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(54) Title: MODIFIED SLUSH MOLDABLE TPU FOR INSTRUMENT PANELS WITH SEAMLESS AIRBAG DEPLOYMENT CAPABILITY

(57) Abstract: A vehicle instrument panel skin comprises residues of a thermoplastic urethane elastomer and a propylene-ethylene copolymer. The thermoplastic urethane elastomer includes a polyol, an organic diisocyanate, an optional chain extender, and an optional hindered amine light stabilizer and a benzotriazole ultraviolet stabilizing agent. A method for forming the instrument panel skin is also provided.

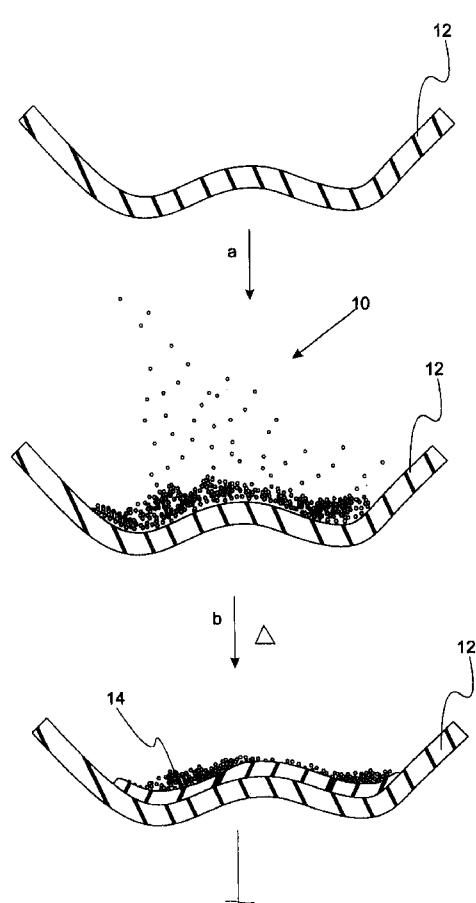


Fig. 1A



EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

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- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
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MODIFIED SLUSH MOLDABLE TPU FOR INSTRUMENT PANELS WITH SEAMLESS AIRBAG DEPLOYMENT CAPABILITY

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to resins that are useful for making instrument panel skins used in automobile interiors.

2. Background Art

10 Currently, three manufacturing processes dominate the vehicle instrument panel manufacturing arena. The dominant processes are slush molding, vacuum forming, and spray urethane. Although each process works reasonably well, there are associated issues.

15 Vacuum formed instrument panels have a hard "hand" and do not perform cleanly (no shredding or sharding) during -30°C airbag deployment at -30°C. Moreover, long term weathering has shown that these products become brittle. Spray urethane (aliphatic with inherent light stability and aromatic where a coating is required for weatherability) have less desirable "hand." Although the spray urethane exhibits property retention after aging and weathering, these materials also exhibit shredding and sharding during -30° seamless airbag deployment. Slush molding can utilize PVC and TPU elastomers. Although certain modified PVCs have acceptable 20 unpainted "hand" for instrument panels, the same materials tend to exhibit the same shredding and sharding issues during -30°C seamless airbag deployments.

Accordingly, there is a need for new material for forming vehicle instrument panels having acceptable aesthetic touch properties while exhibit proper function during low temperature airbag deployment.

SUMMARY OF THE INVENTION

The present invention solves one or more problems of the prior art by providing in at least one embodiment an instrument panel skin suitable for automobile interior applications. The instrument panel skin comprises residues of a thermoplastic urethane elastomer and a propylene-ethylene copolymer. Typically, the thermoplastic urethane elastomer includes a polyol, a chain extender, an organic diisocyanate, and a hindered amine light stabilizer and a benzotriazole ultraviolet stabilizing agent. Advantageously, the instrument panels of the present invention exhibit both improved touch characteristics while exhibiting acceptable low temperature airbag deployment characteristics.

In another embodiment, a method for forming the instrument panel skin set forth above is provided. The method of this embodiment includes a step of introducing a urethane-based resin composition and a propylene-ethylene copolymer into a mold tool. Typically, these compositions are in the form of a powder. The urethane based resin includes residues of a composition having polyol, a chain extender, an organic diisocyanate, and a hindered amine light stabilizer and a benzotriazole ultraviolet stabilizing agent. The urethane based resin composition is heated to a sufficient temperature to form a layer over at least a portion of the mold tool. Excess powder is poured from the mold tool and heating continued if necessary. The instrument panel skin is removed from the mold tool.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1A and 1B are pictorial flowchart depicting an embodiment for forming an instrument panel skin; and

FIGURE 2 is a pictorial flowchart depicting the application of a support structure to an instrument panel skin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Reference will now be made in detail to presently preferred compositions, embodiments and methods of the present invention, which constitute the best modes of practicing the invention presently known to the inventors. The 5 Figures are not necessarily to scale. However, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for any aspect of the invention and/or as a representative basis for teaching one skilled in the art to 10 variously employ the present invention.

