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(71) **Applicant** *(for all designated States except US)*: **KOLON INDUSTRIES, INC.** [KR/KR]; 1-23, Byeoryang-dong, Gwacheon-si, Gyeonggi-do 427-709 (KR).

(72) **Inventors; and**
(75) **Inventors/Applicants** *(for US only)*: **JUNG, Hong Hee** [KR/KR]; 101-406, Siyeong APT., Hyeonggok 2-dong, Gumi-si, Gyeongsangbuk-do 730-782 (KR). **PARK, han soo** [KR/KR]; 550-12, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do 626-110 (KR). **BAEK, Sang-Hyun** [KR/KR]; 216-8, Hyeonggok-dong, Gumi-si, Gyeongsangbuk-do 730-040 (KR).

(74) **Agents**: **KWON, Oh-Sig** et al.; 4F, Jooeunleaderstel, 921, Dunsan-dong, Seo-gu, Daejeon 302-120 (KR).

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(54) **Title**: RELEASE FILM

(57) **Abstract**: The present invention relates to a release film, and more specifically, to a release film including a polyester film and a release coating layer that is formed on one side or both sides of the polyester film, wherein the release coating layer is formed by applying an aqueous coating solution including a silicon-based binder resin and an aqueous silicon-based resin having a phenyl group as a crosslinker and crosslinking and curing it, thereby having the improved adhesion to substrate (smear/rub-off) with the polyester film.

【DESCRIPTION】

【Invention Title】

RELEASE FILM

【Technical Field】

The present invention relates to a release film, and more specifically, to a release film that improves adhesion to substrate(smear/rub-off) between a release coating layer using a silicon-based resin and a polyester film.

【Background Art】

A release film gives release performance by forming a cured coating of silicon composition on a base surface in order to prevent adhesion or sticking between a base such as paper or plastic film, etc. and a sticky material. When the base surface is the plastic film, it is generally referred to as the release film.

The release film temporally protects a sticky adhesive side of an adhesive article from contamination caused by dusts, fragments, moisture, and other contaminants until a use of a label is prepared, for example. Generally, the release film is separated from the adhesive side just before the adhesive article is used.

The release film is formed with a release coating layer that can give the adhesion to substrate(smear/rub-off) with the base while giving the release performance to the base. The release coating layer mainly includes silicon release agent.

The performance of the release film mainly depends on an adhesive that forms an adhesive layer of the adhesive article or a silicon release agent that is used for the release coating layer, etc. Once the release film is bonded to the sticky adhesive side, it should not be voluntarily separated therefrom without release value, but should be easily separated by relatively small release value (release performance) and should not cause a decrease in residual adhesion to substrate(smear/rub-off) of adhesives. Further, when the release film is separated from the adhesive side, wholly leaving the release coating layer of the release film itself remains intact, that is, the internal adhesion of the release film is also important.

In order words, the release coating layer satisfies clearly contradictory conditions in that it is easily and completely released at an opposite side, while it is tightly bonded to a polyester film.

On the other hand, the release film is divided into an off-line coating film and an in-line coating film according to a method of applying the release coating layer on the base film. Generally, the off-line coating is a form of manufacturing the release film by applying the release coating layer on the base film in a form of a finished product and drying it. Generally, the in-line coating is a form of manufacturing the release film by extruding amorphous melts of polymer, solidifying them in a sheet form, and coating the release coating layer on the sheet, and then subjecting to processes such as preheating, stretching, heat-setting, cooling, and the like.

Generally, in the release film, the polyester film is mainly used as the base film. Since the polyester film has a stable chemical structure, it exhibits high mechanical intensity and excellent properties in terms of physical properties such as heat resistance, durability, chemical resistance, and the like. Among these polyesters, in particular, since polyethyleneterephthalate has excellent stability in terms of physical property over the wide range of temperature from a low temperature to a high temperature, excellent chemical resistance, excellent mechanical intensity, surface property, and the uniformity of thickness, and excellent adaptability to process conditions of various applications, it has been widely used as an industrial use, a medical use, a packaging use, and the like. Further, when considering environmental pollutions that have been raised in recent years, since polyethyleneterephthalate is high in terms of recycling, the importance for polyethyleneterephthalate has grown significantly in industrial fields.

