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(54) **Donor substrate for laser induced thermal imaging method and organic electroluminescent display device fabricated using the same**

Donorsubstrat zum Laser induzierten thermischen Übertragen (LITI) and dadurch hergestellte elektrolumineszierende Anzeigevorrichtung

Substrat donneur pour transfert thermique par laser et panneau d'affichage électroluminescent fabriqué en utilisant ce substrat

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(56) References cited:
EP-A- 0 773 707
EP-A- 0 858 110
EP-A- 1 432 049
WO-A-02/070271
US-A- 5 981 136
US-A1- 2002 160 296
US-B1- 6 214 520

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a donor substrate used for forming an organic layer of an organic electroluminescent display device, and the use of this donor substrate in the fabrication of an organic electroluminescent display device fabricated using the same.

2. Description of the Related Art

[0002] In general, an organic electroluminescent (EL) display device includes various layers such as an anode, a cathode, a hole injection layer, a hole transport layer, an emission layer, an electron transport layer, an electron injection layer, etc.

[0003] The organic EL display device is classified into a polymer device and a small molecular organic EL device according to materials. In the case of the small molecular device, each layer is introduced by a vacuum deposition process. In the case of a polymer organic EL display device, an EL element is fabricated by a spin coating process.

[0004] In the case of a mono-color display device, the polymer organic EL display device may be easily fabricated by the spin coating process and driven at relatively low voltage compared to the small molecular organic EL display device, but is lowered in efficiency and lifetime. On the other hand, in the case of a full-color display device, red, green and blue polymers should be patterned, respectively. However, an ink jet method or a laser induced thermal imaging method is not preferable because it deteriorates luminescence characteristics such as efficiency, lifetime, etc. of the organic EL display device.

[0005] In particular, most single polymer material is hardly transferred by the laser induced thermal imaging method. Various methods for patterning the polymer organic EL display device using the laser induced thermal imaging method are disclosed in Korean Patent No. 1998-51844, and U.S. Patent Nos. 5,998,085, 6,214,520, and 6,114,088.

[0006] The laser induced thermal imaging method requires at least a light source, a transfer film, and a substrate, wherein light emitted from the light source is absorbed in a light absorption layer of the transfer film and transformed into heat energy, so that the heat energy transfers a material for forming a transfer layer from the transfer film to the substrate, thereby forming a desired image (refer to U.S. Patent Nos. 5, 220, 348, 5, 256, 506, 5, 278, 023, and 5, 308, 737) .

[0007] Such a laser induced thermal imaging method has been used in fabricating a color filter for a liquid crystal display device, or in patterning an EL material (refer to U.S. Patent No. 5, 998, 085) .

[0008] U.S. Patent No. 5,937,272 relates to a method of forming a highly patterned organic layer in a full-color organic EL display device, in which an organic EL material employs a donor support coated with a transferable material. In this method, the donor support is heated to transfer the organic EL material to a recessed portion of a substrate corresponding to a desired lower pixel, wherein the recessed portion is provided for forming a colored organic EL medium. At this time, the transfer is accomplished by applying heat or light to the donor support to vaporize the organic EL material, thereby transferring it to the pixel.

[0009] U.S. Patent No. 5,688,551 relates to a method of forming a sub-pixel formed in each pixel region, in which the organic EL material is transferred from a donor sheet to a receiver sheet, thereby forming the sub-pixel. At this time, the transfer is performed at a low temperature of about 400°C or less, and a sublimatable organic EL material is transferred from the donor sheet to the receiver sheet, thereby forming the sub-pixel.

[0010] FIG. 1 is a cross-sectional view of a general full-color organic EL display device.

[0011] Referring to FIG. 1, a first electrode 200 is patterned on an insulating substrate 100. The first electrode 200 is formed of a transparent electrode in the case of a bottom emitting structure, and formed of a conductive metal layer including a reflective layer in the case of a top emitting structure.

[0012] Then, a pixel defining layer (PDL) 300 is formed on the first electrode 200 to define a pixel region, and made of an insulating material for insulation of an emission layer.

[0013] Then, an organic layer 33 having red, green and blue organic emission layers R, G and B is formed on the pixel region defined by the pixel defining layer 300. The organic layer 33 may include at least one layer of a hole injection layer, a hole transport layer, a hole blocking layer, an electron transport layer, and an electron injection layer in addition to the organic emission layer. Here, both polymer and small molecular materials may be used to form the organic emission layer.

[0014] Then, a second electrode 400 is formed on the organic layer 33. The second electrode 400 is formed of a conductive metal layer including a reflective layer when the first electrode 200 is a transparent electrode, and formed of a transparent electrode when the first electrode 200 is a conductive metal layer including a reflective layer. Then, the organic EL display device is encapsulated, thereby completing the organic EL display device.

[0015] Alternatively, when the emission layer is formed by the conventional laser induced thermal imaging method, as shown in FIG. 2, a conventional donor substrate 34 for a laser induced thermal imaging method includes a base film 31, a light- to- heat conversion layer 32, and a transfer layer 33, and may further include a buffer layer (not shown) .

[0016] Meanwhile, U.S. Patent Nos. 5, 981, 136, 6, 461, 793, 6, 099, 994 employ a buffer layer or an interlayer provided between the light- to- heat conversion layer 32 and the transfer layer 33 to prevent contaminants from being transferred from the light- to- heat conversion layer 32 to the organic transfer layer 33, wherein the buffer layer or the interlayer includes a metal layer. However, the foregoing patents do not divide the polymer and small molecular materials, so that the following problem arises when the small molecular material is used.

[0017] FIG. 3 illustrates a transfer model of the conventional donor substrate. Referring to FIG. 3, when the light-to-heat conversion layer 32 is expanded by a laser beam, the transfer layer 33 is also expanded and separated from the donor substrate, thereby being transferred to a substrate of the organic EL display device.

[0018] However, when the small molecular material is used as the transfer layer 33 of the conventional donor substrate, adhesion between the surface of the donor substrate and the small molecular transfer layer 33 is deteriorated, so that the substrate of the organic EL display device is stained with the organic small molecular material on the donor substrate during a laminating process. Thus, the unwanted organic small molecular material stains the substrate to which the transfer layer 33 has not to be transferred by the laser beam, thereby directly deteriorating the performance of the display device.

[0019] FIG. 4 is a photograph showing a pattern obtained by applying a laser induced thermal imaging method to a small molecular material using the conventional donor substrate.

[0020] Referring to FIG. 4, the entire surface of a substrate 100 is stained with the transferred small molecular material, so that the pixel is indistinguishablly defined.

SUMMARY OF THE INVENTION

[0021] The present invention, therefore, solves aforementioned problems associated with conventional display devices by providing a donor substrate for a laser induced thermal imaging method capable of transferring without non-transferred region when an emission layer is formed by a laser induced thermal imaging method in fabricating an organic EL display device

[0022] The donor substrate for a laser induced thermal imaging method includes: a base film; a light-to-heat conversion layer formed on the base film; a buffer layer formed on the entire surface of the light-to-heat conversion layer; a metal layer which has a transmissivity of 20% or less with regard to a laser with which the laser induced thermal imaging is carried out and formed on the buffer layer; and a transfer layer formed of small organic molecules for use in an electro-luminescent device and formed on the metal layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The above and other features of the present invention will be described in reference to certain exemplary embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a cross-sectional view of a general full-color organic EL display device;
FIG. 2 is a cross-sectional view illustrating a structure of the conventional donor substrate for a laser induced thermal imaging method;
FIG. 3 illustrates a transfer model of the conventional donor substrate having a small molecular transfer layer;
FIG. 4 is a photograph showing a pattern obtained by applying a laser induced thermal imaging method to a small molecular material using the conventional donor substrate;
FIG. 5 illustrates a transfer mechanism for transferring an organic emission layer used in an organic EL display device using a laser beam;
FIG. 6 is a cross-sectional view illustrating a structure of a donor substrate for a laser induced thermal imaging method according to the present invention;
FIG. 8 illustrates a method of transferring using a donor substrate according to the present invention;
FIG. 9 is a photograph showing a pattern obtained by applying a laser induced thermal imaging method to a small molecular material using a donor substrate according to the present invention;
FIG. 10 is a graph showing voltage-brightness characteristics of organic EL display devices fabricated by transferring small molecular materials using the conventional donor substrate and the donor substrate according to the present invention, respectively; and
FIG. 11 is a graph showing brightness-efficiency characteristics of organic EL display devices fabricated by transferring small molecular materials using the conventional donor substrate and the donor substrate according to an embodiment of the present invention, respectively.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which the invention is shown.

