

HIGHLY EXTENSIBLE AND TOUGH BACKING FILM FOR STRETCH RELEASABLE ADHESIVE TAPE

TECHNICAL FIELD

5 The invention relates to a plastic backing film for a stretch releasable adhesive tape, a stretch releasable adhesive tape including the plastic backing film, an article including the stretch releasable adhesive tape including the plastic backing film, a method of making the stretch releasable adhesive tape including the plastic backing film, and use of the stretch releasable adhesive tape including the plastic backing film.

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BACKGROUND

A stretch releasable adhesive tape is commonly constructed with a backing film coated with a pressure sensitive adhesive (PSA) on one major surface of the backing film. Additionally, the backing film may be further coated with another PSA on another major surface of the
15 backing film, whereby the two major surfaces may be opposing to each other. This type of adhesive tape is often used in products where ease of attachment and re-working are required. The highly extensible and tough backing allows the adhesive tape to be removed by stretch release leading to relatively easily removable adhesive tape that greatly helps assembly workers to re-position a misplaced (or a slight offset in placing) article, resulting in increased
20 productivity and less hassle.

There are a number of commercially available stretch releasable adhesive tapes in the market. Typically, these stretch releasable adhesive tapes are designed and widely used for in-plane (i.e. 0-35° angle) stretching applications. In cases of compact form factor or aesthetical or
25 design consideration, desirable stretch release angle may become more than 45°.

It is important to find a good balance on the adhesion strength, elasticity, tensile strength and converting properties (how easy in converting the films) of the adhesive tape. As a general rule of thumb, the adhesion strength of a stretch releasable adhesive tape is dependent only on the adhesive layer, while the stretch-ability, tensile strength and convertibility of the stretch releasable adhesive tape are all dependent on the backing film.

To this end, a rubber-based backing film for a stretch releasable adhesive tape has been previously proposed. This rubber-based (or elastomeric material) adhesive tape was found to become brittle upon prolong exposure upon heating or degradation. For example, it is known that such rubber-based adhesive tapes had turned brittle and discolored, which were then returned to the supplier of the rubber-based adhesive tapes for refurbishment. In addition to this material issue, there are technical difficulties in converting the rubber-based backing film from big jumbo rolls, thereby making them economically unattractive.

SUMMARY

A plastic backing film for a stretch releasable adhesive tape, a stretch releasable adhesive tape including the plastic backing film, an article including the stretch releasable adhesive tape including the plastic backing film, a method of making the stretch releasable adhesive tape including the plastic backing film, and use of the stretch releasable adhesive tape including the plastic backing film are herein disclosed.

According to a first aspect, a plastic backing film including a blend of at least two copolymers is disclosed. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200%

at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other.

According to a second aspect, an adhesive tape including a plastic backing film is disclosed.

5 The plastic backing film includes a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a
10 second direction, wherein the first direction and second direction are orthogonal to each other. The adhesive tape further includes at least one pressure sensitive adhesive layer. The at least one pressure sensitive adhesive layer is adjacent to a major surface of the plastic backing film.

15 According to a third aspect, an article including a first substrate and an adhesive tape is disclosed. The adhesive tape includes a plastic backing film. The plastic backing film includes a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an
20 elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other. The adhesive tape further includes at least one pressure sensitive adhesive layer. The at least one pressure sensitive adhesive layer is adjacent to a major surface of the plastic backing film. The
25 adhesive tape further includes a tab extending beyond the at least one pressure sensitive

adhesive layer. The tab is a part of the plastic backing film or an extension of the plastic backing film.

According to a fourth aspect, an article including a first substrate, a second substrate, and an adhesive tape is disclosed. The adhesive tape is positioned in between the first substrate and the second substrate. The adhesive tape couples the first substrate to the second substrate. The adhesive tape includes a plastic backing film. The plastic backing film includes a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other. The adhesive tape further includes two pressure sensitive adhesive layers. The first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film and the second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film. The first major surface and the second major surface are opposing surfaces of the plastic backing film. The adhesive tape further includes a tab extending beyond the two pressure sensitive adhesive layers. The tab is a part of the plastic backing film or an extension of the plastic backing film.