The manufacturing process of the release film by the in-line coating includes extruding amorphous melts of polyester casting on a cooling casting drum, solidifying them in a sheet form, applying the release coating solution on the sheet, and then subjecting to heating and stretching processes to prepare the film and in these processes, film intensity, stability, and other preferred physical properties are provided. The film is stretched in one direction or two directions and is then solidified.

Generally, release coating compositions applied on the film surface by the in-line coating should be quickly set or cured for film productivity and adaptability. Further, the release coating compositions should able to be stretched without degrading the intensity and transparency.

In the release coating compositions, silicon release agent can include reactive, cross-linkable silicon-based compounds. The silicon-based compounds may include hydrogen-functional polysiloxane, alkoxy-functional polysiloxane, hydroxyl-functional polysiloxane, vinyl-functional polysiloxane, and the like. All the compounds are sold in a form of a low viscous and easily flowable liquid resin.

Generally, in the in-line coating method, silicon release agent can be used as aqueous emulsion. It is known that as a method of forming a silicon coating on the base surface, there are (1) a method of forming a releasable coating by further reacting vinyl-functional polysiloxane and hydrogen-functional polysiloxane using platinum-based compounds as a catalyst, (2) a method of forming a releasable coating by performing condensation on polysiloxane using organic acid metal salts such as organic tin compounds, etc., as a catalyst, and the like.

Generally, in order to prepare solution for forming the release coating layer as an aqueous solution, emulsifiers are used. when an aqueous coating solution including emulsifiers compares with the prepared solution in a solvent and solventless type, there is a problem in that the adhesion to substrate(smear/rub-off) between the release coating layer and the base film is reduced. Therefore, adhesion promoters are added in order to improve the adhesion to substrate(smear/rub-off). As the adhesion promoters, alkoxysiloxane generally manufactured as described in U.S. Patent No. 6,020,412 can be used.

However, in most cases, since the emulsifier used in order to manufacture the aqueous coating solution abruptly degrades storage stability of the coating compositions while reacting with the adhesion promoter in the state of the prepared solution, in order to apply the emulsifier to a practical process, the fundamental improvement thereof is more needed. Therefore, there are needs to develop a method that can improve the adhesion to substrate(smear/rub-off) between the release coating layer and the base film without using the adhesion promoter layer.

【Disclosure】

【Technical Problem】

An object of the present invention is to provide a release film including a release coating layer formed using an in-line coating method.

Further, the present invention is to provide a crosslinker that improves adhesion to substrate(smear/rub-off) with a polyester film without using adhesion promoter in an aqueous coating solution to be used for an in-line coating.

【Technical Solution】

The present invention relates to a release film, and more specifically, to a release film including a polyester film and a release coating layer that is formed on one side or both sides of the polyester film, wherein the release coating layer is formed by applying an aqueous coating solution including a silicon-based binder resin and an aqueous silicon-based resin having a phenyl group as a crosslinker and crosslinking and curing it.

The aqueous coating solution can includes the silicon-based binder resin, the crosslinker, a catalyst, and water as main compositions and additives for giving various functions.

In other words, the aqueous coating solution is applied to the polyester film in an emulsion or dispersive phase in the water. The dispersion can be made by mixing and agitating aqueous polymer such as polyethyleneglycol or polyvinylalcohol and surfactant such as alkylphenylpolyglycolether as additives.

