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(54) **PERSONALIZABLE SECURITY DOCUMENT AND METHOD OF MANUFACTURING THE SAME**

PERSONALISIERBARES SICHERHEITSDOKUMENT UND VERFAHREN ZUR HERSTELLUNG DAVON

DOCUMENT DE SÉCURITÉ PERSONNALISABLE ET SON PROCÉDÉ DE FABRICATION

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DescriptionTechnical Field

[0001] The present disclosure generally relates to security features for security documents, in particular, personalizable security documents such as identification documents, driver's licenses and the like.

Background

[0002] Generally, physical identification documents contain a variety of different security features to aid in authenticating a document. In some applications, a laser engraved image is considered vital, as the image features are obtained inside a polycarbonate substrate rather than on the surface of the substrate. A laser engraved feature in a polycarbonate substrate may include a black and white (in particular, grayscale) image, a color image, a combination of grayscale and color, or special features like the Mirage technology of the present applicant.

[0003] In case of a color image, producing color inside a polycarbonate substrate using a laser is advantageous over the use of other technologies such as inkjet printing, which produces color images on top of the document. Some technologies use inks applied onto a polycarbonate layer, which is then laminated in order to protect the inks. Subsequently, a laser is used to activate the inks/pigments in order to display colors.

[0004] EP 0 972 632 A1 discloses a security card comprising a laminate of a flexible glass layer and a support. The glass layer has sufficient flexibility to allow substantial bending of the card without causing breakage of the glass. Further, the glass layer acts as a security feature, because delamination in order to falsify information stored in the card is difficult without breaking the glass.

[0005] EP 3 034 318 A1 discloses the preamble of claim 1 and relates to a personalization of physical media by selectively revealing and hiding pre-printed color pixels.

[0006] The present disclosure is directed, at least in part, to improving or overcoming one or more aspects of prior systems, without being limited to a particular type of security document.

Summary of the Disclosure

[0007] According to one aspect of the present disclosure, a personalizable security document comprises the features of claim 1.

[0008] According to another aspect, the present disclosure relates to a method of manufacturing a personalizable security document in accordance with claim 15.

[0009] Other features and aspects of the present disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings**[0010]**

- 5 Fig. 1 shows a top view of an exemplary security document in accordance with the present disclosure; Fig. 2 shows a bottom view of the security document in accordance with the present disclosure; Fig. 3 is a schematic side sectional view illustrating a layer configuration of the security document in accordance with the present disclosure; Fig. 4 is an enlarged view showing a configuration of a security feature in accordance with the present disclosure;
- 10 Fig. 5 is a schematic side sectional view illustrating a process of irradiating laser light onto the security feature in accordance with the present disclosure; and Fig. 6 is a schematic side sectional view showing the security document in accordance with the present disclosure after lamination.

Detailed Description

- 25 **[0011]** The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described herein are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as, a limiting description of the scope of protection. Rather, the scope of protection shall be defined by the appended claims.

- 30 **[0012]** The present disclosure is based at least in part on the realization that, in case of color laser personalization, adding an additional feature to the system may enhance the security of a document. This additional feature can be a flexible layer made of material that is different from the material of the other layers of the documents, such as polycarbonate. For example, a flexible glass substrate or a flexible metallic plate can be used. This provides an additional layer of security.

- 35 **[0013]** In addition, it has been realized that adding a protection on top of the color feature, such as a coating, enhances the optical response of the engraved color. In case layers such as polycarbonate layers are provided directly on top of the coating/inks which are used for producing color using a laser, this can result in an image that has a poor quality in terms of color gamut or image resolution. Therefore, it has been realized that the color gamut, for example, inside the polycarbonate body can be protected with a protective layer in order to increase the image quality.

- 40 **[0014]** More particularly, it has been realized that, when laser-sensitive pigments/inks or solutions are coated inside a laminated polycarbonate structure, the colors

generated by the laser (or any other source activating the pigments/inks) do not appear well, because the colors are transferred directly to the polycarbonate layer adjacent to the pigments/inks. This is also the case for layers other than polycarbonate, for example, PVC layers, TPU layers, PET layers and the like. Therefore, to enhance the overall optical response of the engraved colors, a protective layer can be used on top of the coating and below the adjacent polycarbonate layer to protect the color from getting transferred to the polycarbonate when the laser and the ink interact. In this manner, the optical response for engraving a security feature, which can be a personalized color image, can be increased.

[0015] In addition, it has been realized that any layer on the top (or bottom) of the laser-sensitive material can provide an additional security feature. This is because, when a counterfeiter tries to alter the document, the protective layer is broken.

[0016] Fig. 1 shows a plan view of an exemplary security document 10 in accordance with the present disclosure. As shown in Fig. 1, security document 10 comprises a laminated body 1 formed by a plurality of layers 4, 5, 6, 7, 8 of at least one first material arranged on top of each other in a thickness direction *d* (see, for example, Fig. 3). Body 1 has a first side *S1* and second side *S2* opposite to first side *S1* in thickness direction *d*. Second side *S2* of document 10 is shown in Fig. 2. Each of the plurality of layers 4, 5, 6, 7, 8 is configured as a plastic layer, such as a polycarbonate layer, a PVC layer, a TPU layer or a PET layer. It will be appreciated that in some embodiments all layers are formed from the same material, whereas in other embodiments one or more layers may be formed from different plastic materials.

