.5 kg/15 mm-width and maximum elongation 150 to 300%. The film thickness is 50 to 100 μm, and the thickness of the pressure-sensitive adhesive layer is 10 to 20 μm. This application film enables a marking sheet to be transferred without creating wrinkle and blushing even onto a surface having a convex microstructured surface.

[0004] The applicant of the present invention has also put an application tape on the market, and this tape is commercially available as "#331 Tape." For this application tape, a soft vinyl chloride resin is used as the backing, and properties of the backing are, for example, such that the tape thickness is about 68 gm, the thickness of the pressure-sensitive adhesive layer is about 7 μm, the 10% modulus load is 1.5 kg/15 mm-width, and the maximum elongation is 275%. The applicant of the present invention has put "Scotchcal™ 3650 film" on the market, as a marking film which can be used in combination with this application tape. For this application film, a soft vinyl chloride resin is used as the backing, and properties of the backing are, for example, such that the film thickness is about 80 gm and the maximum elongation is 54%. A-marking product comprising a combination of #331 application tape with Scotchcal™ 3650 film has been highly appreciated by many customers for years and used for application to various three dimensional sites in the field of exterior members of automobiles, motorcycles and so on.

[0005] Further, Scotchcal™ MB305W film and Scotchcal™ CS206C53 film, which are marking films having better applicability to three dimensional surface than Scotchcal™ 3650 film, are also commercially available. For the former film, urethane resin is used as a backing film, and properties of the film are such that the film thickness is about 53 μm and the maximum elongation is 256%. On the other hand, for the latter film, a backing film has a two layer structure of a soft vinyl chloride resin and urethane resin, and properties of the film are such that the film thickness is about 148 μm and the maximum elongation is 85%.

[0006] However, in recent years, there is a demand for the application of a marking product to a severer dimensional surface area than the current area mainly in the field of motorcycle exterior members such as fuel tank, fender, and so on. This demand cannot be sufficiently met by the marking product described in the unexamined publication noted above. Specifically, in the case of severe three dimensional areas in fuel tanks, fenders and so on, increasing the area of a portion on which a marking film is to be applied requires more and more careful application work so as not to cause creation of a wrinkle or introduction of air bubbles, resulting in remarkably deteriorated workability associated with the application of the film. in order to improve the workability associated with the application of the film, it is possible to reduce the thickness of the product film so as to cope with various shapes. In other words, it is possible to enhance the "shape conformability." Such a thin film, however, increases the possibility of breaking during work and, in addition,

is unsatisfactory in the so-called "stiffness," posing problems such as deteriorated workability, complicate registration, and, in some cases, sticking between the films during work. Furthermore, despite careful application work, it is impossible to avoid the creation of a wrinkle or introduction of air bubbles. Further, despite careful work, the marking film after the application is often damaged due to complicate shape in an area where the marking film is applied.

Problem to be Solved by the Invention

[0007] An object of the present invention is to solve the above problems of the prior art and to provide an application film which can be advantageously used as an intermediate transfer member in the application of a marking member to an ad-herend particularly in its severe three dimensional area and, at the same time, has a good balance between softness, rubber elasticity, and stiffness.

Summary of the Invention

[0008] According to the present invention, there is provided an application film for use as an intermediate transfer medium in the application of a marking member to an adherend, comprising a backing; and an adhesive layer provided on one side of the backing, the adhesive layer being applicable to the marking member,

wherein the backing, when tested at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127, has

a 10% modulus load of 0.3 to 1.6 kgf/15 mm,
a 10% modulus stress of 0.1 to 0.8 kgf/mm2,
a 100% modulus stress of 0.7 to 2.5 kgf/mm2, and
a rate of change of modulus stress of not less than 3.0. The term "rate of change of modulus stress" as used herein is a value determined by the following equation:

$$\text{Rate of change of modulus stress} = 100\% \text{ modulus stress}/10\% \text{ modulus stress.}$$

[0009] The present inventors have made various studies on the evaluation of workability associated with the application of a marking film with a view to finding a clue to the solution to problems of the conventional marking products and, as a result, have found that the property required of an application film for the application of a marking member to a severe three dimensional area is a good balance between softness, rubber elasticity, and stiffness. The "softness" is necessary because satisfactory flexibility and elongation are indispensable also for the application film per se in order to render the marking product conformable to a three dimensional area. The reason why the "rubber elasticity" is required is that, even though the softness is satisfactory, in the case of an application film, which is likely to undergo plastic deformation, slacking, which, at the time of application to a three dimensional area, is often created mainly near the end, remains as a wrinkle. By contrast, if the application film used has rubber elasticity, that is, has a wide elasticity region, the shrinking force of the application film can disperse the slack near the end, making it possible to perform application without causing any appearance problem. Further, the stiffness of the application film is also important. If the application film used is not satisfactorily stiff, the application film becomes excessively flexible upon separation of the release sheet from the film at the time of application of a marking member to an adherend, resulting in deteriorated retainability. This renders work, such as registration for application of a marking member, troublesome, resulting in remarkably deteriorated workability.

