

(19) **DANMARK**

(10) **DK/EP 3241946 T3**



Patent- og  
Varemærkestyrelsen

(12) **Oversættelse af  
europæisk patentskrift**

- 
- (51) Int.Cl.: *D 21 H 19/02 (2006.01)*      *B 32 B 29/00 (2006.01)*      *B 32 B 29/06 (2006.01)*  
*C 23 C 4/02 (2006.01)*      *D 21 H 19/06 (2006.01)*      *D 21 H 19/08 (2006.01)*  
*D 21 H 19/82 (2006.01)*
- (45) Oversættelsen bekendtgjort den: **2019-11-25**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2019-08-28**
- (86) Europæisk ansøgning nr.: **16168047.5**
- (86) Europæisk indleveringsdag: **2016-05-03**
- (87) Den europæiske ansøgnings publiceringsdag: **2017-11-08**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Mayr-Melnhof Karton AG, Brahmplatz 6, 1041 Wien, Østrig**
- (72) Opfinder: **VORENKAMP, Harman, Mörikestrasse 6/2, 71549 Auenwald, Tyskland**
- (74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Strandvejen 70, 2900 Hellerup, Danmark**
- (54) Benævnelse: **FREMGANGSMÅDE TIL FREMSTILLING AF ET COATET INDPAKNINGSMATERIALE**
- (56) Fremdragne publikationer:  
**WO-A1-96/31649**  
**WO-A1-2012/099698**  
**WO-A1-2015/049262**  
**DATABASE WPI Week 200432 Thomson Scientific, London, GB; AN 2004-342228 XP002763863, & JP 2003 128777 A (SHOWA DENKO KK) 8. Mai 2003 (2003-05-08)**



## Method for producing a coated packaging material

### Description

- 5 The invention relates to a method for producing a coated packaging material, to a coated packaging material, and to a package comprising such a packaging material.

10 Metal-coated, cellulose-based packaging materials are useful in a multiplicity of applications. For example, metal-coated papers and cards are suitable for producing gift paper, packaging cartons, and other types of packaging. Further known applications are the use of such packaging materials for product identification in tobacco products, labels, cases, cosmetic packaging, lottery slips, and the like. In these applications, the metal-coated packaging material is

15 generally printed with a brand identifier, a decorative design and the like, and may have various levels of gloss and/or other performance features. A desire in particular is for metal-coated packaging materials to have a very highly reflective, lustrous surface. Untreated cellulose-based substrates, however, normally have a relatively irregular surface, meaning that metals or metal particles applied directly

20 do not have any regular orientation and cause incoherent scattering and reflection of incident light, resulting in a matt surface appearance. Customarily, therefore, a priming coat is first applied to the cellulose-containing substrate, and the metal-containing layer is generated subsequently on said coat. WO 2013/134359 A1, for example, discloses the production of priming coat layers from acrylates which are

25 polymerized radically by UV or electron beams (Electron Beam Curing).

WO 2015/049262 A1 discloses a method for the production of brilliant glossy metall coatings on paper substrates with the aid of UV-curable compositions.

- 30 WO 2012/099698 A1 discloses a method for the application of an energy-curable primer and a brilliant metallic ink to a paperboard or paper substrate. The primer

can be cured by using an energy-curing system, such as a UV or EB curing system.

5 WO 96/31649 A1 discloses a sheet material substrate, such as for instance a film or paper sheet, with a polymer base coating overlying and adhered to a surface of the sheet material substrate. The base coating comprises a radiation cured cross-linked polymer derived from at least one vapor deposited acrylate prepolymer composition. A metal layer is deposited on and overlies a surface of the metal layer.

10

From the database WPI, week 200432, Thomson Scientific, London, GB, AN 2004-342228 of May 8, 2003 a starting compound for cationic polymerization reactions is known.

15 Regarded as a disadvantage of the known priming coats, however, is the fact that on curing they experience comparatively severe contraction, resulting in poor adhesion of the priming coat and hence of the metallic layer on the substrate. Furthermore, priming coats frequently comprise high-opacity color and effect systems as well, meaning that the UV light used for curing cannot penetrate down  
20 to the substrate, a phenomenon which may likewise result in incomplete through-curing. Moreover, radical polymerizations wherein the active species is a molecule having an unpaired electron are difficult to control and are inhibited by oxygen; this, without the expensive and complicated use of inert gases and protective rooms, may likewise result in incomplete and non-uniform degrees of  
25 polymerization and in ready detachment of the priming coat.