Except in the examples, or where otherwise expressly indicated, all numerical quantities in this description indicating amounts of material or conditions of reaction and/or use are to be understood as modified by the word "about" in describing the broadest scope of the invention.

15 It is also to be understood that this invention is not limited to the specific embodiments and methods described below, as specific components and/or conditions may, of course, vary. Furthermore, the terminology used herein is used only for the purpose of describing particular embodiments of the present invention and is not intended to be limiting in any way.

20 It must also be noted that, as used in the specification and the appended claims, the singular form "a," "an," and "the" comprise plural referents unless the context clearly indicates otherwise. For example, reference to a component in the singular is intended to comprise a plurality of components.

25 Throughout this application, where publications are referenced, the disclosures of these publications in their entireties are hereby incorporated by reference into this application to more fully describe the state of the art to which this invention pertains.

With reference to Figures 1A and 1B, a pictorial flowchart depicting a slush molding method for forming an instrument panel skin is provided. The method of this embodiment comprises introducing urethane-based resin composition 10 into mold tool 12. At least a portion of mold tool 12 is made from a metal such as 5 stainless steel or nickel. Urethane-based resin composition 10 comprises a thermoplastic urethane elastomer composition and a propylene-ethylene copolymer. Suitable compositions for the thermoplastic urethane elastomer composition are the light stable aliphatic thermoplastic urethane elastomers set forth in U.S. Patent Nos. 5,824,738 and 6,187,859. The entire disclosures of these patents are incorporated by 10 reference in their entirety.

In a variation of the present invention, the thermoplastic urethane elastomer includes residues of a composition having a polyol and an organic diisocyanate. In a refinement, the thermoplastic urethane elastomer includes a chain extender. In a further refinement, the urethane base resin further includes a hindered 15 amine light stabilizer and/or a benzotriazole ultraviolet stabilizing agent.

In a subsequent step b), urethane based resin composition 10 is heated to a sufficient temperature to form layer 14 over at least a portion of mold tool 12. In one refinement, urethane based resin composition 10 is heated to a temperature between about 170° C and 250° C. In step c), powder is poured out from mold tool 12. 20 Mold is further heated if necessary so that all the powder melts. Finally, instrument panel skin 20 is removed from mold tool 12 in step e). Typically, instrument panel skin 20 has a thickness from about 0.5 mm to about 2 mm.

Urethane-based resin composition 10 optionally includes one or more pigments. In a refinement, the pigments are present in an amount from about 0.2 to 25 about 10 weight percent of the total weight of the urethane-based resin composition.

In a variation of the present embodiment, mold tool 12 has a texture surface that contacts urethane-based composition 10 to impart a texture surface onto instrument panel skin 20.

With reference to Figure 2, a flowchart showing the application of a backing to instrument panel skin 20 is provided. In step f), structural component 22 is applied to instrument panel skin 20. Such structural components are applied by any number of methods known to those skilled in the art. In one refinement, structural component 22 has a thickness from about 2 mm to about 20 mm. In some variations, foam resins such as Dow Specflex NM815 are utilized. In one variation, skin 22 may be placed in a mold that provides a predetermined shape and a urethane backing sprayed over the back of instrument panel skin 20. In another variation, structural component 22 can be molded onto instrument panel skin 20. In such circumstances 5 thermoplastic resins may be used.

10

As set forth above, instrument panel skin 20 comprises the residues of urethane-based resin composition that includes thermoplastic urethane elastomer composition and a propylene-ethylene copolymer. The propylene-ethylene copolymer used in the present embodiment is characterized by a number of physical 15 characteristics. In a refinement, the propylene-ethylene copolymer has a total crystallinity less than about 20 %. In another refinement, the propylene-ethylene copolymer has a flexural modulus (1% secant) from about 1500 psi to about 2500 psi and a Shore A hardness from about 40 to about 80 (ISO 898 ASTM D2240). Examples of useful propylene-ethylene copolymers include, but are not limited to the 20 VersifyTM line or elastomers commercially available from The Dow Chemical Company. VersifyTM 2400 is found to be particularly useful. Typically, the propylene-ethylene copolymer is present in an amount from about 1 to 25 weight percent of the urethane-based composition. In yet another refinement, the propylene-ethylene copolymer is present in an amount from about 5 to 20 weight 25 percent of the urethane-based composition. In still another refinement, the propylene-ethylene copolymer is present in an amount of about 20 % weight percent of the urethane-based composition.