[0010] As is apparent from the following detailed description, according to the present invention, a material having properties capable of ensuring particularly excellent softness and rubber elasticity is selected as a backing for an application film, and the thickness of the backing is allowed to synergistically act on these properties to impart stiffness to the film.

Embodiment of the Invention

[0011] The present invention will be described with reference to the following preferred embodiments. In the following description, for easy understanding of the present invention, description is given with reference to a film as the marking member, that is, using the term "marking film."

[0012] Fig. 1 is an enlarged cross-sectional view showing one preferred embodiment of the application film according to the present invention. As shown in the drawing, an application film 10 comprises: a backing 1; and a pressure-sensitive adhesive layer 2 provided on one side of the backing 1, the pressure-sensitive adhesive layer 2 being applicable to a marking film (not shown). The application of a release sheet (not shown) onto the surface of the pressure-

sensitive adhesive layer 2, which is a common practice in the art, is preferred from the viewpoint of avoiding inadvertent sticking between the application films themselves or between the application film and other materials) during storage of the application film 10 in a roll form or other form or at the time of application to a marking film.

[0013] The backing used in the application film according to the present invention is not particularly limited so far as it has necessary softness. Suitable backings usable herein include, for example, soft vinyl chloride resin, urethane resin, polyolefin resin, and polyester resin with soft vinyl chloride resin and urethane resin being preferred. The backing may be constructed of one of these resins or alternatively a laminate of two or more of the above resins in combination.

[0014] The thickness of the backing may greatly vary depending upon desired effect. In general, however, it is preferably 85 to 160 gm. When the thickness of the backing is less than 85 gm, the stiffness of the resultant marking product is unsatisfactory, resulting in excessive softness of the whole product upon separation of a release sheet form a marking film before use of the product. The thickness of the backing is, if necessary, larger than 160 gm.

[0015] The properties of the backing used in the film are particularly important for the practice of the present invention. Specifically, the backing, when tested at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127, should have a 10% modulus load of 0.3 to 1.6 kgf/15 mm, preferably 0.3 to 0.6 kgf/15 mm, and a 10% modulus stress of 0.1 to 0.8 kgf/mm^2, preferably 0-1 to 0.5 kgf/mm^2, and a 100% modulus stress of 0.7 to 2.5 kgf/mm^2, and a rate of change of modulus stress of not less than 3.0, preferably not less than 5.0. When the modulus load and the modulus stress exceed the above respective upper limits, the softness is unsatisfactory, resulting in poor conformability to a three dimensional. When the rate of change of modulus stress is smaller than the above lower limit, the rubber elasticity is unsatisfactory. This causes a wrinkle to be likely created in the peripheral portion of the marking film. Preferably, the backing used herein has a maximum elongation of not less than 200%. When the maximum elongation is less than 200%, the application film cannot be satisfactorily elongated, making it impossible to attain the contemplated object.

[0016] The pressure-sensitive adhesive layer applied to one side of the backing is not particularly limited. Therefore, it may be formed in a suitable thickness using a pressure-sensitive adhesive commonly used in the art by a conventional coating method. An acrylic pressure-sensitive adhesive composed mainly of butyl acrylate, a rubber pressure-sensitive adhesive composed mainly of styrene-butadiene rubber (SBR), a urethane pressure-sensitive adhesive, a silicone pressure-sensitive adhesive, a vinyl acetate pressure-sensitive adhesive and the like, which have hitherto been commonly used in the art, may be mentioned as one example of suitable pressure-sensitive adhesives. Although the thickness of the pressure-sensitive adhesive layer formed by coating the above pressure-sensitive adhesive may widely vary, it is preferably about 10 to 20 μm.