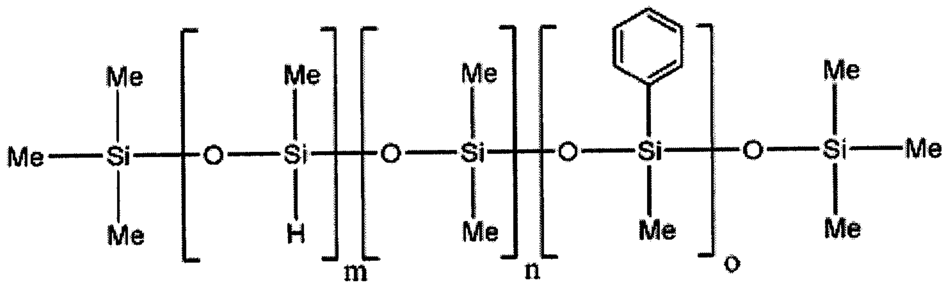
Further, in order to prepare the release film, the aqueous coating solution is applied on the polyester film that is a base film, moisture thereof is evaporated in preheating and stretching processes of the film, and the aqueous coating solution is crosslinked and cured in a heat-setting process, whereby it is formed as a coating layer in which only final solids exist. Therefore, the solids in the present invention signify solids of main components that exist in the release coating layer other than additives.

As the binder resin, linear or branched alkylvinyl polysiloxane can be used, specifically, polydimethylsiloxane having one or more functional group selected from hydroxy group, vinyl group, acetylene group bonded to a terminate or a side branch thereof is used.

The catalyst is used to perform the curing by inducing hydrosilylation reaction of the silicon resin binder and uses one or more metal or ampholytic elements selected from 4 group to 14 group, that is, any one selected from Rh, Pt, Sn, Ti, Pd, Ir, W, and Co.

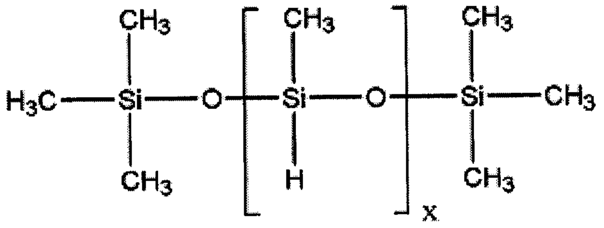
As the crosslinker, a crosslinker where a phenyl group is introduced into a silicon polymer structure is used in order to improve the adhesion to substrate(smear/rub-off) between the binder resin and the polyester film. Specifically, the crosslinker uses only silicon resin having the following Structural Formula 1 into which the phenyl group is introduced or a mixture of the silicon resin having the following Structural Formula 1 and silicon resin having the following Structural Formula 2 or Structural Formula 3 into which a phenyl group is not introduced. As such, if the crosslinker including the phenyl group is applied, the adhesion to substrate(smear/rub-off) between the polyester film and the binder resin is more improved than the case where the crosslinker including the general alkyl group is applied. In particular, in the case of a polyethyleneterephthalate (PET) film, the adhesion to substrate(smear/rub-off) can be more improved due to chemical attraction between the phenyl group having the Structural Formula 1 and the phenyl group of PET.

[Structural Formula 1]



(In the above Structural Formula 1, m, n, and o are a natural number independently from each other selected from 5 to 50,).

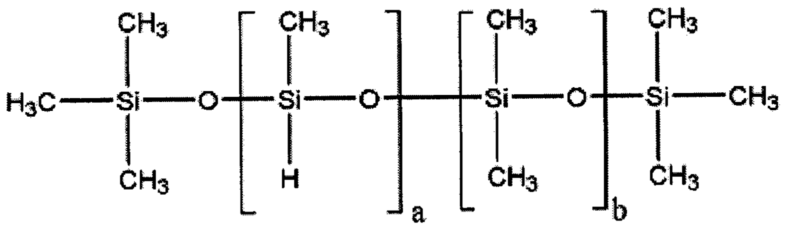
[Structural Formula 2]



$$\mathrm{H_3C{-}Si(CH_3)_2{-}O{-}[Si(CH_3)(H){-}O]_x{-}Si(CH_3)_2{-}CH_3}$$

(In the above Structural Formula 2, x is a natural number selected from 5 to 50).

[Structural Formula 3]



$$\mathrm{H_3C{-}Si(CH_3)_2{-}O{-}[Si(CH_3)(H){-}O]_a{-}[Si(CH_3)_2{-}O]_b{-}Si(CH_3)_2{-}CH_3}$$

(In the above Structural Formula, a and b area natural number independently from each other selected from 5 to 50).