The instrument panel skins of the present invention are found to have significant heat stability. In particular, the elongation properties are found to vary by 30 less than 10% after 500 hours aging at 120°C.. Moreover, the instrument panel skins

5 maintain sufficient elongation to pass a -30°C seamless airbag deployment test before and after heat aging 400 hours at 107°C. In a refinement, the instrument panel skins have a combination of low glass transition temperature and retained elongation greater than about 100% after aging for 500 hours at 120°C. Although the operation of the present invention is not limited to any particularly theory, it is believed that the use of the propylene-ethylene copolymer at least partially responsible for these properties.

10 As set forth above, the thermoplastic skin of the present invention includes the residues of a polyol. Suitable polyols are disclosed in U.S. Patent Nos. 5,824,738 and 6,187,859. Specific examples, include, but are not limit to polyether polyols. In a variation, the polyol is formed in a process utilizing an organometallic catalyst that results in a polyol having a low level of terminal unsaturation. In one refinement, the polyol has a level of terminal unsaturation less than about 0.04 meq/g. In another refinement, the polyol has a level of terminal unsaturation less than about 0.02 meq/g. A representative example of such a polyol is Poly L 255-28 (sold by Olin 15 corporation, Stamford, Connecticut). Poly L 255-28 is a ethylene oxide capped poly (propylene oxide) polyol with an approximate molecular weight of 4000 and a hydroxyl number of 28. The polyol component can be present in amounts ranging from approximately 40% to 70% of the total weight of the thermoplastic urethane elastomer composition. in a refinement, the polyol is present in an amount between 20 40% and 60% of the total weight of the thermoplastic urethane elastomer composition. The amount of polyol is adjusted in this range to vary the hardness of the elastomer produced.

25 In a variation of the present embodiment, the thermoplastic urethane elastomer composition includes a chain extending agent. Suitable chain extending agents include aromatic secondary or aliphatic primary or secondary diamines, ethylene glycol, diethylene glycol, propylene glycol, pentane diol, 3-methylpentane-1,5-diol, hexane diol, HQEE [hydroquinone bis(2-hydroxyethyl) ether], CHDM (1,4-cyclohexanedimethanol), and HBPA (hydrogenated bisphenol A). A particularly useful chain extender is 1,4-butanediol. In a refinement, such chain 30 extenders are present in concentrations varying from 6 weight % to 15 weight % of

the total weight of the thermoplastic urethane elastomer composition. In another refinement, the chain extenders are present in an amount from 7% to 13% of the total weight of the thermoplastic urethane elastomer composition.

The thermoplastic urethane elastomer composition used in the present embodiment includes one or more isocyanates. Suitable isocyanates include aliphatic organic diisocyanates, or mixture of diisocyanates. Specific examples of organic isocyanates include, but are not limited to, (TMXDI) meta-tetramethylxylene diisocyanate and paratetramethylxylene diisocyanate, isophorone diisocyanate (IPDI), dibenzyl diisocyanate, xylene diisocyanate (XDI), 3, 3'-bis toluene-4,4-diisocyanate, hexamethylene diisocyanate (HDI), hydrogenated MDI, hydrogenated XDI, cyclohexane diisocyanate, paraphenylene diisocyanate, mixtures and derivatives thereof and the like. In a refinement, the organic diisocyanates are present in an amount from 20 weight % to 50 weight % of the total weight of the thermoplastic urethane elastomer composition. In another refinement, the organic diisocyanates are present in an amount from 25 weight % to 40 weight % of the total weight of the thermoplastic urethane elastomer composition.

As set forth above, the thermoplastic urethane elastomer composition may include an ultraviolet stabilizing agent. Suitable ultraviolet stabilizing agents may include a combination of a hindered amine light stabilizers (HALS) and a benzotriazole. Examples of HALS include, but are not limited to, bis(1,2,2,6,6-pentamethyl-1-4-piperidinyl) sebacate (Chemical Abstract Number 41556-26-7, also known as Tinuvin 292 or 765 Ciba-Geigy Corp., Hawthorne, NY). Examples of benzotriazoles include hydroxyphenyl benzotriazoles such as a benzotriazole mixture of poly (oxy-1,2-ethanediyl), alpha- [3-[3- (2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxyphenyl]- 1-oxopropyl]-omega-hydroxy- and poly (oxy-1,2-ethanediyl), alpha- [3-[3- (2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxyphenyl]- 1-oxopropyl]-omega-[3-[(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxyphenyl]-1-oxopropoxy]-, Chemical Abstract Number 104810-47-1 and polyethylene glycol with a molecular weight of 300 Chemical Abstract Number

25322-68-3 (also known as Tinuvin 1130 or 213 Ciba-Geigy Corp., Hawthorne, N.Y.) and any other suitable ultraviolet stabilizing agents. In a refinement, the combination of ultraviolet stabilizing agent are present in a ratio in a range of approximately 1:1 to 2:1 by weight. In another variation, the total concentration of ultraviolet stabilizing 5 agents are present in an amount from about 0.5 to 2.0 weight %, of the total weight of the urethane elastomer composition.