It is an object of the present invention to improve a generic method for producing a coated packaging material in such a way that it is possible to produce a priming coat having improved adhesion to cellulose-containing substrates. A further object  
30 of the present invention consists in specifying a package which consists at least partly of such a packaging material.

The objects are achieved in accordance with the invention by a method having the features of claim 1 and by a package as claimed in claim 14. Advantageous embodiments with useful developments of the invention are indicated in the respective dependent claims; advantageous embodiments of each aspect of the invention should be seen as being advantageous embodiments of each other aspect of the invention, and vice versa.

A first aspect of the invention relates to a method for producing a coated packaging material that involves carrying out at least the steps of a) providing a cellulose-containing substrate, b) coating at least one surface region of the substrate with a curable composition and curing the composition to form a priming coat, and c) generating a metal-containing layer on at least one surface region of the priming coat. Improved adhesion of the priming coat on the cellulose-containing substrate is achieved in accordance with the invention by virtue of the composition used in step b) comprising at least one ionically polymerizable monomer which is cured by ionic polymerization. In contradistinction to radical polymerization, the reaction in the case of ionic polymerization is initiated and carried by ions. Like radical polymerization, ionic polymerization may be broken down into the four steps of initiation, growth, chain transfer and termination. The invention is based on the finding that the contraction of a priming coat produced by ionic polymerization is substantially less than in the case of one produced by radical polymerization, and is typically below 5%, more particularly below 3%. As a result, the priming coat produced in accordance with the invention possesses particularly good adhesion on the cellulose-containing substrate. Furthermore, ions as carriers of the polymerization reaction are substantially more long-lived than radicals, react very selectively and are relatively insensitive toward oxygen, meaning that the polymerization can be carried out without an inert gas atmosphere and, after initiation, may even advance continuously in the dark, thus ensuring through-curing down to the substrate even in the case of strongly colored and particularly thick priming coats. Moreover, ionic polymerization allows the production of very flexible priming coats with a correspondingly low tendency to fracture, a particular advantage when using the packaging materials produced in

accordance with the invention to produce packages. Fluting, stamping and embossing, and also microembossments, especially, require a highly flexible base and a highly flexible priming coat, respectively. In contrast to compositions which polymerize radically, moreover, compositions which polymerize ionically can be formulated to be at least approximately odorless and/or emission-free, and, after polymerization, lead to priming coat layers which are also low in emissions or emission-free, resulting in a significantly lower hazard potential and nuisance potential for the processor during production. There is also, advantageously, no need for complex and expensive inert gas or air removal units. Further advantages lie in the possibility of generating highly lustrous metal-containing layers on the priming coat produced in accordance with the invention, since this priming coat, owing to the uniform progress of reaction from the surface in the direction of the substrate in the course of curing, forms a correspondingly uniform and readily coatable surface for the metal-containing layer, with unevennesses in the substrate surface being leveled automatically. The cellulose-containing substrate may in principle be uncoated or may already have been coated with one or more layers, with an uncoated substrate being preferred. For example, the substrate may be coated or uncoated paper, coated or uncoated card, or coated or uncoated board.

20

In one advantageous embodiment of the invention the composition used in step b) is cured anionically or cationically and/or by living ionic polymerization. In an anionic polymerization, the active species are anions. Anionic polymerization takes place preferably in the case of monomers having electron-withdrawing (-M effect) substituents such as nitrile, carboxyl, phenyl and vinyl groups. In a cationic polymerization, the active species are cations. Cationic polymerization takes place preferably in the case of monomers having electron-donating (+M effect) substituents and proceeds in general by way of carbenium, oxonium, ammonium ions and the like. In the absence of termination reactions, the anions or cations are retained even after complete reaction of the monomer, and so the charged polymers, following addition of further monomers, are able to continue their chain growth, bringing about the possibility of what is called living polymerization. By this

30

means, advantageously, covalent attachment of the metal-containing layer to the priming coat is made possible, if the metal-containing coat is likewise produced using a formulation having corresponding ionically polymerizable monomers, in the form of a metal-containing paint or metal-containing ink, for example, with the metal-containing layer thereby adhering to the priming coat in a particularly reliable way. Another possibility, as and when required, is also to first generate a second priming coat layer or functional layer on the first priming coat, before the metal-containing layer is generated.

