

SPECIFICATION

Metallized decorative film laminate and process

Background of the Invention

Field of the Invention

The present invention relates to a metallized decorative film and a process for making it by applying the metallic film by transfer lamination. The decorative film can be used to apply decoration to a desired substrate, e.g., a motor vehicle.

Description of the Prior Art

Metallized decorative films which are suitable for exterior use and which contain a substantially transparent, plasticized film have been formed in the past by laminating the transparent film to a vacuum metallized film, e.g., a vacuum metallized polyester film, which is then overlaminated with a clear polyvinyl fluoride film which aids in protecting the polyester film from ultraviolet degradation. Such complex laminates are rather stiff and difficult to form into complex shapes and are subject to moisture degradation at the exposed edge of the lamination between the polyvinyl fluoride film and the polyester film.

Direct vacuum metallization of a flexible plastic film is difficult to accomplish since various ingredients in the film tend to "gas off" during the metallization process interfering with both the maintenance of the vacuum and the uniformity of the metal deposit. One solution to this problem has been the suggestion that a barrier layer of a long chain thermoplastic polyvinyl resin containing a large number of highly polar groups be placed over the plasticized resin and that this layer be metallized and then coated with a transparent film, U.S. Patent No. 2,993,806 to E.M. Fisher et al. Another solution which has been proposed in U.S. Patent No. 3,107,198 to L.E. Amborski et al. is to treat the metallized layer with a complex compound of the Werner type.

Summary of the Invention

The present invention provides a decorative film laminate which comprises:

- (a) a substantially transparent plastics film;
- (b) a metallic layer formed from one or more metals, alloys or metallic compounds having a thickness of from about 500 to about 12,500 Angstroms adhesively attached to one side of the plastics film; and
- (c) a layer of pressure sensitive adhesive attached to the metallic layer on the side of said metallic layer that is remote from the side attached to the plastics film.

The present invention also provides a method of forming such a laminate which comprises a method of forming the laminate

of Claim 1 which comprises:

- (a) Adhesively attaching a metallized transfer laminate to one side of the substantially transparent plastics film said transfer laminate having the metallic layer attached to a carrier film;

(b) stripping the carrier film from the product resulting from Step (a); and

- (c) attaching a layer of pressure sensitive adhesive to the side of the metallic layer which is remote from the side attached to the substantially transparent film.

The adhesive layer is optionally covered on its exposed surface by a release liner.

Brief Description of the Drawings

Certain preferred embodiments of the present invention are shown in greater enlarged cross-sectional view in the Drawings which accompany and form a portion of this specification wherein:

Figure 1 shows the substantially transparent plastics film to which the metallized layer is to be attached;

- Figure 2* shows the plastics film/metallic layer combination after the latter has been adhesively attached to the plastics film by transfer lamination and as the carrier film in the transfer laminate responsible for the transfer lamination step is being removed;

Figure 3 shows the laminate from Fig. 2 after application of a tie coat to the protective or release coating remaining from the transfer laminate used in the previous step; and

- Figure 4* shows a desired end product after a release liner and pressure sensitive adhesive have been attached to the tie coat in the laminate of Fig. 3.

Description of the Preferred Embodiments

Fig. 1 shows the substantially transparent plastics film 1 which may be any conventional, substantially transparent and flexible film known to persons of ordinary skill in the art of fabricating decorative pressure sensitive products. The term "substantially transparent" as used herein is intended to encompass those plastics films which are transparent enough to allow a viewer to perceive the decorative effect generated by the metallic layer in the laminate of the present invention. Preferably the thickness of the film 1 can range from about 0.05 mm. to about 0.5 mm., and the film can be a homo- or copolymer of vinyl chloride (the preferred film material), a polyester resin, a cellulosic material or the like. Films of this type are well known in the art and have been used heretofore in forming decorative laminates which differ in construction from the present laminate.

Fig. 2 shows the laminate subcombination that results when a thin metallic layer 2 is adhesively attached to the plastics film 1. This is accomplished by transfer laminating this

layer 2 to the film 1 by means of a "metal-
lized transfer laminate" which is indicated
generally by the reference numeral 10 in Fig.