[0017] The strength of adhesion of the pressure-sensitive adhesive layer, that is, the strength of adhesion of the application film to a marking film may be suitably selected by taking into consideration various factors, such as the material of the marking film to be applied, the adhesion of the marking film to an adherend, and working environment for application. In general, the strength of adhesion of the application film to the marking film is suitably in the range of from 10 to 800 gf/25 mm as measured according the procedure specified in JIS Z 0237. This strength of adhesion should be smaller than the strength of adhesion of the marking film to an adherend because in the final stage, the application film should be peeled off from the marking film.

[0018] As briefly described above, the pressure-sensitive adhesive layer of the application film is preferably protected by a release sheet until immediately before use. The release sheet used is not particularly limited and, hence, may be any one commonly used in the art. Suitable release sheets include, for example, sheets of a woven or nonwoven fabric, paper, and plastics, which have been treated for rendering them releasable. Suitable release agents include, for example, silicone release agents.

[0019] The application film may be supplied or stored in various forms. For example, it may be supplied in the form of a rolled tape having a predetermined width. Further, it may be cut into sheets having a desired size and supplied in the form of a desired number of sheets as one set. Furthermore, the application film may be supplied, as a marking product, in combination with the marking film.

[0020] The marking film to be transferred to an adherend through the application film according to the present invention is not particularly limited. For example, marking films noted above in connection with the description of the prior art, such as Scotchcal™ 3650 film, Scotchcal™ MB30SW film. and Scotchcal™ CS206C53 film, all manufactured by Minnesota Mining and Manufacturing Company, can be advantageously used.

[0021] The application of the marking film to an adherend using the application film according to the present invention as an intermediate transfer member may be carried out, for example, by the following procedure.

[0022] At the outset, an application film comprising a backing and a pressure-sensitive adhesive layer is provided. Separately, a marking film comprising a decorative film with a pressure-sensitive adhesive layer and a release sheet provided on the decorative film in its pressure-sensitive adhesive layer side is provided. The application film is applied to the marking film on its surface remote from the pressure-sensitive adhesive layer to form an intermediate transfer member composed of a marking film integrated with an application film, that is, a marking product.

[0023] After the formation of the intermediate transfer member, the intermediate transfer member is positioned on a

predetermined area of an adherend so that the application film faces upward, followed by fixation through the pressure-sensitive adhesive layer of the decorative film.

[0024] Depending upon the size of the marking product and the like, the above fixation may be performed by manual operation alone or, if necessary, in combination with an application device. According to the present invention, at the time of the fixation, the intermediate transfer member may be suitably elongated according to the state of a dimensional area or an adherend, neither creation of a wrinkle nor introduction of air bubbles occurs, and the intermediate transfer member may be intimately adhered to the surface of the adherend. After the completion of the fixation of the intermediate transfer member, the application film is peeled off from the decorative film of the marking film fixed to the adherend. Thus, a decorative film adhered to an adherend in its three dimensional area is prepared.

Examples

[0025] The present invention will be described with reference to the following examples. It should be understood that the present invention is not limited to these examples.

Example 1

Preparation of application film 1 (example of the invention)

[0026] A 145 μm-thick polyurethane film was prepared by extruding a thermoplastic polyurethane elastomer (polyester polyurethane, weight average molecular weight Mw = 5.67 x 10^5, number average molecular weight Mw = 7.54 x 10^4, Mw/Mn = 7.52). An acrylic pressure-sensitive adhesive composed mainly of butyl acrylate was uniformly coated on one side of the polyurethane film to a thickness of 20 μm. For the resultant "application film 1" having a pressure-sensitive adhesive, the 10% modulus load, the 100% modulus load, the maximum elongation, the 10% modulus stress, the 100% modulus stress, and the rate of change of modulus stress were measured at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127. The results are summarized in the following Tables 1 and 2.

Example 2

Preparation of application film 2 (example of the invention)

[0027] 33 parts by weight of dioctyl phthalate as a plasticizer, 15 parts by weight of a polyester plasticizer, and 2 parts by weight of an epoxidated soybean oil as a stabilizer were added to 100 parts by weight of vinyl chloride resin, and the resultant mixture was calendered to prepare a 86 μm-thick vinyl chloride resin film. Subsequently, an acrylic pressure-sensitive adhesive composed mainly of butyl acrylate was uniformly coated on one side of the vinyl chloride resin film to a thickness of 12 μm. For the resultant "application film 2" having a pressure-sensitive adhesive, the 10% modulus load, the 100% modulus load, the maximum elongation, the 10% modulus stress, the 100% modulus stress, and the rate of change of modulus stress were measured at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127. The results are summarized in the following Tables 1 and 2