10 In a further advantageous embodiment of the invention, the composition used in step b) is cured by means of an initiator, more particularly a preferably blocked compound from the group of the Lewis and/or Brønsted acids and/or the Lewis and/or Brønsted bases, and/or by thermal and/or photochemical activation. With the aid of an initiator, the polymerization reaction can on the one hand be initiated

15 in a controlled way and can on the other hand be adjusted in relation to the desired chain-length distribution. The initiator may in principle be added directly or may form only by reaction with the monomer. In the case of a cationic polymerization, Lewis acids can be used that initiate the cationic polymerization even at low temperatures. The resulting polymers possess a relatively high molar

20 mass. Examples of those which can be used, individually and in any desired combination, are metal halides such as  $\text{BF}_3$ ,  $\text{SnCl}_4$ ,  $\text{SbCl}_5$ ,  $\text{ZnCl}_2$ ,  $\text{TiCl}_4$ ,  $\text{PCl}_5$  and  $\text{AlCl}_3$ , oxyhalides such as  $\text{POCl}_3$ ,  $\text{CrO}_2\text{Cl}$ ,  $\text{SOCl}_2$ ,  $\text{VOCl}_3$  and the like, trityl chloride, and also organometallic compounds such as  $\text{RAlCl}_2$ ,  $\text{R}_2\text{AlCl}$ ,  $\text{R}_3\text{Al}$  or benzyl(tetrahydrothiophenium) hexafluoroantimonate. The initiation of the

25 polymerization using Lewis acids may be promoted via the presence of a proton donor such as water, alcohol, or an organic acid. Accordingly, the reaction can also be carried out in the presence of atmospheric moisture, moisture in the substrate, etc. Brønsted acids are able to initiate the reaction by protonating the monomer. The acid used ought generally to be strong enough to produce a

30 sufficient amount of protonated monomers, but ought also not to be too greatly nucleophilic, since otherwise there may be premature termination through a combination with the protonated monomer/oligomer/polymer, something which

would lead to relatively short chain lengths. Halogen acids are therefore less preferable, whereas perchloric, sulfuric, phosphoric, fluorosulfonic, chlorosulfonic, methanesulfonic and trifluoromethanesulfonic acids are particularly suitable.

5 Brønsted bases and/or Lewis bases may be used more particularly for initiating the anionic polymerization. Suitable as initiators here as well are numerous compounds such as, for example, individually and in any desired composition, metal amides such as (Na/K)NH<sub>2</sub> and LiC<sub>2</sub>H<sub>5</sub>, alkoxides, hydroxides, cyanides, phosphines, amines, organometallic compounds, especially organolithium compounds such as alkyllithium compounds, alkoxides, alkali metals or PhMgBr.

10 The polymerization in this case is initiated by the addition of a nucleophile onto the monomer. Through the choice of thermal and/or photochemical activation is it possible to initiate the ionic polymerization reaction as and when required.

Further advantages arise by selecting the at least one ionically polymerizable monomer from a group which encompasses epoxides, more particularly the

15 cycloaliphatic epoxides and glycidyl ethers, isoprenes, cyanoacrylates, lactides, caprolactones, caprolactams, alkylcyclotrisiloxanes, vinyl ethers and isobutenes, and/or from a group which encompasses compounds having at least one electron-donating substituent, more particularly one or more alkoxy, phenyl, vinyl and/or

20 1,1-dialkyl groups. By this means it is possible to produce priming coats having particularly high flexibility, particularly effective adhesion to cellulose, high abrasion resistance, high luster, good hardness, high chemical resistance, and a good barrier effect. An example of an epoxide that can be used is 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexanecarboxylate (7-oxa-

25 bicyclo[4.1.0]heptan-3-ylmethyl- 7-oxa-bicyclo[4.1.0]heptane-3-carboxylate).

