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(54) **Title**: MULTILAYER FLEXIBLE SHEET AND METHOD THEREOF

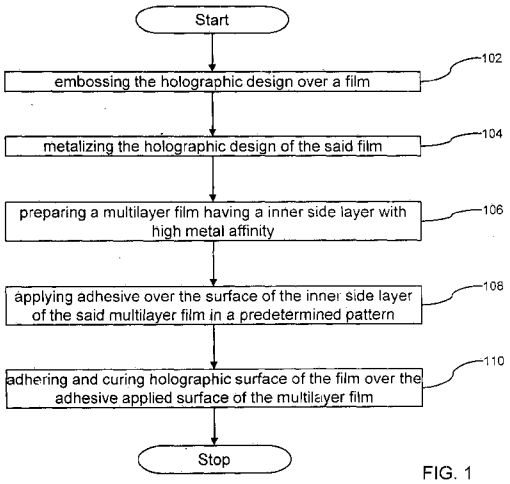

FIG. 1

(57) **Abstract**: A method for transferring a holographic design on a multilayer polyethylene film having DSC (Differential Scanning Calorimeter) melting point less than or equal to 119 degrees centigrade is provided. The holographic film has higher interlayer bond strength against PET (polyethyleneterephthalate) or BOPP (Biaxially oriented polypropylene) enabling surface printing on the other side layer of the multilayer of the holographic film. The films have good oxygen and moisture barrier properties and therefore can be used be used for manufacturing attractive holographic tubes for food product, toothpaste, cosmetics etc.

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MULTILAYER FLEXIBLE SHEET AND METHOD THEREOF.

TECHNICAL FIELD OF THE INVENTION

The invention relates to method for transferring holographic design on a multilayer film, a method for manufacturing holographic multilayer sheet, and the holographic multilayer sheet thereof.

BACKGROUND OF THE INVENTION

Holographic films including metallized layers are known in the art and are utilized for a wide variety of applications. For example, flexible packaging substrates for food products, gift wrapping paper, as a decorative component in non-flexible packages or rigid packages in tubes of toothpaste, cereal boxes, detergent boxes, and the like. For many applications, and in particular in the packaging of food products, it is desirable that these metallized films have good oxygen and moisture barrier properties. Presently, the holographic sheets are manufactured by laminating holographic film of the PET (Poly Ethylene Terephthalate) or BOPP (Biaxially Oriented PolyPropylene). However, presently available holographic films have very low interlayer bonding strength against PET or BOPP interface, which may result into separation of the laminate layer from the metallized interface of the holographic multilayer sheet.

Moreover, PET or BOPP is considered as contamination in all Polyethylene multilayer tube laminate structure.

Therefore, there is need for a process that will create holographic design on pure polyethylene film and then bond the holographic film excellently with the laminated sheets to be used for manufacturing attractive holographic tubes for food product, toothpaste, cosmetics etc.

SUMMARY OF THE INVENTION

An objective of the invention is to provide a method for transferring a holographic design on a multilayer polyethylene film having DSC (Differential Scanning Calorimeter) melting point less than or equal to 119 degrees centigrade.

Another objective of the invention is to provide a method for transferring a holographic design on a multilayer polyethylene film so that the holographic film has higher interlayer bond strength.

Yet another objective of the invention is to provide a method for transferring a holographic design enabling surface printing on the other side layer of the multilayer of the holographic film.

Yet another objective of the invention is to provide a method for manufacturing holographic multilayer sheet.

Yet another objective of the invention is to provide holographic films, which have good oxygen and moisture barrier properties.

Accordingly, the present invention provides a method for transferring a holographic design on a multilayer polyethylene film having DSC (Differential Scanning Calorimeter) melting point less than or equal to 119 degrees centigrade. The method comprises the steps of: embossing a holographic design over a PET (Poly Ethylene Terephthalate) or BOPP (Biaxially Oriented Poly Propylene) film; metalizing the holographic design of the said film; preparing a multilayer having one side layer (herein after referred to as inner-side layer) with high metal affinity; applying adhesive in specific patterns over the surface of said inner side layer of the said multilayer film; adhering and curing holographic surface of the film over the adhesive applied surface of the

multilayer film; and separating PET or BOPP film from the cured film wherein inner side layer in combination with adhesive firmly bond holographic portion.