2. Such laminates are well known but have
not hitherto been used to laminate thin metal-
lic layers to the type of substantially transpar-
ent plastics film used herein to form decora-
tive metallized laminates useful as decorative
trim, for example, on such substrates as motor
vehicles, and the like. Preferred metallized
transfer laminates of this type are available
under the trademark "Chromtex" from Kurz-
Hastings, Inc, Philadelphia, Pa.

The metallized transfer laminate comprises
an adhesive layer 3 attached to a thin metallic
layer 2 which is bonded to a carrier film 4,
preferably by means of a protective or release
coating 5. The metallized transfer laminate 10
is applied to the substantially transparent film
1 in such a way so as to adhesively bond
metallic layer 2 to film 1. The carrier film 4 in
the metallized transfer laminate 10 is then
stripped off as shown in Fig. 2.

The carrier film 4 may be formed of a
suitable flexible material capable of being
coated, if desired, by the resinous solution
which constitutes the protective or release
coating 5. Examples of suitable carrier films 4
are formed from polyethylene terephthalate,
crystallized copolymers of polyethylene tere-
phthalate and isophthalate, oriented polysty-
rene, polyvinyl fluoride, acetate coated paper,
and polyolefins, such as polyethylene and
polypropylene. The carrier film 4 can have a
thickness of from about 0.013 mm. to about
0.125 mm.

The protective or release coating 5 is prefer-
ably included in the metallized transfer lami-
nate 10 since it aids in stripping the carrier
film 4 from the laminate construction after the
metallic layer 2 has been adhesively bonded
to transparent film 1. The release coating 5
may be formed by coating the carrier film 4
and is preferably a resinous solution compris-
ing solvents which do not adversely affect the
film 4 and an organic solute not normally
compatible therewith. Some representative re-
lease coatings include the polyurethanes, sili-
cones, phenol formaldehyde solutions, solvent
systems of polyesters and combinations such
as methyl methacrylate, ethylene terephtha-
late, and ethylene isophthalate and water and
organic solvent systems of polyvinyl acetate
and polyvinyl chloride. The coating used to
form release layer 5 may be uniformly applied
by conventional coating techniques, such as,
direct roller coating, reverse roller coating or
by flexographic or rotogravure coating. The
release coating 5, when dried, constitutes a
layer which, while not bonded to the carrier
film 4 in any chemical sense, superficially
adheres to it.

The metallic layer 2, which is attached,
preferably to the surface of release coating 5,
may be formed of any metal such as gold,

silver, aluminum, magnesium, titanium,
nickel, zinc, copper, chromium, cobalt, sele-
nium or the like. Metallic compounds as well
as alloys can also constitute the layer. Alumi-
num or an aluminum alloy are often preferred
for reasons of economy and durability. The
thickness of this layer will range from about
500 to about 750 Angstroms to about
12,500 Angstroms. The films may be depos-
ited on the release coating 5 by the known
thermal evaporation or cathodic sputtering
techniques as described in U.S. Patent No.
2,993,806.

The nature of adhesive layer 3 in the metal-
lized transfer laminate 10 will depend upon
the character of the plastics film 1 to which it
will be attached. Heat activatable adhesives
that are compatible with plastics film 1 can be
used and include rubber-phenolic and polyes-
ter-isocyanate systems, polyurethane, and so-
lutions of vinyl chloride/vinyl acetate, vinyl
acetate/acrylate and vinyl acetate/maleate co-
polymers. Preferably, the selected adhesive
will dry to a water-white clear film and remain
clear even upon outdoor exposure.

Removal of the carrier film 4 from the
metallized transfer laminate 10/plastic film 1
combination will leave release coating 5 ex-
posed, if such a coating is present. When
such a coating is in the transfer laminate 10
for its release properties, it may be necessary
to apply a resinous tie coat 6 (as shown in
Fig. 3) to the exposed surface of release
coating 5 in order to provide a site for later
secure attachment of a layer of pressure sensi-
tive adhesive 7 and, if desired, a release liner
8 (as shown in Fig. 4). Tie coats which are
compatible with and thus have good anchor-
age to both release coating 5 and the desired
pressure sensitive adhesive 7 will adequately
serve the intended purpose. The tie coat
should also possess good cohesive strength so
that it will not be a site of internal failure in
the final laminate. Polyurethane tie coats hav-
ing the above-described compatibilities and
cohesive strength are one representative class
of tie coats that may be used.

