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(54) **Fóliaanyag különösen biztonsági elemekhez**

# Sheet material, especially for security elements

The invention relates to a film material in particular for security elements with cutouts visible in transmitted light.

EP 330 733 B1 discloses a security element in the form of a filament or strip which is intended for embedment into security documents and which is composed of a plastics film which transmits light, and which has an opaque coating and cutouts where there are, at least in the regions identical with the cutouts, colourant and/or luminescent substances present which under suitable lighting conditions differ from the opaque coating in colour-contrasting form.

EP 613 786 A discloses security elements in the form of security filaments which have an opaque background in the form of a matrix, where there are cutouts in the form of signs, patterns or the like.

The patent specification WO02/31214 A1 discloses metallic coatings on films as security elements.

The layers and/or the cutouts are in essence produced by printing techniques, for example by the intaglio printing process. In this method, the matrices of the printing implements cannot produce homogeneous layers: the appearance of the security elements here, at least under magnification, is coarse-grain and reveals the matrix. These methods moreover require use of high-opacity inks or lacquers which have large pigment size and high density, and which have poor processability.

It was therefore an object of the invention to provide a security element where the appearance of the security element has been improved, and this also applies under magnification, and improved counterfeiting prevention is thus achieved. A further intention is that counterfeiting prevention be additionally improved via use of specific materials.

The invention therefore provides a security element according to Claim 1 and a process for the production of a security element according to Claim 8.

Examples of supportive substrates that can be used are supportive films, preferably flexible transparent or translucent plastics films, for example made of PI, PP, MOPP, PE, PPS, PEEK, PEK, PEI, PAEK, LCP, PEN, PBT, PET, PA, PC, COC, POM, ABS, PVC.

The thickness of the supportive films is preferably from 5 to 700 μm, with preference from 5 to 200 μm, with particular preference from 5 to 50 μm.

Other supportive substrates that can moreover be used are paper and composites with paper, for example composites with plastics with weight per unit area from 20 to 500 $g/m^2$, preferably from 40 to 200 $g/m^2$.

Non-wovens, such as continuous-fibre non-wovens, staple-fibre non-wovens and the like, optionally needled or calendered, can moreover be used as supportive substrates. These non-wovens are preferably composed of plastics, for example PP, PET, PA, PPS and the like, but it is also possible to use non-wovens made of natural, optionally treated fibres, examples being viscose-fibre non-wovens. The weight per unit area of the non-wovens used is about 20 $g/m^2$ to 500 $g/m^2$.

The supportive substrates can additionally have a lacquer layer, which can be unstructured or structured, for example embossed, or can comprise diffraction gratings. The lacquer layer can by way of example be an adhesive lacquer layer or a releasable transfer lacquer layer, and it can be crosslinkable or crosslinked by radiation, for example UV radiation, or by a thermal or reactive route, and can have additional properties, for example scratch resistant and/or antistatic properties, or chemical resistance. Suitable lacquer systems are not only aqueous but also solvent-containing systems, and in particular lacquer systems based on PE acrylate, PET acrylate, urethane acrylate, PVC, PMMA or epoxy acrylate.

The supportive substrate can moreover also have an electrically conductive polymer layer, by way of example based on polyethylenedioxythiophene or derivatives thereof.

For the production of a partial coating, a printing ink soluble in a solvent is applied in the form of the desired cutouts to this supportive substrate or to existing coatings thereon, examples being diffraction gratings, holograms, printed layers such as ink layers, coatings with optically variable pigments and the like.

The ink can be applied by any desired process, for example by intaglio printing, flexographic printing, screen printing, digital printing or the like. The ink used or the lacquer used is soluble in a solvent, preferably in water, but it is also possible to use an ink that is soluble in any desired solvent, for example in alcohol, esters and the like. The ink and the lacquer can be conventional compositions based on natural or synthetic macromolecules. The soluble ink can have pigmentation or no pigmentation. Pigments that can be used are any of the known pigments. $TiO_2$, ZnS, kaolin and the like are particularly suitable.

The printed supportive substrate or, in the case of production of a full-surface coating, the supportive substrate can then be treated by means of an in-line-plasma process (low-pressure or atmospheric-pressure plasma process), corona process or flame process. High-energy plasma, for example Ar plasma or $Ar/O_2$ plasma, is used, where appropriate, to remove toner residues from the printing inks. The sharp delineation that is required for the necessary precision of the coding system in respect of the outlines of the cutouts is thus achieved with a partial coating. At the same time, the surface is activated. Terminal polar groups are produced at the surface here. Adhesion of metals and the like on the surface is thus improved.