[0017] As shown in Figs. 1 and 2, document 10 is a personalizable security document, which comprises a security feature 3 embedded in body 1. In the embodiment shown in Figs. 1 and 2, security feature 3 is visible from both sides *S1* and *S2* after personalization. For example, personalization of security document 10 results in a color feature 2, such as a portrait image, which is visible from both the first side *S1* and the second side *S2*. Here, it will be readily appreciated that color feature 2 will appear mirrored when viewed from second side *S2*. Security feature 3 and the personalization of security document 10 will be described in more detail below.

[0018] Figs. 3 and 4 show a first exemplary embodiment of security feature 3. In the exemplary embodiment, security feature 3 includes a laser-sensitive (laser-activated, laser-reactive) material 3c, such as an ink or pigments which, upon irradiation with laser light, produce a color feature (for example, thermochromic dyes, metallic nanoparticles, dielectric nanoparticles, dyes with nanoparticles, or any combination of the same, for example, provided in several layers). In other words, before irradiation with laser light, laser-sensitive material 3c may be transparent or have a first color, and the laser light activates laser-sensitive material 3c to change its color to a (second) color which can be observed. In this respect,

the contrast/intensity of the resulting color may depend on the laser parameters (intensity, speed, laser focus, laser spacing, repetition rate, laser polarization, laser wavelength, pulse duration and the like). The generation of a color feature using laser-sensitive inks or pigments is well-known, such that the details will be omitted herein. However, it will be appreciated that, using appropriate laser parameters and scanning of the laser beam, color images can be engraved in security feature 3. In this respect, a plurality of different laser-sensitive pigments and/or different laser wavelengths can also be used in combination to produce multicolor images.

[0019] Laser-sensitive material 3c is provided on a substrate 3b. In an exemplary embodiment, substrate 3b is a glass substrate, in particular, a flexible glass substrate. Further, laser-sensitive material 3c is formed as a coating on substrate 3b. It will be appreciated, however, that in other embodiments laser-sensitive material 3c may be applied onto substrate 3b by a different process (e.g., as a film layer that is bonded to substrate 3b using an adhesive, and the like). Laser-sensitive material 3c includes an ink or pigments that change their color upon irradiation with laser light. For example, said ink or pigments may include solutions of nanoparticles and/or thermochromic pigments. Such laser-sensitive materials are known to a skilled person, and a detailed description will be omitted herein.

[0020] As shown in Fig. 4, security feature 3 further includes a protective material 3a provided over laser-sensitive material 3c. Protective material 3a is provided to separate laser-sensitive material 3c from a first layer 5 of the plurality of layers arranged on top of security feature 3 (see, for example, Fig. 3). Protective material 3a is formed by a material that is different from the at least one first material of the plurality of layers 4, 5, 6, 7, 8 disposed on top of and below security feature 3. In the exemplary embodiment shown in Figs. 3 and 4, protective material 3a is configured as a glass barrier, for example, a flexible glass barrier, having a thickness between 30 μm and 100 μm , preferably around 70 μm . In some embodiments, the configuration of the glass barrier may be the same as that of substrate 3b on which laser-sensitive material 3c is provided (perhaps with different thickness).

[0021] As schematically shown in Fig. 3, a structure formed by substrate 3b, laser-sensitive material 3c and protective material 3a is provided in a second layer 6 of the plurality of layers adjacent to first layer 5. For example, said structure may be accommodated in a recess 6a formed in second layer 6. Accordingly, as shown in Fig. 3, it follows that an area of said structure, in particular, substrate 3b, laser-sensitive material 3c and protective material 3a is smaller than an area of each of the plurality of layers 4, 5, 6, 7, 8. Of course, it is also contemplated that substrate 3b, laser-sensitive material 3c and protective material 3a have different areas, as long as protective material 3a covers at least the portion of laser-sensitive material 3c that will form color feature 2. Here, cross-

sections of substrate 3b, laser-sensitive material 3c and protective material 3a in a plane perpendicular to thickness direction d do not need to be the same, and can have any desired shape such as a circular shape, a rectangular shape, a polygonal shape and the like.

[0022] In the example shown in Fig. 3, a thickness of the structure formed by substrate 3b, laser-sensitive material 3c and protective material 3a is substantially the same as the thickness of second layer 6, for example, between 50 μm and 200 μm , preferably between 70 μm and 150 μm . In the example shown in Fig. 3, two layers 4, 5 are provided on top of second layer 6, and two layers 7, 8 are provided below second layer 6. Of course, it will be appreciated that in other embodiments different numbers of layers may be provided on top of and below second layer 6, as long as at least one layer is provided on top of second layer 6, and one layer is provided below second layer 6.