[0025] In the drawings, the thickness of layers and regions are exaggerated for clarity. Like numbers refer to like elements throughout the specification.

[0026] FIG. 5 illustrates a transfer mechanism for transferring an organic emission layer used in an organic EL display device.

[0027] In general, a mechanism for transferring and patterning an organic layer using a laser is as follows. As shown in FIG. 5, an organic layer S2 attached to a substrate S1 is separated from the substrate S1 by the laser, and transferred to a substrate S3 to be separated from a region not affected by the laser beam.

[0028] As a factor affecting the transfer characteristics, there are a first adhesion W12 between the substrate S1 and the organic layer S2, a cohesion W22 of the organic layer S2 itself, and a second adhesion W23 between the organic layer S2 and the substrate S3.

[0029] The first adhesion, the cohesion, and the second adhesion may be represented with surface tensions $\gamma1$, $\gamma2$ and $\gamma3$ and interfacial tensions $\gamma12$ and $\gamma23$ as follow.

$$W12 = \gamma1 + \gamma2 - \gamma12$$

$$W22 = 2\gamma2$$

$$W23 = \gamma2 + \gamma3 - \gamma23$$

[0030] To improve the transfer characteristics, the cohesion should be smaller than each of the first and second adhesions.

[0031] In general, each layer of the organic EL display device is formed of an organic material. In the case of using a small molecular material, the first and second adhesions are larger than the cohesion, so that an EL material is transferred from a donor substrate 34 to the organic EL display device, thereby causing a mass transition and forming a fine pattern of the emission layer. Through this transfer, the emission layer may be finely patterned and decrease misalignment.

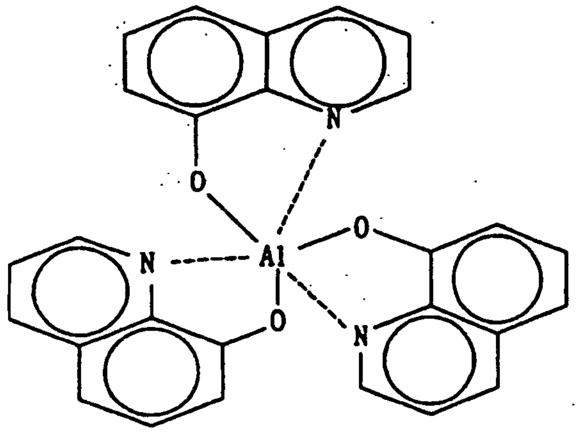
[0032] FIG. 6 is a cross-sectional view illustrating a structure of a small molecular donor substrate for a laser induced thermal imaging method according to the present invention.

[0033] Referring to FIG. 6, the donor substrate 34 includes a base film 31, a light-to-heat conversion layer 32 formed on the base film 31, a buffer layer 35 formed on the light-to-heat conversion layer 32 over the entire surface of the base film 31, a metal layer 36 formed on the entire surface of the buffer layer 35, and a transfer layer 33 formed of an organic material and formed on the metal layer 36, which are sequentially stacked.

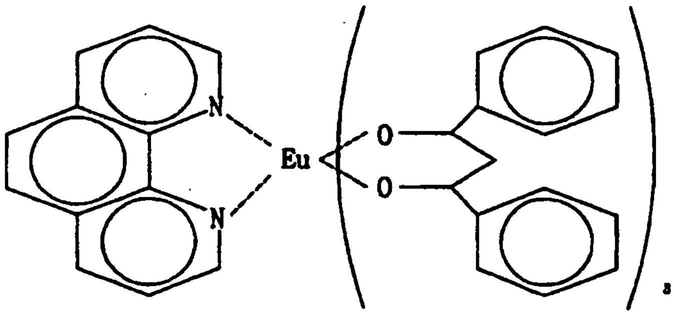
[0034] According to the first embodiment of the present invention, a small molecular organic material is used as the organic material, wherein the small molecular organic material forms at least one layer of a hole transport layer, a hole injection layer, an emission layer, a hole blocking layer, an electron transport layer, and an electron injection layer.

[0035] In the case where a small molecular organic EL material is used as the organic material, the small molecular organic EL material may be formed of: materials represented as the following chemical formulas 1 through 4; or a small molecular phosphorescent material employing a phosphorescent dopant such as one organic metal complex selected from a group consisting of Ir, Pt, Eu, and Tb, which is capable of emitting phosphorescence in a triplet state, together with a luminescent host material such as carbazole-based, arylamine-based, hydrazone-based, stilbene-based, starburst-based, or oxadiazole-based material.

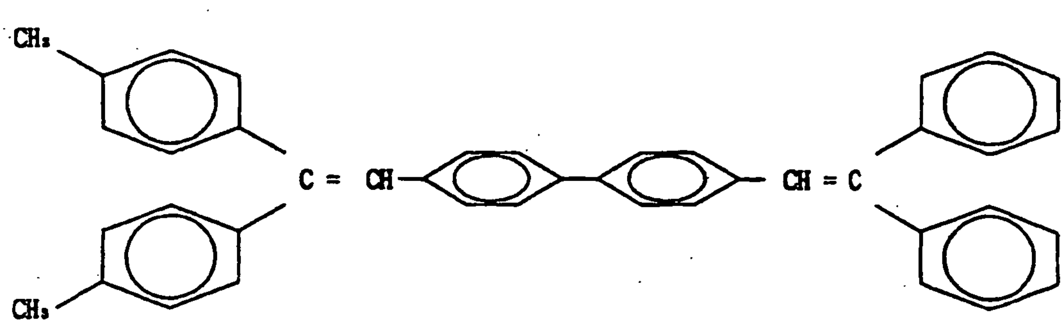
[Chemical Formula 1]



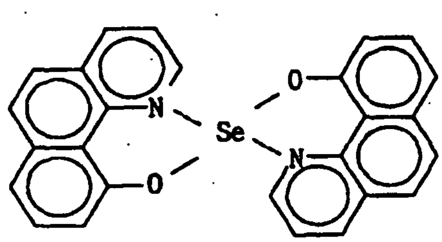
[Chemical Formula 2]



[Chemical Formula 3]



[Chemical Formula 4]



[0036] At this time, the transfer layer 33 is formed to a thickness of 100 through (50,000 Å) by a typical coating method, for example, extrusion, spin, knife coating, 5,000 nm vacuum deposition, chemical vapor deposition, etc.

[0037] Meanwhile, the film structure of the donor substrate shown in FIG. 6 may vary according to a use. For example, a gas generating layer (not shown) may be further formed beneath the light- to- heat conversion layer to enhance sensitivity of the film, and a buffer layer (not shown) may be interposed between the metal layer 36 and the transfer layer 33.

[0038] The base film 31 is made of a transparent polymer such as, polyester including polyethylene terephthalate; polyacryl; polyepoxy; polyethylene; polystyrene, etc. Among them, the polyethylene terephthalate is mostly used as the base film 31. Preferably, the base film 31 has a thickness of 10 through 500 μm. Here, the base film 31 functions as a supporting film. Alternatively, the base film 31 may include complexes.