In a further advantageous embodiment of the invention the curing in step b) is carried out at an atmospheric humidity and/or surface humidity of between 5% and 65%. The atmospheric humidity in the context of the present invention refers

30 to the relative atmospheric humidity, expressed in percent (%), which for the current temperature and the current pressure indicates the ratio of the instantaneous water vapor content to the maximum possible water vapor content

in the ambient atmosphere of the substrate. Correspondingly, the surface humidity indicates the relative atmospheric humidity directly at the surface of the substrate to be coated. If the substrate is colder than the ambient air, there may be cooling of the air directly at the substrate surface, and consequently the surface humidity may in some cases be higher than the (ambient) atmospheric humidity. Values between 5% and 65% are understood more particularly as atmospheric and/or surface humidity values of 5%, 6%, 7%, 8%, 9%, 10%, 11%, 12%, 13%, 14%, 15%, 16%, 17%, 18%, 19%, 20%, 21%, 22%, 23%, 24%, 25%, 26%, 27%, 28%, 29%, 30%, 31%, 32%, 33%, 34%, 35%, 36%, 37%, 38%, 39%, 40%, 41%, 42%, 43%, 44%, 45%, 46%, 47%, 48%, 49%, 50%, 51%, 52%, 53%, 54%, 55%, 56%, 57%, 58%, 59%, 60%, 61%, 62%, 63%, 64% or 65%, and also corresponding values in-between. By this means it is possible to set the properties of the priming coat ideally, since water influences the cure rate, the conversion and the degree of crosslinking, and hence the resulting hardness or flexibility of the priming coat.

15

Further advantages arise if the composition used in step b) comprises at least one polyol, more particularly from a group which encompasses polyethylene glycols, polypropylene glycols, polyethylenepropylene glycols and poly(tetrahydrofuran)dioles. This permits targeted flexibilization of the priming coat.

20

In a further advantageous embodiment of the invention the composition used in step b) comprises nanoparticles, more particularly from the group of modified and unmodified silica particles. Using nanoparticles as fillers allows the priming coat to be functionalized specifically, in relation, for example, to its coloration, contraction on curing, combined toughness and flexibility, and coefficient of thermal expansion.

25

In a further advantageous embodiment of the invention the curable composition comprises at least one solvent, more particularly a weakly polar solvent from the group of methylene chloride, toluene, apolar hydrocarbons and tetrahydrofuran. Since ions constitute the active species of the polymerization, great influence over

30

the reaction can be gained via the solvent or solvent mixture by providing the respective ions specifically in the form of covalent polymers, a contact ion pair, a solvent-separated ion pair, or free ions. By this means it is possible in particular to adjust the rate of the polymerization and also the average chain length of the polymers and hence the mechanical properties of the priming coat.

In a further advantageous embodiment of the invention the ionic polymerization is terminated by addition of at least one counterion and/or of at least one terminating reagent and/or by backbiting, and/or in that at least one second monomer type is added when the at least one monomer has reached or exceeded a predetermined degree of polymerization. This as well is a simple way of specifically adjusting the mechanical properties of the priming coat. The ionic polymerization may be terminated spontaneously, by combination with the counterion and/or by addition of terminating reagents (water, methanol, etc.). If only the growing chain is terminated, by transfer of protons to a monomer or by backbiting and elimination of a proton, for example, the degree of polymerization is indeed limited, and yet the polymerization rate remains at least approximately unchanged. "Backbiting" refers to an intramolecular electrophilic aromatic substitution reaction which is possible in particular with aromatic monomers, causing the initiator complex to reform. Where at least one second monomer (of different kind) is added, block copolymers can be prepared. In this case it is of course possible to add different kinds of monomers in each case when a defined average chain length is reached or exceeded, in order to prepare different block copolymers from two, three, four or more monomer types.

Further advantages come about if the curable composition is applied to the substrate by means of a leveling coating process, more particularly by means of doctor, blade and/or film press and/or by means of a contour coating process, more particularly by means of casting, spraying, curtain coating and/or airbrush, and/or by a printing process, more particularly by planographic printing, gravure printing, digital printing, screen printing and/or relief printing. The use of a leveling coating process allows material to be smoothed and is particularly useful insofar

as any subsequent non-contact application techniques largely retain the contour of the substrate surface. This means that a rough surface contour in the base material or the substrate is compensated and thereby smoothed with the aid of a leveling coating process. Generally speaking, the smoother the web of material, the higher the product quality achieved. Through the use of leveling or evening-out coating processes it is possible, in summary, to generate a primer having a particularly smooth surface on rough substrates. This smooth surface is then particularly suitable for subsequent generation of the metal-containing layer. The use of contour coating processes offers the fundamental advantage that no pressure is exerted at the point of contact between substrate and composition, thereby preventing (excessively) deep penetration of the composition into the cellulose base material. Particularly uniform priming coats can be produced by this means. At the same time, particularly low quantities of composition are needed for application in order to achieve a desired thickness of the priming coat, and so the method can be carried out particularly economically. With the aid of a printing process, the priming coat can be generated particularly quickly and flexibly on the substrate, and the surface of the substrate or of the priming coat can be simultaneously structured as and when required.