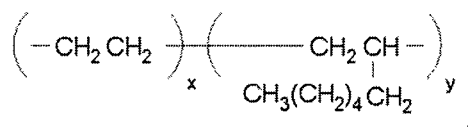
According to a fifth aspect, a method of coupling and decoupling two substrates is disclosed. The method includes providing a first substrate and a second substrate. The method further includes positioning an adhesive tape in between the first substrate and the second substrate. The adhesive tape includes a plastic backing film. The plastic backing film includes a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer

or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other. The adhesive tape further includes two pressure sensitive adhesive layers. The first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film and the second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film. The first major surface and the second major surface are opposing surfaces of the plastic backing film.

The adhesive tape further includes a tab extending beyond the two pressure sensitive adhesive layers. The tab is a part of the plastic backing film or an extension of the plastic backing film. The method further includes pulling on the tab of the adhesive tape to stretch the adhesive tape to release the adhesive tape from the first substrate, from the second substrate, or from both the first substrate and the second substrate.

According to a sixth aspect, a method of making an adhesive tape is disclosed. The method includes providing a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The method further includes extruding the blend of at least two copolymers by cast extrusion or blown extrusion to form a plastic backing film. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other. The method further includes positioning at least one pressure sensitive adhesive layer adjacent to a major surface of the plastic backing film.

In various embodiments of the various aspects of present disclosure, the plastic backing film includes a poly(ethylene-octene) block copolymer. Preferably, the poly(ethylene-octene) block copolymer has the following structure



wherein x and y are any suitable integers.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily drawn to scale, emphasis instead generally being placed upon illustrating the principles of various embodiments. In the following description, various embodiments of the invention are described with reference to the following drawings.

Fig. 1 shows the operating conditions (including setting temperature of barrel and die) for the cast extrusion method for forming the plastic backing film described in the examples section.

Fig. 2 shows the properties of various plastic backing films formed by the cast extrusion method described in the examples section.

Fig. 3A shows a schematic diagram of the stretch-release test and Fig. 3B shows the test results.

DESCRIPTION

The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the invention may be practised. These embodiments are described in sufficient detail to enable those skilled in the art to practise the invention. Other embodiments may be utilized and structural and/or chemical changes may be made without departing from the scope of the invention. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

10 According to a first aspect, a plastic backing film including a blend of at least two copolymers is disclosed. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer.

In various embodiments, the plastic backing film includes a blend of only two olefin block copolymers. In other embodiments, the plastic backing film includes a blend of two olefin random copolymers. In further embodiments, the plastic backing film includes a blend of one olefin block copolymer and one olefin random copolymer. In yet other embodiments, the plastic backing film includes a blend of two olefin block copolymers and one olefin random copolymer. In even further embodiments, the plastic backing film includes a blend of three
20 olefin block copolymers.

It is to be understood and appreciated that other combinations of any other numbers of olefin block copolymer and/or olefin random copolymers may be used. Furthermore, the plastic backing film may further include a low density olefin polymer, preferably a linear low density olefin polymer, such as but is not limited to, a linear low density polyethylene (LLDPE).

In present context, the term “blend” (alternatively, a mixture) refers a composition of two or more copolymers, which may or may not be miscible with one another. The polymer blend can have different molecular structures (with respect to chain length, architecture, or rigidity) or sizes (i.e. molecular weight), as determined from transmission electron spectroscopy, light scattering, x-ray scattering, and any other method known in the art. Unless otherwise indicated, references to the term “polymer” include references to a copolymer.

A fundamental advantage of polymer blends is driven by their ability to combine unique features of individual resin or component. Key to the success of polymer blends lies in the selection of intrinsically complementing polymeric systems. By specifically tailoring or selecting the individual copolymers to form blend, the resultant blend can have improved or more desirable properties compared to the properties of the individual copolymers making up the blend.

To this end, a plastic backing film with a high tensile elongation and a high tensile strength as backing material for use in a stretch releasable adhesive tape or other applications that require extendable substrate is proposed herein. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other. In particular, the use of a blend of copolymers for an extendable substrate provides a good balance between strength and stretch-ability to produce cost-effective tough backing. Specifically, by careful identification and selection of suitable copolymers, trade-offs between strength and elasticity may be minimized. This has been clearly demonstrated in illustrative but non-limiting

exemplified experiments described in later paragraphs, whereby the blends of DOW Chemical INFUSE™ olefin block copolymers are tested and have shown substantial increase in stretching properties and toughness, for example, compared to the respective individual INFUSE™ olefin block copolymer.

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Other advantages of using polymer blends for the plastic backing film include the following:

(A) The blending of commercially available polymers is a more cost-effective method of developing a new product that meets the market requirements, as opposed to developing a totally new polymer which generally involves prohibitively high research, development and capital costs.