[0039] The light-to-heat conversion layer 32 is formed of a light absorbing material capable of absorbing infrared to visible light, which is one of an organic layer, a metal layer, and a combined layer thereof including a laser absorbing material.

[0040] As a film having the foregoing characteristics, there is a polymer organic layer containing metal, metal oxide, metal sulfide, carbon black, graphite, or infrared dye.

[0041] Here, the metal includes Al, Sn, Ni, Ti, Co, Zn, Pb, etc. having an optical density of 0.2 through 3.0, and the metal oxide and sulfide include the oxide and the sulfide of the metals. Preferably, the polymer organic layer includes Al or aluminum oxide.

[0042] The polymer organic layer containing the carbon black, the graphite, or the infrared dye is made of a polymer binding resin containing a coloring agent such as pigment, dye, or the like; and a dispersing agent. Here, the polymer binding resin includes only (meta) acrylate oligomer such as acryl- (meta) acrylate oligomer, ester- (meta) acrylate oligomer, epoxy- (meta) acrylate oligomer, urethane- (meta) acrylate oligomer, or the like. Alternatively, the polymer binding resin may include a mixture of the foregoing oligomer and (meta) acrylate monomer, or only (meta) acrylate monomer. Further, the carbon black or the graphite preferably has a diameter of 0.5 μm or less, and an optical density of 0.5 through 4.

[0043] Meanwhile, when the light- to- heat conversion layer 32 is too thin, its energy absorptivity is lowered, so that the amount of heat energy transformed from light energy is decreased, thereby decreasing the tension. Further, the amount of energy transmitted through the light- to- heat conversion layer 32 is increased, thereby damaging a circuit of the organic EL display device.

[0044] Also, while the transfer layer is transferred and expanded by the energy of the laser beam, the transfer layer should be kept to have a predetermined thickness or less in order to decrease a curvature radius of the transfer layer, thereby preventing an edge open defect due to a step of the pixel defining layer of the organic EL display device.

[0045] On the other hand, when the light-to-heat conversion layer 32 is too thick, the laser beam cannot be uniformly transmitted throughout the light-to-heat conversion layer 32, thereby deteriorating the transfer characteristics. In particular, when the light-to-heat conversion layer 32 is too thickly formed, coherence between the film and the substrate is poor at the step of the pixel defining layer to define the pixel region of the organic EL display device, so that the edge open defect is likely to arise.

[0046] Thus, in the case where the light- to- heat conversion layer 32 is made of the metal, the metal oxide or the metal sulfide, the light- to- heat conversion layer 32 is formed to a thickness of 10 through 500 nm (100 through 5, 000Å) using a vacuum deposition method, an electron beam deposition method, or a sputtering method. Further, in the case where the light- to- heat conversion layer 32 is made of an organic layer, the light- to- heat conversion layer 32 is formed to a thickness of 0.1 through 1 μm by extrusion, spin, knife coating, vacuum deposition, chemical vapor deposition, etc.

[0047] Further, when the gas generating layer causes decomposition reaction by absorbing light or heat, a nitrogen gas, a hydrogen gas, etc. are generated to provide transfer energy. Here, the gas generating layer may be made of a material selected from the pentaerythrite tetranitrate (PETN) , tri nitro toluene (TNT) , etc.

[0048] The buffer layer 35 is formed on the light-to-heat conversion layer 32. The buffer layer 35 is formed to enhance the interfacial characteristics between the light-to-heat conversion layer 32 and the metal layer 36. Here, the buffer layer 35 may be formed of metal oxide, metal sulfide, nonmetallic inorganic compounds, or organic material, wherein the metal oxide or the like is formed by oxidizing a surface of the metal layer after forming the metal layer, or by a separate process. Further, the organic material may be formed by coating an inert polymer or by depositing a small molecular material. Preferably, the buffer layer 35 has a thickness of 0.01 through 2 μm.

[0049] Meanwhile, the metal layer 36 formed on the buffer layer 35 throughout the base film includes metal having a laser beam transmissivity of 20% or less. Further, the metal layer 36 is formed to have a thickness of 1 μm or less by a vacuum deposition method, an electron beam deposition method, or a sputtering method. Here, when the metal layer 36 is too thick, the metal layer 36 is hardly expanded while the light- to- heat conversion layer 32 is expanded, thereby deteriorating the transfer characteristics. Therefore, the thickness of the metal layer 36 is determined as long as it may prevent the light energy of the laser beam and the heat energy of the light- to- heat conversion layer 32 from being transferred to the transfer layer 33 and prevent the transfer layer 33 from being thermally deformed.

[0050] At this time, the metal layer 36 enhances the adhesion between the small molecular transfer layer 33 and the donor substrate 34 to prevent the small molecular transfer layer 33 from staining a region to which the transfer layer 33 is not transferred.

[0051] The metal layer 36 may include one of Al, Ag, Cr, Sn, Ni, Ti, Co, Zn, Au, Cu, W, Mo, and Pb, and preferably includes Al or Ag.

[0052] Hereinbelow, a method of forming a fine pattern of a small molecular organic thin film using a donor substrate according to the present invention will be described with reference to FIG. 8. In the following description, the donor substrate according to the present invention is applied to the organic EL display device for the sake of description, but not limited to and may vary.

[0053] FIG. 8 is a view illustrating a transferring method using a donor substrate according to the present invention. First, a transparent electrode layer 200 is formed on a transparent substrate 100. Separately, there are provided a donor substrate 34 including a light-to-heat conversion layer 32, a buffer layer 35, a metal layer 36, and a base film 31; and a transfer layer 33 formed on the donor substrate 34.

[0054] The transfer layer 33 is fabricated by coating the donor substrate 34 with a material for forming a small molecular organic thin layer. At this time, to improve various characteristics, the small molecular material may include an additive with a predetermined content. For example, a dopant may be added to the transfer layer 33 to enhance efficiency of an emission layer. As described above, the transfer layer 33 may be formed by extrusion, spin, and knife coating methods,

[0055] As described above, the transfer layer 33 may be formed of a single layer or at least two layers using the small molecular organic material as necessary.

[0056] Then, the donor substrate 34 is disposed to be spaced apart from the substrate 100 having the transparent electrode layer 200 at a predetermined distance, and an energy source 57 is applied to the donor substrate 34.

[0057] The energy source 57 from a transfer apparatus passes through the base film 31 and activates the light-to-heat conversion layer 32, thereby allowing the light-to-heat conversion layer 32 to emit heat by pyrolysis reaction.

[0058] Then, the light- to- heat conversion layer 32 of the donor substrate 34 is expanded due to the emitted heat, so that the transfer layer 33 is separated from the donor substrate 34 and transferred onto the pixel region defined by the pixel defining layer formed on the substrate 100 of the organic EL display device, thereby forming the emission layer with a desired pattern and a desired thickness.

[0059] According to the present invention, the metal layer 36 is employed to enhance the interfacial characteristics between the donor substrate 34 and the small molecular transfer layer 33, in particular, the adhesion therebetween, thereby preventing the small molecular material from staining the substrate 100 of the organic EL display device 100 while the small molecular material is transferred by the laser beam.

[0060] According to an embodiment of the present invention, a laser, a xenon lamp, a flash lamp, or the like may be employed as the energy source. Among them, the laser is excellent in the transfer effect. At this time, the laser is a general laser of solid, gas, semiconductor, dye, or the like. Further, the laser beam may have various shapes such as a circular shape, or the like.

[0061] After completing the transfer process, an annealing process, i.e. a heat treatment process is performed to solidify and fix the transferred material.

[0062] Here, the transfer process may be performed once or many times. That is, in order to make the small molecular organic layer have a desired thickness, the transfer process may be performed once or many times. Preferably, the transfer process is performed once in consideration of the convenience and the stability of the process.

[0063] FIG. 9 is a photograph showing a pattern obtained by applying a laser induced thermal imaging method to a small molecular material using a donor substrate according to the present invention.

