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(54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE AND METHOD FOR MANUFACTURING THE SAME

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(57) **ABSTRACT**

An organic electroluminescent element is formed to have a transparent electrode as a cathode. An ultraviolet-absorbing layer having a higher ultraviolet absorptivity than the transparent electrode is formed on the transparent electrode. A sealing film is formed on the ultraviolet-absorbing layer by a plasma CVD process.

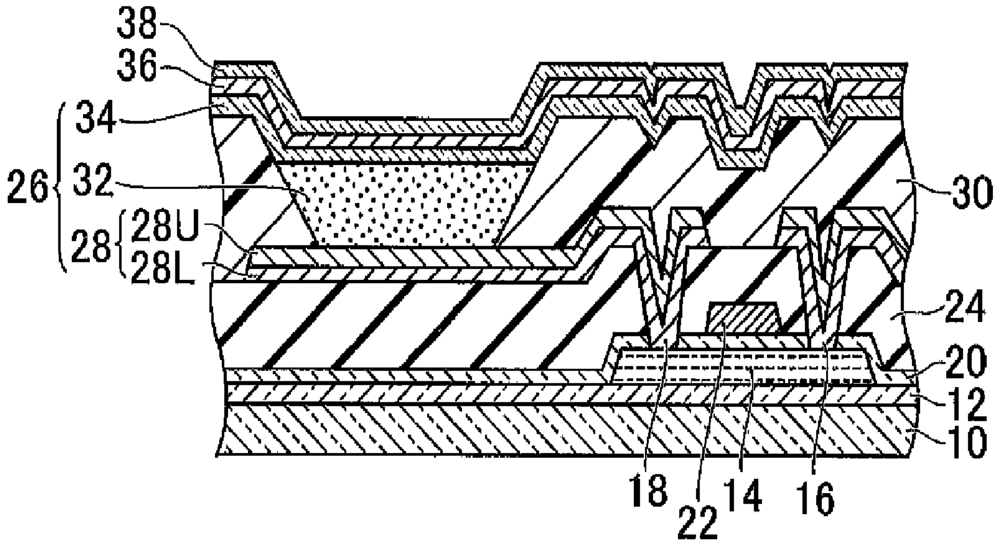


FIG.1

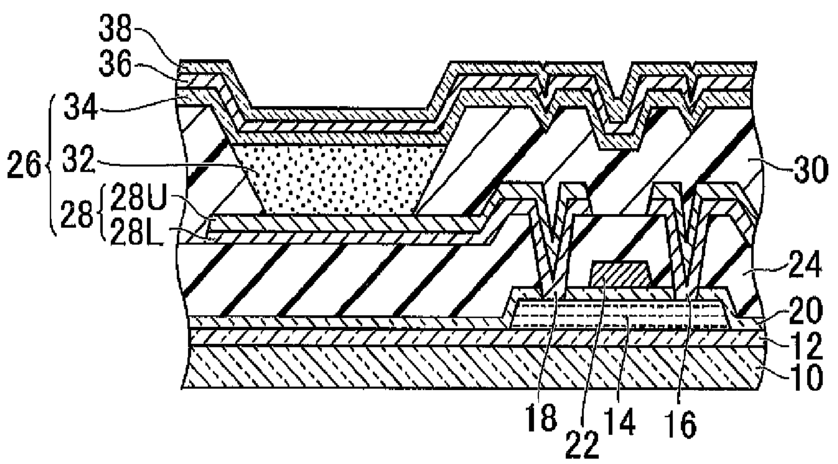


FIG.2