The content of the crosslinker is 10 to 60 wt% in the content of the entire solids of the aqueous coating solution, more preferably 20 to 50 wt%. When the content of the crosslinker is less than 10 wt%, the adhesion to substrate(smear/rub-off) between the polyester film and the release coating layer is degraded and when the content of the crosslinker exceeds 60 wt%, the non-reacted crosslinker may remain. The remaining crosslinker due to the non-reaction is in an oligomer state, such that it may be transferred to an opposite side that the aqueous coating solution is applied when it is stored in a roll state or transferred to the adhesives when it is adhered to adhesives.

The polyester film is prepared by general film preparing method polyethyleneterephthalate(PET) resin, which is prepared through condensation polymerization of acid components using aromatic dicarboxylic acid as main components and glycol components using alkyleneglycol as main components, and comprised of ethyleneterephthalate as main repeating unit within molecules.

The detailed example of the aromatic dicarboxylic acid may include dimethylterephthalic acid, terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, cyclohexanedicarboxylic acid, diphenoxyethandicarboxylic acid, anthracenedicarboxylic acid, α,β-bis (2-chlorophenoxy)ethane-4,4′-dicarboxylic acid, and the like. Among them, the dimethylterephthalic acid or terephthalic acid is in particular preferable.

The detailed example of the alkylene glycol may include ethylene glycol, trimethylglycol, tetramethyleneglycol, pentamethyleneglycol, hexamethyleneglycol, and the like. Amongthem, ethylene glycol is in particular preferable.

The release film according to the present invention may be prepared by any of an in-line coating method or an off-line coating method. but preferably, is prepared by the in-line coating method.

The aqueous coating solution is applied by the known coating method. An example of the known coating method may include a roll coating, a gravure roll coating, a roll brush coating, a spray coating, an air knife coating, a slot coating, a dip or meniscus coating, and the like.

When the release film is prepared by the in-line coating method, in the case where the polyester film is a uniaxial stretching film, a non-crystalline sheet is prepared and the coating may be then performed by the above-mentioned coating methods before the stretching process or before the heat-setting process after the stretching process.

In the case of a biaxial stretching process, the non-crystalline sheet is prepared and the coating may be then performed before the stretching process, before a transverse direction (TD) stretching process after a machine direction

(MD) stretching process, or before the heat-setting process after the transverse direction stretching process.

In general, when the coating is performed before the machine direction stretching process, since a separate drying process is required, it is preferable to perform the coating before the transverse direction stretching after the machined direction stretching.

When the release film is prepared by the in-line coating method, it has effects that moisture is evaporated in the preheating and stretching processes, the curing is made at the heat-setting temperature that is high temperature, and the silicon-based resin is oriented to the polyester film by the stretching, making it possible to obtain a coating film having excellent physical properties.

Also, when the surface of the polyester film is surface-treated by a method such as an electric corona discharge before prepared solution is coated, hydrophobic property of the polyester film is reduced such that the prepared solution is easier wetted, thereby improving adhesion to substrate(smear/rub-off) of the release coating layer to the surface of the polyester film.

In the release coating layer, a dry applying thickness is prepared at 0.01 to 2μm. When the dry applying thickness is less than 0.01μm, it is not possible to give sufficient release performance and when the dry applying thickness exceeds 2μm, the adhesion to substrate(smear/rub-off) can be degraded.

In addition, the thickness of the polyester film is not limited, but the thickness of 4 to 500μm is suitable to achieve the sufficient release performance and adhesion to substrate(smear/rub-off).

【Advantageous Effects】

The present invention can provide the release film having excellent storage stability of prepared solution since the aqueous coating solution for forming the release coating layer does not use adhesion promoter and excellent adhesion to substrate(smear/rub-off)with the polyester film by using the crosslinker having a unique phenyl group.

Further, the present invention can form the eco-friendly, thin, and uniform film since the coating is performed by the in-line coating using the aqueous coating solution.

【Best Mode】

Hereinafter, the present invention will be described in detail with reference to examples. However, the following examples illustrates the present invention, by way of example only and the contents of the present invention are not limited to the following examples.