[0064] Referring to FIG. 9, the donor substrate according to the present invention allows a small molecular transfer material on a lower electrode 200 of a substrate 100 to be clearly patterned to thereby distinctly define the pixel region.

[0065] FIG. 10 is a graph showing voltage-brightness characteristics of organic EL display devices fabricated by transferring small molecular materials using the conventional donor substrate and the donor substrate according to the present invention, respectively. FIG. 11 is a graph showing brightness-efficiency characteristics of organic EL display devices fabricated by transferring small molecular materials using the conventional donor substrate and the donor substrate according to the present invention, respectively.

[0066] Referring to FIGs. 10 and 11, the organic EL display fabricated by using the donor substrate of the present invention is excellent in the voltage-brightness and brightness-efficiency characteristics compared to the conventional organic EL display.

[0067] As described above, a donor substrate for a laser induced thermal imaging method includes a metal layer between a buffer layer and a transfer layer, so that the interfacial characteristics between the donor substrate and a small molecular material are improved, thereby enhancing the characteristics of the transferring pattern and the device.

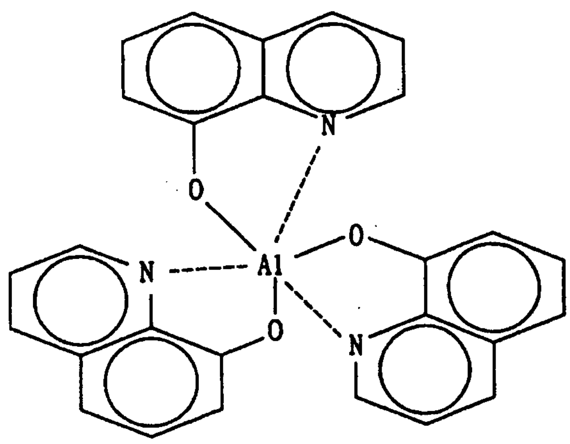
Claims

1. A donor substrate for a laser induced thermal imaging method, comprising

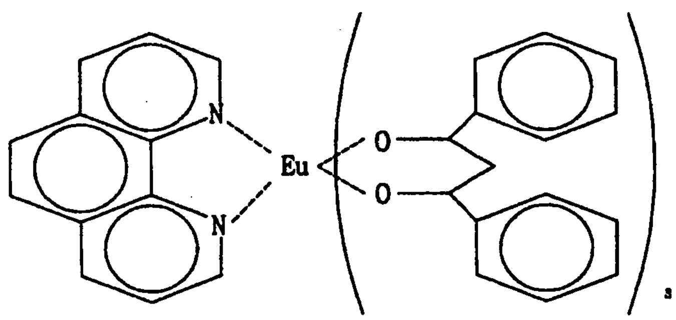
a base film;
a light-to-heat conversion layer formed on the base film;
a buffer layer formed on an entire surface of the light-to-heat conversion layer;
a metal layer which has a transmissivity of 20% or less with regard to a laser with which the laser induced thermal imaging is carried out and formed on the buffer layer; and
a transfer layer formed of small organic molecules for use in an electroluminescent device and formed on the metal layer.

2. The donor substrate as claimed in claim 1, wherein the small organic molecules for use in an electroluminescent device is formed of: one of materials represented as the following chemical formulas 1 through 4; or a small molecular phosphorescent material employing one organic metal complex selected from a group consisting of Ir, Pt, Eu, and Tb, together with one luminescent host material selected from a group consisting of carbazole-based, arylamine-based, hydrazone-based, stilbene-based, starburst-based, and oxadiazole-based materials.

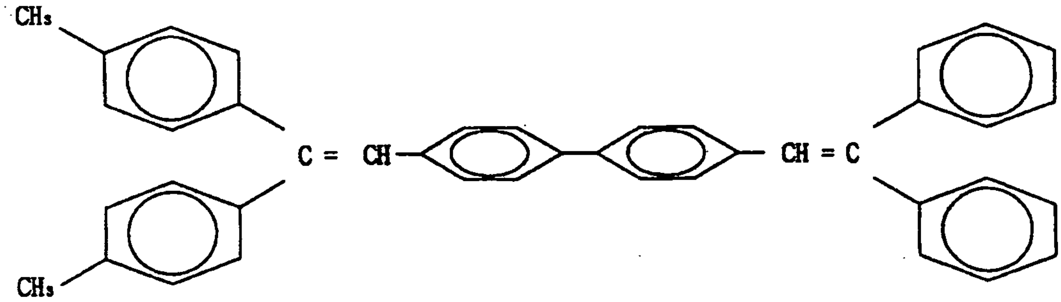
[Chemical Formula 1]



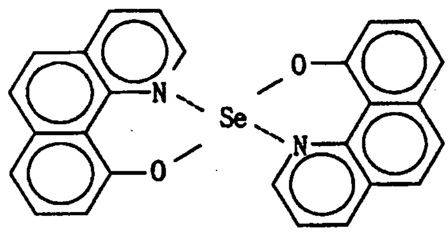
[Chemical Formula 2]



[Chemical Formula 3]



[Chemical Formula 4]



3. The donor substrate as claimed in claim 1, wherein the metal layer has a thickness of 1 μm or less.

4. The donor substrate as claimed in claim 1, wherein the metal layer includes one selected from a group consisting of Al, Ag, Cr, Sn, Ni, Ti, Co, Zn, Au, Cu, W, Mo, and Pb.

5. The donor substrate as claimed in claim 1, further comprising a gas generating layer formed beneath the light-to-heat conversion layer.

6. Use of the donor substrate as claimed in claim 1 in the fabrication of an organic electroluminescent display device.

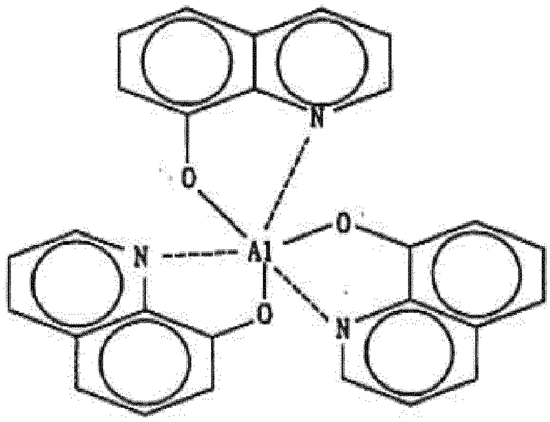
Patentansprüche

1. Donorsubstrat für ein laserinduziertes wärmebildgebendes Verfahren, umfassend

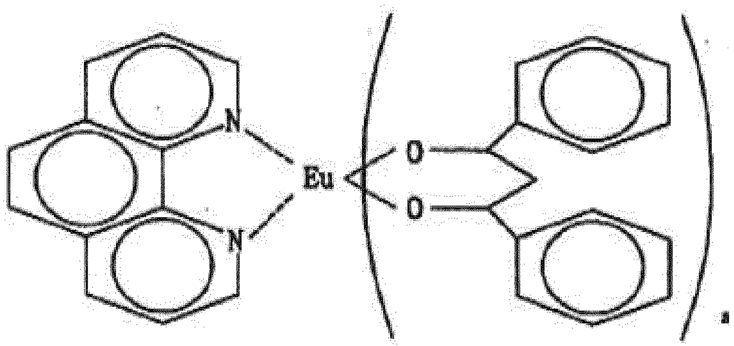
einen Basisfilm;
eine Licht-Wärme-Umwandlungsschicht, die auf dem Basisfilm ausgebildet ist;
eine Pufferschicht, die auf einer gesamten Oberfläche der Licht-Wärme-Umwandlungsschicht ausgebildet ist;
eine Metallschicht, die eine Durchlässigkeit von 20 % oder weniger in Bezug auf einen Laser aufweist, mit dem die laserinduzierte Wärmebildgebung durchgeführt wird, und die auf der Pufferschicht ausgebildet ist; und
eine Transferschicht, die aus kleinen organischen Molekülen zur Verwendung in einer elektrolumineszierenden Vorrichtung gebildet und auf der Metallschicht ausgebildet ist.