In a further advantageous embodiment of the invention the priming coat is surface-treated before step c). By this means it is possible to improve the application and the adhesion of the subsequent layer or layers. For this purpose, for example, the priming coat may be plasma-treated. A further possibility is to provide the priming coat with a particular visual appeal or to carry out other functionalizations.

In a further embodiment of the invention, the metal-containing layer is produced by applying and drying and/or curing a metallic paint and/or by physical and/or chemical vapor deposition, more particularly by organometallic chemical vapor deposition. This represents a particularly flexible way of generating the metal-containing layer.

In a further advantageous embodiment of the invention a top layer, which more particularly is opaque or transparent, is applied to the metal-containing layer. As well as protecting the metal-containing layer from environmental effects, it is also possible by this means to influence the visual appeal of the packaging material, as  
5 and when required.

Further a packaging material comprising a cellulose-containing substrate with a layer system is disclosed, said layer system comprising at least one priming coat and a metal-containing layer. Improved adhesion of the priming coat on the  
10 cellulose-containing substrate of the packaging material is ensured in that the priming coat is or comprises at least one polymer cured by ionic polymerization. The contraction of a priming coat produced by ionic polymerization is substantially less than in the case of one produced by radical polymerization, and is typically below 5%, more particularly below 3%. As a result, the priming coat possesses  
15 particularly good adhesion on the cellulose-containing substrate. Furthermore, ions as carriers of the polymerization reaction are substantially more long-lived than radicals, react very selectively and are relatively insensitive toward oxygen, meaning that the polymerization can be carried out without an inert gas atmosphere and, after initiation, may even advance continuously in the dark, thus  
20 ensuring through-curing down to the substrate even in the case of strongly colored and particularly thick priming coats. Moreover, ionic polymerization allows the production of very flexible priming coats with a correspondingly low tendency to fracture, a particular advantage when using the packaging material produced in accordance with the invention to produce packages. Fluting, stamping and  
25 embossing, and also micro embossments, especially, require a highly flexible base and a highly flexible priming coat, respectively. In contrast to compositions which polymerize radically, moreover, compositions which polymerize ionically can be formulated to be at least approximately odorless and/or emission-free, and, after polymerization, lead to priming coat layers which are also low in emissions or  
30 emission-free, resulting in a significantly lower hazard potential and nuisance potential for the processor during production. There is also, advantageously, no need for complex and expensive inert gas or air removal units. Further advantages

lie in the possibility of generating highly lustrous metal-containing layers on the priming coat produced in accordance with the invention, since this priming coat, owing to the uniform progress of reaction from the surface in the direction of the substrate in the course of curing, forms a correspondingly uniform and readily

5    coatable surface for the metal-containing layer, with unevennesses in the substrate surface being leveled automatically. The cellulose-containing substrate may in principle be uncoated or may already have been coated with one or more layers, with an uncoated substrate being preferred. For example, the substrate may be coated or uncoated paper, coated or uncoated card, or coated or uncoated board.

10   The cellulose base material of the substrate may preferably have a mass per unit area of between 5 g/m<sup>2</sup> and 2000 g/m<sup>2</sup>, more particularly between 100 g/m<sup>2</sup> and 1000 g/m<sup>2</sup> and more preferably between 200 g/m<sup>2</sup> and 800 g/m<sup>2</sup>. This allows the packaging material to be adapted particularly flexibly to different end uses. If the base material has a mass per unit area of between about 5 g/m<sup>2</sup> and about

15   150 g/m<sup>2</sup>, it is referred to in the context of the invention as paper. Base material having a mass per unit area of between about 150 g/m<sup>2</sup> and about 800 g/m<sup>2</sup> is referred to in the context of the invention as card, whereas base material having a mass per unit area of between about 800 g/m<sup>2</sup> and about 2000 g/m<sup>2</sup> is referred to as board. In its most simple embodiment, the priming coat consists exclusively of

20   the ionically polymerized polymer. Alternatively, in addition to the ionically polymerized polymer, the priming coat may comprise further substances. Moreover, the substrate may be a laminate. A laminate consists of one or more layers of paper impregnated in a resin such as phenolic resin or melamine resin and assembled under high pressure. The topmost layer of the layer system (finish