	TRANSPARENT ELECTRODE			ULTRAVIOLET-ABSORBING LAYER			LUMINESCENT EFFICIENCY	RELIABILITY
	MATERIAL	THICKNESS	TRANSMITTANCE	MATERIAL	THICKNESS	TRANSMITTANCE		
COMPARATIVE EXAMPLE 1	IZO	300 nm	70.2 %	—	—	—	70.6cd/A	×
COMPARATIVE EXAMPLE 2	IZO	300 nm	70.2 %	—	—	—	50.2cd/A	O
COMPARATIVE EXAMPLE 3	IZO-A	300 nm	62.3 %	—	—	—	55.4cd/A	O
COMPARATIVE EXAMPLE 4	IZO-A	600 nm	37.2 %	—	—	—	61.7cd/A	O
EXAMPLE 1	IZO-A	300 nm	62.3 %	ITO	200 nm	70.4 %	62.5cd/A	O
EXAMPLE 2	IZO-A	300 nm	62.3 %	IZO-B	200 nm	53.6 %	65.8cd/A	O
EXAMPLE 3	IZO-A	300 nm	62.3 %	BD	160 nm	90.1 %	72.4cd/A	O

FIG.3

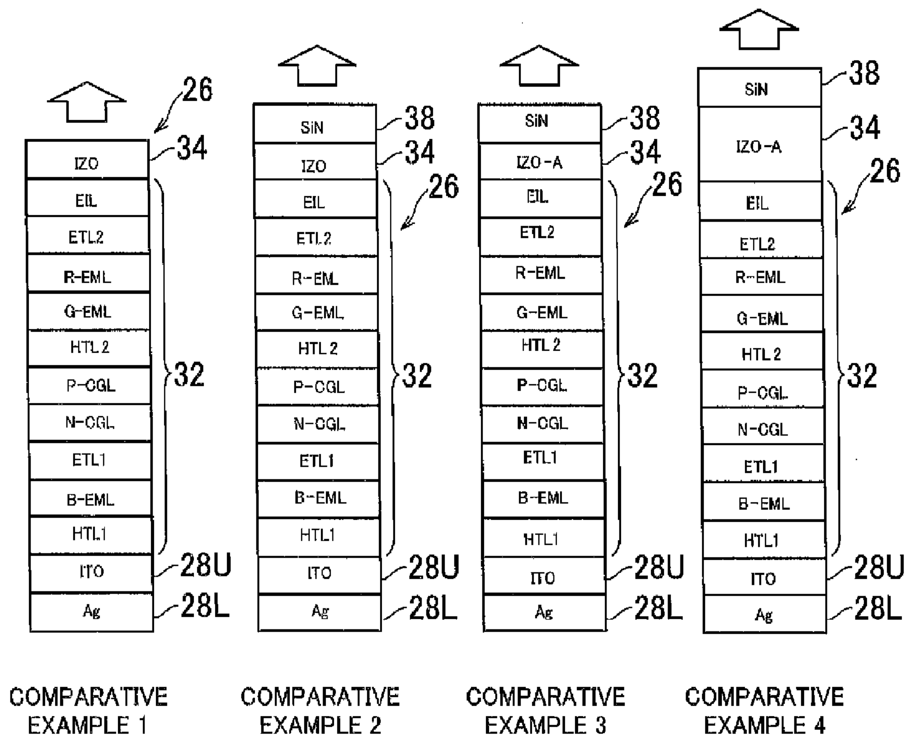
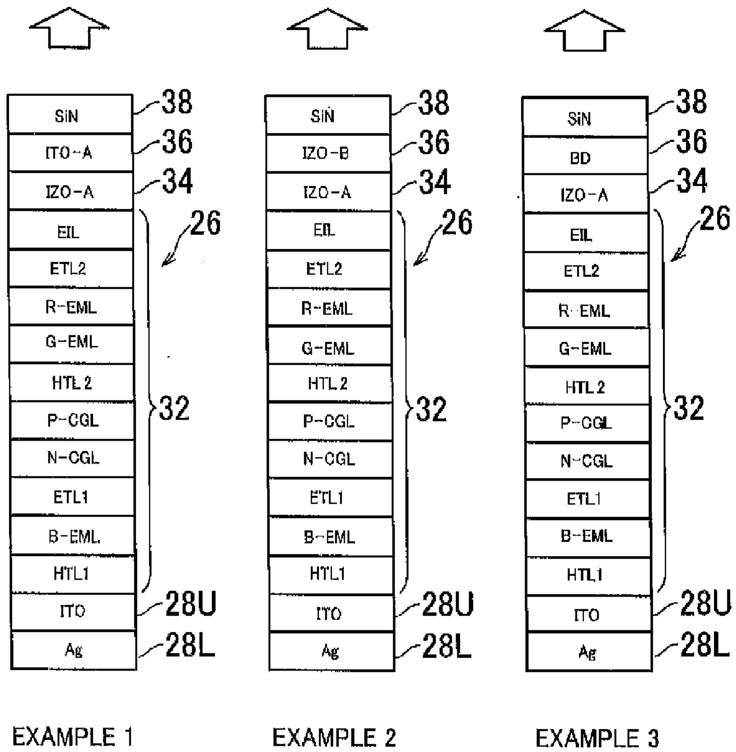