Simultaneously with the use of the plasma treatment or corona treatment or flame treatment, it is optionally possible to apply a thin layer of metal or metal oxide as adhesion promoter, for example via sputtering or deposition from the vapour. Particularly suitable materials are Cr, Al, Ag, Ti, Cu, Ta, Sn, $TiO_2$, Si oxides or chromium oxides. The thickness of this adhesion-promoter layer is generally from 0.1 nm to 5 nm, preferably from 0.2 nm to 2 nm, particularly preferably from 0.2 to 1 nm.

The actual functional layer is then applied by means of a PVD process or CVD process.

Suitable materials are any of the elements, compounds of these or alloys of these, which in the form of stoichiometric or non-stoichiometric compound in any oxidation state exhibit a colour and are not transparent.

Suitable materials here are in particular Al, Fe, Cu, Ag and alloys, for example Cu/Al alloys.

The element, the compound or the alloy is vaporized or sputtered in the vapour-deposition device here, and deposited onto the supportive substrate. The oxidation level or the gradient of oxidation of the coating is established in a defined manner here via controlled introduction of gas, e.g. by way of a gas lance, for example via introduction of oxygen.

The coating can therefore by way of example be oxidized to give non-stoichiometric or stoichiometric oxides via appropriately metered introduction of oxygen, and this also causes a change of appearance.

By way of example, the appearance of Al oxide depends on oxidation states, being coloured or black (non-stoichiometric Al oxide). Controlled introduction of gas can by way of example also be used to oxidize only the surface of the Al coating, while the region situated thereunder is retained in the form of metallic Al. The layer thus appears metallic/transparent or semitransparent when viewed from one side, but black/coloured when viewed from the other side.

In the case of oxidation of Fe, the coating appears red, Cu appears blue, Ag appears black, and Cu/Al materials have a silver-coloured to copper-coloured appearance, depending on oxidation level.

It is also possible to use non-metallic layers as coating, examples being ceramics, silicon, fluorescent pigments and the like, and these coatings can be produced by means of the PVD process or CVD process described.

Full oxidation of the material can provide transparent layers with different refractive indices.

Fig. 1 is a diagram describing the device or the process for a PVD process for the deposition of the layers on a supportive substrate. The meaning of the numerals here is as follows: 1 the substrate, 2 the material to be vaporized and deposited, 3 the vaporized material, 4 the vaporizer, 5 the gas introduction system and 6 a chill roll.

Coatings thus produced, for example black coatings, have diffuse scattering properties and provide additional protection from copying. At the same time, legibility of any information optionally present in positive or negative form, because contrast is significantly increased, even when layer thickness is low, and defined high optical density is achieved.

The effect of a silver-coloured coating is that the security element by way of example becomes almost entirely invisible on embedment into paper.

The ink layer applied during production of a partial coating is, where appropriate, then removed by a suitable solvent appropriate to the composition of the ink layer. It is preferable that the ink is water-soluble. The removal process can, where appropriate, be assisted by a mechanical effect.

To achieve a further improvement in the solvation of the covered ink layer, it is also possible to apply, over the entire surface or in precise registration, a thin pigmented ink layer or a layer made entirely of pigment, the thickness of the said layer being about 0.01-5 μm.

Removal of the ink with the functional layer regions located above the ink gives the desired final product.

However, it is also possible to use other known structuring processes for the production of a partial coating, an example being etching or use of a template in the sputtering process or in the process of deposition from the vapour.

The process described can also, where appropriate, be repeated any number of times,

and it is possible here to apply a plurality of layers covering part or all of a surface and having defined oxidation gradients, which can also be different in the individual layers.

Other functional and/or decorative layers can then be applied to all or part of the surface of the supportive substrate, and where appropriate these can be applied with precise registration or with overlap or with covering effect.
These other layers can by way of example have particular chemical, physical, and also optical properties.

The optical properties of another layer can be influenced via visible dyes/pigments, luminescent dyes/pigments which fluoresce/phosphoresce in the visible region, in the UV region or in the IR region, special-effect pigments, such a liquid crystals, pearl-lustre, bronzes and/or multilayer colour-change pigments and heat-sensitive inks/pigments. These can be used in any possible combination. It is also possible to use phosphorescent pigments alone or in combination with other dyes and/or pigments.

