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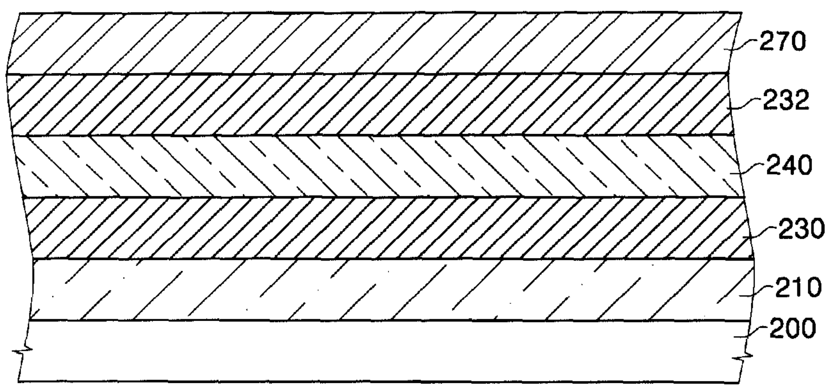
(54) **Organic light emitting display device**

(57) An organic light emitting display device having multiple emission layers (230,232) is provided, in which an organic charge transport layer (240) is interposed between the emission layers (230,232) to enhance interfacial properties between layers, and thus a stable process is ensured. Further, a hole transport layer and an electron transport layer are formed of an organic material like the charge transport layer, thereby simplifying the process.

Fig.2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an organic light emitting display device, and more particularly, to an organic light emitting display device having multiple emission layers, in which a charge transport layer between the emission layers is formed of an organic material to thereby enhance interfacial properties between the layers.

2. Description of the Related Art

[0002] An organic light emitting display device has the advantages of being able to emit light by itself, being thin and lightweight, having an ideal structure including simple parts and formed by a simple process, ensuring high picture quality and a wide viewing angle, being able to near-perfectly reproduce a moving picture, and being capable of realizing high colour purity. Further, the organic light emitting display device has electrical properties of low power consumption and low driving voltage so that the organic light emitting display device is suitable for a mobile display.

[0003] In general, the organic light emitting display device includes a substrate, a pixel electrode formed on the substrate, an organic layer comprising an emission layer (EML) formed on the pixel electrode, and a counter electrode formed on the organic layer. The organic layer may further include a hole injection layer (HIL) and a hole transport layer (HTL) between the pixel electrode and the emission layer (EML), and an electron transport layer (ETL) and an electron injection layer (EIL) between the emission layer (EML) and the counter electrode.

[0004] The organic light emitting display device with this configuration operates as follows. When a voltage is applied between the pixel electrode and the counter electrode, a hole is injected from the pixel electrode to the emission layer via the hole injection layer (HIL) and the hole transport layer (HTL), and an electron is injected from the counter electrode to the emission layer via the electron injection layer (EIL) and the electron transport layer (ETL). Then, the hole and the electron are recombined in the emission layer, thereby creating an exciton. Thus, light is emitted while the exciton is transitioned from an excited state to a ground state.

[0005] The organic light emitting display device includes an organic layer between the pixel electrode and the counter electrode to emit light, and is classified into a small molecule organic light emitting display device and a polymer organic light emitting display device according to the kind of the organic layer.

[0006] A polymer has a structure in which tens through hundreds of monomer units (i.e., repeating units) are connected to one another by a covalent bond. Therefore, the polymer is more useful for forming a thin organic layer than small molecules, and a polymer organic layer has higher impact resistance than a small molecule organic layer. Further, the polymer includes not only a monomer for transporting holes but also a monomer for transporting electrons, so that early organic light emitting display devices were manufactured by interposing only the emission layer of the polymer between the pixel electrode and the counter electrode. In the meantime, there have been attempts to apply a multilayered structure to the polymer organic light emitting display device in order to optimise driving voltage, brightness and luminous efficiency.

