

Description

The invention relates to a multilayered film, in particular heat-embossable film, consisting of a base film, a decorative layer, provided with a three-dimensional pattern, preferably a structure having an optically diffractive effect, and comprising at least two successive layers of lacquer, as well as possibly consisting of an adhesive layer arranged on the side of the decorative layer away from the base film, the two successive layers of lacquer having distinctly different optical characteristics and the interface between the layers of lacquer forming the three-dimensional pattern. Furthermore, the invention relates to a method of producing such films, a first layer of lacquer being applied to the base film, the said layer then being provided with the three-dimensional pattern and subsequently a second layer of lacquer being applied.

It is known to improve the security against forgery of documents, for example cheque cards, credit cards, savings books or similar security media by providing them with a film, in particular a heat-embossable film, which is equipped with a three-dimensional pattern. Such a three-dimensional pattern may, for example, be a structure having an optically diffractive effect, preferably a hologram, by means of which quite specific effects can be produced, whether by exposure to natural light or by exposure to artificial light of a certain wavelength. To forge such security films, it is necessary to remove the three-dimensional pattern exactly and to transfer it onto the forged film. This is only possible if the layer of lacquer generally covering the three-dimensional pattern is removed.

Until now, the general procedure when introducing holograms into embossing films was to have a metallized layer into which the hologram or other structure having an optically diffractive effect was then embossed. The metal layer provided with this structure was then covered with a protective layer of lacquer, lacquers being chosen

which although on the one hand adhering very well to the metal layer, on the other hand could also scarcely be dissolved, or only with great difficulty, with usual solvents. Nevertheless, forgers succeeded again and again
5 in exposing the surface of the three-dimensional pattern.

GB-A-1 568 563 discloses a film of the type mentioned at the beginning in which a three-dimensional pattern is formed between two layers of lacquer, it being intended for the one layer of lacquer to be transparent
10 while the other layer of lacquer is pigmented. Nothing is said as to the type of lacquers used. Regarding the point that one layer of lacquer is pigmented, it must be assumed that the layers of lacquer are applied one after the other, to be precise in each case after complete
15 curing of the first layer, from which it appears quite possible to separate the two layers of lacquer from each other and thus expose the three-dimensional pattern. This is the case in particular if, as further provided by GB-A-1 568 563, a metallization is provided between the
20 two layers of lacquer forming the three-dimensional pattern. The known film is thus not suitable for the desired use for improving the security of documents against forgery.

To improve the security of documents against
25 forgery, it is also known, from US-A-4,469,725, to bond together two films which are in each case provided with mutually aligned depressions or elevations, although the procedure adopted is for the two films first to be provided with the depressions and elevations and then
30 laid one on top of the other in such a way that the depressions and elevations engage each other satisfactorily. Under certain circumstances, this does indeed achieve the effect that the separation of the two films in the region of the profiling is only possible with
35 extreme difficulty, provided that suitable binders are used. However, a disadvantage with a procedure according to US-A-4,469,725 is that the method of production is extremely complicated and extreme accuracy is required,

in particular in guiding the films for joining the profiling together.

The invention is therefore based on the object of ensuring the security against forgery of multilayered films, in particular heat-embossable films with a structure having an optically diffractive effect, by an exposure of the three-dimensional pattern being virtually ruled out, the intention being for this improvement in the security against forgery to be achievable in a simple, yet reliable way. At the same time, a method of producing corresponding films in a simple way is to be proposed.

To achieve this object, it is now proposed by the invention for the film mentioned at the beginning to proceed in such a way that the two successive layers of lacquer forming the three-dimensional pattern are transparent and consist of lacquers which can be crosslinked with each other.