26
34
IZO
EIL
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
32
28U
28L
COMPARATIVE EXAMPLE 1
SiN
38
IZO
34
EIL
26
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
32
28U
28L
COMPARATIVE EXAMPLE 2
SiN
38
IZO-A
34
EIL
26
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
32
28U
28L
COMPARATIVE EXAMPLE 3
SiN
38
IZO-A
34
EIL
26
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
32
28U
28L
COMPARATIVE EXAMPLE 4

FIG.4


SiN
ITO-A
IZO-A
EIL
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
38
36
34
26
32
28U
28L
EXAMPLE 1
SiN
IZO-B
IZO-A
EIL
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
EXAMPLE 2
SiN
BD
IZO-A
EIL
ETL2
R-EML
G-EML
HTL 2
P-CGL
N-CGL
ETL1
B-EML
HTL1
ITO
Ag
EXAMPLE 3

ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE AND METHOD FOR MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority from Japanese application JP2014-207329 filed on Oct. 8, 2014, the content of which is hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an organic electroluminescent display device and a method for manufacturing the organic electroluminescent display device.

[0004] 2. Description of the Related Art

[0005] An organic electroluminescent display device has a sealing structure for isolating an organic electroluminescent (EL) element from the air. The sealing structure is, of course, required to have barrier properties and also required to have transparency for top emission types, which allow emitted light to exit through the top. To meet these requirements for the material, silicon nitride (SiN) is used as sealing films. Many of such silicon nitride films are formed by plasma chemical vapor deposition (CVD) (JP2009-037813A).

[0006] In a plasma CVD process, ultraviolet rays are emitted. The top layer electrode of a top-emitting organic EL element is transparent. Thus, the ultraviolet rays, which pass through this electrode, deteriorate or deactivate the light-emitting materials, and consequently reduce the luminescent efficiency.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to reduce the effect of ultraviolet rays emitted in a plasma CVD process.

[0008] (1) A method for manufacturing an organic electroluminescent display device according to an aspect of the present invention includes the following steps. An organic electroluminescent element is formed to have a transparent electrode as a cathode. An ultraviolet-absorbing layer having a higher ultraviolet absorptivity than the transparent electrode is formed on the transparent electrode. A sealing film is formed on the ultraviolet-absorbing layer by a plasma CVD process. According to this aspect, the ultraviolet-absorbing layer, which absorbs ultraviolet rays, can reduce the effect of the ultraviolet rays emitted in the plasma CVD process on the organic electroluminescent element.

[0009] (2) In the method according to the item (1), the sealing film may be formed of a silicon nitride-containing material by using silane gas in the plasma CVD process.

[0010] (3) In the method according to the item (1) or (2), both the transparent electrode and the ultraviolet-absorbing layer may be formed of indium zinc oxide, and the ultraviolet-absorbing layer may have a higher percentage of oxygen than the transparent electrode.

[0011] (4) In the method according to the item (1) or (2), the transparent electrode may be formed of indium zinc oxide, and the ultraviolet-absorbing layer may be formed of amorphous indium tin oxide.