Physical properties of a prepared film were measured and the measured results were represented by the following Table 2 and the substantial measuring methods are as follows.

(1) Release value

Nitto 31B tape was put on a release coating layer, reciprocally rubbed by going and returning twice using a rubber roll of 2kg, and then cut at a size 25 mm × 20 cm to prepare a sample. After the prepared sample was applied with a load of 20 g/cm^2 and left at 70°C for a day, T-type release evaluation was performed using a universal tester (Model No. Instron 4304 manufactured by Instron Co.). The release speed was set to 300 mm/minute.

(2) Adhesion to substrate(smear/rub-off)

The adhesion to substrate(smear/rub-off) is evaluated as follows by strongly rubbing the release coating layer by goning and returning five times using a thumb

<Division Class>

A Class: Smear phenomenon is not observed at all

B Class: Smear phenomenon starts to be observed

C Class: Rub-off phenomenon starts to be observed

D Class: Rub-off phenomenon is easily observed.

(3) Back side transfer rate

The release coating layer of the release film prepared in Examples and Comparative Examples contacts the PET film prepared separately the release coating layer, it was applied with 50 g/ cm^2 and left at 40°C for 3 days. Thereafter, the transfer rate was measured before and after the polyethyleneterephthalate (PET) film was left.

Back side transfer rate (%) = (release value before polyethyleneterephthalate (PET) film is left release value after polyethyleneterephthalate (PET) film is left.) × 100/ release value before polyethyleneterephthalate (PET) film is left.

<Division Class>

◎ Class : Back side transfer rate of 95% or more

o Class: Back side transfer rate of 90 to 95%

Δ Class: Back side transfer rate of 80 to 90%

X Class: Back side transfer rate of 80 less than 80%

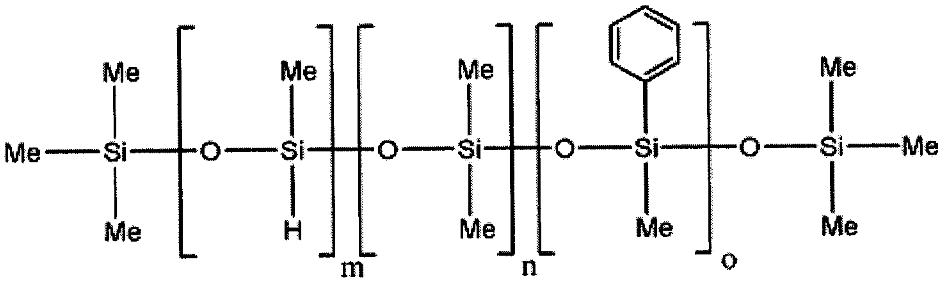
(4) Stability of Prepared Solution

The prepared solution is made so that the entire solids of coating solution is 1%, 10%, 25%, and 50% and each prepared solution was applied on a biaxially stretched 30 μm PET film and a haze change thereof was observed over time, thereby measuring pot life . The haze was measured by an ASTM D-1003 method.

At this time, since the haze of the coated film is increased as the stability of the silicon prepared solution is degraded; a time to maintain the initial haze value should be measured.

Unless otherwise described, in the following Examples, as the binder resin, divinylpolydimethylsiloxane (viscosity 14000, mPa.s) was used and the crosslinker including the phenyl group used the following Structural Formula 1.

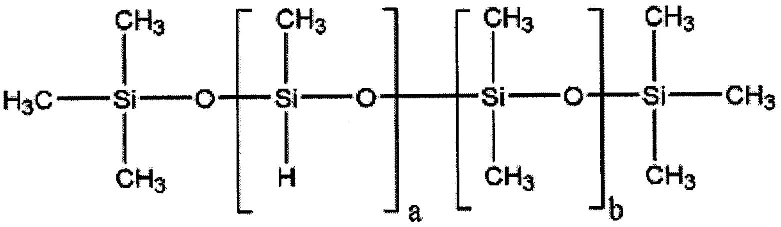
[Structural Formula 1]



(m = 10, n = 10, o = 10)

The crosslinker, which does not include the phenyl group, used the following Structural Formula 3.