Fig. 4 in the Drawings shows a preferred
and finished laminate of the present invention
wherein a layer of pressure sensitive adhesive
7 and a release liner 8 have been applied to
the exposed surface of the tie coat 6.

The pressure sensitive adhesive 7 which is
used in the present laminate may also be any
of the pressure sensitive adhesives which are
known and conventionally used in the art. As
for the applicable tacky, pressure sensitive
adhesives which may be utilized in the prod-
uct of this invention, they may be based upon
any elastomeric material such as: (1) natural
rubber; (2) synthetic rubbers including, for
example, styrene-butadiene copolymers, poly-
isobutylene, butadiene-acrylonitrile copolym-
ers, polychloroprene, and polyisoprene; (3)
acrylic copolymers containing at least 50 per-

cent, by weight, of a C_4 - C_{12} alkyl acrylate ester, i.e., an alkyl acrylate ester wherein the alkyl group contains from 4 to 12 carbon atoms, together with a hardening comonomer, for example, vinyl acetate, styrene, methyl methacrylate, methyl acrylate, ethyl acrylate, ethyl methacrylate and vinyl chloride; and (4) polymers of alkyl vinyl ethers such, for example, as polymethyl vinyl ether and polyethyl vinyl ether. Acrylic pressure sensitive adhesives are most preferred since they have the best balance of adhesive and cohesive properties for the present laminate. The thickness of the adhesive layer 7 will generally be in the range of from about 0.013 mm. to about 0.05 mm.

If the laminate of the present invention is to be manufactured at one location and used at another location, a release liner 8 is preferably affixed to the side of the pressure sensitive layer 7 which is furthest removed from film 1. The release liner 8 may be any of the release liners known to persons of ordinary skill in the art of making pressure sensitive products including removable, water soluble protective coatings, and the like. One preferred liner material is silicone coated release paper having a thickness of from about 0.05 mm. to about 0.3 mm. Of course, if the film/adhesive composite is to be manufactured and applied to a desired substrate at the same manufacturing location, a release liner may not be needed.

A preferred process for affixing the combination containing the film 1 and the pressure sensitive adhesive 7 and release liner 8 comprises transfer coating. In such a process, a fluid solution of the adhesive 7 is applied to the release liner 8, and the resulting composite is heated to dry the adhesive layer 7. The adhesive side of this adhesive/liner laminate is then laminated to the exposed surface of the protective layer 6 at a conventional lamination nip to form the product shown in Fig. 4.

When the laminate of the present invention is to be used, the adhesive layer 7 is brought into contact with a desired substrate and, when properly positioned, pressure is applied to securely affix it to a desired substrate, e.g. a motor vehicle.

The Example which follows illustrates certain preferred embodiments of the present invention.

EXAMPLE

This Example illustrates how one product of the present invention was made under laboratory conditions.

A transparent polyvinyl chloride (PVC) exterior grade film having a thickness of about 0.07 mm. was laminated to a release coated polyester film which had been metallized followed by coating of the metallized surface with a clear, light stable, heat activatable

adhesive ("No. 9353 Chromtex Smooth Gold 78 with 840 adhesive", available from Kurzhastings, Inc., Philadelphia, Pa.). This metallized transfer laminate was 0.02 mm. in thickness and had its adhesive side laminated to the matte or dull side of the PVC film by passing both films over a series of heated drums. This raised the temperature of the heat activatable adhesive to about 135°C. for proper activation and formation of a satisfactory bond of the metallized transfer laminate to the PVC film. The polyester film was then removed from the transfer laminate leaving a PVC film/adhesive/metal layer/release coated intermediate structure.

In order to satisfactorily bond pressure sensitive adhesive and release paper to the release coated side of the structure resulting from the previous steps, approximately 0.005 mm. of a polyurethane polymer tie coat was applied to the release coating. The polyurethane polymer that was used was a fully reacted polyurethane polymer supplied as a solution in toluene and isopropanol (available as "Milloxane LS-516" from Millmaster Onyx). After the tie coat layer was allowed to dry by being heated at 70°C. for 30 sec., a layer of about 0.025 mm. of pressure sensitive adhesive was applied to the tie coat layer by means of a conventional transfer technique. The adhesive that was used herein was a high molecular weight thermoplastic acrylic terpolymer, which is available as "Durotak 80-1053" from National Starch and Chemical Corp. In such a technique, the wet adhesive is coated directly onto release paper at a thickness of about 0.076 mm. followed by evaporation of the solvent by heating at 100°C. for 2 minutes. This is followed by lamination of the dried adhesive to the tie coat layer by passing the adhesive/release liner laminate and the PVC containing laminate through a laminating nip.