25   film) may be an opaque or transparent top coat (overlay) for protection from mechanical exposure. At least one layer in the layer system may also carry a motif (decorative laminate). It may additionally be the case that the packaging material is equipped with electrical and/or electronic components and/or energy sources, which are electrically connected to one another by way of the metal-containing

30   layer, in the form of conductor tracks, optionally ("paper or card circuit board"). Further features and their advantages are evident from the descriptions of the first aspect of the invention, with advantageous embodiments of the first aspect of the

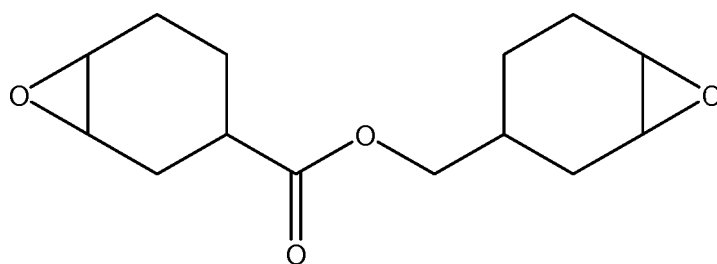
invention being regarded as advantageous embodiments of the second aspect of the invention, and vice versa.

5 A second aspect of the invention relates to a package which comprises at least one packaging material obtained by a method according to the first aspect of the invention. This ensures improved adhesion of the priming coat on the cellulose-containing substrate of the packaging material. The package may take the form, for example, of food packaging, more particularly of packaging for solid foodstuffs, of packaging for confectionery, or as beverage packaging for liquid foodstuffs, as  
10 packaging for tobacco products, as gift or surround packaging, as carrier packaging, etc.

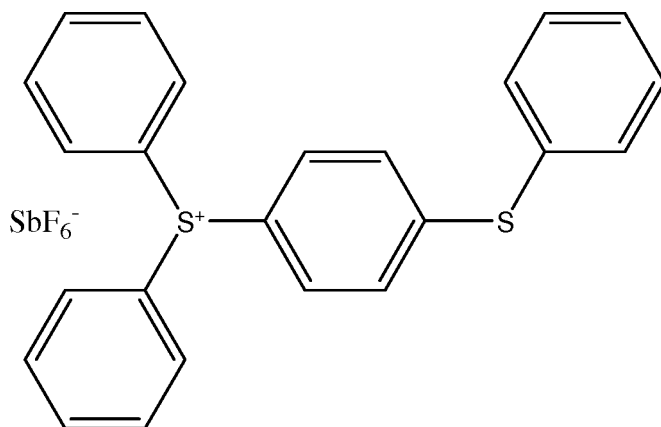
Further features and their advantages are evident from the descriptions of the first aspect of the invention, with advantageous embodiments of the first aspect of the  
15 invention being regarded as advantageous embodiments of the second aspect of the invention, and vice versa.

Further features of the invention are apparent from the claims, the figures, and the description of the figures. The features and combinations of features stated above  
20 in the description, and also the features and combinations of features stated below in the description of the figures and/or shown in isolation in the figures, can be used not only in the combination indicated in each case but also in other combinations, without departing from the scope of the invention. Consequently, the invention should be deemed to embrace and disclose additionally  
25 embodiments that are not explicitly shown and elucidated in the figures but are apparent from and can be generated by separate combinations of features from the embodiments that are elucidated. The disclosure should also be deemed to encompass embodiments and combinations of features which, therefore, do not have all of the features of an originally formulated independent claim. Here, the  
30 single figure shows a schematic sectional view from the side of a packaging material of the invention, according to one working example.

The single figure shows a schematic sectional view from the side of a packaging material 10 of the invention, according to one embodiment. The packaging material comprises a substrate 12, which of a cellulose-containing base material 14 and comprises an inside 16 facing away from the packaged contents, and an outside 18 facing away from the packaged contents. In the present embodiment, the base material 14 comprises uncoated paper having a mass per unit area of about 100 g/m<sup>2</sup>. On the outside 18 of the substrate 12 there is a layer system 20 which comprises a priming coat 22, a metal-containing layer 24, and a top layer 26. To produce the priming coat 22, which in principle may also be referred to a primer, the substrate 12 was coated with a composition containing a cationically polymerizable monomer which was cured by irradiation with UV light. The monomer used was the cycloaliphatic epoxy resin 7-oxa-bicyclo[4.1.0]heptan-3-ylmethyl 7-oxa-bicyclo[4.1.0]heptane-3-carboxylate with the formula



together with a photoinitiator based on antimony hexafluoride and having the formula