In another variation of the present invention, the urethane elastomer composition includes an antioxidant. Virtually any suitable antioxidant, or mixture of antioxidants, may be used in the practice of the present invention. Representative 10 examples include, but are not limited to, Irganox 1010 [tetrakis (methylene(3,5-di-tert-butyl-4-hydroxycinnamate)] methane from Ciba-Geigy; Irganox 1076 [Octodecyl 3,5 di-tert-butyl-4-hydroxyhydrocinnamate] from Ciba-Geigy; Irganox 245 [Ethylene bis (oxyethylene) bis-(3-tert-butyl-4-hydroxy-5-methylhydrocinnamate)] from Ciba-Geigy; and Vanox 15 830 (a proprietary blend of a phenolic compound, alkylated diphenylamines and trialkyl phosphite from R. T. Vanderbilt). The antioxidants may be present at a total concentration in a range of approximately 0.10 weight % to 1.0 weight % of the total weight of the urethane elastomer composition. In another refinement, the antioxidants may be present at a total concentration in a range of approximately 0.25 weight % to 20 0.75 weight % of the total weight of the urethane elastomer composition.

The following examples illustrate the various embodiments of the present invention. Those skilled in the art will recognize many variations that are within the spirit of the present invention and scope of the claims.

Table 1 provides the compositions of several test samples that were 25 used to form skin layers via a slush molding process as set forth above. The components are blended together in a Leistritz twin screw extruder. The resulting pellets are cyrogenically ground into a powder, dried, and molded into test panels using a Ford random square grain tool. Table 2 provides the properties of skins made from the test compositions. The aacct Elongation at break is after 500 hrs at 120 C.

Table 1. Sample compositions

Sample No.	1	2	3	4	5	6
Bayer Texin DP7- 3042 3597478 lot 6236 (TPU composition)	73.00	63.00	73.00	63.00	73.00	63.00
Dow Versify 2400	20.00	30.00				
Dow Versify 3401			20.00	30.00		
Dow Versify 4200					20.00	30.00
Clariant 3T4A Medium Dark Pebble Concentrate (pigment)	7.00	7.00	7.00	7.00	7.00	7.00
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Table 2. Physical properties.

Sample No.	Method	Requirements	1	3	5
Skin Thickness	ISO 4593 AST, D374 Method C	0.5-2.0 mm or as specified on engineering document	Thickness, mm: 1.00	Thickness, mm: 1.02	Thickness, mm: 1.08
Hardness Shore "A" (ASTM D2240)	ISO 898 ASTM D2240 15 s dwell	80-90 or as specified on engineering document	Mean: 70	Mean: 68	Mean: 79
Tear Strength	ISO 34 Method B Proc (ASTM D624) kN/M Die C	40 kN/m ASTM D624, Die C, 50m mm/min	Mean: 31.4	Mean: 28	Mean: 29
Tensile Strength at maximum load	ISO 527-2 50 mm/min (D3574 MPa)	25 MPa	Mean: 4.4	Mean: 4.6	Mean 4.4
Elongation at break	ISO 527-2 50 mm/min	600%	Mean: 200 σ 19	Mean: 230 σ 28	Mean: 206 σ 17

Sample No.	Method	Requirements	1	3	5
Resistance to Heat Aging Color Stability(AATCC color test)	ISO 188 Method B ASTM E145 Type II A 500 hr 120°C ISO 105-A02 AATCC Proc. 1	Rating 3 minimum No tackiness, spewing, or staining. Hue change in the positive delta b should be reported. Spotty or non-uniform staining cause for rejection. Color shift reversals after 16 hrs Xenon acceptable. Topcoated & two-tone tst per 3.8.2 after color & gloss	Rating: 5 ΔE: 0.581 Δb: 0.042	Rating: 5 ΔE: 0.712 Δb: 0.710	Rating: 4-5 ΔE: 0.512 Δb: 0.500
Cold Flexibility	180° at -20C with 19-20 mm mandrel 50 mm x 150 mm	No cracks	No cracks	No cracks	No cracks
Elongation at break	ISO 527-1 Type 2 ASTM D638 Mill 100 mm/min remove foam	-5% change from original	(0%) Mean: 200 σ 3.6 Original: 200	(-8.69%) Mean: 210 σ 27 Original: 230	(-44%) Mean: 115 Original: 206