[0023] One or more of the layers provided on top of second layer 6 may have a recess that conforms with recess 6a. For example, first layer 5 may have a recess 5a which has essentially the same size as recess 6a. Likewise, a third layer 7 arranged below second layer 6 may have a recess 7a with a size that is substantially the same as the size of recess 6a. Here, it will be appreciated that Fig. 3 shows a state of document 10 before lamination of layers 4, 5, 6, 7, 8. After lamination, any recesses in the layers, such as recesses 5a and 7a will be filled with the material of the respective layers. Of course, it will also be appreciated that, in some embodiments, no recesses 5a, 7a (or only one of the recesses) may be present before lamination.

[0024] Fig. 5 shows a schematic illustration of a process for personalizing document 10, in particular, security feature 3 of the same. Here, for the sake of illustration, Fig. 5 again shows the state of document 10 before lamination. Of course, it will be appreciated that, in a practical implementation, the personalization will generally be performed after lamination of document 10. In other words, a personalizable security document 10 in accordance with the present disclosure is generally produced and supplied to customers prior to personalization, and personalization will usually be performed by the customers. Of course, there also may be cases where the personalized document is supplied to customers. In such a case, the personalization can be performed before lamination, as illustrated in Fig. 5.

[0025] Fig. 6 shows security document 10 after lamination of the plurality of layers 4, 5, 6, 7, 8. As shown in Fig. 6, security feature 3 is securely embedded inside body 1 of security document 10. Here, it will be appreciated that at least portions of the layers 4, 5 arranged on top of laser-sensitive material 3c (security feature 3) are transparent to visible light such that color feature 2 is visible from first side S1. In some embodiments, the same applies to the layers 7, 8 arranged below the laser-sensitive material. This results in that color feature 2 can also be seen from second side S2. In some embodi-

ments, laser-sensitive material 3c and/or the laser used to activate the same is configured such that, when laser-sensitive material 3c is irradiated with laser light 9, color feature 2 is formed such that it has different appearances when viewed in transmission and in reflection, respectively.

[0026] In case security feature 3 is visible from both sides S1 and S2, a transparent window 11 extending through body 1 of security document 10 is formed by the transparent portions of the layers arranged above and below security feature 3. Here, as previously mentioned, it will be appreciated that in some embodiments the area (size) of security feature 3 (substrate 3b, laser-sensitive material 3c and protective material 3a) is smaller than the area of the layers 4, 5, 6, 7, 8 forming body 1. In this case, a plurality of security features may be included in document 10. In other embodiments, however; it is also contemplated that security feature 3 (substrate 3b, laser-sensitive material 3c and/or protective material 3a) has the same size as each of the layers. In other words, security feature 3 is not provided in a recess formed in second layer 6, but instead replaces second layer 6 and is sandwiched between first layer 5 and third layer 7.

[0027] In other embodiments, it is also contemplated to sandwich security feature 3 having a size that is smaller than a size of layers 4, 5, 7, 8 of security document 10 between two layers 5, 7. In other words, second layer 6 may be omitted. Also in this case, security feature 3 will be securely embedded inside body 1 after lamination. However, the resulting thickness of body 1 may be less uniform due to the absence of the material of second layer 6 surrounding security feature 3.

[0028] In yet other embodiments, laser-sensitive material 3c may be provided directly on a top surface of third layer 7. In other words, third layer 7 forms the substrate on which laser-sensitive material 3c is provided, and no separate member is provided to form said substrate. Also in this case, however, protective material 3a will be provided over laser-sensitive material 3c to separate the same from adjacent layer 5. Second layer 6 surrounding protective material 3a may be provided, or may be omitted in other embodiments. In the latter case, protective material 3a may be formed as a layer having the same size as the remaining layers of document 10.

[0029] While protective material 3a has been described above as a glass barrier such as a flexible glass barrier with a thickness between 30 μm and 100 μm , in other embodiments, protective material 3a may be formed as a material layer deposited on top of laser-sensitive material 3c, for example, a silica layer or another glass-like layer, a titanium dioxide layer, or a metallic layer. In this case, protective material 3a may have a significantly reduced thickness, for example, between 20 nm and 1000 nm, preferably between 50 nm and 500 nm. It will be appreciated that the thickness of surrounding second layer 6, if present, can be adapted accordingly to the resulting total thickness of security feature 3 in this case.

Industrial applicability

[0030] . With the above-described personalizable security document, security can be enhanced, because the flexible layer of protective material such as glass acts as an additional security feature. In case of tampering, not only will the colors be destroyed, but, in some cases, also the protective layer. Accordingly, with the present disclosure, any kind of laser-reactive coatings can be protected inside a laminated polycarbonate body, by being sandwiched between two physical layers such as two flexible glass layers, or by being provided on a flexible glass layer and being covered by a vapour-deposited or chemically-deposited layer such as silica. The colors produced by the laser light are of high quality compared to other technologies, and the present disclosure can be used to produce high-quality color images using a single laser or, in other cases, multiple lasers.