2. Donorsubstrat nach Anspruch 1, wobei die kleinen organischen Moleküle zur Verwendung in einer elektrolumineszierenden Vorrichtung aus Folgendem gebildet sind: einem der Materialien, die in den folgenden chemischen Formeln 1 bis 4 dargestellt sind; oder einem kleinmolekularen phosphoreszierenden Material, das einen organischen Metallkomplex verwendet, der ausgewählt ist aus einer Gruppe, bestehend aus Ir, Pt, Eu und Tb, zusammen mit einem lumineszierenden Trägermaterial, das ausgewählt ist aus einer Gruppe, bestehend aus carbazolbasierten, arylaminbasierten, hydrazonbasierten, stilbenbasierten, starburstbasierten und oxadiazolbasierten Materialien.

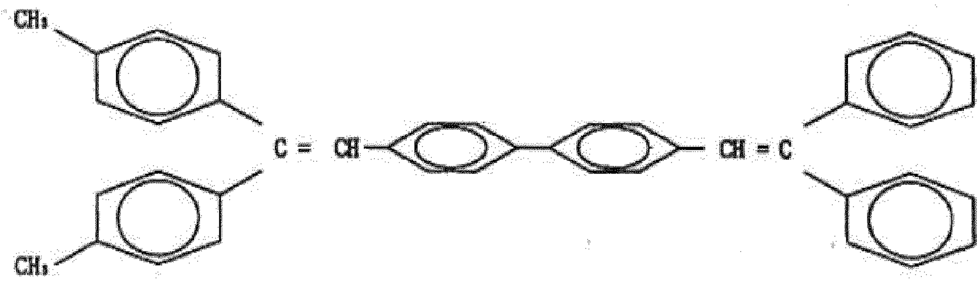
[Chemische Formel 1]



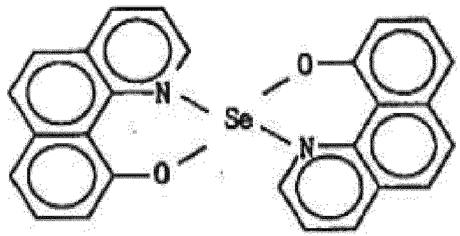
[Chemische Formel 2]



[Chemische Formel 3]



[Chemische Formel 4]



3. Donorsubstrat nach Anspruch 1, wobei die Metallschicht eine Dicke von 1 μm oder weniger aufweist.

4. Donorsubstrat nach Anspruch 1, wobei die Metallschicht eines enthält, das ausgewählt ist aus einer Gruppe, bestehend aus Al, Ag, Cr, Sn, Ni, Ti, Co, Zn, Au, Cu, W, Mo und Pb.

5. Donorsubstrat nach Anspruch 1, ferner umfassend eine Gaserzeugungsschicht, die unterhalb der Licht-Wärme-Umwandlungsschicht ausgebildet ist.

6. Verwendung des Donorsubstrats nach Anspruch 1 bei der Herstellung einer organischen elektrolumineszierenden Anzeigevorrichtung.

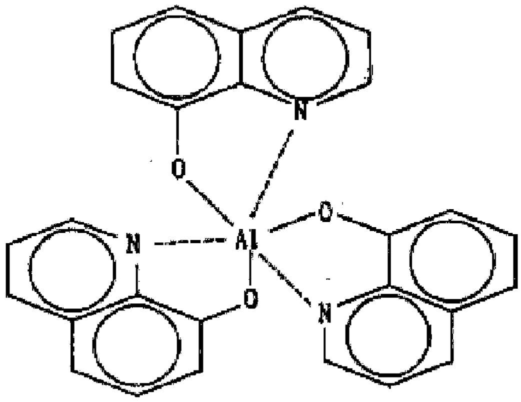
Revendications

1. Substrat donneur pour procédé d'imagerie thermique induit par laser comprenant

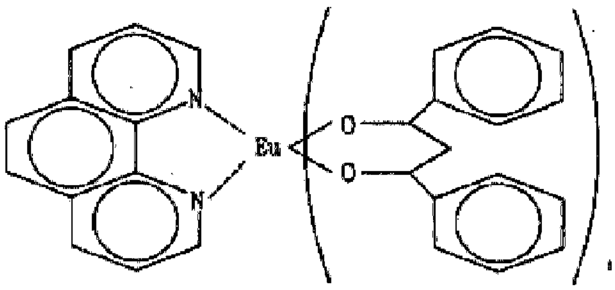
un film de base ;
une couche de conversion lumière-à-chaleur formée sur le film de base ;
une couche tampon formée sur toute une surface de la couche de conversion lumière-à-chaleur ;
une couche métallique ayant une transmissivité de 20 % ou moins par rapport à un laser avec lequel l'imagerie thermique induite par laser est mise en oeuvre et formée sur la couche tampon ; et
une couche de transfert constituée de petites molécules organiques utilisables dans un dispositif électroluminescent et formée sur la couche métallique.

2. Substrat donneur selon la revendication 1, dans lequel les petites molécules organiques utilisables dans un dispositif électroluminescent sont constituées comme suit : un des matériaux représentés par les formules chimiques 1 à 4 qui suivent ; ou un matériau phosphorescent à petites molécules comprenant un complexe de métal organique choisi dans le groupe constitué par Ir, Pt, Eu, et Tb, conjointement avec un matériau hôte luminescent choisi dans le groupe constitué par les matériaux à base de carbazole, à base d'arylamine, à base d'hydrazone, à base de stilbène, à base de "starburst", et à base d'oxadiazole.

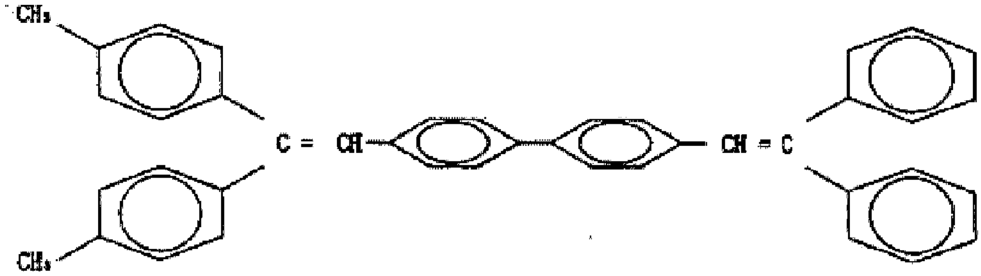
[Formule chimique 1]



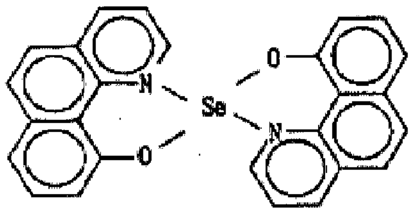
[Formule chimique 2]



[Formule chimique 3]



[Formule chimique 4]



3. Substrat donneur selon la revendication 1, dans lequel la couche métallique a une épaisseur de 1 μm ou moins.

4. Substrat donneur selon la revendication 1, dans lequel la couche métallique comprend un métal choisi dans le groupe constitué par Al, Ag, Cr, Sn, Ni, Ti, Co, Zn, Au, Cu, W, Mo, et Pb.

5. Substrat donneur selon la revendication 1, comprenant en outre une couche génératrice de gaz formée sous la couche de conversion lumière-à-chaleur.

6. Utilisation du substrat donneur selon la revendication 1 dans la fabrication d'un dispositif d'affichage électroluminescent organique.