[Structural Formula 3]



$$H_3C-Si(CH_3)_2-O-[Si(CH_3)(H)-O]_a-[Si(CH_3)_2-O]_b-Si(CH_3)_2-CH_3$$

(a = 10, b = 10)

The catalyst used a platinum catalyst ($Na_2PtCl_44H_2O$) and the emulsifier used polyvinylalcohol (Mowiol (4-80) by Hoechst Co.), the adhesion promoter used γ-acryloxypropyltrimethoxysilane.

<Example 1>

Preparation of Coating Solution A

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids, the crosslinker including the phenyl group is 10 wt% in the content of the entire solids, and the crosslinker including no the phenyl group is 40 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm with respect to the content of resin, the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution.

The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution A by using a gravure coater so that the thickness of the coating solution A is 8 μm, wherein the coating solution A is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 2>

Preparation of Coating Solution B

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids, the crosslinker including the phenyl group is 20 wt% in the content of the entire solids, and the crosslinker including no the phenyl group is 30 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm and the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution. The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution B by using a gravure coater so that the thickness of the coating solution B is 8 μm, wherein the coating solution B is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 3>

Preparation of Coating Solution C

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids, the crosslinker including the phenyl group is 30 wt% in the content of the entire solids, and the crosslinker including no the phenyl group is 20 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm and the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution. The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution C by using a gravure coater so that the thickness of the coating solution C is 8 μm, wherein the coating solution C is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 4>

Preparation of Coating Solution D

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids, the crosslinker including the phenyl group is 40 wt% in the content of the entire solids, and the crosslinker including no the phenyl group is 10 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm and the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the binder resin. The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution D by using a gravure coater so that the thickness of the coating solution D is 8 μm, wherein the coating solution D is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 5>

Preparation of Coating Solution E

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids and the crosslinker including the phenyl group is 50 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm and the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution.

The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 μm, wherein the coating solution E is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 6>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 µm, wherein the coating solution E is prepared to have the content of the entire solids of 5%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.1 µm is uniformly formed on a base film having a thickness of 30 µm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 7>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 µm, wherein the coating solution E is prepared to have the content of the entire solids of 25%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.5 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 8>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 μm, wherein the coating solution E is prepared to have the content of the entire solids of 50%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 1.0 μm is uniformly formed on a base film having a thickness of 30 µm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 9>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 µm, wherein the coating solution E is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 µm is uniformly formed on a base film having a thickness of 12 µm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 10>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 µm, wherein the coating solution E is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 µm is uniformly formed on a base film having a thickness of 100 µm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Example 11>

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution E by using a gravure coater so that the thickness of the coating solution E is 8 μm, wherein the coating solution E is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 250 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Comparative Example 1>

Preparation of Coating Solution F

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids and the crosslinker including no the phenyl group is 40 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm with respect to the content of resin, the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution. The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution F by using a gravure coater so that the thickness of the coating solution F is 8 μm, wherein the coating solution F is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

<Comparative Example 2>

Preparation of Coating Solution G

The mixing is performed so that the binder resin is 50 wt% in the content of the entire solids, the crosslinker including no the phenyl group is 49.8 wt% in the content of the entire solids, and the adhesion promoter is 0.2 wt% in the content of the entire solids and water is added to the mixture so that each of the contents of the entire solids is 1%, 10%, 25%, and 50% in the coating solution, thereby preparing solution. At this time, as the additives, the catalyst used 100 ppm with respect to the content of resin, the emulsifier used 5 parts by weight for every 100 parts by weight of the content of the solids in the coating solution. The stability of the prepared solution for such a prepared coating solution was measured and the measured results were represented by Table 2.

Preparation of Release Film

A sheet obtained by melting and extruding polyethyleneterephthalate resin and rapidly cooling it was preheated at 95°C in a preheating part and stretched and cooled four times in a machine direction (MD). The cooled film is applied with the coating solution G by using a gravure coater so that the thickness of the coating solution G is 8 μm, wherein the coating solution G is prepared to have the content of the entire solids of 10%. It is dried and preheated at 130°C, stretched in a transverse direction (TD) four times, and heat-set at 230°C, thereby preparing the release film where the coating layer having a dry pick-up thickness of 0.2 μm is uniformly formed on a base film having a thickness of 30 μm.