[0031] An exemplary method of manufacturing a personalizable security document as described above comprises the following steps:

In a first step, a laser-sensitive material 3c is provided on a substrate 3b or layer 7. Next, a protective material 3a is provided over laser-sensitive material 3c. A structure formed by substrate 3b or layer 7, laser-sensitive material 3c and protective material 3a is arranged between at least two layers 4, 5, 6, 7, 8 of at least one first material that is different from the protective material, such as polycarbonate, PVC and TPU. The at least two layers 4, 5, 6, 7, 8 are laminated to form a body 1 of personalizable security document 10. At least portions of one or more layers arranged on top of laser-sensitive material 3c are transparent to visible light such that a color feature produced upon irradiation of laser-sensitive material 3 with laser light 9 is visible from a first side S1 of body 1.

[0032] Here, it will be appreciated that, generally, the personalization of security feature 3 is performed after the step of laminating the plurality of layers. Of course, as previously mentioned, in some embodiments, the personalization may also be performed prior to laminating the layers.

[0033] As also explained above, in some embodiments, the method includes providing a structure or module formed by substrate 3b, laser-sensitive material 3c and protective material 3a in a recess formed in second layer 6 either prior to arranging the plurality of layers on top of each other, or while doing so. For example, said structure or module may be arranged on top of third layer 7, and second layer 6 with the corresponding recess 6a may then be arranged around said structure, before subsequent first layer 5 is arranged on top of second layer 6. As mentioned above, in some embodiments, second layer 6 may be omitted. In other words, said structure is embedded between first layer 5 and third layer 7 arranged directly below first layer 5.

[0034] In other embodiments, laser-sensitive material 3c may be applied directly on top of third layer 7. In other words, a step of applying laser-sensitive material 3c onto

third layer 7 may be present. In a next step, protective material 3a is then provided over laser-sensitive material 3c to protect the same. In some embodiments, this may include bonding a barrier such as a flexible glass barrier to substrate 3b with laser-sensitive material 3c, or to third layer 7 with laser-sensitive material 3c. In other embodiments, a step of depositing protective material 3a on laser-sensitive material 3c may be included to form a silica layer or another glass-like layer. In some embodiments, a material may be deposited on laser-sensitive material 3c in a first step, and oxidized or treated in another appropriate manner in a subsequent step to form the protective layer. It is also contemplated to form the protective layer by appropriate treatment of laser-sensitive material 3c, such as oxidizing the top portion of a metallic layer or the like.

[0035] It will be appreciated that the foregoing description provides examples of the disclosed systems and methods. However, it is contemplated that other implementations of the disclosure may differ in detail from the foregoing examples. All references to the disclosure or examples thereof are intended to reference the particular example being discussed at that point and are not intended to imply any limitation as to the general disclosure.

[0036] Recitation of ranges of values herein are merely intended to serve as a shorthand method for referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All method steps described herein can be performed in any suitable order, unless otherwise indicated or clearly contradicted by the context.

[0037] Although the preferred embodiments of the present disclosure have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

Claims

1. A personalizable security document (10) comprising:

a laminated body (1) formed by a plurality of layers (4, 5, 6, 7, 8) of at least one first material arranged on top of each other in a thickness direction (d), the body (1) having a first side (S1) and a second side (S2) opposite to the first side (S1) in the thickness direction; and
a security feature (3) embedded in the body (1), wherein the security feature (3) includes:

a substrate (3b);
a laser-sensitive material (3c) provided on the substrate (3b); and
a protective material (3a) provided over the laser-sensitive material (3c) to separate the laser-sensitive material from a first layer (5)