It is moreover possible that electrically conductive layers are present on the substrate or are subsequently applied, an example being electrically conductive polymeric layers or conductive ink layers or conductive lacquer layers.

In order to establish the electrical properties, materials can be added to the ink/lacquer that is to be applied, examples of these being graphite, carbon black, conductive organic or inorganic polymers, metal pigments (for example copper, aluminium, silver, gold, iron, chrome and the like), metal alloys such as copper-zinc or copper-aluminium, or else amorphous or crystalline ceramic pigments such as ITO, ATO, FTO and the like. Other materials that can be used as additive are doped or undoped semiconductors, for example silicon, germanium, or doped or undoped polymeric semiconductors or ion conductors such as amorphous or crystalline metal oxides or metal sulphides. Other materials that can be used, or added to the lacquer, in order to establish the electrical properties of the layer are polar or to some extent polar compounds such as surfactants, or nonpolar compounds such as silicone additives or hygroscopic or non-hygroscopic salts.

An electrically conductive layer applied can also be an electrically conductive polymer layer. The electrically conductive polymers can by way of example be polyaniline or polyethylenedioxythiophene or its derivatives. It is particularly preferable to use PEDT/TS or PEDT methanol as electrically conductive polymer.

In order to produce a layer with magnetic properties it is possible to use paramagnetic, diamagnetic, and also ferromagnetic substances, for example iron, nickel and cobalt or their compounds or salts (for example oxides or sulphides), or alloys of rare earth metals, for example cobalt/samarium alloys.

Particularly suitable materials are magnetic pigment inks using pigments based on Fe oxides, iron, nickel, cobalt and their alloys, barium or cobalt ferrites, and magnetically hard and magnetically soft types of iron and of steel in aqueous or solvent-containing dispersions. Examples of solvents that can be used are isopropanol, ethyl acetate, methyl ethyl ketone, methoxypropanol and mixtures of these.

The pigments have preferably been introduced into acrylate polymer dispersions with molecular weight from 150 000 to 300 000, in nitrocellulose, acrylate-urethane acrylate styrene, or PVC in the form of dispersions or in dissolved systems.

Particularly suitable materials for the production of layers with variable magnetic properties are magnetic inks which are capable of creating a magnetic field with high flux density. The measurable gradient of the magnetic flux is then produced via thickness modulation of the magnetic layers.

Particularly suitable materials are magnetic inks using pigments based on Cr/Ni steel. In contrast to conventional magnetic inks, which are black, brown or grey, these magnetic inks have a silver-coloured appearance, while at the same time exhibiting the required magnetic properties described above.

It is thus possible to produce the metallic-lustre appearance desired or required for many applications in a single operation simply by printing of these magnetic inks. Overprinting or coating with metallic or metal layers to produce the desired appearance is therefore not necessary, but can easily take place by way of example in order to introduce other identification features.

It is also possible by way of example to add carbon black or graphite to the magnetic

ink used, and it is thus possible in particularly advantageous manner to produce, by the process of the invention, a layer that is simultaneously magnetic and electrically conductive in a defined coding system.

It is also possible to use other surface relief structures as additional security features, examples being diffraction grids, holograms and the like, and these structures can optionally also have been metallized or partially metallized.

In order to produce surface structures of this type, UV-curable thermoformable lacquer is first applied. It is then possible by way of example to produce a surface structure by using a female mould to transfer a structure into the said lacquer, which at the time of transfer of the structure has been precured as far as the gel point, whereupon then the radiation-curable lacquer is fully hardened after the surface structure has been applied.

By virtue of the use of the UV-curable lacquer, layers applied thereto after the hardening process are stable even when exposed to temperature change, and this also applies to any surface structure that may have been introduced.

The coating of the invention can moreover additionally have been combined with a layer that creates a colour-shift effect, and in that case the coating can function as layer reflecting electromagnetic waves.

The coating creating the colour-shift effect here has in each case at least one layer reflecting electromagnetic waves, one spacer layer (for example one or more polymeric layers), and one layer composed of metallic clusters. The following are applied to the supportive substrate: a partial or full-surface layer reflecting electromagnetic waves, for example the coating of the invention, and then one or more partial and/or full-surface polymeric layers of defined thickness. A layer composed of metallic clusters, which is produced by means of a vacuum process or from solvent-based systems, is applied to the said spacer layer.

An appropriate colour-shift effect can likewise be achieved through printing with a coating composition which comprises optically variable pigments.