[0012] (5) In the method according to the item (1) or (2), the ultraviolet-absorbing layer may be formed to contain an aromatic compound or a heterocycle compound.

[0013] (6) In the method according to any one of the items (1) to (4), the ultraviolet-absorbing layer may be conductive and in close contact with the transparent electrode.

[0014] (7) An organic electroluminescent display device according to an aspect of the present invention includes an organic electroluminescent element having a transparent electrode as a cathode, an ultraviolet-absorbing layer on the transparent electrode, and a sealing film on the ultraviolet-absorbing layer. The ultraviolet-absorbing layer has a higher ultraviolet absorptivity than the transparent electrode. The sealing film is made of a silicon nitride-containing material. According to this aspect, the ultraviolet-absorbing layer, which absorbs ultraviolet rays, can reduce the effect of the ultraviolet rays on the organic electroluminescent element.

[0015] (8) In the organic electroluminescent display device according to the item (7), the transparent electrode may be formed of indium zinc oxide, and the ultraviolet-absorbing layer may be formed of indium zinc oxide having a higher percentage of oxygen than the transparent electrode.

[0016] (9) In the organic electroluminescent display device according to the item (7), the transparent electrode may be formed of indium zinc oxide, and the ultraviolet-absorbing layer may be formed of amorphous indium tin oxide.

[0017] (10) In the organic electroluminescent display device according to the item (7), the ultraviolet-absorbing layer may be formed to contain an aromatic compound or a heterocycle compound.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. **1** is a diagram showing an organic electroluminescent display device according to an embodiment of the present invention;

[0019] FIG. **2** is a table showing the results of an experiment to determine the effect of ultraviolet rays emitted in a plasma CVD process on an organic electroluminescent element;

[0020] FIG. **3** is a diagram showing organic electroluminescent elements according to Comparative Examples 1 to 4; and

[0021] FIG. **4** is a diagram showing organic electroluminescent elements according to Examples 1 to 3.

DETAILED DESCRIPTION OF THE INVENTION

[0022] An embodiment of the present invention will now be described with reference to the accompanying drawings.

[0023] FIG. **1** is a diagram showing an organic electroluminescent display device according to an embodiment of the present invention. The organic electroluminescent display device has a substrate **10** made of, for example, glass. An undercoat **12** is disposed on the substrate **10** and acts as a barrier against impurities from the substrate **10**. A semiconductor layer **14** is disposed on the undercoat **12**. A source electrode **16** and a drain electrode **18** are disposed on the semiconductor layer **14**. A gate insulating film **20** covers the semiconductor layer **14**. A gate electrode **22** is disposed on the gate insulating film **20**. An interlayer insulating film **24** covers the gate electrode **22**. The semiconductor layer **14**, the source electrode **16**, the drain electrode **18**, and the gate electrode **22** constitute a thin film transistor.

[0024] The organic electroluminescent display device has an organic electroluminescent element **26**. The organic electroluminescent element **26** includes a lower electrode **28** (e.g., an anode). The lower electrode **28** is disposed on the interlayer insulating film **24**. The lower electrode **28** includes a lower layer **28**L that reflects light and an upper layer **28**U that allows light to pass through it. A conductive layer including a portion to be the lower electrode **28** extends through the interlayer insulating film **24** and is electrically coupled to one of the source electrode **16** and the drain electrode **18** on the semiconductor layer **14**.

[0025] An insulating layer **30** is disposed on the interlayer insulating film **24** and the lower electrode **28**. The insulating layer **30** has an opening to part of the lower electrode **28**. The insulating layer **30** forms a bank enclosing the part of the lower electrode **28**.

[0026] The organic electroluminescent element **26** includes an organic layer **32**. The organic layer **32** is disposed on the lower electrode **28**. The organic layer **32** includes at least a light-emitting layer and may further include at least one of an electron transport layer, a hole transport layer, an electron injection layer, and a hole injection layer. At least one layer constituting the organic layer **32** is made of an organic material.