Thus, in the case of the film according to the invention, the three-dimensional pattern is formed between two layers of lacquer which, since they are both transparent, can only be separated from each other mechanically with great difficulty, because it is not possible within the scope of usual mechanical processes to separate two transparent layers satisfactorily during working. Moreover, the separation of the layers of lacquer is made that much more difficult, however, above all because they consist of lacquers which crosslink with each other, i.e. bond together physically and chemically in such a way that even a separation with solvents, by the effect of heat etc. is ruled out. The use of lacquers crosslinking with each other cannot be regarded as obvious in this case, because in actual fact it must be feared, above all with regard to the subtleties of structures having an optically diffractive effect, that the structure is at least disturbed by the crosslinking process. However, contrary to expectations, this is in fact not so. Such a crosslinking also does not appear to

be possible with a structure of the film according to GB-A-1 568 563, because this could after all mean a migration of pigments between the two layers of lacquer, as a result of which, in the case of the known film, the
5 recognizability of the structure would be disturbed.

A particularly secure adhesion in the region of the interface is obtained with a procedure according to the invention if the layers of lacquer forming the three-dimensional pattern are of acrylate lacquers which can be
10 crosslinked by UV radiation, of polyurethane lacquers which can be crosslinked by heat, or a mixture of these lacquers, to be precise above all because with these lacquers a gradual curing or drying can take place, a bonding of the two layers of lacquer in the region of the
15 interface occurring during this curing process.

One possibility of producing different optical characteristics of the two transparent layers of lacquer is to colour them differently. However, it is favourable in particular if, according to the invention, the layers
20 of lacquer forming the three-dimensional pattern consist of lacquers each having a very different refractive index.

In order to make the three-dimensional pattern or the structure having an optical diffractive effect
25 visible to the naked eye, it may be favourable if, as further proposed by the invention, the decorative layer comprises a non-translucent, preferably metal layer, which is arranged on the surface away from the base film of the layers of lacquer forming the three-dimensional
30 pattern between them.

Due to the reflection occurring on it of the incident light, the non-translucent or metal layer intensifies the contrasts in the region of the boundary layer having the three-dimensional pattern in comparison
35 with a film in which only the two layers of lacquer forming the interface have different optical characteristics.

For the production of films, in particular heat-embossable films, it is generally customary to apply a first layer of lacquer to the base film, the said layer then being provided with the three-dimensional pattern and allowed to cure, and subsequently to apply a second layer of lacquer. In order now to achieve a crosslinking of the layers of lacquer, as envisaged by the invention, it is particularly favourable if a method is employed in which, before complete drying or curing of the first layer of lacquer, it is provided with the three-dimensional pattern and the second layer of lacquer is applied. By this procedure, the formation of the bonds between the layers of lacquer is greatly enhanced, so that a particularly good adhesion is achieved.

Further details of the invention emerge from the following description of an exemplary embodiment of a film and of the method of production with reference to the drawing, in which:

Fig. 1 shows a section through a film according to the invention and

Fig. 2 shows diagrammatically a section taken from an apparatus for the production of films according to the invention.

The film according to Figure 1 comprises, in a way known per se, a base film 1, for example a polyester film having a thickness of approximately 19 μm . Provided on the base film 1 is a release layer 2, for example a wax-like layer or a special layer of lacquer. The release layer 2 is adjoined by a decorative layer, which is denoted overall by 3 and consists of a first layer of lacquer 4, a second layer of lacquer 5, in each case having a thickness of approximately 1-5 μm , as well as of a metal layer 6, which is for example vapour-deposited.

The decorative layer 3 can be detached from the base film 1, for example under the effect of heat and

pressure, and during use is secured to the object to be decorated or to be protected, for example a credit card consisting of plastic, by means of a layer of adhesive 7, which may, for example, be 0.2 to 0.7 μm thick. The layer
5 of adhesive 7 may be formed by a hot-melt adhesive or by a special lacquer which becomes tacky when heated.

As indicated diagrammatically in Figure 1, the interface 8 between the two layers of lacquer 4 and 5 is provided with a three-dimensional pattern. The three-
10 dimensional pattern of the interface 8 may, for example, be a structure having an optically diffractive effect, for example a so-called "hologram".

In order for the three-dimensional pattern or structure of the interface 8 to be visible, the lacquers
15 4 and 5 of the decorative layer 3 are, on the one hand, transparent. On the other hand, they each have distinctly different optical characteristics, preferably very different refractive indices.