FIG. 1
(PRIOR ART)

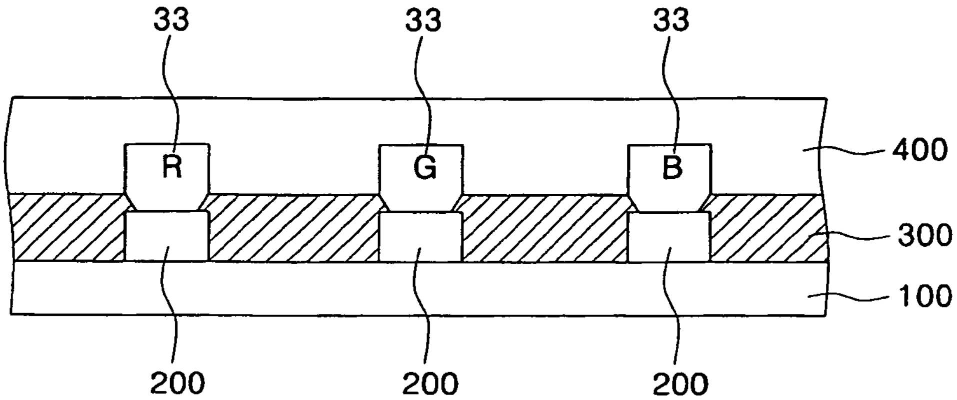


FIG. 2
(PRIOR ART)

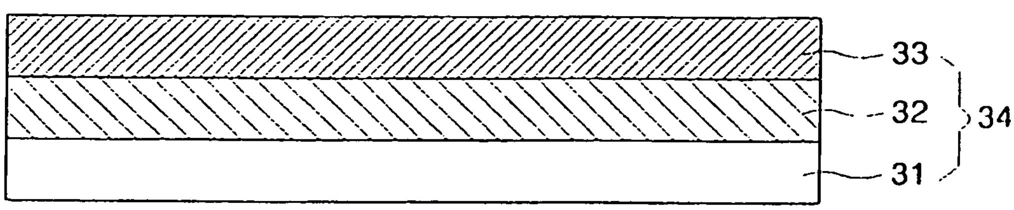


FIG. 3
(PRIOR ART)

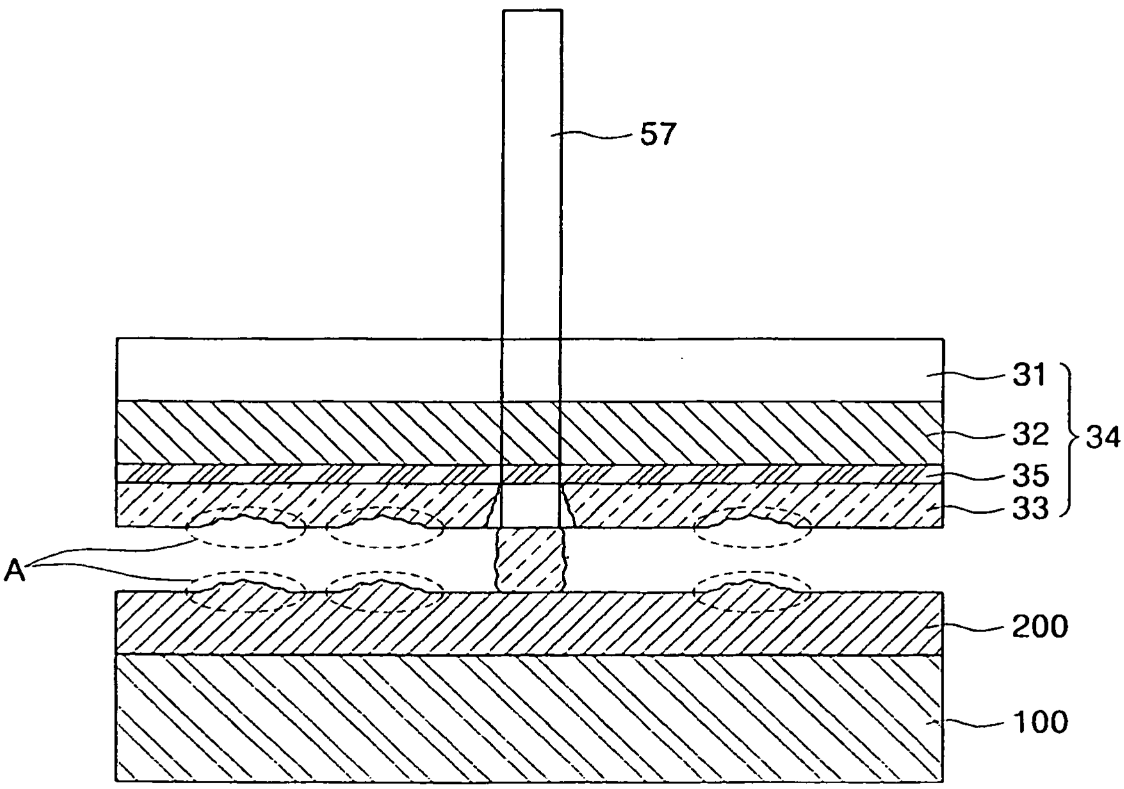


FIG. 4
(PRIOR ART)