[0027] The organic electroluminescent element **26** has a transparent electrode **34** (e.g., a cathode) as its top layer. The transparent electrode **34** is disposed on the organic layer **32**. The transparent electrode **34** is formed to lie on the insulating layer **30** to be the bank.

[0028] An ultraviolet-absorbing layer **36** is disposed on the transparent electrode **34**. The ultraviolet-absorbing layer **36** has a higher ultraviolet absorptivity than the transparent electrode **34**. The ultraviolet-absorbing layer **36**, which absorbs ultraviolet rays, can reduce the effect of the ultraviolet rays on the organic electroluminescent element **26**. The ultraviolet-absorbing layer **36** may be formed of a conductive material so as to be in close contact with the transparent electrode **34**. In this case, the transparent electrode **34** and the ultraviolet-absorbing layer **36** constitute an electrode having low electrical resistance together.

[0029] The organic electroluminescent element **26** is sealed off from moisture by a sealing film **38**. The sealing film **38** on the ultraviolet-absorbing layer **36** is made of a material containing silicon nitride.

[0030] The following describes a method for manufacturing the organic electroluminescent display device according to an embodiment of the present invention with reference to FIG. **1**.

[0031] In this embodiment, the substrate **10** made of, for example, glass is prepared. On the substrate **10**, the undercoat **12** is formed to be a barrier against impurities from the substrate **10**. The semiconductor layer **14** is formed on the undercoat **12**, and the gate insulating film **20** is formed to cover the semiconductor layer **14**. The gate electrode **22** is formed on the gate insulating film **20**. The interlayer insulating film **24** is formed to cover the gate electrode **22**.

[0032] The organic electroluminescent element **26** is formed on the interlayer insulating film **24**. To that end, the lower electrode **28** is formed on the interlayer insulating film **24**. The lower electrode **28** is formed of a plurality of layers. For example, the lower layer **28**L is formed of a light-reflective conductive material, and the upper layer **28**U is formed of a light-transmissive conductive material.

[0033] The conductive layer including a portion to be the lower electrode **28** is formed to extend through the interlayer insulating film **24** and include portions to be the source electrode **16** and the drain electrode **18** on the semiconductor layer **14**. The semiconductor layer **14**, the source electrode **16**, the drain electrode **18**, and the gate electrode **22** constitute a thin film transistor.

[0034] The insulating layer **30** is formed on the interlayer insulating film **24** and the lower electrode **28**. The insulating layer **30** is formed to have an opening to part of the lower electrode **28**. The insulating layer **30** is formed to be a bank enclosing the part of the lower electrode **28**.

[0035] The organic layer **32** is formed on the lower electrode **28**. The organic layer **32** includes at least a light-emitting layer and may further include at least one of an electron transport layer, a hole transport layer, an electron injection layer, and a hole injection layer. At least one layer constituting the organic layer **32** is made of an organic material. The organic layer **32** is formed by vapor deposition or sputtering.

[0036] The transparent electrode **34** is formed on the organic layer **32**. The transparent electrode **34** is formed to lie on the insulating layer **30** to be the bank. The organic electroluminescent element **26**, having the transparent electrode **34** as its top layer, is thus formed.

[0037] On the transparent electrode **34**, the ultraviolet-absorbing layer **36** having a higher ultraviolet absorptivity than the transparent electrode **34** is formed. The ultraviolet-absorbing layer **36** is preferably made of a material that absorbs at least 50% of light with wavelengths of 430 nm or less. The ultraviolet-absorbing layer **36** that is formed of a conductive material so as to be in close contact with the transparent electrode **34** can constitute an electrode having low electrical resistance together with the transparent electrode **34**.

[0038] The sealing film **38** is formed on the ultraviolet-absorbing layer **36** by a plasma CVD process. In the plasma CVD process, ultraviolet rays are emitted. The ultraviolet rays have wavelengths of 430 nm or less. The sealing film **38** is formed of a silicon nitride-containing material by using silane gas in the plasma CVD process.