[0007] However, when a polymer emission layer is formed by a wet process such as a spin coating method or an ink jet method, a material for the hole injection layer (HIL) or the hole transport layer (HTL) which has been formed under the emission layer may be soluble in an organic solvent used in the wet process for forming the emission layer. Therefore, the material for the hole injection layer (HIL) or the hole transport layer (HTL) must not be soluble in the organic solvent. For example, water-soluble materials such as PEDOT (poly-3,4-ethylenedioxythiophene), PANI (polyaniline) or etc. are used for the hole transport layer (HTL). However, poor interfacial properties between the water-soluble hole transport layer (HTL) and the hydrophobic emission layer causes the device to be deteriorated, thereby decreasing the lifespan of the device.

[0008] Korean Patent Application No. 1997-0045389 proposes a method of increasing luminous efficiency by using a small-molecule material as a hole transport layer (HTL), wherein the small-molecule material is insoluble in a solvent capable of solving the polymer material. However, this patent is premised on that an ordinary small-molecule material cannot be used as the hole transport layer (HTL).

[0009] In an organic light emitting display device, a first electrode, a hole transport layer, a first emission layer, a charge transport layer, a second emission layer, an electron transport layer, an electron injection layer, and a second electrode are sequentially stacked on a substrate. Here, the first electrode and the second electrode may be used as a pixel electrode and a counter electrode, respectively. Further, the charge transport layer formed of inorganic material such as vanadium oxide (V_2O_5) serves to transport electrons to the first emission layer adjacent to the first electrode, and transport holes into the second emission layer adjacent to the second electrode. As the holes and the electrons are recombined in the respective emission layers, it is possible to increase luminous efficiency as much as the stacked number of the emission layers. However, the charge transport layer formed of an inorganic material such as vanadium oxide (V_2O_5) has an effect on a lower organic layer while being formed, so that processes are unstably performed. Further, a difference in layer-forming temperature between the organic layer and the inorganic layer deteriorates interfacial properties therebetween.

SUMMARY OF THE INVENTION

[0010] The organic light emitting display device according to the present invention comprises a substrate; a first electrode formed on the substrate; a second electrode; at least two emission layers between the first electrode and the second electrode; and at least one organic charge transport layer between the emission layers.

[0011] In other words, the present invention provides an organic light emitting display device having multiple emission layers, in which an organic charge transport layer is interposed between the emission layers to enhance interfacial properties between layers, thereby increasing luminous efficiency.

[0012] The organic light emitting display device may further comprise at least one thin film transistor between the substrate and the first electrode.

[0013] According to a preferred embodiment of the invention the charge transport layer has a HOMO ranging from 5.3 to 6.0eV and a LUMO ranging from 2.0 to 3.0eV. It further may have an electron mobility and a hole mobility which differ from each other by a factor of 100 or less.

[0014] Further, the organic light emitting display device may further 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, which is preferably formed of an organic material, particularly a small molecule organic material, fromed between the first electrode and the emission layer and/or between the second electrode and the emission layer. Each of these layers may be formed by a deposition method.

[0015] According to an aspect of the present invention, an organic light emitting display includes: a substrate; a first electrode formed on the substrate; a first emission layer formed on the first electrode; a first charge transport layer formed on the first emission layer, the first charge transport layer comprising an organic material, the first charge transport layer capable of transporting electrons and holes; a second emission layer formed on the first charge transport layer; and a second electrode formed on the second emission layer. Herein the HOMO and the LUMO levels as well as the electron mobility and the hole mobility may have values as described above. The organic light emitting display device may further include at least one of a second charge transport layer between the first electrode and the first emission layer and a third charge transport layer between the second emission layer and the second electrode, the second and third charge transport layers comprising a small molecule organic material. Each of the first, second and third charge transport layers may be formed of N,N'-bis(1-naphthyl)-N,N'-dipheyl-1,1'biphenyl-4,4'diamine.