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(B) Polymer blends can fill the cost-performance gaps in the existing commercial polymers. As mentioned earlier, several properties can be uniquely combined in a blend that a single resin often cannot provide. In present case, as clearly demonstrated in illustrative but non-limiting exemplified experiments described in later paragraphs, synergistic improvements in properties such as tensile strength and elongation have been achieved.

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(C) Polymer blending can be done at relatively low cost using an extruder. Production of new polymers, on the other hand, requires capital-intensive plants and reactors that must operate on a reasonably large scale for reasons of economics.

20

(D) The flexibility of extruder blending enables custom production of different blends in a wide range or production volumes. Polymerization plants are generally not as flexible and not economical for small volume production.

(E) Blends can be formulated, optimized and commercialized generally at a much faster rate than new polymers.

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It is readily apparent from the aforementioned advantages that use of commercially available polymers is generally preferred, although not absolutely necessary. Accordingly, in various embodiments, the use of commercially available olefin block copolymers and olefin random copolymers is preferred.

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For the purposes of brevity and convenience, the following discussion describes in more details the plastic backing film including a blend of commercially available olefin block copolymers and/or olefin random copolymers, and it is to be understood and appreciated that the scope of present disclosure is not limited to only plastic backing films including blends of

10 commercially available olefin block copolymers and/or olefin random copolymers.

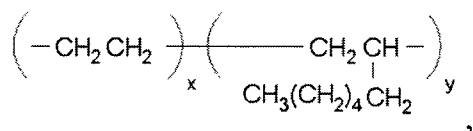
In present context where commercially available olefin block copolymers are employed, the phrase “olefin block copolymer” refers to DOW Chemical INFUSE™ copolymer having a structure that is arranged into alternating “soft” and “hard” blocks. The soft blocks serve to

15 deliver flexibility while the hard blocks serve to deliver heat resistance. In various embodiments, the blend may include extrusion-or soft compounds-grade from melt-flow index (MFI) of 0.5, including INFUSE™ 9000, INFUSE™ 9010, INFUSE™ 9007, INFUSE™ 9077, to melt-index of 1.0, including INFUSE™ 9100 and INFUSE™ 9107.

Preferably, the blend has a melting temperature (T_m) in the range of 38 °C to 120 °C, and
20 more preferably, the MFI of the blend is in a range from 0.1 to 1.0 g/10 min as measured according to ASTM D 1238 at 190 °C with a 2.16 kg weight.

The olefin block copolymer present in the DOW Chemical INFUSE™ copolymers includes a poly(ethylene-octene) block copolymer. More specifically, according to various
25 embodiments, the plastic backing film includes a blend of at least a poly(ethylene-octene)

block copolymer and another copolymer, wherein the poly(ethylene-octene) block copolymer has the following structure



wherein x and y are any suitable integers.

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Suitable olefin block copolymers for use in the blend of the plastic backing film include the following list, but are not limited to such list:

(A) INFUSE™ 9000 having a density of 0.877 g/cm³ (ASTM D792) and a MFI of 0.50 g/10 min (190°C/2.16 kg, ASTM D1238)

10 (B) INFUSE™ 9007 having a density of 0.866 g/cm³ (ASTM D792) and a MFI of 0.50 g/10 min (190°C/2.16 kg, ASTM D1238)

(C) INFUSE™ 9010 having a density of 0.877 g/cm³ (ASTM D792) and a MFI of 0.50 g/10 min (190°C/2.16 kg, ASTM D1238)

15 (D) INFUSE™ 9077 having a density of 0.869 g/cm³ (ASTM D792) and a MFI of 0.50 g/10 min (190°C/2.16 kg, ASTM D1238)

(E) INFUSE™ 9100 having a density of 0.877 g/cm³ (ASTM D792) and a MFI of 1.0 g/10 min (190°C/2.16 kg, ASTM D1238)

(F) INFUSE™ 9107 having a density of 0.866 g/cm³ (ASTM D792) and a MFI of 1.0 g/10 min (190°C/2.16 kg, ASTM D1238)

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In present context, the phrase “olefin random copolymer” refers to DOW Chemical ENGAGE™ copolymer having a structure arranged into random structure of “soft” and “hard” segments. In one exemplified example, ENGAGE™ 8842 is used as a strain dopant in

an INFUSE™-ENGAGE™ blend system to produce highly extensible substrate (tensile elongation of over 1,200%).