- of the plurality of layers arranged on top of the security feature, the protective material (3a) being formed by a material that is different from the at least one first material of the plurality of layers (4, 5, 6, 7, 8), wherein at least portions of the layers (4, 5) arranged on top of the laser-sensitive material are transparent to visible light such that a color feature (2) produced upon irradiation of the laser-sensitive material (3c) with laser light (9) is visible from the first side (S1), the security document being **characterised in that** the protective material (3a) is configured as a glass barrier, or as a silica layer or another glass-like layer deposited on the laser-sensitive material (3c).
2. The security document of claim 1, wherein a structure formed by the substrate (3b), the laser-sensitive material (3c) and the protective material (3a) is provided in a second layer (6) of the plurality of layers adjacent to the first layer (5).
 3. The security document of claim 2, wherein a thickness of the structure is substantially the same as the thickness of the second layer (6), for example, between 50 μm and 200 μm , preferably between 70 μm and 150 μm .
 4. The security document of claim 1, wherein a structure formed by the substrate (3b), the laser-sensitive material (3c) and the protective material (3a) is embedded between the first layer (5) and a third layer (7) arranged directly below the first layer.
 5. The security document of any one of claims 2 to 4, wherein the substrate (3b) is a glass substrate, preferably a flexible glass substrate.
 6. The security document of claim 1, wherein the substrate (3b) is formed by a third layer (7) arranged directly below the first layer (5).
 7. The security document of any one of claims 1 to 6, wherein the laser-sensitive material (3c) is formed as a coating on the substrate (3a).
 8. The security document of any one of claims 1 to 7, wherein the laser-sensitive material (3c) includes an ink or pigments that change their color upon irradiation with the laser light (9), said ink or pigments including, for example, solutions of nanoparticles and/or thermochromic pigments.
 9. The security document of any one of claims 1 to 8, wherein the protective material (3a) is configured as the glass barrier, and the glass barrier is a flexible glass barrier having a thickness between 30 μm and 100 μm , preferably around 70 μm .
 10. The security document of any one of claims 1 to 9, wherein the glass barrier has the same configuration as the substrate (3b).
 11. The security document of any one of claims 1 to 8, wherein the protective material (3a) is configured as the silica layer or another glass-like layer deposited on the laser-sensitive material (3c), the silica layer or another glass-like layer having a thickness between 20 nm and 1000 nm, preferably between 50 nm and 500 nm.
 12. The security document of any one of claims 1 to 11, wherein at least portions of one or more layers (7, 8) arranged below the laser-sensitive material are transparent to visible light such that the color feature (2) produced upon irradiation of the laser-sensitive material (3c) with the laser light (9) is visible from both the first side (S1) and the second side (S2).
 13. The security document of any one of claims 1 to 12, wherein each of the plurality of layers (4, 5, 6, 7, 8) is configured as a polycarbonate layer, a PVC layer or a TPU layer.
 14. The security document of any one of claims 1 to 13, wherein the laser-sensitive material, when irradiated with appropriate laser light, is configured such that the color feature has different appearances when viewed in transmission and in reflection, respectively.
 15. A method of manufacturing a personalizable security document (10), the method comprising:
 - providing a laser-sensitive material (3c) on a substrate (3b);
 - providing a protective material (3a) over the laser-sensitive material (3c), the protective material (3a) being configured as a glass barrier, or as a silica layer or another glass-like layer deposited on the laser-sensitive material (3c);
 - arranging a structure formed by the substrate (3b), the laser-sensitive material (3c) and the protective material (3a) between at least two layers (4, 5, 6, 7, 8) of at least one first material that is different from the protective material, such as polycarbonate, PVC and TPU; and
 - laminating the at least two layers (4, 5, 6, 7, 8) to form a body (1) of the personalizable security document (10),
 - wherein at least portions of one or more layers (4, 5) arranged on top of the laser-sensitive material are transparent to visible light such that a color feature produced upon irradiation of the

laser-sensitive material (3c) with laser light is visible from a first side (S 1) of the body (1).

beispielsweise zwischen 50 μm und 200 μm , bevorzugt zwischen 70 μm und 150 μm .

Patentansprüche

1. Personalisierbares Sicherheitsdokument (10) mit:

einem laminierten Körper (1), der aus mehreren Schichten (4, 5, 6, 7, 8) aus mindestens einem ersten Material, die in einer Dickenrichtung (d) aufeinander angeordnet sind, ausgebildet ist, wobei der Körper (1) eine erste Seite (S1) und eine zweite Seite (S2) entgegengesetzt zu der ersten Seite (S1) in der Dickenrichtung aufweist; und
einem Sicherheitsmerkmal (3), das in dem Körper (1) eingebettet ist,
bei dem das Sicherheitsmerkmal (3) aufweist:

ein Substrat (3b);
ein laserempfindliches Material (3c), das auf dem Substrat (3b) vorgesehen ist; und
ein Schutzmaterial (3a), das über dem laserempfindlichen Material (3c) zum Trennen des laserempfindlichen Materials von einer ersten Schicht (5) der mehreren Schichten, die auf dem Sicherheitsmerkmal angeordnet ist, vorgesehen ist, wobei das Schutzmaterial (3a) durch ein Material gebildet wird, das sich von dem mindestens einen ersten Material der mehreren Schichten (4, 5, 6, 7, 8) unterscheidet,
wobei zumindest Abschnitte der Schichten (4, 5), die auf dem laserempfindlichen Material angeordnet sind, für sichtbares Licht transparent sind, so dass ein Farbmerkmal (2), das bei einer Bestrahlung des laserempfindlichen Materials (3c) mit Laserlicht (9) erzeugt wird, von der ersten Seite (S1) aus sichtbar ist, wobei das Sicherheitsdokument **dadurch gekennzeichnet ist, dass** das Schutzmaterial (3a) als eine Glasbarriere oder eine Siliziumdioxidschicht oder andere glasartige Schicht, die auf dem laserempfindlichen Material (3c) abgetrennt ist, ausgebildet ist.

2. Sicherheitsdokument nach Anspruch 1, bei dem eine Struktur, die durch das Substrat (3b), das laserempfindliche Material (3c) und das Schutzmaterial (3a) ausgebildet wird, in einer zweiten Schicht (6) der mehreren Schichten, die benachbart zu der ersten Schicht (5) ist, vorgesehen ist.