[0016] According to an aspect of the present invention, an organic light emitting display device includes: a substrate; a first electrode formed on the substrate; a first emission layer formed on the first electrode; optionally at least one of a hole injection layer and a first hole transport layer between the first electrode and the first emission layer; a first electron transport layer formed on the first emission layer; a second hole transport layer formed on the first electron transport layer; a second emission layer formed on the second hole transport layer; a second electrode formed on the second emission layer; and optionally at least one of a hole blocking layer, a second electron transport layer and an electron injection layer between the second emission layer and the second electrode. In this structure the first electron transport layer may comprise Alq_3 and the second hole transport layer may comprise CuPC and NPD. The first electron transport layer and the second electron transport layer are preferably formed of the same material. In the same way, the first hole transport layer and the second hole transport layer are preferably formed of the same material. Further, each of the first electron transport layer and the second hole transport layer may comprise a small molecule organic material.

[0017] Further preferred embodiments of the present invention are subject matter of the depending claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] A more complete appreciation of the present invention, and many of the above and other features and advantages of the present invention, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

FIG. 1 is a cross-sectional view of a general structure of an organic light emitting display device;

FIG. 2 is a cross-sectional view of an organic light emitting display device according to an exemplary embodiment of the present invention;

FIG. 3 is a cross-sectional view of an organic light emitting display device according to another exemplary embodiment of the present invention; and

FIG. 4 is a graph showing a relationship between efficiency and brightness of the organic light emitting display device according to the present invention.

DETAILED DESCRIPTION

[0019] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown.

[0020] FIG. 1 is a general structure of an organic light emitting display device, in which a first electrode 110, a hole transport layer 120, a first emission layer 130, a charge transport layer 140, a second emission layer 132, an electron transport layer 150, an electron injection layer 160, and a second electrode 170 are sequentially stacked on a substrate 100. Here, the first electrode 110 and the second electrode 170 may be used as a pixel electrode and a counter electrode, respectively. Further, the charge transport layer 140 serves to transport electrons into the first emission layer 130 adjacent to the first electrode 110, and transport holes into the second emission layer 132 adjacent to the second electrode 170. As the holes and the electrons are recombined in the respective emission layers, it is possible to increase luminous efficiency as much as the stacked number of the emission layers. At this time, the first electrode 110 is formed of ITO (indium tin oxide). The hole transport layer 120 has a stacked structure of CuPc (copper phthalocyanine) 122 and NPB (N,N'-bis(1-naphthyl)-N,N'-dipheyl-1,1'biphenyl-4,4'diamine) 124. The first and second emission layers 130 and 132 are formed of Alq3/(10-(2-benzothiazolyl)-1,1,7,7-tetramethyl-2,3,6,7-tetrahydro-1H,5H,11H-[1]benzopyrano[6,7,8-ij]-quinolizin-11-one (Product name: C545T). The electron transport layer 150 is formed of Alq3 (tris-(8-hydroxyquinoline)aluminum). The charge transport layer 140 is formed of vanadium oxide (V_2O_5). The electron injection layer 160 between the electron transport layer 150 and the second electrode 170 is formed of lithium fluoride (LiF). The counter electrode 170 is formed of Al (aluminum). Preferably, a LiF layer is formed to have a thickness of about 10Å not only to enhance interfacial properties between an organic layer and a reflective electrode, but also to lower a work function of aluminum used as the reflective electrode.

[0021] When the charge transport layer is formed of an inorganic material such as vanadium oxide (V_2O_5), manufacturing processes are unstably performed because the inorganic layer has an effect on a lower organic layer while being formed. Further, a difference in layer-forming temperature between the organic layer and the inorganic layer deteriorates interfacial properties therebetween.

[0022] FIG. 2 is a cross-sectional view of an organic light emitting display device according to an exemplary embodiment of the present invention.

[0023] A first electrode 210, a first emission layer 230, a charge transport layer 240, a second emission layer 232 and a second electrode 270 are sequentially stacked on a substrate 200. In the case where the first electrode 210 is used as a pixel electrode, one or more thin film transistors may be further disposed between the substrate 200 and the first electrode 210. At this time, the organic light emitting display device may have a top emission structure, a bottom emission structure, or a dual emission structure.

[0024] The first electrode 210 is formed of a transparent electrode such as indium tin oxide, indium zinc oxide, etc.