Alternatively or additionally it is also possible in principle to use other epoxides and/or vinyl resin-based monomers. The cationic polymerization starts by opening of the epoxide rings, and brings about ongoing chain growth. The contraction during the polymerization was in this case at most 3%, meaning that adhesion of the substrate 12 was excellent. Because of the insensitivity of the cationic polymerization toward oxygen, it was possible to carry out the reaction without a protective gas atmosphere. The atmospheric humidity was set at about 30%. In addition, even prior to the UV irradiation, the composition was heated to a temperature of about 45 °C or more by means of an infrared heat source in order to achieve an increase in the reaction rate. The temperature of the substrate 12 was held at not less than 40 °C until the end of the polymerization, in order to ensure complete through-curing of the priming coat 22. As well as very good flexibility, the priming coat 22 also possesses high abrasion resistance and also a very high luster owing to the uniform surface, thereby considerably boosting not only the adhesion but also the luster and the reflection of the metal-containing layer 24 applied subsequently. The composition for the priming coat 22, the metal-containing layer 24, and the concluding, fundamentally optional top layer 26 were each applied by printing. To produce the metal-containing layer 24, a conventional metallic paint was applied and cured. An alternative option is for the metallic paint as well to comprise an ionically polymerizable monomer as curing agent, allowing covalent attachment to the priming coat 22, optionally. The top layer 26 consists of a transparent clearcoat varnish, and protects the underlying layers of the layer system 20 from environmental effects.

It will be appreciated that the layer system 20 may also be generated only on the inside 16 or both on the inside 16 and on the outside 18. In that case, moreover, layer systems 20 generated on the inside 16 and on the outside 18 may be alike or different.

The parameter values reported in the documents for the definition of process conditions and measurement conditions for the characterization of specific properties of the subject matter of the invention should be regarded as being

encompassed by the scope of the invention even within the scope of deviations – resulting, for example, from measurement errors, system errors, weighing errors, DIN tolerances and the like.

**Patentkrav**

**1.** Fremgangsmåde til fremstilling af et coatet indpakningsmateriale (10), især et laminat, omfattende mindst trinnene:

- 5           a) at tilvejebringe et celluloseholdigt substrat (12);  
            b) at coate mindst et overfladeområde af substratet (12) med en hærdelig sammensætning og at hærde sammensætningen for at danne en grunding (22); og  
            c) at generere et metalholdigt lag (24) på mindst et overfladeområde af  
10           grundingen (22);

**kendetegnet ved, at**

- den i trin b) anvendte sammensætning indeholder mindst en ionisk polymeriserbar monomer, som hærdes ved ionisk polymerisering, og ved at den i trin b) anvendte sammensætning ikke er en radikal polymeriserende  
15 sammensætning.

**2.** Fremgangsmåde ifølge krav 1,

**kendetegnet ved, at**

- den i trin b) anvendt sammensætning hærdes anionisk eller kationisk og/eller ved  
20 levende ionisk polymerisering.

**3.** Fremgangsmåde ifølge krav 1 eller 2,

**kendetegnet ved, at**

- den i trin b) anvendte sammensætning hærdes ved hjælp af en initiator, især en  
25 fortrinsvis blokeret forbindelse fra gruppen af Lewis- og/eller Brønstedsyernerne og/eller Lewis- og/eller Brønstedbaserne, og/eller ved termisk og/eller fotokemisk aktivering.

**4.** Fremgangsmåde ifølge et af kravene 1 til 3,

**kendetegnet ved, at**

- den mindst ene ionisk polymeriserbare monomer er valgt fra en gruppe som omfatter epoxider, især cycloalifatiske epoxider og glycidylethere, isoprener, cyanoacrylater, lactider, caprolactoner, caprolactamer, alkylcyclotrisiloxaner, vinyl-  
30 ethere og isobutener, og/eller fra en gruppe, som omfatter forbindelser med

mindst en elektrondonerende substituent, især en eller flere alkoxy-, phenyl-, vinyl- og/eller 1,1-dialkylgrupper.

**5.** Fremgangsmåde ifølge et af kravene 1 til 4,

5 **kendetegnet ved, at**

hærdningen i trin b) udføres ved en luft- og/eller overfladefugtighed på mellem 5% og 65%.