Accordingly, in various embodiments, the plastic backing film includes a blend of at least a
5 poly(ethylene-octene) random copolymer and another copolymer.

Suitable olefin random copolymers for use in the blend of the plastic backing film include the following list, but are not limited to such list:

- (A) ENGAGE™ 8842 having a density of 0.857 g/cm³ (ASTM D792) and a MFI of 1.0
10 g/10 min (190°C/2.16 kg, ASTM D1238)
- (B) ENGAGE™ 8480 having a density of 0.902 g/cm³ (ASTM D792) and a MFI of 1.0
g/10 min (190°C/2.16 kg, ASTM D1238)
- (C) ENGAGE™ 8540 having a density of 0.908 g/cm³ (ASTM D792) and a MFI of 1.0
g/10 min (190°C/2.16 kg, ASTM D1238)

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In a second aspect, an adhesive tape including a plastic backing film is disclosed. The plastic backing film includes a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has
20 an elasticity recovery of 50% or less. Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other.

The adhesive tape further includes at least one pressure sensitive adhesive layer. The at least
25 one pressure sensitive adhesive layer is adjacent to a major surface of the plastic backing film.

In present context, the phrase “pressure sensitive adhesive” refers to adhesive compositions that have (1) aggressive and persistent tack, (2) adherence with no more than finger pressure, (3) sufficient ability to hold onto an adherend, and (4) sufficient cohesive strength to be
5 cleanly removable from the adherend.

In present context, the phrase “major surface” refers to an outer surface that is in-plane with the plastic backing film.

10 In various alternative embodiments, the adhesive tape includes two pressure sensitive adhesive layers. The first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film. The second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film. The first major surface and the second major surface are opposing surfaces of the plastic backing film.

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In various embodiments, the adhesive tape further includes a tab extending beyond the first pressure sensitive adhesive layer and if present, the second pressure sensitive adhesive layer. The tab may be a part of the plastic backing film or an extension of the plastic backing film.

20 With an adhesive tape that adheres (or couples) a first substrate to an article, or adheres (or couples) a first substrate to a second substrate of an article, releasing (or decoupling) the adhesive from one or both substrates includes pulling on a tab and stretching. The tab extends beyond at least one of the substrates. As mentioned above, the tab can be a part of the plastic backing film (i.e., an extension of the plastic backing film), a part of at least one pressure
25 sensitive adhesive layer (i.e., an extension of the pressure sensitive adhesive layer), attached to the plastic backing film, attached to at least one pressure sensitive adhesive layer, or a part

of both the plastic backing film and at least one pressure sensitive adhesive layer (i.e., an extension of both the plastic backing film and at least one pressure sensitive adhesive layer).

At least one substrate does not contact the pressure sensitive adhesive layer in the region of the tab. Generally, if there are two substrates in the article, both substrates do not contact the

5 pressure sensitive adhesive layer in the region of the tab. The tab is usually pulled in a direction that is parallel to or substantially parallel (i.e. in-plane) to the major surfaces of the substrates. That is, the tab is pulled in a direction that is 0 degrees, less than 5 degrees, less than 10 degrees, less than 15 degrees, less than 20 degrees, less than 25 degrees, less than 30 degrees, or less than 35 degrees. A further advantage of the present adhesive tape is that the
10 tab may be pulled in a direction that is orthogonal to the major surface of the plastic backing film, i.e. close to 90 degrees, 85 degrees, 80 degrees, 75 degrees, 70 degrees, 65 degrees, or 60 degrees.

The tab often includes a part of the plastic backing film. In some embodiments, the tab is
15 formed from a second region of the plastic backing film that extends beyond a first region of the plastic backing film that is in contact with the pressure sensitive adhesive layers. The tab is often non-tacky in these embodiments. In other embodiments, the tab includes the plastic backing film and at least one of the pressure sensitive adhesive layers. The tab is often tacky in these embodiments. A tacky tab can be made non-tacky by covering the tab region with a
20 non-tacky material.