Sample No.	Method	Requirements	1	3	5
3.7.7 Fogging	SAE J1756 3 hr at 100°C, 21°C cooling, post condition 1 & 16 hrs	70 minimum N clear film droplet or crystals	1 h 90(94,95,82) Droplets throughout 16 h 99(99,98,98)	1 h 94(96,94,93) Droplets & iridescence 16 h 99(99,98,98) Droplets	1 h 97(97,98,96) Slight fog 98(98,98,97) Slight fog 16 h
Resistance to Fade, SAE J1885	Xenon Arc Weatherometer, min (SAE J1885, ISO 105/A02/AATCC Evaluation Procedure 1	1504 kJ/m ² exposure, min Rating 3- 4 min	489 kJ Sample 1 ΔE : 0.855 Sample 2 ΔE : 0.834	489 kJ Sample 1 ΔE : 0.302 Sample 2 ΔE : 0.234 ΔE : 0.141	489 kJ Rating: 4-5 kJ Rating: 4-5 489 kJ ΔE : 0.141 489 kJ ΔE : -0.003 489 kJ Db: -0.160
Mandrel Bend after 489 kJ	19-20 mandrel, 180° , remove foam	No cracking, 180° in 19-20 mm mandrel	No cracks	No cracks	No cracks

Sample No.	Method	Requirements	1	3	5
Resistance to Fade	Xenon Arc Weatherometer, min (SAE J1885, ISO 105/A02/AATCC Evaluation Procedure 1	1504 kJ/m ² exposure, min Rating 3-4 min	1504 kJ Sample 1 ΔE : 0.589 Sample 2 ΔE : 0.682	1504 kJ Sample 1 ΔE : 0.401 Sample 2 ΔE : 0.417	1504 kJ Sample 1 ΔE : 0.245 Sample 2 ΔE : 0.264
Mandrel Bend after 1504 kJ	19-20 mandrel, 180°, remove foam	No cracking, 180° in 19-20 mm mandrel			No cracks
Cold Impact	FLTM BO 151-02, 35°C, 90° pendulum angle	Rating 0 max	Rating: 0	Rating: 0	Rating: 0
Resistance to Abrasion	SAE J948 Taber, 250 cycles, 500 gram weight, CS10 wheels	Must be compatible with the unabraded adjacent area	Sample compatible with the unabraded adjacent area	Sample compatible with the unabraded adjacent area; slight color transfer from wheels; grain is intact	Sample compatible with the unabraded adjacent area; slight color transfer from wheels; grain is intact

Sample No.	Method	Requirements	1	3	5
Resistance to Scuffing	SAE J365 250 cycles	No evidence of lifting, peeling or excessive scuffing. Must be compatible with adjacent unscuffed area	Evidence of excessive scuffing. Sample is not compatible with adjacent unscuffed area	Sample is not compatible with adjacent unscuffed area; scuffing is not excessive	Sample is not compatible with adjacent unscuffed area; lifting and peeling
Resistance to Marring	SAE J365 10 cycles	No severe change in gloss, mar can be removed with 4 rubs of the thumb across mar	No change in gloss, mar can be removed with 4 rubs of the thumb across mar	No change in gloss; mar can be removed with 4 rubs of the thumb across mar	No apparent change from original state
Resistance to Scratching	FLTM BN108-13	Rating 1 max at 2N with 1 mm Rating 1 max at 2N with 7 mm	2N Rating 1mm: 1 2N Rating 7mm: 1	2N Rating 1mm: 1 2N Rating 7mm: 1	2N Rating 1mm: 1 Rating 7mm: 1
Specific Gravity	ASTM D792		1.06	1.05	1.042

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be
5 made without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

- 1 1. An instrument panel skin comprising:
2 residues of a composition having polyol, a chain extender, an organic
3 diisocyanate, and a hindered amine light stabilizer and a benzotriazole ultraviolet
4 stabilizing agent; and a propylene-ethylene copolymer;
- 1 2. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer is present in an amount from about 1 to 25 weight percent of the
3 urethane-based composition.
- 1 3. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer is present in an amount from about 5 to 20 weight percent of the
3 urethane-based composition.
- 1 4. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer is present in an amount from about 10 to 15 weight percent of the
3 urethane-based composition.
- 1 5. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer has a total crystallinity less than about 20 %.
- 1 6. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer has a flexural modulus (1% secant) from about 1500 psi to about
3 2500 psi.
- 1 7. The instrument panel skin of claim 1 wherein the propylene-
2 ethylene copolymer has a Shore A hardness from about 40 to about 80.
- 1 8. The instrument panel skin of claim 1 wherein the polyol is a
2 polyether polyol.