[0039] According to this embodiment, the ultraviolet-absorbing layer **36**, which absorbs ultraviolet rays, can reduce the effect of the ultraviolet rays emitted in the plasma CVD process on the organic electroluminescent element **26**. Consequently, higher definition, higher brightness, greater longevity, or lower power consumption can be achieved.

[0040] An embodiment according to the present invention is expected to produce such effects, especially, for 15-inch or smaller high-definition organic EL displays with a resolution of 300 ppi or more, or for 102-inch or smaller organic EL displays with a resolution of 4K (3840×2160).

Examples

[0041] To evaluate the effectiveness of this embodiment, the transparent electrode **34** and the ultraviolet-absorbing layer **36** were formed of various materials, the sealing film **38** was formed on them by a plasma CVD process, and then the luminescent efficiency of the organic electroluminescent element **26** was measured. Also for comparative examples in which the ultraviolet-absorbing layer **36** was not formed, the luminescent efficiency was measured.

[0042] FIG. **2** is a table showing the results of an experiment to determine the effect of ultraviolet rays emitted in the plasma CVD process on the organic electroluminescent element **26**. In the table, “transmittance” indicates the transmittance of ultraviolet rays with a wavelength of 420 nm, “luminescent efficiency” indicates a value measured when the organic electroluminescent element **26** was driven at a current of 10 mA/cm^2, and "reliability" indicates an evaluation at 80° C. at 80% relative humidity for 1000 hours.

[0043] FIG. **3** is a diagram showing the organic electroluminescent elements 26 according to Comparative Examples 1 to 4. In each of Comparative Examples 1 to 4, the lower electrode **28** includes the lower layer **28**L made of silver Ag, which reflects light, and the upper layer **28**U formed of indium tin oxide ITO that crystallized out on the lower layer **28**L. The organic layer **32** includes a first hole transport layer HTL1, a blue light-emitting layer B-EML, a first electron transport layer ETL1, an N carrier generation layer N-CGL, a P carrier generation layer P-CGL, a second hole transport layer HTL2, a green light-emitting layer G-EML, a red light-emitting layer R-EML, a second electron transport layer ETL2, and an electron injection layer EIL, which are stacked in this order from the lower electrode **28**.

[0044] In Comparative Example 1, as shown in FIG. **3**, the transparent electrode **34** is formed of indium zinc oxide IZO on the organic layer **32**. In Comparative Example 1, the sealing film **38** is not formed. That is, no plasma CVD process is performed. Thus, no ultraviolet rays reduce the luminescent efficiency. Accordingly, as shown in FIG. **2**, the luminescent efficiency is high. However, reliability in terms of resistance to moisture is not ensured.

[0045] In Comparative Example 2, as shown in FIG. **3**, the sealing film **38** is formed of silicon nitride SiN. That is, the plasma CVD process is performed. The spectrum of SiH_4 plasma in the plasma CVD process has a peak light emission at a wavelength of 420 nm and a broad light emission in a wavelength range of 350 nm or less. These range of ultraviolet rays deteriorate or deactivate the light-emitting materials, and consequently reduce the luminescent efficiency. The transparent electrode **34** was formed of indium zinc oxide IZO. The oxygen flow rate of indium zinc oxide IZO during sputter deposition was 0.2 sccm. As shown in FIG. **2**, the ultraviolet absorptivity of the transparent electrode **34** was 35% or less. Accordingly, in the plasma CVD process for forming the sealing film **38**, the light-emitting materials were damaged and deteriorated by ultraviolet rays. The luminescent efficiency in Comparative Example 2 exhibits about a 40% drop compared with Comparative Example 1, in which no plasma CVD process is performed.