The pressure sensitive adhesive layers as well as plastic backing film of the adhesive tape are typically highly extensible. Pulling on the tab causes the adhesive tape to elongate or stretch. Stretching reduces the volume of the adhesive tape in the region between the first substrate
25 and the second substrate and facilitates release of the adhesive tape from one or both substrates. Pulling on the tab can release the pressure sensitive adhesive layers from both

substrates if the pressure sensitive adhesive layers have sufficient cohesive strength, if the pressure sensitive adhesive layers adhere more strongly to the plastic backing film than to the substrates, and if the adhesive tape can be elongated sufficiently to reduce its volume between the substrates without breaking or snapping back into its original position or
5 dimensions. The stretched adhesive tape can be removed (i.e. decoupled) from between the two substrates, the two substrates can be separated, or both. The adhesive tape typically can be stretched at least 500% in a first direction or second direction (often the first direction is lengthwise while the second direction is orthogonal to the first direction, and the length can be increased at least 500%) without breaking or snapping under the stretch releasing
10 conditions.

In various embodiments, the at least one pressure sensitive adhesive layer includes an acrylate-based adhesive composition. The acrylate-based adhesive composition may further include a tackifying resin in a range from 10 to 70 wt%. The thickness of the pressure
15 sensitive adhesive layer of at least 25 μm and the 180° peel adhesion of the pressure sensitive adhesive layer to stainless steel may be at least 8 N/cm, and is cleanly removed from the adherend.

According to a further aspect, a method of making an adhesive tape is disclosed. The method
20 includes providing a blend of at least two copolymers. Each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer. The method further includes extruding the blend of at least two copolymers by cast extrusion or blown extrusion to form a plastic backing film. The plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa. In addition, the plastic backing film has an elasticity recovery of 50% or less.
25 Furthermore, the plastic backing film has an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and

second direction are orthogonal to each other. The method further includes positioning at least one pressure sensitive adhesive layer adjacent to a major surface of the plastic backing film.

- 5 In various embodiments, prior to the positioning of the at least one pressure sensitive adhesive layer, the extruded plastic backing film may be subjected to a pre-treatment method selected from the group consisting of corona discharge method, plasma discharge method, flame processing method, acid etching method, and chemical primer processing method. Preferably, the pre-treatment method is corona discharge method.

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In summary, a newly developed all-thermoplastic elastomer (100% use) backing film based on commercially available ethylene-octene block copolymers is described herein. Through the combination of two or more ethylene-octene block copolymers and or random copolymers, one can tailor the performance (strength/strain) of the resulting backing film that
15 is not possible to be achieved with respective individual copolymers. The combination of two or more ethylene-octene block copolymers and or random copolymers is capable of minimizing trade-offs between tensile strength and elasticity, without sacrificing convertibility (or easy to be converted). In addition, this blend is not susceptible to heat-induce embrittlement.

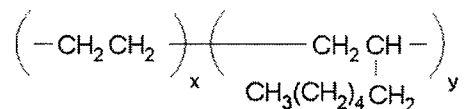
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In order that the invention may be readily understood and put into practical effect, particular embodiments will now be described by way of the following non-limiting examples.

EXAMPLES

- 25 The backing film as described in this example is made of highly extensible material. Specifically, the backing film is plastically extensible and is not elastically deformed material

(or rubber). The plastic backing film is made of a thermoplastic elastomeric compound, including olefin block copolymer (OBC) and/or random poly(alkylene) copolymer. By using a blend of DOW poly(ethylene-octene) copolymers represented in a general formula



- 5 under the trademark INFUSE™ and ENGAGE™ to form the plastic backing film, the resulting plastic backing film has (1) a tensile strength in a range from 4.5 MPa to 11 MPa, (2) is capable of achieving an elongation (at breaking point) in both directions (orthogonal to each other) in a range of 500% to 1,200%, (3) is a substantial non-elasticity with elastic recovery of less than about 50%, and more preferably less than about 20% after elongation.
- 10 The backing film may be manufactured using any known film forming method, such as cast extrusion method or blown extrusion method.

BACKING FILM PREPARATION

All samples of the backing films are prepared using cast extrusion method as follow.

- 15 Equipment configuration consisted of a 21.77mm POTOP twin screw extruder feeding into a 200mm cast film extrusion die with a 2~8 mil die gap. The drop die configuration feed into a horizontal two roll nip. The tooling roll is 260mm in diameter and the backup steel roll is 300mm in diameter. The rewinding speed is set from 1.0~2.0 m/min. The setting temperature of barrel and die is described in Fig. 2. Properties of various samples of the backing films are
- 20 summarized in Fig. 1.