9 The instrument panel skin of claim 1 wherein the polyol has
4 less than about 0.04 meq/g terminal unsaturation.

11 The instrument panel skin of claim 1 wherein the isocyanate
is present in an about of about 20 to 50 weight percent.

12 The instrument panel skin of claim 1 wherein the urethane
2 based composition further includes at least one antioxidant or a residue thereof.

1 14. The instrument panel skin of claim 1 having at least one
2 textured surface.

1 15. A method of forming a instrument panel skin, the method
2 comprising:

3 a) introducing a urethane-based resin composition into a mold
4 tool, the urethane base resin comprising:

5 residues of a composition having polyol, a chain extender, an organic
6 diisocyanate, and a hindered amine light stabilizer and a benzotriazole ultraviolet
7 stabilizing agent; and

8 a propylene-ethylene copolymer;

11 c) pouring out powder from the mold tool;

12 d) optionally continuing to heat the mold tool so that all the
13 powder melts; and

14 e) removing the instrument panel skin from the mold tool.

1 16. The method of claim 15 wherein the propylene-ethylene
2 copolymer is present in an amount from about 1 to 25 weight percent of the urethane-
3 based composition.

1 17. The method of claim 15 further comprising:
2 f) applying the instrument panel skin to a structural component.

1 18. The method of claim 1 wherein step f) comprising spraying a
2 urethane composition to the instrument panel skin.

1 19. The method of claim 1 wherein step f) comprising molding the
2 structural component onto the instrument panel skin.

1 20. The method of claim 1 wherein the mold tool has a texture
2 surface that contacts the urethane-based composition to impart a texture surface onto
3 the instrument panel skin.