**6.** Fremgangsmåde ifølge et af kravene 1 til 5,

10 **kendetegnet ved, at**

den i trin b) anvendte sammensætning omfatter mindst en polyol, især fra en gruppe, som indeholder polyethylenglycoler, polypropylenglycoler, polyethylenpropylenglycoler og poly(tetrahydrofuran)dioler.

15 **7.** Fremgangsmåde ifølge et af kravene 1 til 6,

**kendetegnet ved, at**

den i trin b) anvendte sammensætning indeholder nanopartikler, især fra gruppen af modificerede og umodificerede silicapartikler.

20 **8.** Fremgangsmåde ifølge et af kravene 1 til 7,

**kendetegnet ved, at**

den hærdelige sammensætning indeholder mindst et opløsningsmiddel, især et svagt polært opløsningsmiddel fra gruppen af methylenchlorid, toluen, apolære carbonhydrider og tetrahydrofuran.

25

**9.** Fremgangsmåde ifølge et af kravene 1 til 8,

**kendetegnet ved, at**

den ioniske polymerisering afsluttes ved tilsætning af mindst en modion og/eller af mindst en afbrydelsesreagens og/eller ved backbiting, og/eller ved at mindst en

30 anden monomertype tilsættes, når den mindst ene monomer har nået eller overskredet en forudbestemt polymeriseringsgrad.

**10.** Fremgangsmåde ifølge et af kravene 1 til 9,

**kendetegnet ved, at**

35 den hærdelige sammensætning påføres substratet ved hjælp af en udglattende

coatingfremgangsmåde, især ved hjælp af rakel, klinge og/eller filmpresse, og/eller ved hjælp af en konturcoatingfremgangsmåde, især ved hjælp af støbning, sprøjtning, gardin-coating og/eller luftbørste, og/eller ved en trykfremgangsmåde, især ved fladtryk, dybtryk, digitaltryk, serigrafi og/eller bogtryk.

**11.** Fremgangsmåde ifølge et af kravene 1 til 10,

**kendetegnet ved, at**

grundingen (22) er overfladebehandlet forud for trin c).

10

**12.** Fremgangsmåde ifølge et af kravene 1 til 11,

**kendetegnet ved, at**

det metalholdige lag (24) fremstilles ved påføring og tørring og/eller hærkning af en metallak og/eller ved fysisk og/eller kemisk gasfasepådamning, især ved

15 organometallisk kemisk gasfasepådamning.

**13.** Fremgangsmåde ifølge et af kravene 1 til 12,

**kendetegnet ved, at**

på det metalholdige lag (24) påføres et beskyttelseslag (26), som især er opakt

20 eller transparent.

**14.** Indpakning som omfatter mindst et indpakningsmateriale (10) som er opnået med en fremgangsmåde ifølge et af kravene 1 til 13.

1

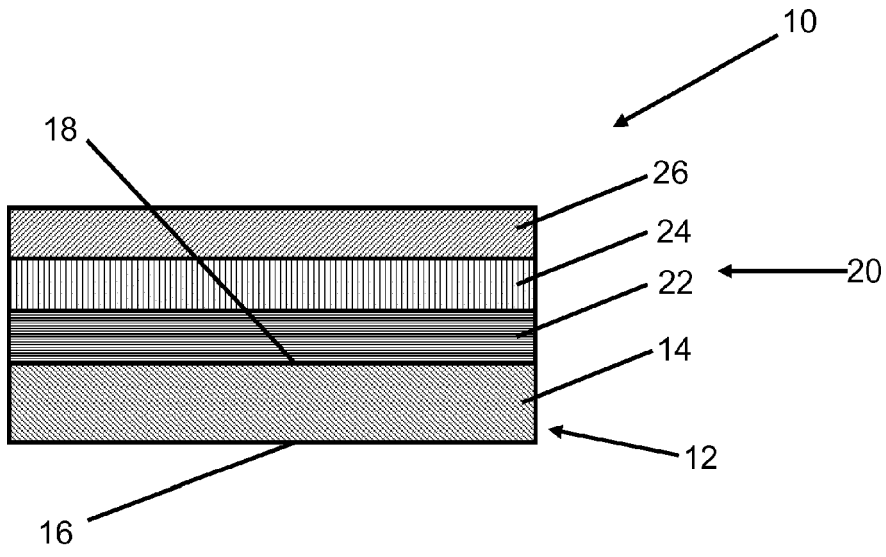


Fig.