After lamination, a high level of adhesion was exhibited between the layer of pressure sensitive adhesive and tie coat. The resulting laminate is useful as a metallized film for such end uses as automobile trim.

The above Example shows a preferred embodiment of the present invention and should not be construed in a limiting sense. The scope of protection that is sought is given in the claims which follow.

120 CLAIMS

1. A decorative film laminate which comprises:

(a) a substantially transparent plastics film:

(b) a metallic layer formed from one or

more metals, alloys or metallic compounds having a thickness of from about 500 to about 12,500 Angstroms adhesively attached to one side of the plastics film; and

(c) a layer of pressure sensitive adhesive

attached to the metallic layer on the side of



cent, by weight, of a C₄-C₁₂ alkyl acrylate ester, i.e., an alkyl acrylate ester wherein the alkyl group contains from 4 to 12 carbon atoms, together with a hardening comonomer, for example, vinyl acetate, styrene, methyl methacrylate, methyl acrylate, ethyl acrylate, ethyl methacrylate and vinyl chloride; and (4) polymers of alkyl vinyl ethers such, for example, as polymethyl vinyl ether and polyethyl vinyl ether. Acrylic pressure sensitive adhesives are most preferred since they have the best balance of adhesive and cohesive properties for the present laminate. The thickness of the adhesive layer 7 will generally be in the range of from about 0.013 mm. to about 0.05 mm.

If the laminate of the present invention is to be manufactured at one location and used at another location, a release liner 8 is preferably affixed to the side of the pressure sensitive layer 7 which is furthest removed from film 1. The release liner 8 may be any of the release liners known to persons of ordinary skill in the art of making pressure sensitive products including removable, water soluble protective coatings, and the like. One preferred liner material is silicone coated release paper having a thickness of from about 0.05 mm. to about 0.3 mm. Of course, if the film/adhesive composite is to be manufactured and applied to a desired substrate at the same manufacturing location, a release liner may not be needed.

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(c) a layer of pressure sensitive adhesive

attached to the metallic layer on the side of

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- said metallic layer that is remote from the side attached to the plastics film.
2. A laminate as claimed in Claim 1 wherein the transparent plastics film is selected from a homopolymer of vinyl chloride, a copolymer of vinyl chloride, a polyester resin, and a cellulose material.
3. A laminate as claimed in Claim 1 wherein the transparent plastics film is from about 0.05 mm. to about 0.5 mm. in thickness.
4. A laminate as claimed in Claim 1 wherein the adhesive is a heat activatable adhesive.
5. A laminate as claimed in Claim 1 wherein a release coat layer and tie coat layer lie between the metallic layer and the pressure sensitive adhesive.
6. A laminate as claimed in Claim 1 wherein the pressure sensitive adhesive is an acrylic pressure sensitive adhesive.
7. A laminate as claimed in Claim 1 wherein a release liner is also present and is joined to the surface of the pressure sensitive adhesive.
8. A laminate as claimed in Claim 1 wherein the plastics film is polyvinyl chloride, the pressure sensitive adhesive is an acrylic adhesive and a release liner is also present and is attached to the surface of the pressure sensitive adhesive.
9. A method of forming the laminate of Claim 1 which comprises:
- (a) adhesively attaching a metallized transfer laminate of one side of the substantially transparent plastics film, said transfer laminate having the metallic layer attached to a carrier film;
- (b) stripping the carrier film from the product resulting from Step (a); and
- (c) attaching a layer of pressure sensitive adhesive to the side of the metallic layer which is remote from the side attached to the substantially transparent film.
10. A method as claimed in Claim 9 which further comprises applying a tie coat to the product resulting from Step (b) prior to application of the layer of pressure sensitive adhesive.
11. A method as claimed in Claim 9 wherein the pressure sensitive adhesive is attached to a release liner when attached to the metallic layer.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.