The release value, adhesion to substrate(smear/rub-off), and back side transfer rate of such a prepared film were measured and the measured results were represented by the following Table 2.

[Table1]

			EXAMPLE											COMPARATIVE EXAMPLE	
			1	2	3	4	5	6	7	8	9	10	11	1	2
Release Coating Layer	Binder solids (wt%)		50	50	50	50	50	50	50	50	50	50	50	50	50
	Cross-linker solids (wt%)	Including phenyl group	10	20	30	40	50	50	50	50	50	50	50	0	0
		Including no phenyl group	40	30	20	10	0	0	0	0	0	0	0	50	49.8
	Adhesion promotor solids (wt%)		0	0	0	0	0	0	0	0	0	0	0	0	0.2
	Coating thickness (μm)		0.2	0.2	0.2	0.2	0.2	0.1	0.5	1.0	0.2	0.2	0.2	0.2	0.2
Base film thickness (μm)			30	30	30	30	30	30	30	30	12	100	250	30	30

[Table2]

		EXAMPLE											COMPARATIVE EXAMPLE	
		1	2	3	4	5	6	7	8	9	10	11	1	2
Releasing strength (g/25mm)		4	4	4	4	4	4	4	4	4	4	4	4	4
Adhesive strength		B	A	A	A	A	A	A	A	A	A	A	C	A
Rear transfer rate		◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
Stability of prepared solution (hr)	1%	12	12	12	12	12	-	-	-	-	-	-	12	3
	10%	24↑	24↑	24↑	24↑	24↑	-	-	-	-	-	-	24↑	2
	25%	24↑	24↑	24↑	24↑	24↑	-	-	-	-	-	-	24↑	1
	50%	12	12	12	12	12	-	-	-	-	-	-	12	0.2

(In the above Tables 1 and 2, 24↑ means that the stability is maintained for 24 hours or more)

As can be appreciated from the results, in <Comparative Example 1>, if only the crosslinker including no the phenyl group is applied, the adhesion to substrate(smear/rub-off) is poor and in <Example 1>, In case of the crosslinker of 40% including no the phenyl group is applied and the crosslinker of 10% including the phenyl group is applied, the smear phenomenon starts to be observed as compared to the case where the content of the crosslinker including the phenyl group is increased. Also, as can be appreciated from <Comparative Example 2>, in case of the adhesion promoter is applied in order to improve the adhesion to substrate(smear/rub-off), the adhesion to substrate(smear/rub-off) is improved but the stability of prepared solution is drastically degraded.

Generally, in order to apply it to the field, the stability of prepared solution should be secured for at least 10 hours. However, in case of the adhesion promoter is applied, since the stability of prepared solution is 3 hours or less even when the concentration is low, it can be appreciated that separate facilities are needed or there is a need to adjust the conditions, etc. In <Examples 2 to 5>, in order to prepare the release film having excellent stability of prepared solution in the preparation and excellent adhesion to substrate(smear/rub-off) in products, it is advantageous to apply the crosslinker including the phenyl group and it can be appreciated that when the amount of the crosslinker is 20 to 50% with respect to the solids, the effect is excellent. As can be appreciated from <Example 6 to 8>, the effect is shown regardless of the thickness of the coating layer and as can be appreciated from <Examples 9 to 11>, the effect is shown excellent regardless of the thickness of the flim.

Those skilled in the art will appreciate that the conceptions and specific embodiments disclosed in the foregoing description may be readily utilized as a basis for modifying or designing other embodiments for carrying out the same purposes of the present invention. Those skilled in the art will also appreciate that such equivalent embodiments do not depart from the spirit and scope of the invention as set forth in the appended claims.