The introduction of the three-dimensional pattern for forming the interface 8 takes place in a way known
20 per se from the production of embossing films, either in a stroke process or in a rolling process.

For production of the film, two different possibilities are provided, namely either a so-called dry
25 texturing or a wet texturing.

In the dry texturing, a lacquer is applied to the base film 1 and at least substantially dried. In this first lacquer, the three-dimensional pattern is then introduced in a stroke or rolling process. Subsequently,
30 the application of the second layer of lacquer then takes place.

As the first lacquer for dry texturing, a lacquer of the following composition may be used, which is applied to the base film over the entire surface in a
35 weight per unit area of 2.5 to 3.0 g/m^2 :

Lacquer A

	Composition	Parts by weight	Designa- tion	(Manufact- urer)
5	Aliphatic trifunctional acrylic ester	1000	SR 444	(Sartomer)
	Relative thinner	200	SR 285	(Sartomer)
	Silicone-modified polyester resin	300	Silico ftal HTL	(Goldschmidt)
10	Acrylic resin containing hydroxyl groups	1500	G-Cure 867	(Henkel)
	Photoinitiator	100	Dorocur 1664	(Merck)
	Aromatic polyfunctional isocyanate component	1400	Desmodur IL	(Bayer)
15	Toluene	2000		
	Methyl ethyl ketone	500		

When introducing the texturing to the layer of lacquer formed by the lacquer A, the stroke process operates for example with a contact pressure of 1 tonne/cm², a temperature of 110°C and a duration of pressure of 0.4 sec. If a rolling process is used for introducing the three-dimensional pattern, one may operate with a linear pressure of 150 kp/cm, a temperature of approximately 110°C and a running speed of the roller or of the film with the lacquer of 15 m/min.

The second layer of lacquer is likewise applied over the entire surface in a weight per unit area of 1.0 to 1.5 g/m², the following lacquer being an example of one which may be used:

Lacquer B

	Composition	Parts by weight	Design- ation	(Manufact- urer)
5	Aliphatic pentafunctional acrylic ester containing hydroxyl groups	1000	SR 399	(Sartomer)
	Aliphatic polyester urethane acrylate	1000	Genomer T 1200	(Rahn)
10	Photoinitiator	800	Irgacure 651	(Ciba)
	Methyl ethyl ketone	1500		

15 The bonding of the layers of the lacquers A and B takes place by crosslinking between the not completely cured constituents of the two layers of lacquer following the application of the second layer of lacquer, as a result of which a virtually inseparable bond is produced in the region of the interface 8.

20 If quicker working is desired, a method of wet texturing is employed. The application of the first layer of lacquer is in this case represented diagrammatically in Fig. 2. The first layer of lacquer 4' is applied to the base film 1' in a way known per se, for example in a gravure printing process. The base film 1' with the first layer of lacquer 4' then runs over the surface of a cooled and co-rotated roll 10, having a three-dimensional pattern 9, in such a way that the first layer of lacquer 4' faces the three-dimensional pattern 9 and thus becomes textured in accordance with the configuration of the interface 8' during running over the roll 10. The base film 1' with the layer of lacquer 4' is pressed by means of a rubber roll 11 against the textured roll 10. During the further wrapping of the base film 1' with the layer of lacquer 4' around the textured roll 10, an irradiation with UV rays takes place, as indicated by the arrows 12, to be precise through the base film 1' from its reverse side, which means that the UV radiation 12 reaches the

layer of lacquer 4' after corresponding attenuation in the base film 1'. If the base film 1' consists of polyester material, it may generally be assumed that only radiation having a wavelength of more than 360 nm is allowed to pass, as a result of which only a partial curing of the lacquer 4' curable by UV radiation takes place.

The base film 1' with the layer of lacquer 4' forming the interface 8' subsequently runs to (sic) the textured roll 10 via a detachment roll 13, as a result of which the base film 1' with the layer of lacquer 4' is detached from the textured roll 10.