Therefore the invention enables high interlayer bond strength and transferring of holographic design from the PET or BOPP film to the multilayer film. The invention further enables surface printing on the other side layer of the multilayer of the holographic film.

Brief Description of the Drawings

So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to various embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

FIG. 1 is a flow chart depicting the method for transferring a holographic design, in accordance with an embodiment of the invention.

FIG. 2 illustrates a few predetermined definite patterns of adhesive application, in accordance with an embodiment.

DESCRIPTION OF THE INVENTION

Various embodiments of the present invention provide a method for transferring a holographic design on a multilayer polyethylene film having DSC (Differential Scanning Calorimeter) melting point less than or equal to 119 degrees centigrade.

Figure 1 is a flowchart depicting the method for transferring a holographic design on a multilayer polyethylene film having DSC melting point less than or

equal to 119 degrees centigrade. In accordance with an embodiment of the invention, at step 102, a holographic design is embossed over a PET or BOPP film. At step 104, the holographic design of the said film is metalized. At step 106, a multilayer having one side layer (herein after referred to as inner-side layer) with high metal affinity is prepared. At step 108, adhesive is applied over the surface of said inner side layer of the said multilayer film in a predetermined pattern. At step 110, holographic surface of the film is adhered and cured over the adhesive applied surface of the multilayer film. At step 112, PET or BOPP film is separated from the cured film wherein inner side layer in combination with adhesive firmly bond with the holographic portion enabling transfer of holographic design from the PET or BOPP film to the multilayer film.

In accordance with an embodiment of the invention, curing in step 110 is carried out for a duration of about 24 to 72 hours, preferably 48 hrs and at a temperature of about 35 to 50 ^{0}C, preferably 45^{0}C.

In accordance with an embodiment of the invention, the multilayer sheet is produced by co-extrusion blown process and has a haze value of less than or equal to 15 and thickness between 40 micron to 100 micron. It may be apparent to a person skilled in the art that the other side layer of the multilayer is suitable for surface printing with high bond strength.

In accordance with an embodiment of the invention, the inner layer of the multilayer having high metal affinity is a co-polymer of ethylene such as Ethylene Acrylic Acid with an acid percentage value from five to ten.

In accordance with an embodiment of the invention, the adhesive at step 108 is applied in a predetermined definite pattern on the inner layer of the outer multilayer in such a manner that adhesive layer has numerous fine clear spots and channels where adhesive is absent. These clear spots are utilized for

anchoring extruded molten polymers such as low-density polyethylene, linear low-density polyethylene, ethylene acrylic acid and the like. Examples of the predetermined definite pattern include applying the adhesive in dots, lines, dotted lines, cross lines and the like. Figure 2 illustrates a few predetermined definite patterns.

In accordance with an embodiment of the invention, the adhesive used at step 108 has a composition of two parts polyurethane, two parts polyester, two parts epoxy, all heat curable or photopolymer based acrylic ultraviolet curable adhesive.

In another embodiment, the invention provides a method of manufacturing holographic multilayer sheet comprising steps of laminating holographic side of the multilayer manufactured by the method of the first embodiment with a barrier layer and extruding with extrusion polymer and sealant layer to form a holographic multilayer sheet. The barrier layer may be an aluminum foil or multilayer film having three to nine layers including barrier polymer such as EVOH (Ethylene Vinyl Alcohol), nylon, polyethyleneterephthalate and the like at the core and other layers made of polyolefin or its copolymer.

The holographic multilayer sheet manufactured by the method of the present invention is suitable for manufacturing tubes used for various applications including foods, dentifrice, cosmetics, pharmaceuticals and the like.

It will readily be appreciated by those skilled in the art that the present invention is not limited to the specific embodiments herein shown. Thus variations may be made within the scope and spirit of the accompanying claims without sacrificing the principal advantages of the invention.

CLAIMS

1. A method for transferring a holographic design on a multilayer film, the method comprising:

    a. embossing the holographic design over a film;

    b. metalizing the holographic design of the said film;

    c. preparing a multilayer film having a inner side layer with high metal affinity;

    d. applying adhesive over the surface of the inner side layer of the said multilayer film , wherein the adhesive is applied in a predetermined pattern; and

    e. adhering and curing holographic surface of the film over the adhesive applied surface of the multilayer film.