[0025] The charge transport layer 240 is formed of a small molecule organic material having a highest occupied molecular orbital (HOMO) level and a lowest unoccupied molecular orbital (LUMO) level, which are proper to transport an electron and a hole to the emission layer, and having a little difference between hole mobility and electron mobility. The charge transport layer 240 allows the electron or the hole to move to the first and second emission layers 230 and 232, thereby emitting light. Preferably, the charge transport layer 240 has a HOMO level of 5.3 through 6.0eV, and a LUMO level of 2.0 through 3.0eV. Further, the electron mobility and the hole mobility of the charge transfer material are preferably different by a factor of no more than 100. The reason why the small molecule organic material is used for the charge transport layer 240 is that it may be easily formed by a deposition method. In the case where the first electrode 210 is employed as the pixel electrode and the second electrode 270 is employed as a counter electrode, the charge transport layer 240 transports the electrons and the holes to the first emission layer 230 and the second emission layer 232, respectively.

[0026] The charge transport layer 240 may have a monolayer structure or a multilayer structure. For example, when the charge transport layer 240 has a monolayer structure, it may include naphthyl-substituted benzidine derivative (NPB). On the other hand, when the charge transport layer 240 has a multilayer structure, it may have a stacked structure of an electron transport layer and a hole transport layer, e.g., a stacked structure of Alq3, CuPC/NPB.

[0027] The first emission layer 230 and the second emission layer 232 may be emission layers patterned corresponding to red, green and blue, and be formed of a phosphorescent material or a fluorescent material. Further, the first emission layer 230 and the second emission layer 232 may have the same colour or different colours.

[0028] When the first emission layer 230 and the second emission layer 232 are red, a host material may include carbazole biphenyl (CBP) or 1,3-N,N-dicarbazole-benzene (mCP) and a dopant material may be a phosphorescent material including at least one selected from the group consisting of PIQIr ((acac)(bis(1-phenylisoquinoline)acetylacetonate iridium)), PQIr ((acac)(bis(1-phenylquinoline)acetylacetonate iridium)), PQIr (tris(1-phenylquinoline) iridium, and PtOEP (octaethylporphyrin platinum). Alternatively, the red emission layer may be formed of a fluorescent material such as 2-(4-biphenylyl)-5-phenyl-1,3,4-oxidiazole (PBD): tris(dibenzoylmethanido)(*o*-phenanthroline)europium(III) complex (Eu(DBM)3 (Phen)) or perylene.

[0029] When the first emission layer 230 and the second emission layer 232 are green, a host material may include CBP or mCP, and a dopant material may be a phosphorescent material including Ir(ppy)3 (fac tris(2-phenylpyridine) iridium). Further, the green emission layer may be formed of a fluorescent material such as Alq3 (tris(8-hydroxylquinoline)aluminum).

[0030] When the first emission layer 230 and the second emission layer 232 are blue, they may be formed of a fluorescent material because the optical properties of the blue emission layer are unstable when the blue emission layer is formed of a phosphorescent material. The fluorescent material may include one selected from the group consisting of 4,4-bis-(2,2-diphenyl-vinyl)-biphenyl (DPVBi), spiro-DPVBi, spiro-sexiphenyl (spiro-6P), DSB (distyrylbenzene), DSA (distyryl arylene), PFO (poly dioctyl-fluorene)-based polymer and PPV (polyphenylene vinylene)-based polymer.

[0031] The first emission layer 230 and the second emission layer 232 may be formed in each unit pixel area by a laser induced thermal imaging method or a vacuum deposition method using a fine metal mask.

[0032] The second electrode 270 may be formed of a metal material having a relatively low work function. For example, the metal material may include Al, MgAg, Ca, MgCa, etc.

[0033] FIG. 3 is a cross-sectional view of an organic light emitting display device according to another exemplary embodiment of the present invention.

[0034] Referring to FIG. 3, a first electrode 210; a hole transport and/or injection layer 220; a first emission layer 230; a charge transport layer 240; a second emission layer 232; at least one layer 255 of a hole blocking layer, an electron injection layer and an electron transport layer; a second electrode 270 are sequentially stacked on a substrate 200. In FIG. 3, the hole transport and/or injection layer 220 is interposed between the first electrode 210 and the first emission layer 230, and the at least one layer 255 of the hole blocking layer, the electron injection layer and the electron transport layer is interposed between the second electrode 270 and the second emission layer 232, but not limited thereto. Alternatively, either the hole transport and/or injection layer 220 or the at least one layer 255 of the hole blocking layer, the electron injection layer and the electron transport layer may be provided.