[0046] In Comparative Example 3, as shown in FIG. **3**, the transparent electrode **34** was formed of indium zinc oxide IZO-A having higher ultraviolet absorptivity than indium zinc oxide IZO constituting the transparent electrode **34** of Comparative Example 2. Accordingly, as shown in FIG. **2**, the light-emitting materials was less damaged than Comparative Example 2. The indium zinc oxide IZO-A was deposited by sputtering, and the oxygen flow rate during the sputter deposition was 0.3 sccm.

[0047] In Comparative Example 4, as shown in FIG. **3**, the transparent electrode **34** was formed of indium zinc oxide IZO-A like the transparent electrode **34** of Comparative Example 3, but was formed thicker than the transparent electrode **34** of Comparative Example 3. This lowered the ultraviolet transmittance and reduced damage from ultraviolet rays. Thus, as shown in FIG. **2**, the luminescent efficiency was better than Comparative Example 3.

[0048] FIG. **4** is a diagram showing the organic electroluminescent elements 26 according to Examples 1 to 3. In each of Examples 1 to 3, the structure of the lower electrode **28** and the organic layer **32** is the same as that of Comparative Example 1. The sealing film **38** is also formed of silicon nitride SiN as in Comparative Examples 2 to 4.

[0049] In Example 1, as shown in FIG. **4**, the transparent electrode **34** was formed of indium zinc oxide IZO-A by sputtering. The ultraviolet-absorbing layer **36** was formed of amorphous indium tin oxide ITO-A by sputtering. According to this example, as shown in FIG. **2**, the ultraviolet damage was further reduced, and the luminescent efficiency was better than Comparative Example 4.

[0050] In Example 2, as shown in FIG. **4**, both the transparent electrode **34** and the ultraviolet-absorbing layer **36** were formed of indium zinc oxide. However, indium zinc oxide IZO-B constituting the ultraviolet-absorbing layer **36** was formed to have a higher percentage of oxygen than indium zinc oxide IZO-A constituting the transparent electrode **34** by at least 5% or more. The indium zinc oxide IZO-B was deposited by sputtering, and the oxygen flow rate during the sputter deposition was 0.5 sccm. According to this example, as shown in FIG. **2**, the ultraviolet damage was further reduced, and the luminescent efficiency was better than Example 1.

[0051] In Example 3, as shown in FIG. **4**, the transparent electrode **34** was formed of indium zinc oxide IZO-A by sputtering. Then, on the transparent electrode **34**, the ultraviolet-absorbing layer **36** was formed of an organic-containing material BD containing an aromatic compound or a heterocycle compound. The organic-containing material BD may contain an inorganic compound, such as transition metal, alkali metal, alkaline earth metal, or a main group element.

[0052] Examples of the aromatic compound include one or more compounds selected from the group consisting of benzene, indene, naphthalene, azulene, styrene, toluene, xylene, mesitylene, cumene, anthracene, phenanthrene, naphthacene, triphenylene, pyrene, and chrysene.

[0053] Examples of the heterocycle compound include one or more compounds selected from the group consisting of 1,4-dioxane, 1,3,5-triazine, 1,3-thiazole, 1,2-oxathiolane, 2,3-dihydroazete, 4,5-dihydro-1,3-thiazole, 3,4,5,6-tetrahydro-1,2-diazine, furan, thiophene, pyrrole, imidazole, pyran, pyridine, pyrimidine, pyrazine, pyrrolidine, piperazine, piperidine, morpholine, indole, purine, quinoline, isoquinoline, quinuclidine, chromene, thianthrene, phenothiazine, phenoxiazine, xanthene, acridine, phenazine, and carbazole.

[0054] The organic-containing material BD has a fluorescence or phosphorescence peak spectrum in a wavelength range of 440 to 470 nm and absorbs light with wavelengths of 450 nm or less. The extinction coefficient k of the organic-containing material BD was 0.05 or more in a wavelength range of 430 nm. The ultraviolet-absorbing layer **36** was formed to be 160 nm thick by depositing the organic-containing material DB.