3. Sicherheitsdokument nach Anspruch 2, bei dem eine Dicke der Struktur im Wesentlichen dieselbe wie die Dicke der zweiten Schicht (6) ist,

4. Sicherheitsdokument nach Anspruch 1, bei dem eine Struktur, die durch das Substrat (3b), das laserempfindliche Material (3c) und das Schutzmaterial (3a) ausgebildet wird, zwischen der ersten Schicht (5) und einer dritten Schicht (7), die direkt unterhalb der ersten Schicht angeordnet ist, eingebettet ist.

5. Sicherheitsdokument nach einem der Ansprüche 2 bis 4, bei dem das Substrat (3b) ein Glassubstrat ist, bevorzugt ein flexibles Glassubstrat.

6. Sicherheitsdokument nach Anspruch 1, bei dem das Substrat (3b) durch eine dritte Schicht (7) gebildet wird, die direkt unterhalb der ersten Schicht (5) angeordnet ist.

7. Sicherheitsdokument nach einem der Ansprüche 1 bis 6, bei dem das laserempfindliche Material (3c) als eine Beschichtung auf dem Substrat (3a) ausgebildet ist.

8. Sicherheitsdokument nach einem der Ansprüche 1 bis 7, bei dem das laserempfindliche Material (3c) eine Tinte oder Pigmente aufweist, die bei einer Bestrahlung mit dem Laserlicht (9) ihre Farbe ändern, wobei die Tinte oder Pigmente beispielsweise Lösungen von Nanopartikeln und/oder thermochromen Pigmenten aufweisen.

9. Sicherheitsdokument nach einem der Ansprüche 1 bis 8, bei dem das Schutzmaterial (3a) als die Glasbarriere ausgebildet ist und die Glasbarriere eine flexible Glasbarriere mit einer Dicke zwischen 30 μm und 100 μm , bevorzugt etwa 70 μm , ist.

10. Sicherheitsdokument nach einem der Ansprüche 1 bis 9, bei dem die Glasbarriere dieselbe Konfiguration wie das Substrat (3b) aufweist.

11. Sicherheitsdokument nach einem der Ansprüche 1 bis 8, bei dem das Schutzmaterial (3a) als die Siliziumdioxidschicht oder andere glasartige Schicht, die auf dem laserempfindlichen Material (3c) abgetrennt ist, ausgebildet ist, wobei die Siliziumdioxidschicht oder andere glasartige Schicht eine Dicke zwischen 20 nm und 1000 nm, bevorzugt zwischen 50 nm und 500 nm, aufweist.

12. Sicherheitsdokument nach einem der Ansprüche 1 bis 11, bei dem mindestens Abschnitte einer oder mehrerer Schichten (7, 8), die unterhalb des laserempfindlichen Materials angeordnet sind, für sichtbares Licht transparent sind, so dass das Farbmerkmal (2), das bei der Bestrahlung des laserempfindlichen Materials (3c) mit dem Laserlicht (9) erzeugt

wird, von sowohl der ersten Seite (S1) als auch der zweiten Seite (S2) aus sichtbar ist.

13. Sicherheitsdokument nach einem der Ansprüche 1 bis 12, bei dem jede der mehreren Schichten (4, 5, 6, 7, 8) als eine Polycarbonatschicht, eine PVC-Schicht oder eine TPU-Schicht ausgebildet ist. 5
14. Sicherheitsdokument nach einem der Ansprüche 1 bis 13, bei dem das laserempfindliche Material bei einer Bestrahlung mit geeignetem Laserlicht derart ausgebildet ist, dass das Farbmerkmal unterschiedliche Erscheinungsbilder aufweist, wenn es jeweils in Transmission und in Reflexion betrachtet wird. 10
15. Verfahren zum Herstellen eines personalisierbaren Sicherheitsdokuments (10), mit: 15

Vorsehen eines laserempfindlichen Materials (3c) auf einem Substrat (3b); 20

Vorsehen eines Schutzmaterials (3a) über dem laserempfindlichen Material (3c), wobei das Schutzmaterial (3a) als eine Glasbarriere oder als eine Siliziumdioxidschicht oder andere glasartige Schicht, die auf dem laserempfindlichen Material (3c) abgeschieden ist, ausgebildet ist; 25

Anordnen einer Struktur, die durch das Substrat (3b), das laserempfindliche Material (3c) und das Schutzmaterial (3a) gebildet wird, zwischen mindestens zwei Schichten (4, 5, 6, 7, 8) aus mindestens einem ersten Material, das sich von dem Schutzmaterial unterscheidet, beispielsweise Polycarbonat, PVC oder TPU; und 30

Laminieren der mindestens zwei Schichten (4, 5, 6, 7, 8) zum Ausbilden eines Körpers (1) des personalisierbaren Sicherheitsdokuments (10), wobei mindestens Abschnitte einer oder mehrerer Schichten (4, 5), die auf dem laserempfindlichen Material angeordnet sind, für sichtbares Licht transparent sind, so dass ein Farbmerkmal, das bei einer Bestrahlung des laserempfindlichen Materials (3c) mit Laserlicht erzeugt wird, von einer ersten Seite (S1) des Körpers (1) aus sichtbar ist. 35