[0035] The hole transport and/or injection layer 220 may have a monolayer of NPB or a stacked structure of CuPC/NPB.

[0036] The hole blocking layer, the electron transport layer and the electron injection layer are formed of a publicly known material. The hole injection layer, the hole transport layer, the hole blocking layer, the electron transport layer and the electron injection layer may be formed of a small molecule material, and one or more layers among them may be formed by a deposition method.

[0037] Below, exemplary embodiments of the present invention will be described to facilitate understanding of the present invention, but the present invention is not limited to the following exemplary embodiments.

<Exemplary embodiment 1>

[0038] ITO was patterned as a first electrode on a substrate, and a pixel area was defined. Then, NPB as a first charge transport layer was formed to a thickness of 600Å on the first electrode by a deposition method. Then, a stacked structure of Alq3 and C545T for a green emission layer was formed to a thickness of 300Å as the first emission layer on the first charge transport layer. NPB as a second charge transport layer was formed to a thickness of 300Å on the first emission layer. Then, a stacked structure of Alq3 and C545T, i.e.,10-(2-benzothiazolyl)-1,1,7,7- tetramethyl- 2,3,6,7- tetrahydro- 1H, 5H, 11H-[1] benzopyrano[6,7,8-ij]-quinolizin-11-one was formed to a thickness of 300Å as a second emission layer on the second charge transport layer. Then, NPB was formed to a thickness of 100Å as a third charge transport layer on the second emission layer. Then, a second electrode was formed of aluminum on the third charge transport layer. At this time, because the second electrode was formed of aluminum, LiF was formed to a thickness of 10Å in consideration of interfacial properties between the third charge transport layer and the second electrode.

<Exemplary embodiment 2>

[0039] ITO was patterned as a first electrode on a substrate, and a pixel area was defined. Then, CuPC and NPB were formed to a thickness of 400Å and a thickness of 300Å, respectively, as a first hole transport layer on the first electrode. Then, a stacked structure of Alq3 and C545T for a green emission layer was formed to a thickness of 300Å as a first emission layer on the first hole transport layer. Then, Alq3 was formed to a thickness of 200Å as a first electron transport layer on the first emission layer. Then, CuPC and NPB were formed to a thickness of 300Å, respectively, as a second hole transport layer on the first electron transport layer. Then, a stacked structure of Alq3 and C545T was formed to a thickness of 300Å as a second emission layer on the second hole transport layer. Then, Alq3 was formed to a thickness of 200Å as a second electron transport layer on the second emission layer. Then, aluminum was formed as a second electrode on the second electron transport layer. At this time, because the second electrode was formed of aluminum, LiF was formed to a thickness of 10Å in consideration of interfacial properties between the second electron transport layer and the second electrode.

<Comparative example 1>

[0040] A first electrode, a hole transport layer, an emission layer, a electron transport layer and a second electrode are sequentially stacked on the substrate, which are formed by the same method but different in the number of emission layers compared to < Exemplary embodiment 1>.

[0041] FIG. 4 is a graph showing a relationship between efficiency and brightness of an organic light emitting display device according to <Exemplary embodiment 1>, <Exemplary embodiment 2>, and <Comparative example 1>.

[0042] Referring to FIG. 4, the organic light emitting display devices having multiple emission layers according to <Exemplary embodiment 1> (B) and <Exemplary embodiment 2> (C) are excellent in luminous efficiency compared to the organic light emitting display device having a single emission layer according to <Comparative

example 1> (A). Further, even though the organic light emitting display device according to <Exemplary embodiment 1> (B) has better luminous efficiency than that of <Exemplary embodiment 2> (C), but a simple structure of <Exemplary embodiment 2> is more preferable in terms of the manufacturing process.

[0043] Thus, the organic light emitting display device having the multiple emission layers needs a driving voltage increased by 3 through 4V, but the luminous efficiency increases as much as the stacked number of the emission layers.