Example 3

Preparation of application film 3 (example of the invention)

[0028] 26 parts by weight of dioctyl phthalate as a plasticizer, 14 parts by weight of a polyester plasticizer, and 2 parts by weight of an epoxidated soybean oil as a stabilizer were added to 100 parts by weight of vinyl chloride resin, and the resultant mixture was calendered to prepare a 146 gm-thick vinyl chloride resin film. Subsequently, an acrylic pressure-sensitive adhesive composed mainly of butyl acrylate was uniformly coated on one side of the vinyl chloride resin film to a thickness of 15 μm. For the resultant "application film 3" having a pressure-sensitive adhesive, the 10% modulus load, the 100% modulus load, the maximum elongation, the 10% modulus stress, the 100% modulus stress, and the rate of change of modulus stress were measured at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127. The results are summarized in the following Tables 1 and 2.

Example 4 (comparative example)

[0029] For comparison, #331 application tape (lot No. 33080326), commercially available from Sumitomo 3M Ltd., using vinyl chloride resin film as a backing was used as "application film 4".

[0030] The above backing film was prepared by adding 33 parts by weight of dioctyl phthalate as a plasticizer and

2 parts by weight of an epoxidated soybean oil as a stabilizer to 100 parts by weight of vinyl chloride resin and calendering the resultant mixture. The backing film had a thickness of 68 μm. A pressure-sensitive adhesive layer in the application tape was one prepared by uniformly coating an acrylic pressure-sensitive adhesive composed mainly of butyl acrylate on one side of the backing to a thickness of 7 μm. For the resultant "application film 41, having a pressure-sensitive adhesive, the 10% modulus load, the 100% modulus load, the maximum elongation, the 1006 modulus stress, the 100% modulus stress, and the rate of change of modulus stress were measured at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127. The results are summarized in the following Tables 1 and 2.

Table 1

Application Film	Modulus load (kgf/15 mm)		Maximum elongation (%)
	10%	100%	
1	0.31	1.6	650
2	0.53	2.7	318
3	1.6	4.5	270
4 (Comp. Ex.)	1.5	2.8	275

Table 2

Application Film	Modulus stress (kgf/mm^2)		Rate of change of modulus stress*
	10%	100%	
1	0.14	0.73	5.2
2	0.41	2.1	5.1
3	0.71	2.1	3.0
4 (Comp. Ex.)	1.4	2.8	2.0

*Rate of change of modulus stress 100% modulus stress/10% modulus stress

Example 5

[0031] This example demonstrates the use of an application film as an intermediate transfer member to transfer a marking film to an adherend. The application films prepared in Examples 1 to 4 were each applied to and intimately contacted with two marking films, Scotchcal™ 3650 film and Scotchcal™ CS206C53 film, commercially available from Sumitomo 3M Ltd. The resultant intermediate transfer members were cut into circles with the diameter varied from 50 to 100 mm in increments of 5 mm. A release sheet of the marking film was peeled off from the films in a circle form, and the films were then applied onto the surface of a sphere having a radius of 75 mm. The difficulty of applying the film to the surface of the sphere increased with an increase in diameter of the circle. The critical point at which the workability associated with the application or the circular film is deteriorated and a wrinkle is created (i.e., the maximum diameter of the circular film which can be applied) for each example is summarized in the following Table 3.

Table 3

	Marking Film	
Application film	3650	CS206C53
1	80 mm	95 mm
2	80 mm	90 mm
3	80 mm	90 mm
4 (Comp. Ex.)	60 mm	70 mm

[0032] As is apparent from the results given in Table 3, the use of the application film according to the present invention enables the workability associated with the application of a marking film to be improved over that for the conventional high-functional application film and can prevent the creation of a wrinkles.

Effect of the Invention

[0033] As is apparent from the foregoing description, the use of the application film according to the present invention enables a marking film to be easily applied even to areas having irregularities or severe three dimensional areas such as in fuel tanks and fenders, without drawbacks such as creation of wrinkles and introduction of air bubbles and, at the same time, offers very good workability. Further, the application film of the present invention is "stiff". This also offers good workability and easy registration, avoiding such inconvenience that films stick to each other during working. Furthermore, damage to the marking film after the application can be avoided by using the film according to the present invention.