40

Revendications

1. Document de sécurité personnalisable (10) comprenant : 50

un corps stratifié (1) formé par une pluralité de couches (4, 5, 6, 7, 8) d'au moins un premier matériau disposées les unes sur les autres dans une direction d'épaisseur (d), le corps (1) ayant un premier côté (S1) et un deuxième côté (S2) opposé au premier côté (S1) dans la direction d'épaisseur ; et 55

un élément de sécurité (3) intégré dans le corps (1),

dans lequel l'élément de sécurité (3) comprend :

un substrat (3b) ;
 un matériau sensible au laser (3c) pourvu sur le substrat (3b) ; et
 un matériau de protection (3a) pourvu sur le matériau sensible au laser (3c) pour séparer le matériau sensible au laser d'une première couche (5) de la pluralité de couches disposées au-dessus de l'élément de sécurité, le matériau de protection (3a) étant formé d'un matériau différent dudit au moins un premier matériau de la pluralité de couches (4, 5, 6, 7, 8), dans lequel au moins des parties des couches (4, 5) disposées au-dessus du matériau sensible au laser sont transparentes à la lumière visible de sorte qu'une caractéristique de couleur (2) produite lors de l'irradiation du matériau sensible au laser (3c) avec la lumière laser (9) est visible du premier côté (S1), le document de sécurité étant **caractérisé en ce que** le matériau de protection (3a) est configuré comme une barrière de verre, ou comme une couche de silice ou une autre couche semblable à du verre déposée sur le matériau sensible au laser (3c). 60

2. Document de sécurité de la revendication 1, dans lequel une structure formée par le substrat (3b), le matériau sensible au laser (3c) et le matériau de protection (3a) est fournie dans une deuxième couche (6) de la pluralité de couches adjacente à la première couche (5). 65
3. Document de sécurité de la revendication 2, dans lequel l'épaisseur de la structure est sensiblement la même que l'épaisseur de la deuxième couche (6), par exemple entre 50 μm et 200 μm , de préférence entre 70 μm et 150 μm . 70
4. Document de sécurité de la revendication 1, dans lequel une structure formée par le substrat (3b), le matériau sensible au laser (3c) et le matériau de protection (3a) est intégrée entre la première couche (5) et une troisième couche (7) disposée directement sous la première couche. 75
5. Document de sécurité de l'une quelconque des revendications 2 à 4, dans lequel le substrat (3b) est un substrat en verre, de préférence un substrat en verre flexible. 80
6. Document de sécurité de la revendication 1, dans lequel le substrat (3b) est formé par une troisième 85

- couche (7) disposée directement sous la première couche (5).
7. Document de sécurité de l'une quelconque des revendications 1 à 6, dans lequel le matériau sensible au laser (3c) est formé comme un revêtement sur le substrat (3a). 5
8. Document de sécurité de l'une quelconque des revendications 1 à 7, dans lequel le matériau sensible au laser (3c) comprend une encre ou des pigments qui changent de couleur sous l'effet de la lumière laser (9), ladite encre ou lesdits pigments comprenant, par exemple, des solutions de nanoparticules et/ou des pigments thermochromiques. 10
9. Document de sécurité de l'une quelconque des revendications 1 à 8, dans lequel le matériau de protection (3a) est configuré comme la barrière de verre, et la barrière de verre est une barrière de verre flexible ayant une épaisseur comprise entre 30 μm et 100 μm , de préférence autour de 70 μm . 20
10. Document de sécurité de l'une quelconque des revendications 1 à 9, dans lequel la barrière de verre a la même configuration que le substrat (3b). 25
11. Document de sécurité de l'une quelconque des revendications 1 à 8, dans lequel le matériau de protection (3a) est configuré comme la couche de silice ou une autre couche semblable à du verre déposée sur le matériau sensible au laser (3c), la couche de silice ou une autre couche semblable à du verre ayant une épaisseur comprise entre 20 nm et 1000 nm, de préférence entre 50 nm et 500 nm. 30
12. Document de sécurité de l'une quelconque des revendications 1 à 11, dans lequel au moins des parties d'une ou plusieurs couches (7, 8) disposées sous le matériau sensible au laser sont transparentes à la lumière visible, de sorte que la caractéristique de couleur (2) produite lors de l'irradiation du matériau sensible au laser (3c) avec la lumière laser (9) est visible à la fois du premier côté (S1) et du deuxième côté (S2). 40
13. Document de sécurité de l'une quelconque des revendications 1 à 12, dans lequel chacune de la pluralité de couches (4, 5, 6, 7, 8) est configurée comme une couche de polycarbonate, une couche de PVC ou une couche de TPU. 50
14. Document de sécurité de l'une quelconque des revendications 1 à 13, dans lequel le matériau sensible au laser, lorsqu'il est irradié par une lumière laser appropriée, est configuré de manière à ce que la caractéristique de couleur ait des apparences différentes lorsqu'elle est vue en transmission et en ré-

flexion, respectivement.