2. The method according to claim 1, wherein a multilayer sheet is produced by co-extrusion blown process, the multilayer sheet having a haze value of less than equal to fifteen and thickness between forty and one hundred micron.

3. The method according to claim 1 further comprising the step of separating the film from the cured film, the inner side layer in combination with adhesive firmly bonding with the holographic portion.

4. The method according to claim 1, wherein the multilayer polyethylene film has a DSC (Differential Scanning Calorimeter) melting point less than or equal to 119 degree centigrade.

5. The method according to claim 1, wherein the design is embossed over a PET (Poly Ethylene Terephthalate) or BOPP (BIAXIALLY ORIENTED POLY PROPYLENE) film.

6. The method according to claim 1, wherein the step of curing is carried out for a duration of 24 to 72 hours.

7. The method according to claim 1, wherein the step of curing is carried out at a temperature between 35 to 50^0C.

8. The method according to claim 1, wherein the application of adhesive over the surface of the inner side layer of the said multilayer film in a predetermined pattern includes applying adhesive at some parts over the surface of the inner side layer depending upon the predetermined pattern.

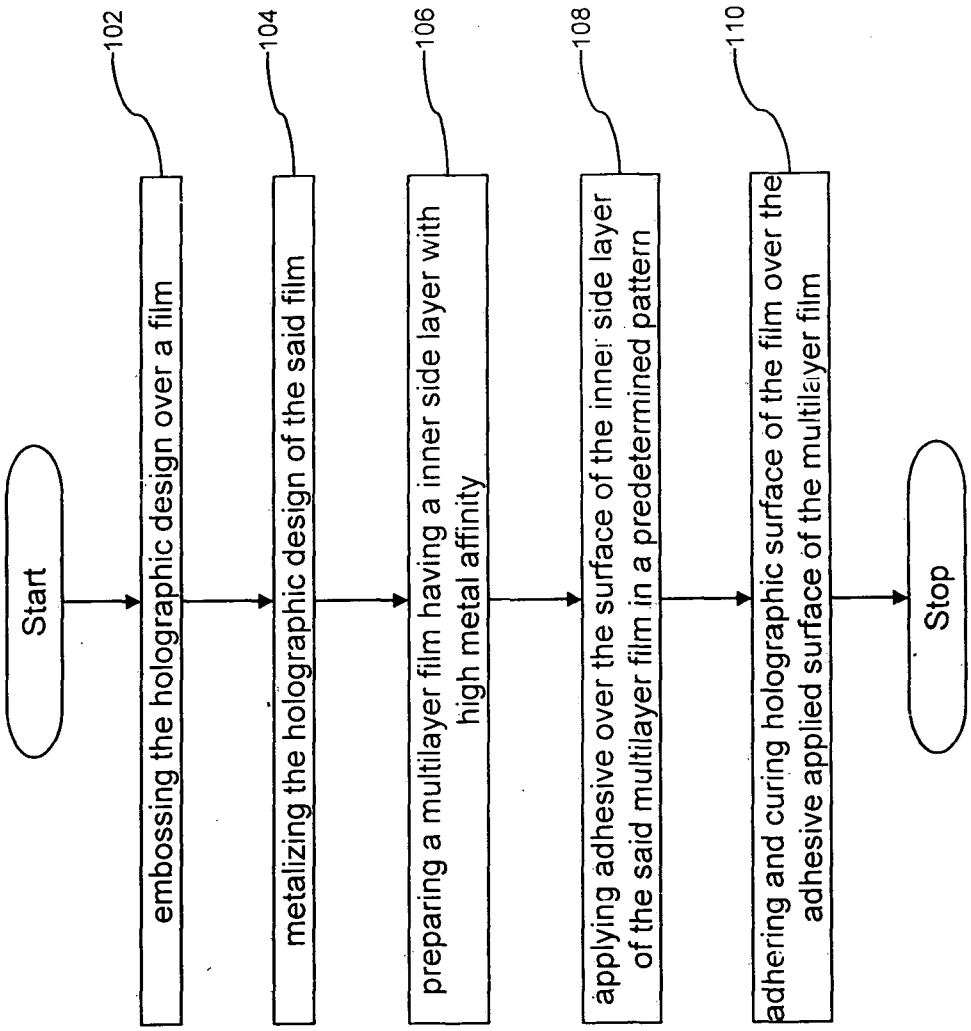
Start
102
embossing the holographic design over a film
104
metalizing the holographic design of the said film
106
preparing a multilayer film having a inner side layer with high metal affinity
108
applying adhesive over the surface of the inner side layer of the said multilayer film in a predetermined pattern
110
adhering and curing holographic surface of the film over the adhesive applied surface of the multilayer film
Stop