BRIEF DESCRIPTION OF THE DRAWING

[0034] Fig. 1 is an enlarged cross-sectional view of one preferred embodiment of the application film according to the present invention.

[0035] Fig. 1 is an illustration of an application film 10 having a backing 1 and an adhesive layer 2.

Claims

1. An application film for use as an intermediate transfer medium in the application of a marking member to an adherend, comprising:

   a backing; and an adhesive layer provided on one side of the backing, the adhesive layer being applicable to the marking member,
   wherein the backing, when tested at a tensile speed of 200 mm/min according to the procedure set forth in JIS K 7127, has

   a 10% modulus load of 0.3 to 1.6 kgf/15 mm,
   a 10% modulus stress of 0.1 to 0.8 kgf/mm^2,
   a 100% modulus stress of 0.7 to 2.5 kgf/mm^2, and a rate of change of
   modulus stress (100% modulus stress/10% modulus stress) of not less than 3.0.

2. The application film according to claim 1, wherein the backing has a thickness of 85 to 160 μm.

3. The application film according to claim 1 or 2, wherein the strength of adhesion to the marking member is 10 to 800 gf/mm.

Patentansprüche

1. Applikationsfilm zur Verwendung als Zwischenübertragungsmedium bei der Applikation eines Markierungselements auf einen Haftgrund, umfassend: einen Träger; und eine Klebeschicht, die sich auf einer Seite des Trägers befindet, wobei die Klebeschicht auf das Markierungselement aufgebracht werden kann, wobei der Träger beim Testen mit einer Zuggeschwindigkeit von 200 mm/min gemäß dem in JIS K 7127 dargelegten Verfahren

   eine Belastung bei 10% Dehnung von 0,3 bis 1,6 kgf/15 mm,
   eine Spannung bei 10% Dehnung von 0,1 bis 0,8 kgf/mm^2,
   eine Spannung bei 100% Dehnung von 0,7 bis 2,5 kgf/mm^2 und eine Änderungsrate der Spannung (Spannung bei 100% Dehnung/Spannung bei 10% Dehnung) von nicht weniger als 3,0 aufweist.

2. Applikationsfilm gemäß Anspruch 1, wobei der Träger eine Dicke von 85 bis 160 μm hat.

3. Applikationsfilm gemäß Anspruch 1 oder 2, wobei die Haftfestigkeit des Markierungselements 10 bis 800 gf/mm beträgt.

Revendications

1. Film d'application à utiliser comme moyen de transfert intermédiaire dans l'application d'un élément de marquage sur un adhérent, comprenant : un support ; et une couche d'adhésif déposée sur une face du support, la couche adhésive étant applicable à l'élément de marquage,

   dans lequel le support, lorsqu'on l'essaye à une vitesse de traction de 200 mm/min. selon la procédure établie dans la norme JIS K 7127, a

   une charge de 0,3 à 1,6 kgf/15 mm pour un coefficient d'allongement de 10 %,
   une contrainte de 0,1 à 0,8 kgf/mm^2 pour un coefficient d'allongement de 10 %,
   une contrainte de 0,7 à 2,5 kgf/mm^2 pour un coefficient d'allongement de 100 %, et
   un taux de variation de la contrainte correspondant au coefficient d'allongement (contrainte correspondant au coefficient d'allongement de 100 % / contrainte correspondant au coefficient d'allongement de 10 %) non inférieur à 3,0.

2. Film d'application selon la revendication 1, dans lequel le support a une épaisseur de 85 à 160 μm.

3. Film d'application selon la revendication 1 ou 2, dans lequel la tenue en adhérence de l'élément de marquage est comprise entre 10 et 800 gf/mm.

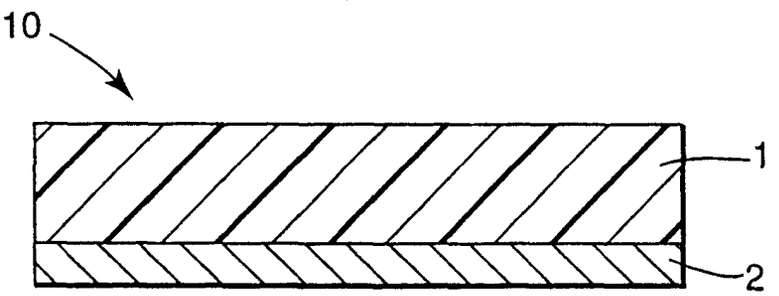

Fig. 1