[0044] As described above, the present invention provides an organic light emitting display device having multiple emission layers, in which a small molecule organic material is interposed between emission layers to enhance interfacial properties between layers, thereby increasing luminous efficiency.

[0045] Although the present invention has been described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that a variety of modifications and variations may be made to the present invention without departing from the spirit or scope of the present invention defined in the appended claims, and their equivalents.

Claims

1. An organic light emitting display device, comprising:

    a substrate (200);
    a first electrode (210) formed on the substrate (200);
    a second electrode (270);
    at least two emission layers (230, 232) between the first electrode (210) and the second electrode (270); and
    at least one organic charge transport layer (240) between the emission layers (230, 232).

2. The organic light emitting display device according to claim 1, further comprising at least one thin film transistor between the substrate (200) and the first electrode (210).

3. The organic light emitting display device according to claim 1 or 2, wherein the charge transport layer (240) has a highest occupied molecular orbital level (HOMO) of 5.3 through 6.0eV and a lowest unoccupied molecular orbital level (LUMO) of 2.0 through 3.0eV.

4. The organic light emitting display device according to one of the preceding clams, wherein the charge transport layer has electron mobility and hole mobility which are different by a factor of 100 or less.

5. The organic light emitting display device according to one of the preceding clams, wherein the organic charge transport layer (240) is formed of N,N'-bis(1-naphthyl)-N, N'- dipheyl- 1,1'biphenyl- 4,4'diamine (NPD).

6. The organic light emitting display device according to one of the preceding clams, wherein the organic charge transport layer (240) has a stacked structure of an electron transport layer and a hole transport layer.

7. The organic light emitting display device according to claim 6, wherein the organic charge transport layer (240) has a stacked structure of tris-(8-hydroxyquinoline)aluminum (Alq_3), copper phthalocyanine (CuPC) and N,N'-bis(1-naphthyl)-N,N'-dipheyl-1,1'biphenyl-4,4'diamine (NPD).

8. The organic light emitting display device according to one of the preceding clams, wherein the organic charge transport layer (240) is formed of a small molecule organic material.

9. The organic light emitting display device according to one of the preceding clams, wherein the organic charge transport layer (240) is formed by a deposition method.

10. The organic light emitting display device according to one of the preceding clams, further comprising at least one layer (220) of a hole injection layer and a hole transport layer, and/or at least one layer (255) of a hole blocking layer, an electron transport layer and an electron injection layer, the at least one layer (220, 255) being disposed between the first electrode (210) and the second electrode (270).

11. The organic light emitting display device according to claim 10, wherein the at least one layer (220) of the hole injection layer and the hole transport layer, and/or at least one layer (255) of the hole blocking layer, the electron transport layer and the electron injection layer is formed of a small molecule organic material.

12. The organic light emitting display device according to claim 10 or 11, wherein the at least one layer (220) of the hole injection layer and the hole transport layer, and/or at least one layer (255) of the hole blocking layer, the electron transport layer and the electron injection layer is formed by a deposition method.

13. The organic light emitting display device according to one of the clams 1 to 12, comprising:

    a substrate (200);
    a first electrode (210) formed on the substrate (200);

a first emission layer (230) formed on the first electrode (210);
a charge transport layer (240) formed on the first emission layer (230), the first charge transport layer (240) comprising an organic material, the first charge transport layer (240) capable of transporting electrons and holes;
a second emission layer (232) formed on the first charge transport (240) layer; and
a second electrode (270) formed on the second emission layer (232).

14. The organic light emitting display device according to claim 13, wherein the first charge transport (240) layer has a highest occupied molecular orbital level (HOMO) of 5.3 through 6.0eV and a lowest unoccupied molecular orbital level (LUMO) of 2.0 through 3.0eV, and the first charge transport layer (240) has electron mobility and hole mobility which are different by a factor of 100 or less.

15. The organic light emitting display device according to claim 13 or 14, further comprising:

at least one of a second charge transport layer between the first electrode (210) and the first emission layer (230) and a third charge transport layer between the second emission layer (232) and the second electrode (270), the second and third charge transport layers comprising a small molecule organic material.