1/3

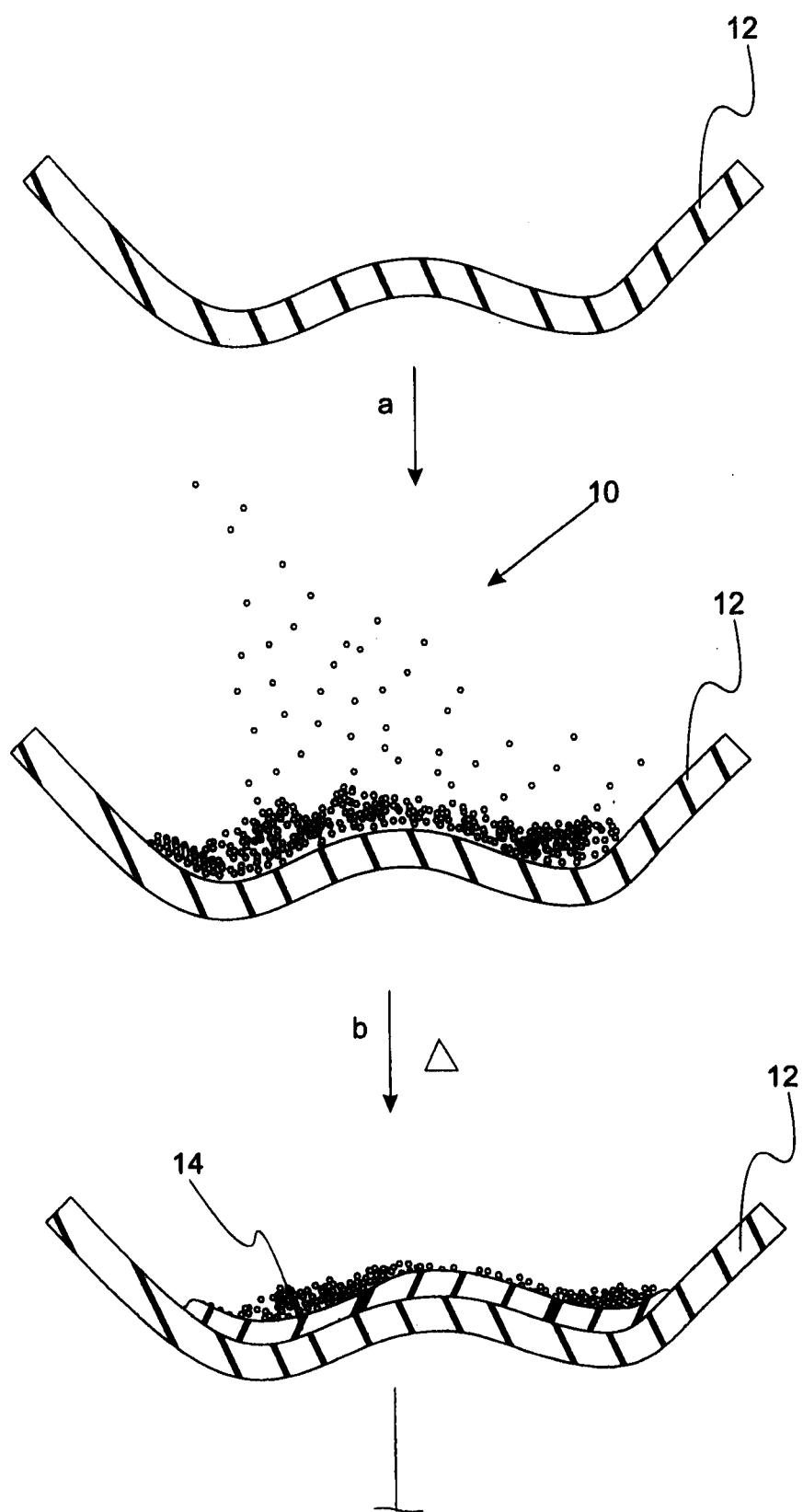


Fig. 1A

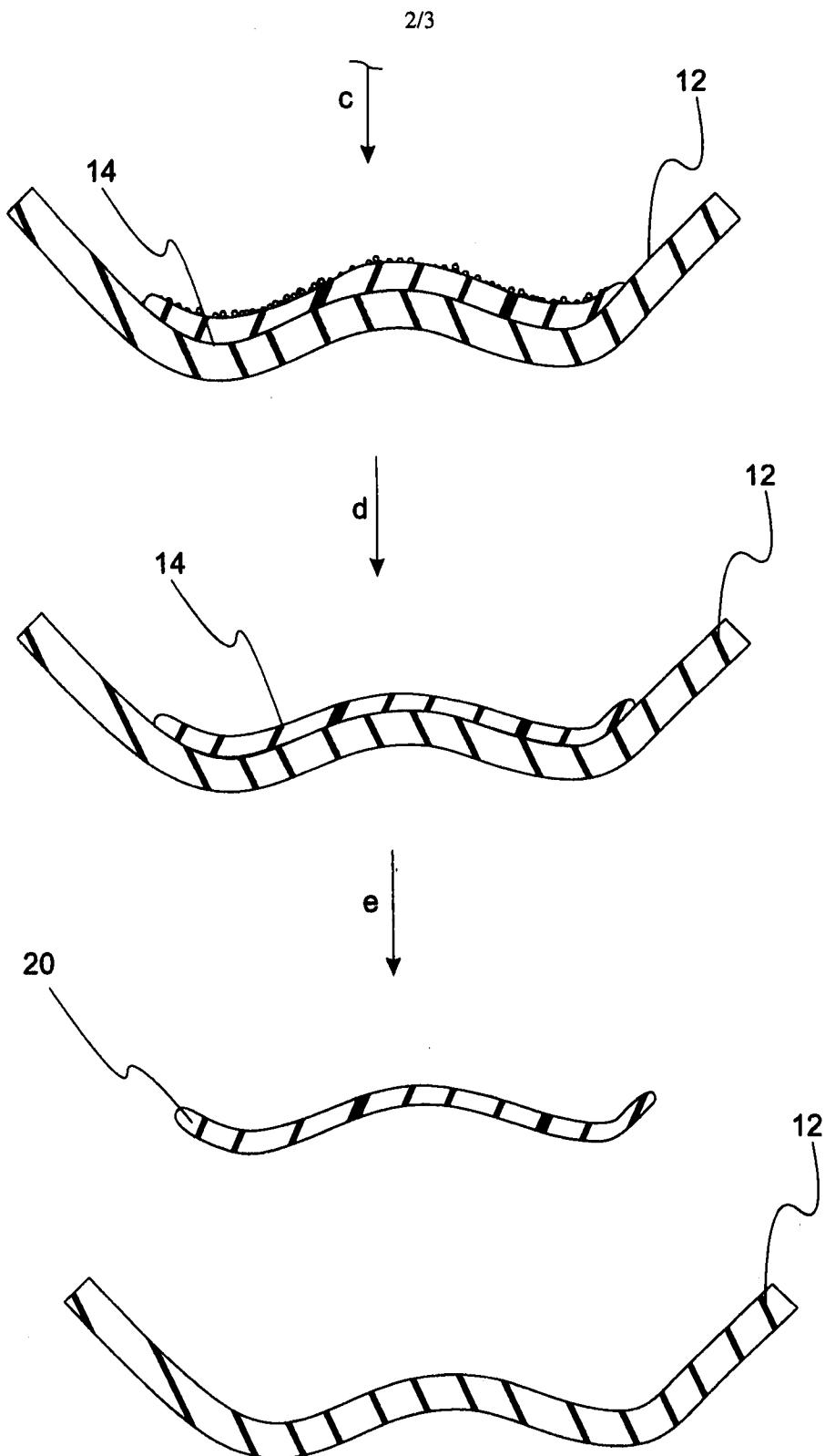


Fig. 1B

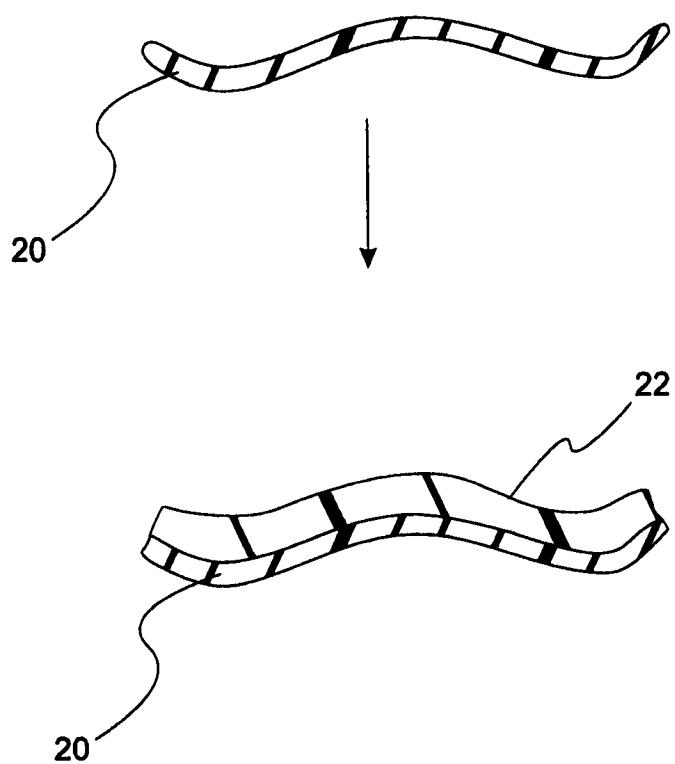


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/033396

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08L75/08 C08G18/48 C08G18/66 B29C41/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08G C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE WPI Week 200163 Thomson Scientific, London, GB; AN 2001-560626 XP002526256 & JP 2001 207051 A (ASAHI KASEI KOGYO KK) 31 July 2001 (2001-07-31) abstract</p> <p>-----</p> <p>US 6 187 859 B1 (HUMPHREY WILLIAM M [US] ET AL) 13 February 2001 (2001-02-13) cited in the application column 1, line 58 - column 2, line 12 column 4, line 40 - column 6, line 23 table 3</p> <p>-----</p> <p>-/-</p>	1-14
A		1-20

Further documents are listed in the continuation of Box C.

See patent family annex.

- * Special categories of cited documents :
- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/033396