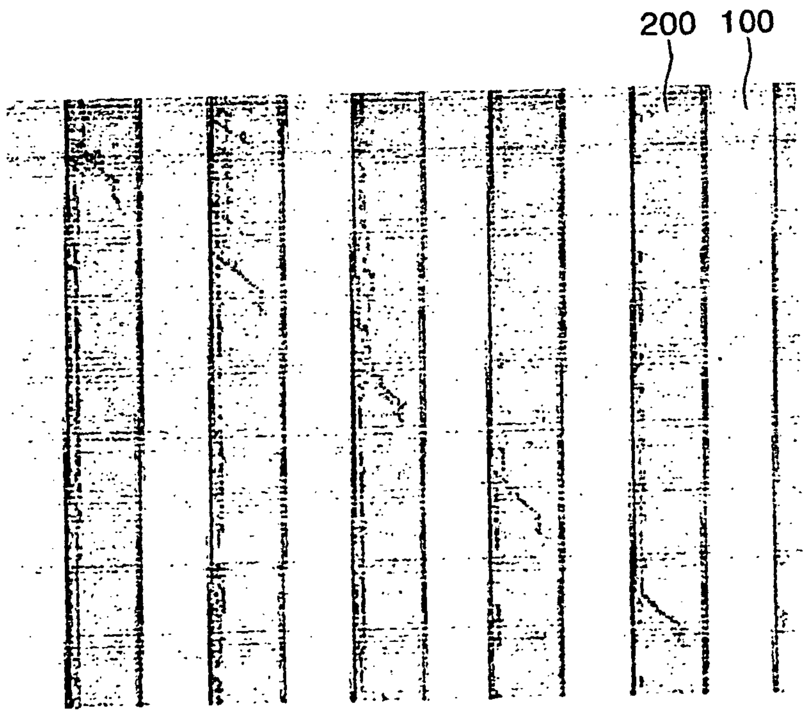


FIG. 5

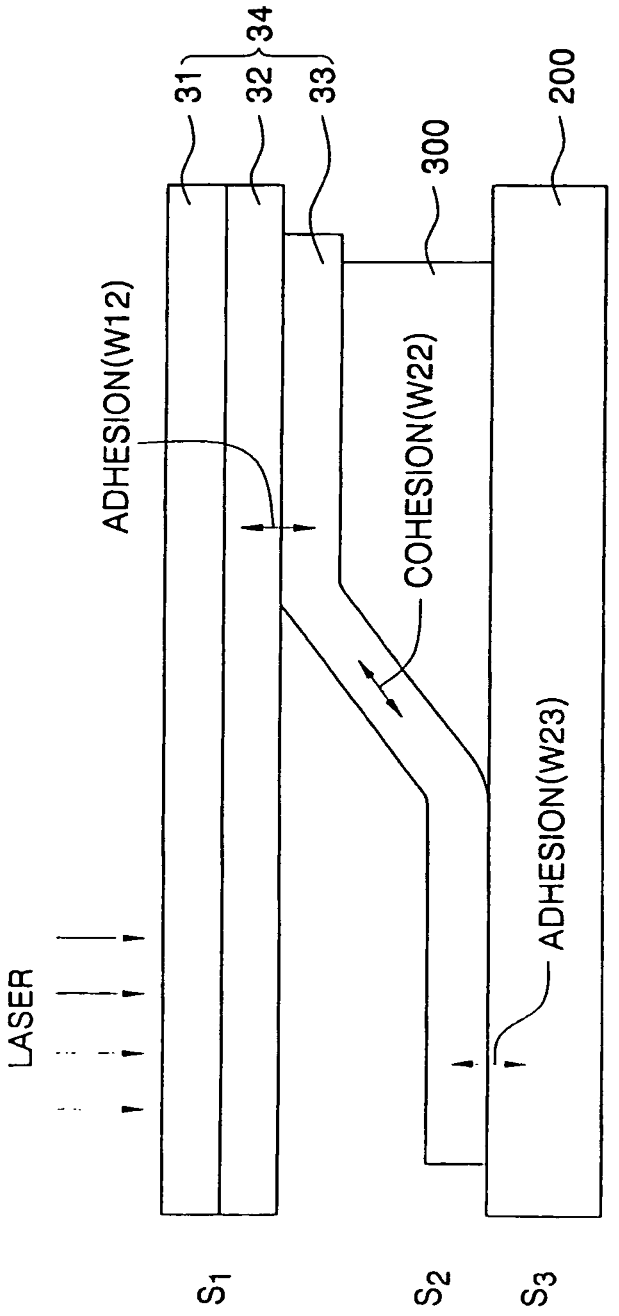

34
31
32
33
300
200
ADHESION(W12)
COHESION(W22)
ADHESION(W23)
LASER
S_1
S_2
S_3

FIG. 6

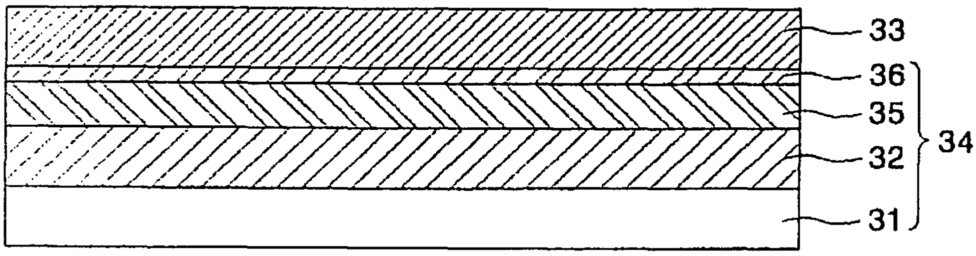


FIG. 8

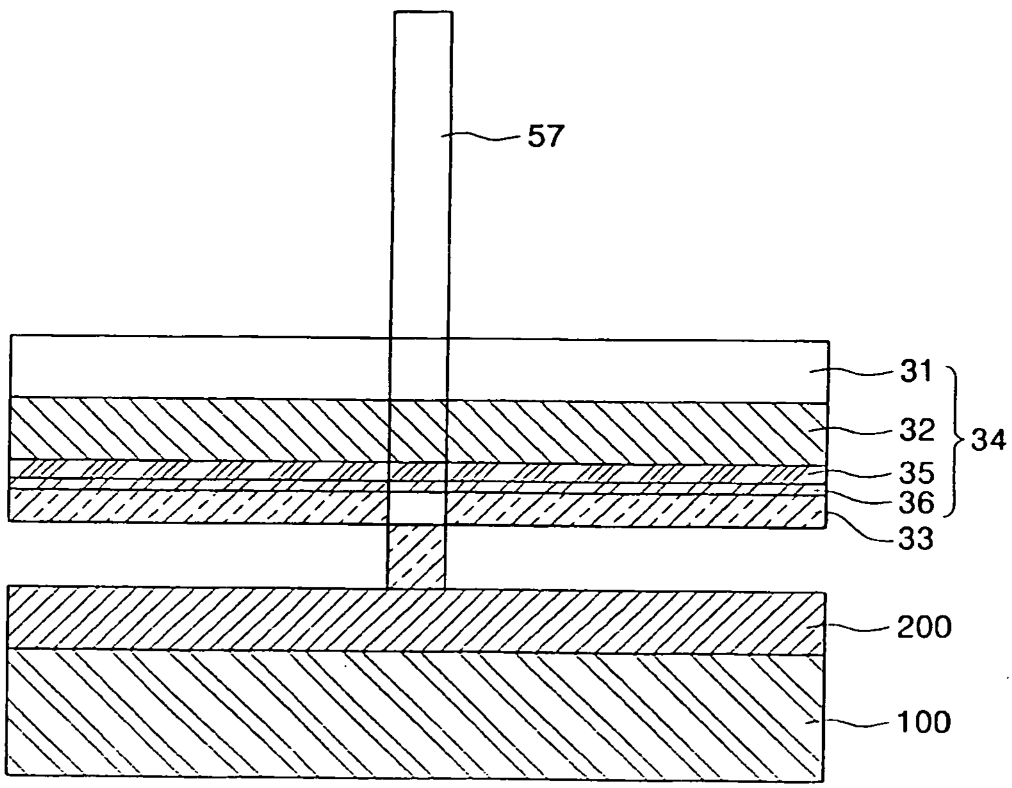


FIG. 9

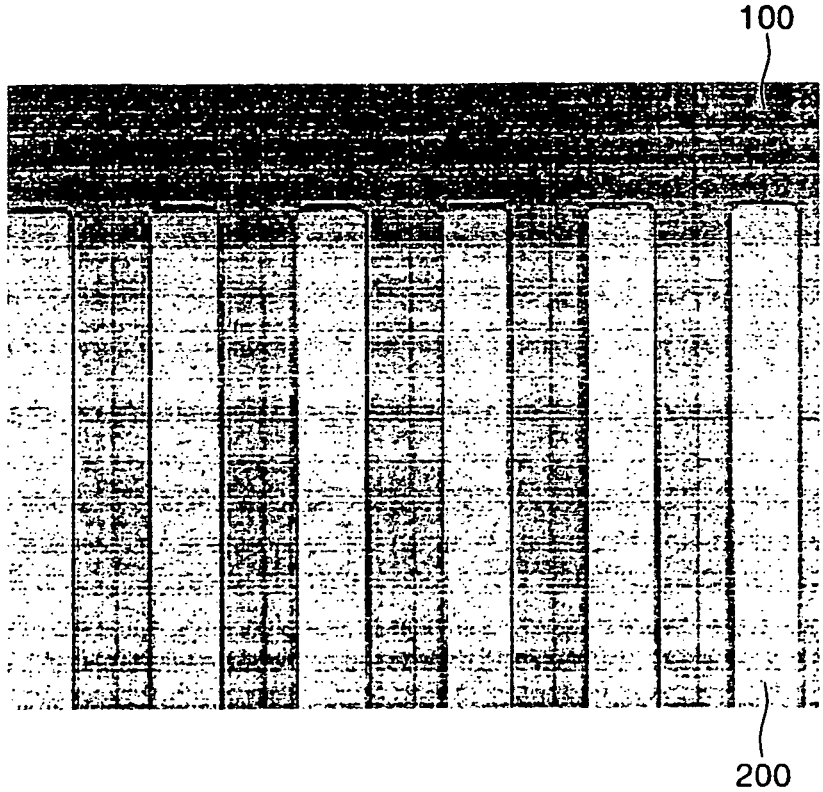


FIG. 10

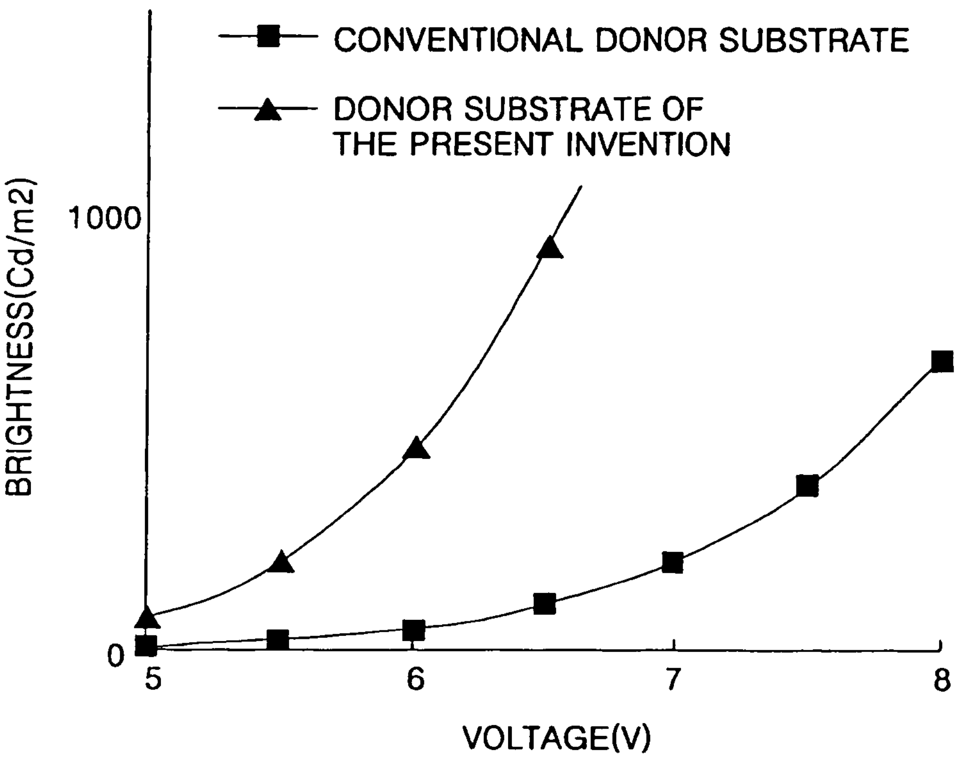
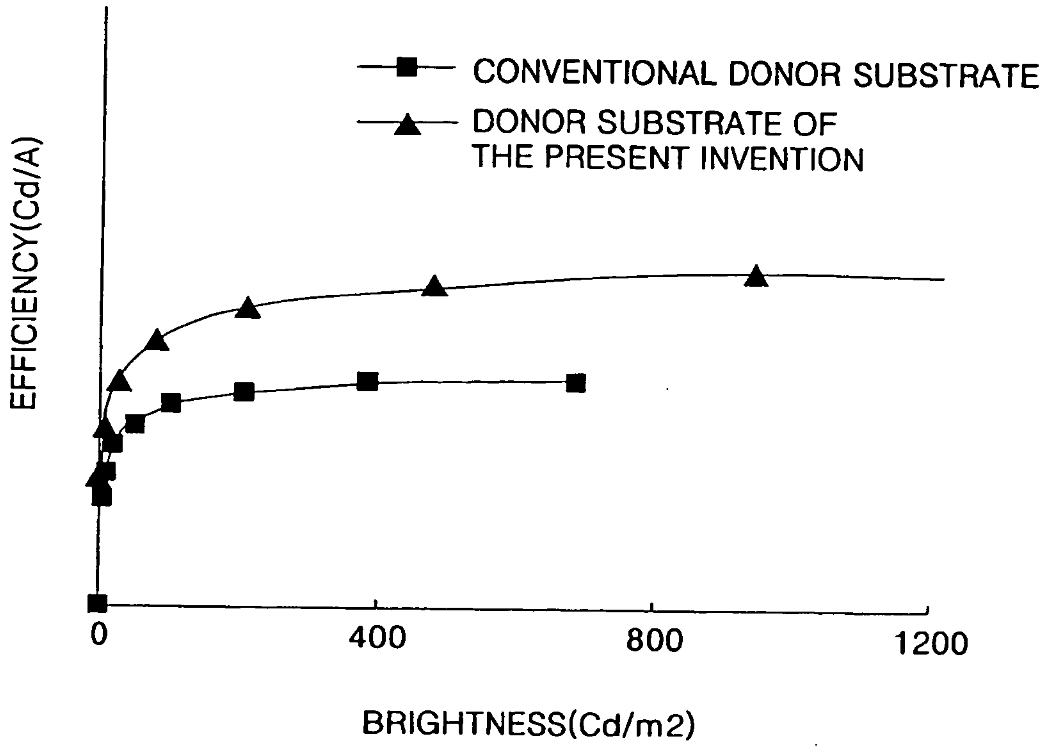

CONVENTIONAL DONOR SUBSTRATE
DONOR SUBSTRATE OF THE PRESENT INVENTION
BRIGHTNESS(Cd/m2)
1000
0
5
6
7
8
VOLTAGE(V)

FIG. 11


CONVENTIONAL DONOR SUBSTRATE
DONOR SUBSTRATE OF THE PRESENT INVENTION
EFFICIENCY(Cd/A)
0
400
800
1200
BRIGHTNESS(Cd/m2)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 199851844 **[0005]**
- US 5998085 A **[0005] [0007]**
- US 6214520 B **[0005]**
- US 6114088 A **[0005]**
- US 5220348 A **[0006]**
- US 5256506 A **[0006]**
- US 5278023 A **[0006]**
- US 5308737 A **[0006]**
- US 5937272 A **[0008]**
- US 5688551 A **[0009]**
- US 5981136 A **[0016]**