- The backing film may be pre-treated prior to the adhesive coating or laminating process, using one or more of the following methods, including corona discharge method, plasma discharge method, flame processing method, acid etching method, and chemical primer
- 25 processing method, so as to improve the adhesion between the backing film and the adhesive

layer. When an ethylene-octene copolymer and its blends are being used as the material for backing film, pre-treatment using corona discharge is generally preferable.

ADHESIVE PROPERTIES AND PERFORMANCE

- 5 The adhesive tape consists of at least one pressure sensitive adhesive layer adjacent to a major surface of the plastic backing film. The pressure sensitive adhesive layer comprises an acrylate based adhesive composition. The acrylate based adhesive composition further comprises with a tackifying resin. The amount of tackifying resin is preferably 10 to 70 wt%. The thickness of adhesive layer is preferably 25 to 50 μm . 180° peel adhesion of adhesive
10 layer to stainless steel is at least 8 N/cm. The adhesive is cleanly removed from stainless steel.

The peeling test is conducted with reference to modified ASTM D3330. Test sample of 0.75 inch width and 12 inch length was prepared and rolled onto a stainless steel substrate with the
15 2kg roller, once in each direction, at a speed of 24 inch/min. The sample was then allowed to dwell on the substrate for 20 minutes and peeled at 180° angle using Instron with crosshead speed of 12 inch/min.

By “comprising” it is meant including, but not limited to, whatever follows the word
20 “comprising”. Thus, use of the term “comprising” indicates that the listed elements are required or mandatory, but that other elements are optional and may or may not be present.

By “consisting of” is meant including, and limited to, whatever follows the phrase
“consisting of”. Thus, the phrase “consisting of” indicates that the listed elements are
25 required or mandatory, and that no other elements may be present.

The inventions illustratively described herein may suitably be practiced in the absence of any element or elements, limitation or limitations, not specifically disclosed herein. Thus, for example, the terms “comprising”, “including”, “containing”, etc. shall be read expansively and without limitation. Additionally, the terms and expressions employed herein have been
5 used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification
10 and variation of the inventions embodied therein herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this invention.

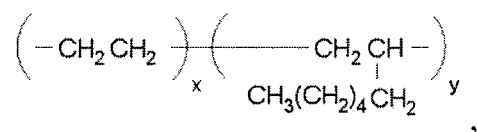
By “about” in relation to a given numerical value, such as for temperature and period of time,
15 it is meant to include numerical values within 10% of the specified value.

The invention has been described broadly and generically herein. Each of the narrower species and sub-generic groupings falling within the generic disclosure also form part of the invention. This includes the generic description of the invention with a proviso or negative
20 limitation removing any subject matter from the genus, regardless of whether or not the excised material is specifically recited herein.

Other embodiments are within the following claims and non-limiting examples. In addition, where features or aspects of the invention are described in terms of Markush groups, those
25 skilled in the art will recognize that the invention is also thereby described in terms of any individual member or subgroup of members of the Markush group.

CLAIMS

1. A plastic backing film comprising a blend of at least two copolymers, wherein each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other.
2. The plastic backing film of claim 1, wherein the blend has a melting temperature of in the range of 38 °C to 120 °C.
3. The plastic backing film of claim 1, wherein the blend has a melt-flow index in a range from 0.1 to 1.0 g/10 min as measured according to ASTM D 1238 at 190 °C with a 2.16 kg weight.
4. The plastic backing film of claim 1, wherein the blend comprises two olefin block copolymers.
5. The plastic backing film of claim 1, wherein the blend comprises two olefin random copolymers.
6. The plastic backing film of claim 1, wherein the blend comprises one olefin block copolymer and one olefin random copolymer.
7. The plastic backing film of claim 1, wherein the blend comprises two olefin block copolymers and one olefin random copolymer.
8. The plastic backing film of claim 1, wherein the blend comprises three olefin block copolymers.
9. The plastic backing film of claim 1, wherein the olefin block copolymer is a poly(ethylene-octene) block copolymer.
10. The plastic backing film of claim 9, wherein the poly(ethylene-octene) block copolymer comprises the following structure



wherein x and y are any suitable integers.

11. The plastic backing film of claim 1, wherein the olefin random copolymer is a poly(ethylene-octene) random copolymer.

5 12. The plastic backing film of claim 1, further comprising a linear low density olefin polymer.

13. The plastic backing film of claim 12, wherein the linear low density olefin polymer comprises linear low density polyethylene (LLDPE).