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 410 638 B1 (KAUFHOLD WOLFGANG [DE] ET AL) 25 June 2002 (2002-06-25) column 2, lines 16-40 column 8, line 62 - column 10, line 64; examples 1,7 -----	1-20
A	US 6 896 962 B1 (VALLIGNY DOMINIQUE [FR] ET AL) 24 May 2005 (2005-05-24) column 2, line 39 - column 4, line 24 -----	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/033396

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
JP 2001207051	A	31-07-2001		NONE		
US 6187859	B1	13-02-2001	CA DE DE EP ES JP JP US	2157214 A1 69516978 D1 69516978 T2 0712887 A2 2149303 T3 3822271 B2 8325348 A 5824738 A		08-04-1996 21-06-2000 07-12-2000 22-05-1996 01-11-2000 13-09-2006 10-12-1996 20-10-1998
US 6410638	B1	25-06-2002	BR CA CN DE EP JP MX ZA	0002079 A 2307369 A1 1272514 A 19920367 A1 1050549 A2 2000351895 A PA00003984 A 200002146 A		02-01-2001 04-11-2000 08-11-2000 16-11-2000 08-11-2000 19-12-2000 08-03-2002 06-11-2000
US 6896962	B1	24-05-2005	EP WO FR JP	1206375 A1 0108934 A1 2797240 A1 2003522068 T		22-05-2002 08-02-2001 09-02-2001 22-07-2003