15. Procédé de fabrication d'un document de sécurité personnalisable (10), le procédé comprenant les étapes consistant à :

fournir un matériau sensible au laser (3c) sur un substrat (3b) ;

fournir un matériau de protection (3a) sur le matériau sensible au laser (3c), le matériau de protection (3a) étant configuré comme une barrière de verre, ou comme une couche de silice ou une autre couche semblable à du verre déposée sur le matériau sensible au laser (3c) ;

disposer une structure formée par le substrat (3b), le matériau sensible au laser (3c) et le matériau de protection (3a) entre au moins deux couches (4, 5, 6, 7, 8) d'au moins un premier matériau différent du matériau de protection, tel que le polycarbonate, le PVC et le TPU ; et laminer lesdites au moins deux couches (4, 5, 6, 7, 8) pour former le corps (1) du document de sécurité personnalisable (10),

dans lequel au moins des parties d'une ou plusieurs couches (4, 5) disposées sur le matériau sensible au laser sont transparentes à la lumière visible, de sorte qu'une caractéristique de couleur produite lors de l'irradiation du matériau sensible au laser (3c) avec la lumière laser est visible d'un premier côté (S1) du corps (1).

FIG 1

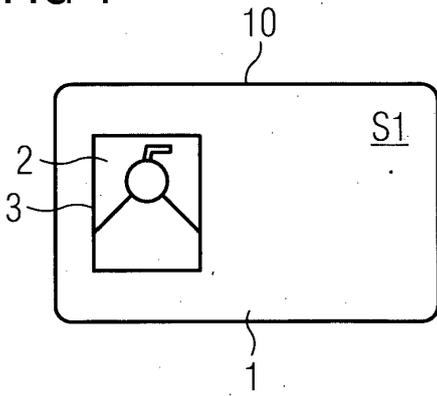


FIG 2

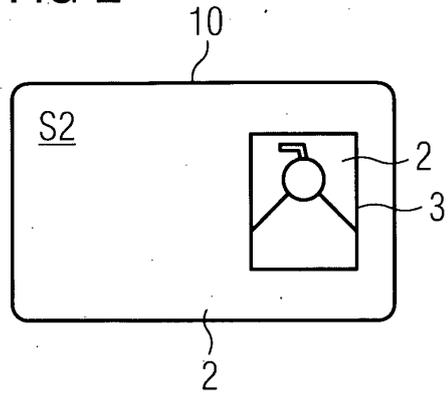


FIG 3

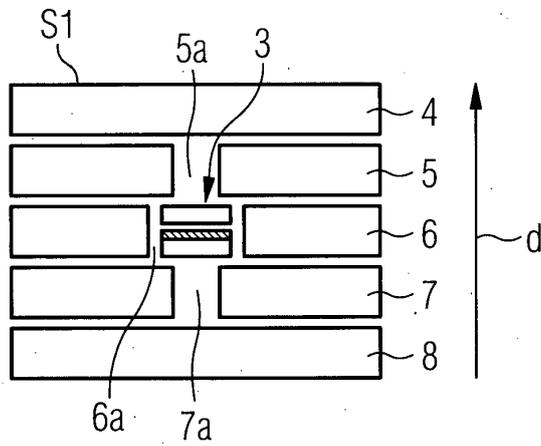


FIG 4

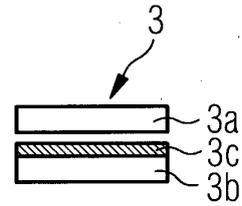


FIG 5

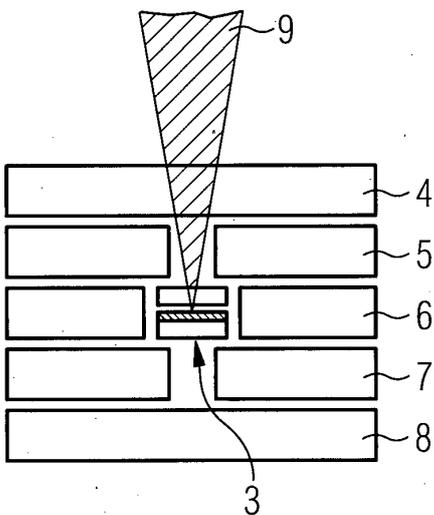
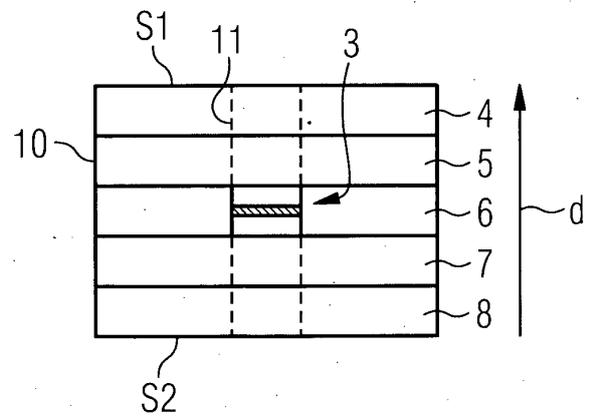


FIG 6



REFERENCES CITED IN THE DESCRIPTION

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