- US 6461793 B **[0016]**
- US 6099994 A **[0016]**

专利名称(译)	用于激光诱导热成像方法的供体基板和使用其制造的有机电致发光显示装置		
公开(公告)号	EP1635408B1	公开(公告)日	2013-09-18
申请号	EP2004090507	申请日	2004-12-22
[标]申请(专利权)人(译)	三星斯笛爱股份有限公司		
申请(专利权)人(译)	三星SDI CO.，LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
发明人	SONG, MYUNG-WON, SAMSUNG SDI CO., LTD. CHUNG, HO-KYOON, SAMSUNG SDI CO., LTD. LEE, SEONG-TAEK, SAMSUNG SDI CO., LTD. KIM, MU-HYUN, SAMSUNG SDI CO., LTD. CHIN, BYUNG-DOO,JEONGDEUN MAEUL DONG-A 2-DANJI APT KANG, TEA-MIN, SAMSUNG SDI CO., LTD. LEE, JAE-HO, SAMSUNG SDI CO., LTD.		
IPC分类号	H01L51/56 B41M5/42 B41M5/46 H01L51/40		
CPC分类号	H01L51/0013 B41M5/385 B41M5/42 B41M5/426 B41M5/46 B41M2205/38 C23C14/048 H01L51/56 Y10S428/917 Y10T428/24479		
代理机构(译)	hengelhaupt，Jürgen		
优先权	1020040071882 2004-09-08 KR		
其他公开文献	EP1635408A1		
外部链接	Espacenet		

摘要(译)

提供了用于激光诱导热成像方法的供体基板和使用该供体基板制造的有机电致发光显示装置。供体基底包括：基膜;在基膜上形成光热转换层;形成在光热转换层的整个表面上的缓冲层;在缓冲层上形成金属层;转印层由有机材料形成并形成在金属层上，从而通过使用激光诱导热成像方法转移小分子材料来增强转印图案的特性。

$$W_{12} = \gamma_1 + \gamma_2 - \gamma_{12}$$