The fabrication of the film provided with the first layer of lacquer 4' according to Fig. 2 then takes place in such a way that a further layer of a curable lacquer is applied to the layer of lacquer 4' in a gravure printing process, the final curing of the two layers of lacquer 4', then taking place either by renewed UV radiation or by the effect of heat, depending on their composition.

The following lacquers may be employed for wet texturing:

For the first layer of lacquer 4' a lacquer C, which is applied over the entire surface in a weight per unit area of 1.5 to 2.0 g/m²:

Lacquer C

Composition	Parts by weight	Design- ation	(Manufact- urer)
Aliphatic, silicone- modified acrylic ester	1000	Silicone acrylate VP 6536	(Röhm)
Aliphatic pentafunctional acrylic ester containing hydroxyl groups	1000	SR 399	(Sartomer)
Aliphatic polyester urethane acrylate	1000	Genomer D 900	(Rahn)
Photoinitiator	80	Dorocur 1664	(Merck)
Methyl ethyl ketone	1500		

For the second layer of lacquer, a lacquer D, the application of which is likewise over the entire surface, for example in a gravure printing process, takes place in a weight per unit area of 1.0 to 1.5 g/m².

5 Lacquer D

	Composition	Parts by weight	Design- ation	(Manufact- urer)
10	Aliphatic, trifunctional acrylic ester	1000	SR 444	(Sartomer)
	Relative thinner	2000	SR 285	(Sartomer)
	Aliphatic polyester urethane acrylate	1000	Genomer D 900	(Rahn)
	Aliphatic polyester acrylate	1000	Prepoliner VSP 2051	(Degussa)
15	Copolymerizing tertiary amine	600	Uvecryl P 101	(UCB)
	Photoinitiator	400	Irgacure 651	(Ciba)
20	Methylethylketone	1000		

Instead of the lacquers B and D described above, which are in each case curable by means of UV radiation, it would also be possible to employ the following lacquer E, a crosslinking polyurethane lacquer:

Lacquer E

	Composition	Parts by weight	Design- ation	(Manufac- turer)
5	Low viscosity nitro-cellulose	600	Collodium-	(Wolff)
			Wolle E330	
	High molecular weight polymethylmetacrylate resin	600	Plexigum M 527	(Röhm)
	Silicone-modified	150	Silicoftal	
10	polyester resin		HTL	(Goldschmidt)
	Polymethylmetacrylate resin containing hydroxyl groups	600	Degalan LS 150/300	(Degussa)
	Aromatic, polyfunctional isocyanate component	1400	Desmodur IL	(Bayer)
15	Ethylacetate	2000		
	Methylethylketone	2400		
	Cyclohexanone	600		

20 If lacquer E is used, a thermal curing must take place, for example in a drying cabinet at a temperature of approximately 70 to 80°C for twelve hours.

25 When the two layers of lacquer 4, 5 are applied to the base film 1, if appropriate, the metal layer 6 can also be applied, for example by vacuum vapour deposition, but also by sputtering. It would also be conceivable to provide coloured layers of lacquer etc. The film is then completed by applying the layer of adhesive 7.



Patent claims

1. Multilayered film, in particular heat-embossable film, consisting of a base film, a decorative layer, provided with a three-dimensional pattern, preferably a structure having an optically diffractive effect, and comprising at least two successive layers of lacquer, as well as possibly consisting of an adhesive layer arranged on the side of the decorative layer away from the base film, the two successive layers of lacquer having distinctly different optical characteristics and the interface between the layers of lacquer forming the three-dimensional pattern, characterized in that the two successive layers of lacquer (4, 5) forming the three-dimensional pattern are transparent and consist of lacquers which can be crosslinked with each other.

2. Film according to Claim 1, characterized in that the layers of lacquer (4, 5) forming the three-dimensional pattern (8) consist of acrylate lacquers which can be crosslinked by UV radiation, of polyurethane lacquers which can be crosslinked by heat, or a mixture of these lacquers.

3. Film according to Claim 1 or 2, characterized in that the layers of lacquer (4, 5) forming the three-dimensional pattern (8) consist of lacquers each having a very different refractive index.