The security element can moreover also comprise a layer with magnetic properties.

A protective lacquer layer can moreover be provided to one or both sides of the security elements or film materials of the invention. The protective lacquer can be a pigmented or unpigmented lacquer, where pigments used can be any of the known pigments or dyes, for example $TiO_2$, ZnS, kaolin, ATO, FTO, aluminium, chromium oxides and silicon oxides or by way of example organic pigments such as phthalocyanine blue, i-indolide yellow, dioxazine violet and the like. It is moreover possible to add luminescent dyes/pigments which fluoresce/phosphoresce in the visible region, in the UV region or in the IR region, special-effect pigments, such a liquid crystals, pearl-lustre, bronzes and/or multilayer colour-change pigments and heat-sensitive inks/pigments. These can be used in any possible combination. It is also possible to use luminescent pigments alone or in combination with other dyes and/or pigments.

These coatings can have been applied over an entire surface or partially, for example in the form of positive or negative signs, patterns, letters and the like.

A protective lacquer layer, which optionally can have pigmentation, can have been provided to one or both sides of the security element of the invention.

It is moreover possible that a heat- or cold-sealable adhesive or a self-adhesive coating has been provided to one or both sides of the security element of the invention, for application to or embedment into a substrate, and these adhesives or adhesive coatings can have pigmentation.

The security element of the invention can moreover have been laminated with one or more supportive substrates which optionally have functional and/or decorative layers, optionally with use of a lamination adhesive.

The security elements and the film material are, optionally after appropriate further processing, therefore suitable as security features in data carriers, in particular documents of value such as passes, cards, banknotes or labels, seals and the like, and also as packaging material for example in the pharmaceutical, electronics and/or food industry, for example in the form of blister films, folding boxes, coverings, film

packaging and the like.

For the use as security features, the substrates and film materials are preferably cut into strips or filaments or patches, where the width of the strips or filaments can preferably be from 0.05 to 10 mm and the average widths/lengths of the patches are preferably from 0.3 to 20 mm.

For the use in or on packaging, the film material is preferably cut into strips, tapes, filaments or patches, where the width of the filaments, strips or tapes can preferably be from 0.05 to 50 mm and the average widths and lengths of the patches are preferably from 2 to 30 mm.

A corresponding security filament or security strip can also be used as peripheral reinforcement in packaging, documents of value and the like in the region of the edges, and also by way of example as longitudinal or transverse reinforcement in the packaging or in the document of value, and it is also possible in each case here that there are a plurality of filaments or strips provided at a defined distance from one another.

# FÓLIAANYAG KÜLÖNÖSEN BIZTONSÁGI ELEMEKHEZ

## SZABADALMI IGÉNYPONTOK

1. Biztonsági elem, amely olyan átlátszó fóliaanyagból készül, amelynek van egy részben átlátszatlan bevonata mélyedésekkel, azzal jellemezve, hogy az átlátszatlan bevonat fizikai gőzfázisú leválasztási (PVD) vagy kémiai gőzfázisú leválasztási (CVD) eljárással van előállítva, és egyetlen egy anyagi összetevőből, például egy elemből, egy vegyületből vagy egy ötvözetből készül, amely átlátszatlan bevonat – a fóliaanyag különböző oldalairól tekintve – különböző vizuális megjelenéssel rendelkezik, és a mélyedéseket jelek, betűk, minták és/vagy vonalak formájában tartalmazza, továbbá a különböző vizuális megjelenés az elem, a vegyület vagy az ötvözet oxidációs gradiensének meghatározott beállításával van létrehozva, és az átlátszatlan bevonat az egyik oldalon fémesnek, a másik oldalon pedig színesnek vagy feketének látszik.

2. Az 1. igénypont szerinti biztonsági elem, azzal jellemezve, hogy az átlátszatlan bevonat több, meghatározott oxidációs gradiensű rétegből áll.

3. Az 1. vagy a 2. igénypont szerinti biztonsági elem, azzal jellemezve, hogy a bevonat különböző oxidációs számú vagy gradiensű Al-, Fe-, Cu-, Ag- vagy Cu/Al-ötvözetből van előállítva.

4. Az 1-3. igénypontok egyike szerinti biztonsági elem, azzal jellemezve, hogy a fóliaanyag az egyik vagy mindkét oldalán el van látva egy védőlakkréteggel.