16. The organic light emitting display device according to claim 15, wherein each of the first, second and third charge transport layers is formed of N,N'-bis(1-naphthyl)-N,N'-dipheyl-1,1'biphenyl-4,4'diamine.

17. The organic light emitting display device according to one of the clams 1 to 12, comprising:

a substrate;
a first electrode formed on the substrate;
a first emission layer formed on the first electrode;
optionally at least one of a hole injection layer and a first hole transport layer between the first electrode and the first emission layer;
a first electron transport layer formed on the first emission layer;
a second hole transport layer formed on the first electron transport layer;
a second emission layer formed on the second hole transport layer;
a second electrode formed on the second emission layer; and
optionally at least one of a hole blocking layer, a second electron transport layer and an electron injection layer between the second emission layer and the second electrode.

18. The organic light emitting display device according to claim 17, wherein the first electron transport layer comprises tris-(8-hydroxyquinoline)aluminum (Alq_3), and the second hole transport layer comprises copper phthalocyanine (CuPC) and N,N'-bis(1-naphthyl)-N, N'- dipheyl- 1,1'biphenyl- 4,4'diamine (NPD).

19. The organic light emitting display device according to claim 17 or 18, wherein the first electron transport layer and the second electron transport layer are formed of the same material, and the first hole transport layer and the second hole transport layer are formed of the same material.

20. The organic light emitting display device according to one of claims 17 to 19, wherein each of the first electron transport layer and the second hole transport layer comprises a small molecule organic material.