4. Film according to one of Claims 1 to 3, characterized in that the decorative layer (3) comprises a nontranslucent, preferably metal layer (6), which is arranged on the surface away from the base film (1) of the layers of lacquer (4, 5) forming the three-dimensional pattern (8) between them.

5. Method of producing films according to one of the preceding claims, a first layer of lacquer being applied to the base film, the said layer then being provided with the three-dimensional pattern and subsequently a second layer of lacquer being applied, characterized in that, before complete drying or curing of the first layer of lacquer, it



is provided with the three-dimensional pattern and the second layer of lacquer is applied.



EP 0 210 619 B1

(As printed)

Claims

1. Multilayered film, in particular heat-embossable film, consisting of a base film, a decorative layer, provided with a three-dimensional pattern, preferably a structure having an optically diffractive effect, and comprising at least two successive layers of lacquer, as well as possibly consisting of an adhesive layer arranged on the side of the base film away from the decorative layer, the two successive layers of lacquer having distinctly different optical characteristics and the interface between the layers of lacquer forming the three-dimensional pattern, characterized in that the two successive layers of lacquer (4, 5) forming the three-dimensional pattern are transparent and consist of lacquers which can be crosslinked with each other.

2. Film according to Claim 1, characterized in that the layers of lacquer (4, 5) forming the three-dimensional pattern (8) consist of acrylate lacquers which can be crosslinked by UV radiation, of polyurethane lacquers which can be crosslinked by heat, or a mixture of these two lacquers.

3. Film according to Claim 1 or 2, characterized in that the layers of lacquer (4, 5) forming the three-dimensional pattern (8) consist of lacquers each having a very different refractive index.

4. Film according to one of Claims 1 to 3, characterized in that the decorative layer (3) comprises a non-translucent, preferably metal layer (6), which is arranged on the surface away from the base film (1) of the layers of lacquer (4, 5) forming the three-dimensional pattern (8) between them.

5. Method of producing films according to one of the preceding claims, a first layer of lacquer being applied to the base film, the said layer then being provided with the three-dimensional pattern and subsequently a second layer of lacquer being applied, characterized in that, before complete drying or curing of the first layer of lacquer, it is provided with the three-dimensional pattern and the second layer of lacquer is applied.

(As printed)

Revendications

1. Feuille multicouche, en particulier feuille déformable par estampage à chaud, se composant d'une feuille support, d'une couche décorative comprenant au moins deux couches consécutives de vernis et comportant un dessin en relief, de préférence une structure à effet optique de diffraction, ainsi qu'éventuellement une couche de colle disposée sur la face, opposée à la feuille support, de la couche décorative, les deux couches consécutives de vernis ayant des propriétés optiques nettement distinctes et l'interface située entre les deux couches de vernis formant le dessin en relief, caractérisée en ce que les deux couches consécutives de vernis (4, 5) formant le dessin en relief sont transparentes et se composent de vernis réticulables entre eux.

2. Feuille selon la revendication 1, caractérisée en ce que les couches de vernis (4, 5) formant le dessin en relief (8) se composent de vernis d'acrylate réticulables au moyen d'un rayonnement ultraviolet, de vernis se réticulant sous l'action de la chaleur ou d'un mélange de ces vernis.

3. Feuille selon la revendication 1 ou 2, caractérisée en ce que les couches de vernis (4, 5) formant le dessin en relief se composent de vernis ayant des indices de réfraction fortement différenciés.

4. Feuille selon l'une quelconque des revendications 1 à 3, caractérisée en ce que la couche décorative (3) comprend une couche non transparente, de préférence une couche métallique, qui est disposée sur la face, opposée à la feuille support (1), des couches de vernis (4, 5) formant entre elles le dessin en relief (8).

5. Procédé de fabrication de feuilles selon l'une quelconque des revendications précédentes, dans lequel on applique une première couche de vernis sur la feuille support, puis on revêt ladite couche de vernis du dessin en relief, puis on applique une seconde couche de vernis, caractérisé en ce qu'on revêt la première couche de vernis du dessin en relief et on applique la seconde couche de vernis avant le séchage complet ou le durcissement complet de ladite première couche de vernis.