5. Az 1-4. igénypontok egyike szerinti biztonsági elem, azzal jellemezve, hogy a fóliaanyag az egyik vagy mindkét oldalán el van látva egy melegen vagy hidegen záró ragasztóbevonattal vagy egy öntapadó bevonattal.

6. Az 1-5. igénypontok egyike szerinti biztonsági elem, azzal jellemezve, hogy a fóliaanyag kasírozva van egy vagy több hordozóanyaggal, amelyeknek további funkcionális és/vagy díszítő rétegei lehetnek.

7. Értékhordozó dokumentumok vagy csomagolások, azzal jellemezve, hogy rendelkeznek egy, az 1-6. igénypontok egyike szerinti biztonsági elemmel.

8. Eljárás egy, az 1-7. igénypontok egyike szerinti biztonsági elem előállítására, azzal jellemezve, hogy egy első lépésben felviszünk egy oldószerben oldódó festékkészítményt egy hordozóanyagra,

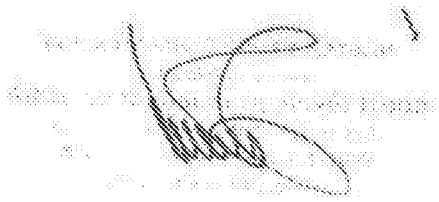
egy második lépésben a hordozóanyagot, illetve a hordozóanyagon lévő rétegeket gyártósorba integrált plazma-, korona- vagy lángkezelési eljárással kezeljük, és

egy harmadik lépésben felviszünk egy fémréteget fém-összetevőből, amelynek oxidációs számát a felületen adagolt oxigénellátással szelektíven szabályozzuk,

egy negyedik lépésben az oldódó festékkészítményt a rajta lévő réteggel együtt oldószerrel és mechanikai hatás gyakorlásával eltávolítjuk.

9. A 8. igénypont szerinti eljárás, azzal jellemezve, hogy egy további lépésben további, funkcionális és/vagy díszítő tulajdonságokkal rendelkező rétegeket viszünk fel.

(A meghatalmazott)



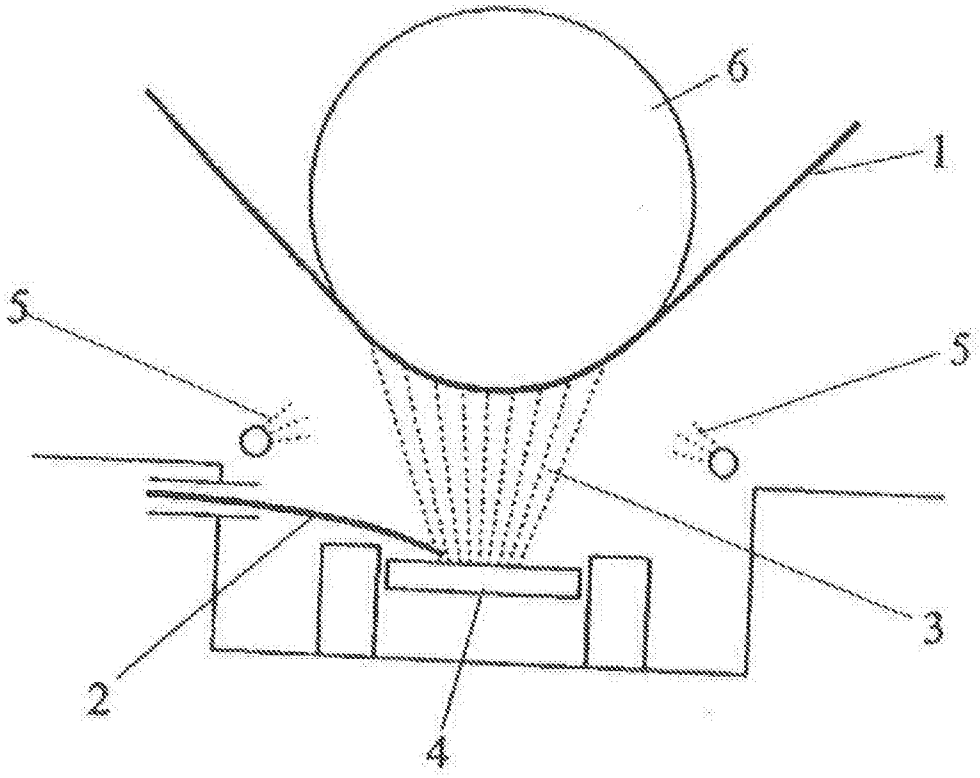



Fig. 1