【CLAIMS】

【Claim 1】

A release film comprising:

a polyester film; and

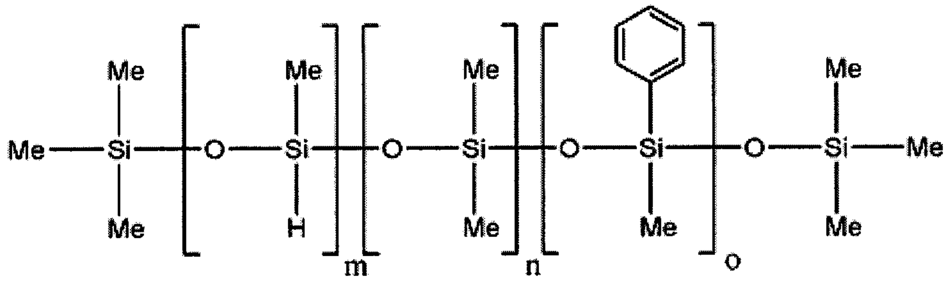
a release coating layer that is formed on one side or both sides of the polyester film,

wherein the release coating layer is formed by applying an aqueous coating solution including a silicon-based binder resin and an aqueous silicon-based resin having a phenyl group as a crosslinker and crosslinking and curing it.

【Claim 2】

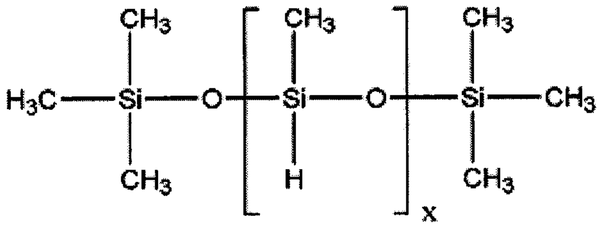
The release film according to claim 1, wherein the crosslinker uses only silicon resin having the following Structural Formula 1 or a mixture of the silicon-based resin having the following Structural Formula 1 and a silicon-based resin having the following Structural Formula 2 or Structural Formula 3.

[Structural Formula 1]



(In the above Structural Formula 1, m, n, and o are a natural number independently from each other selected from 5 to 50).

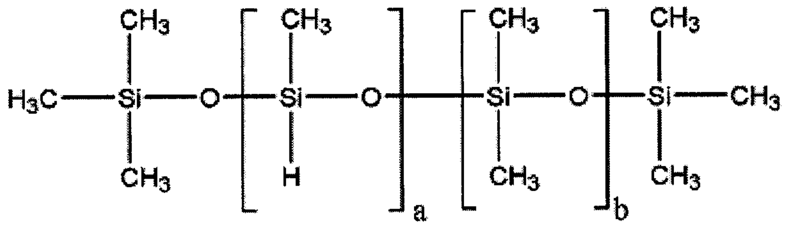
[Structural Formula 2]



$$H_3C-\underset{CH_3}{\overset{CH_3}{Si}}-O-\left[\underset{H}{\overset{CH_3}{Si}}-O\right]_x-\underset{CH_3}{\overset{CH_3}{Si}}-CH_3$$

(In the above Structural Formula 2, x is a natural number selected from 5 to 50).

[Structural Formula 3]



$$H_3C-\underset{CH_3}{\overset{CH_3}{Si}}-O-\left[\underset{H}{\overset{CH_3}{Si}}-O\right]_a-\left[\underset{CH_3}{\overset{CH_3}{Si}}-O\right]_b-\underset{CH_3}{\overset{CH_3}{Si}}-CH_3$$

(In the above Structural Formula, a and b are a natural number independently from each other selected from 5 to 50).

【Claim 3】

The release film according to claim 1, wherein the binder resin is polydimethylsiloxane having one or more functional group selected from hydroxy group, vinyl group, acetylene group bonded to a terminate or a side branch thereof.

【Claim 4】

The release film according to claim 1, wherein the aqueous silicon-based resin having the phenyl group is 10 to 60% in the content of the entire solids of the aqueous coating solution.

【Claim 5】

The release film according to claim 1, wherein the thickness of the release coating layer is 0.01 to 2 μm.

【Claim 6】

The release film according to claim 5, wherein the thickness of the polyester film is 4 to 500 μm.