FIG. 1

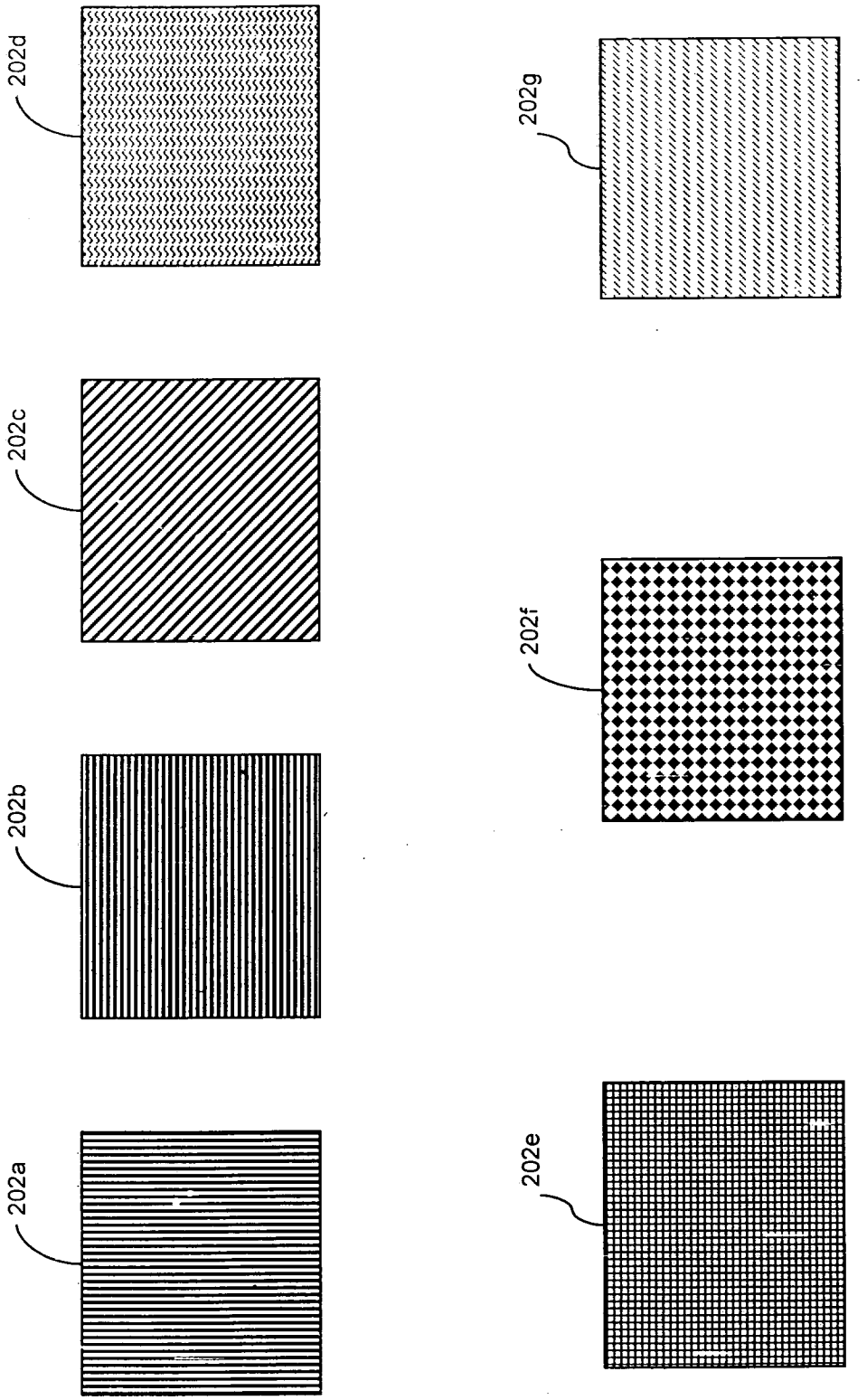

FIG. 2