Fig.1

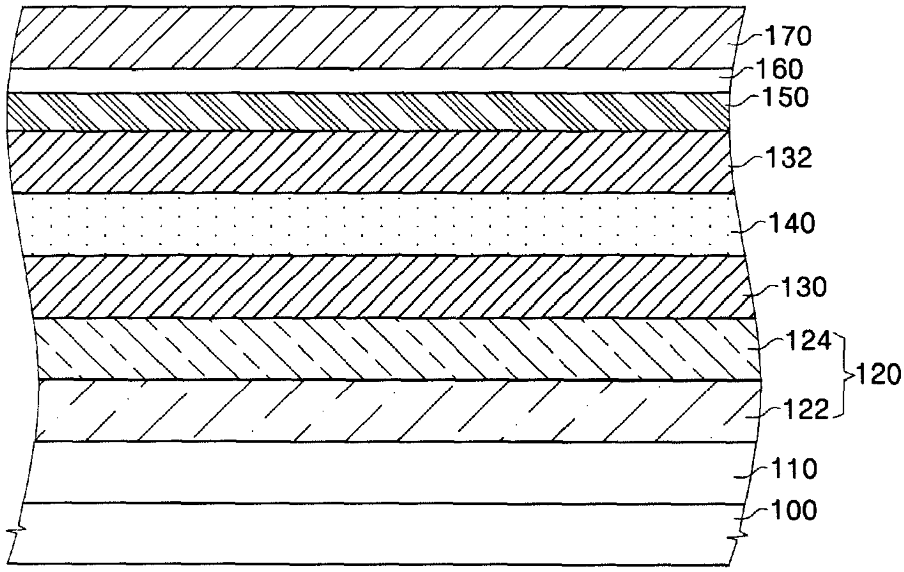


Fig.2

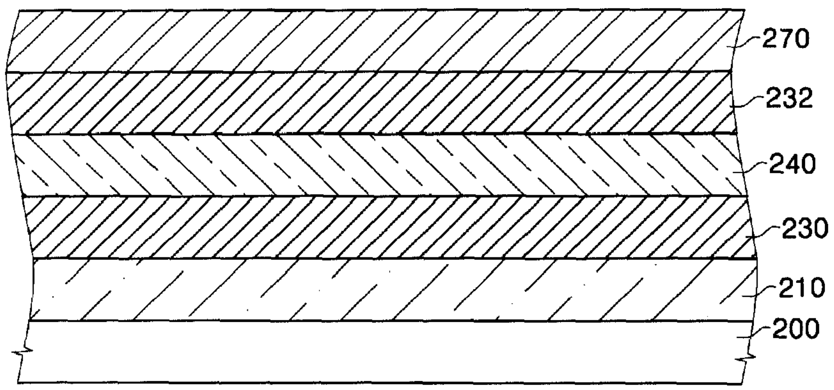


Fig.3

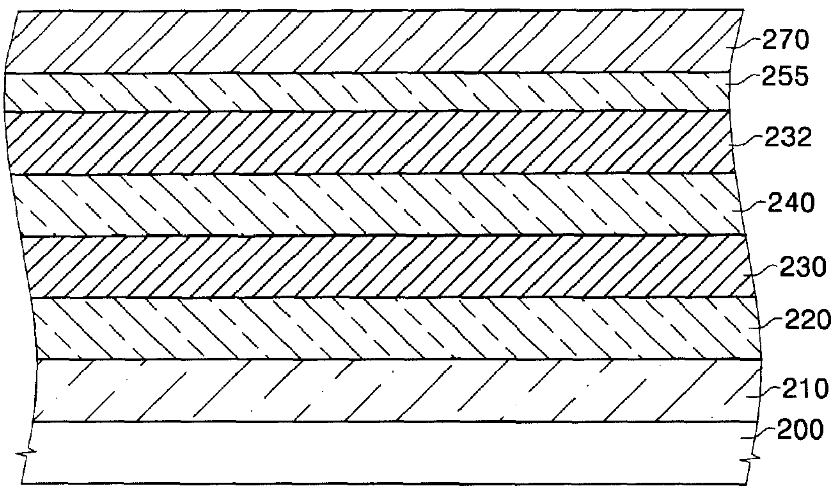
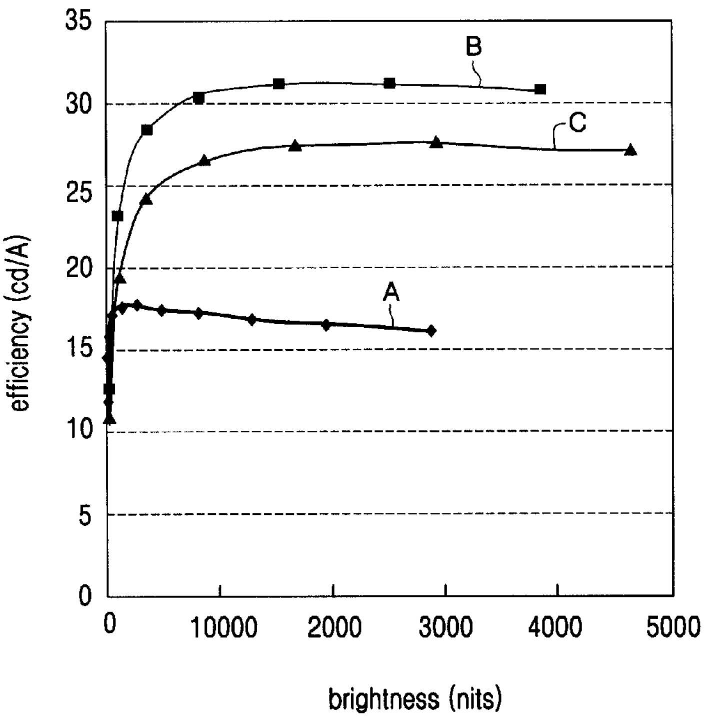


Fig.4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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 7192

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 1 478 025 A (EASTMAN KODAK CO [US]) 17 November 2004 (2004-11-17) * paragraphs [0022], [0058], [0080], [0081], [0088] - [0091] * -----	1,3-15, 17-20 2	INV. H01L51/52
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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	21 November 2006	Faou, Marylène

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专利名称(译)	有机发光显示装置		
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摘要(译)

提供了一种具有多个发光层（230,232）的有机发光显示装置，其中有机电荷传输层（240）插入在发光层（230,232）之间以增强层之间的界面性质，因此确保了稳定的工艺。此外，空穴传输层和电子传输层由诸如电荷传输层的有机材料形成，从而简化了工艺。

Fig.2