14. An adhesive tape comprising:

10 a plastic backing film comprising a blend of at least two copolymers, wherein each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second
15 direction, wherein the first direction and second direction are orthogonal to each other; and

at least one pressure sensitive adhesive layer, wherein the at least one pressure sensitive adhesive layer is adjacent to a major surface of the plastic backing film.

15. The adhesive tape of claim 14, comprising two pressure sensitive adhesive layers,
20 wherein the first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film and the second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film, wherein the first major surface and the second major surface are opposing surfaces of the plastic backing film.

16. The adhesive tape of claim 15, further comprising a tab extending beyond the first pressure sensitive adhesive layer and the second pressure sensitive adhesive layer, wherein the tab is a part of the plastic backing film or an extension of the plastic backing film.
- 5 17. The adhesive tape of claim 14, wherein the at least one pressure sensitive adhesive layer comprises an acrylate-based adhesive composition.
18. The adhesive tape of claim 17, wherein the acrylate-based adhesive composition further comprises a tackifying resin.
19. The adhesive tape of claim 18, wherein the acrylate-based adhesive composition
10 comprises the tackifying resin in a range from 10 to 70 wt%.
20. The adhesive tape of claim 14, wherein the thickness of the pressure sensitive adhesive layer is of at least 25 μm .
21. The adhesive tape of claim 14, wherein the 180° peel adhesion of the pressure sensitive adhesive layer to stainless steel is of at least 8 N/cm and is cleanly removed from the
15 stainless steel.
22. An article comprising:
a first substrate; and
an adhesive tape comprising:
a plastic backing film comprising a blend of at least two copolymers, wherein each
20 of the at least two copolymers is an olefin block copolymer or an olefin random copolymer, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second
25 direction are orthogonal to each other;

at least one pressure sensitive adhesive layer, wherein the at least one pressure sensitive adhesive layer is adjacent to a major surface of the plastic backing film; and

a tab extending beyond the at least one pressure sensitive adhesive layer, wherein the tab is a part of the plastic backing film or an extension of the plastic backing film.

23. An article comprising:

a first substrate;

a second substrate; and

an adhesive tape positioned in between the first substrate and the second substrate, wherein the adhesive tape couples the first substrate to the second substrate, the adhesive tape comprising:

a plastic backing film comprising a blend of at least two copolymers, wherein each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other;

two pressure sensitive adhesive layers, wherein the first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film and the second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film, wherein the first major surface and the second major surface are opposing surfaces of the plastic backing film; and

a tab extending beyond the two pressure sensitive adhesive layers, wherein the tab is a part of the plastic backing film or an extension of the plastic backing film.

24. A method of coupling and decoupling two substrates, the method comprising:

5 providing a first substrate and a second substrate;
positioning an adhesive tape in between the first substrate and the second substrate, the adhesive tape comprising:

10 a plastic backing film comprising a blend of at least two copolymers, wherein each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other;

15 two pressure sensitive adhesive layers, wherein the first pressure sensitive adhesive layer is adjacent to a first major surface of the plastic backing film and the second pressure sensitive adhesive layer is adjacent to a second major surface of the plastic backing film, wherein the first major surface and the second major surface are opposing surfaces of the plastic backing film; and

20 a tab extending beyond the two pressure sensitive adhesive layers, wherein the tab is a part of the plastic backing film or an extension of the plastic backing film; and

25 pulling on the tab of the adhesive tape to stretch the adhesive tape to release the adhesive tape from the first substrate, from the second substrate, or from both the first substrate and the second substrate.

25. A method of making an adhesive tape, comprising:

providing a blend of at least two copolymers, wherein each of the at least two copolymers is an olefin block copolymer or an olefin random copolymer;

extruding the blend of at least two copolymers by cast extrusion or blown extrusion to form a plastic backing film, wherein the plastic backing film has a tensile strength in a range from 4.5 MPa to 11 MPa, an elasticity recovery of 50% or less, and an elongation in a range from 500% to 1,200% at breaking point in a first direction and a second direction, wherein the first direction and second direction are orthogonal to each other; and

positioning at least one pressure sensitive adhesive layer adjacent to a major surface of the plastic backing film.

26. The method of claim 25, wherein prior to the positioning of the at least one pressure sensitive adhesive layer, the extruded plastic backing film is subjected to a pre-treatment method selected from the group consisting of corona discharge method, plasma discharge method, flame processing method, acid etching method, and chemical primer processing method.

27. The method of claim 26, wherein the pre-treatment method is corona discharge method.