[0055] As shown in FIG. **2**, the ultraviolet-absorbing layer **36** made of the organic-containing material BD exhibited a higher ultraviolet absorptivity than the ultraviolet-absorbing layer **36** made of the indium zinc oxide IZO-B of Example 2. Accordingly, the luminescent efficiency of Example 3 is higher than that of Example 2 and approximately equal to that of Comparative Example 1, in which no silicon nitride deposition step is performed.

[0056] According to Examples 1 to 3, in a wavelength range of 420 nm or less, the ultraviolet-absorbing layer **36** having ultraviolet absorptivity was confirmed to protect the organic electroluminescent element **26** and thus achieve higher luminescent efficiency.

[0057] While there have been described what are at present considered to be certain embodiments of the invention, it will be understood that various modifications may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A method for manufacturing an organic electroluminescent display device, comprising:

forming an organic electroluminescent element having a transparent electrode as a cathode;

forming an ultraviolet-absorbing layer having a higher ultraviolet absorptivity than the transparent electrode on the transparent electrode; and

forming a sealing film on the ultraviolet-absorbing layer by a plasma CVD process.

2. The method according to claim **1**, wherein

the sealing film is formed of a silicon nitride-containing material by using silane gas in the plasma CVD process.

3. The method according to claim **1**, wherein

both the transparent electrode and the ultraviolet-absorbing layer are formed of indium zinc oxide, and

the ultraviolet-absorbing layer has a higher percentage of oxygen than the transparent electrode.

4. The method according to claim **1**, wherein

the transparent electrode is formed of indium zinc oxide, and

the ultraviolet-absorbing layer is formed of amorphous indium tin oxide.

5. The method according to claim **1**, wherein

the ultraviolet-absorbing layer is formed to contain an aromatic compound or a heterocycle compound.

6. The method according to claim **1**, wherein

the ultraviolet-absorbing layer is conductive and in close contact with the transparent electrode.

7. An organic electroluminescent display device, comprising:

an organic electroluminescent element having a transparent electrode as a cathode;

an ultraviolet-absorbing layer on the transparent electrode, the ultraviolet-absorbing layer having a higher ultraviolet absorptivity than the transparent electrode; and

a sealing film on the ultraviolet-absorbing layer, the sealing film being made of a silicon nitride-containing material.

8. The organic electroluminescent display device according to claim **7**, wherein

the transparent electrode is formed of indium zinc oxide, and

the ultraviolet-absorbing layer is formed of indium zinc oxide having a higher percentage of oxygen than the transparent electrode.

9. The organic electroluminescent display device according to claim **7**, wherein

the transparent electrode is formed of indium zinc oxide, and

the ultraviolet-absorbing layer is formed of amorphous indium tin oxide.

10. The organic electroluminescent display device according to claim **7**, wherein

the ultraviolet-absorbing layer is formed to contain an aromatic compound or a heterocycle compound.

* * * * *

专利名称(译)	有机电致发光显示装置及其制造方法		
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申请号	US14/877716	申请日	2015-10-07
[标]申请(专利权)人(译)	株式会社日本显示器		
申请(专利权)人(译)	日本展示INC.		
当前申请(专利权)人(译)	日本展示INC.		
[标]发明人	YASUKAWA KOJI TAKAGI JUN		
发明人	YASUKAWA, KOJI TAKAGI, JUN		
IPC分类号	H01L51/52 H01L27/32 H01L51/56		
CPC分类号	H01L51/5234 H01L51/56 H01L2251/301 H01L27/3244 H01L2251/308 H01L51/5246 H01L51/5044 H01L51/5218 H01L51/5253 H01L51/5278		
优先权	2014207329 2014-10-08 JP		
外部链接	Espacenet USPTO		

摘要(译)

形成有机电致发光元件以具有透明电极作为阴极。在透明电极上形成紫外线吸收率高于透明电极的紫外线吸收层。通过等离子体CVD工艺在紫外线吸收层上形成密封膜。

An organic electroluminescent element is formed to have a transparent electrode as a cathode. An ultraviolet-absorbing layer having a higher ultraviolet absorptivity than the trans-