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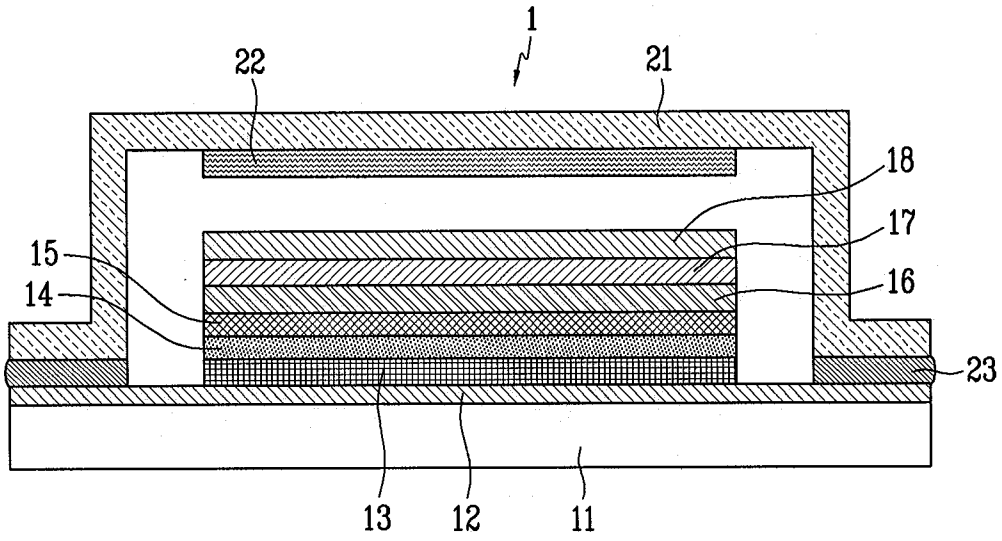
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(54) Title: GETTER FOR ORGANIC ELECTROLUMINESCENT DEVICE AND ORGANIC ELECTROLUMINESCENT DEVICE INCLUDING THE SAME



(57) Abstract: The present invention relates to a getter for an organic electroluminescent device including a hygroscopic organic metallic compound that includes at least one hygroscopic organic metallic compound. The getter includes the highly hygroscopic organic metallic compound and thereby suppresses occurrence and generation of dark spots due to external moisture, and can improve a lifespan of the device. Additionally, the getter can be used for a rear emitting or front emitting device due to good light transmittance.

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【SPECIFICATION】

【Invention Title】

GETTER FOR ORGANIC ELECTROLUMINESCENT DEVICE AND ORGANIC ELECTROLUMINESCENT DEVICE INCLUDING THE SAME

【Technical Field】

The present invention relates to a getter including a highly hygroscopic organic metallic compound and an organic electroluminescent device including the same. More particularly, the present invention relates to a getter for an organic electroluminescent device that suppresses occurrence and generation of a dark spot due to external moisture and that has good light transmittance.

【Background Art】

Although an organic electroluminescent device (organic LED) has merits such as a wide viewing angle, low power consumption, and high color reproducibility, the device performance is deteriorated by moisture. In order to improve the life-span of the device, it is preferable to include a desiccant for absorbing moisture inside the device.

Such a desiccant is called a getter.

Methods for installing the moisture absorbent desiccant in the device include placing hygroscopic inorganic filler powders such as calcium oxide (CaO), barium oxide (BaO), calcium chloride ($CaCl_2$), phosphate pentoxide

(P_2O_5), a molecular sieve, and so on in a water permeable bag and sealing it; compressing the powders into a pellet shape; and mixing the powders with a polymer binder to provide a film.

However, the method of placing the filler powders into a water permeable bag causes problems in that the thickness thereof is overly increased compared to that of a film, the bag swells at a high temperature, and the filler powders become separated. The pellet desiccant is hard to make as a thin film and has insufficient durability.

The film desiccant in which the inorganic filler and the polymer binder are mixed had advantages such as the simple structure and a thin thickness of hundreds of micrometers, but it causes problems that the powders become separated and drop off, and it is only applied for an opaque getter for the back substrate that emits light and is not applied to the front substrate that emits light since most inorganic fillers are opaque materials.

A conventional moisture absorbent getter is described in Japanese Patent laid-open No. P09-148066 and European Patent EP 776147. These patents improve the life-span by mounting a desiccant of an inorganic drying agent such as calcium oxide (CaO) in an organic ELD.

U.S. Patent laid-open publication No. 2002-0183431 discloses a technique to provide a film getter in which an inorganic filler of a metal oxide having a large surface area is mixed with a polymer binder and formed into a film.

Japanese Patent laid-open No. 2003-144830 discloses a getter

including a cyclic or linear metal organic compound in which a substituent such as an alkoxide group is bound with a metal.

【Disclosure】

【Technical Problem】

An exemplary embodiment of the present invention provides a getter for an organic electroluminescent device having excellent early hygroscopic velocity due to superior reactivity with moisture compared to that of the conventional getter, as well as being transparent by including a hygroscopic organic metallic compound. Further, it can be filled on an extra space part of a thin film or a bag.

【Technical Solution】

According to one embodiment of the present invention, provided is a getter for an organic electroluminescent device that includes at least one hygroscopic organic metallic compound selected from the group consisting of the compound represented by the following Formulas 1 and 2:

Formula 1

M^1-$(R^1)_n$

Formula 2

R^2-$(M^2)_m$

wherein, in the above formulas,

M^1 is at least one selected from the group consisting of a Group 1A alkali metal, a Group 2A alkaline-earth metal, and a Group 3A metal;

M^2 is a Group 1A alkali metal;

R^1 is an organic group selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, a linear alkoxy alkyl, a branched alkoxy alkyl, an alkynyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a linear or branched silyl alkyl, an acyl, an ester, an amide, a linear or branched aryl alkyl, a linear or branched heteroaryl alkyl, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^1 independently include or do not include at least one substituent selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, aldehyde, an acyl, an ester, an amide, an amino, and a silyl;

R^2 is independently an organic group selected from the group consisting of a linear alkylene, a branched alkylene, a cyclic alkylene, a linear alkoxy alkylene, a branched alkoxy alkylene, an alkene, a linear alkylthio alkylene, a branched alkylthio alkylene, an amino alkylene, a linear or branched silyl alkylene, a linear or branched aryl alkylene, a linear or branched hetero aryl alkylene, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^2 independently include or do not include at least one substituent selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched

alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, an aldehyde, an acyl, an ester, an amide, an amino, and a silyl;

n is an integer ranging from 1 to 3 that is determined depending on M^1;

m is an integer ranging from 2 to 4 that is determined depending on R^2; and

an M^1-R^1 and an R^2-M^2 bond of the organic metallic compounds represented by the above Formulas 1 and 2 is a direct bond between a metal and carbon.

The organic group R^1 of the above Formula 1 is independently selected from the group consisting of a C1 to C20 linear alkyl, a C3 to C20 branched alkyl, and a C3 to C12 cyclic alkyl.

The organic group, R^2 of the above Formula 2 is independently selected from the group consisting of a C1 to C20 linear alkylene, a C3 to C20 branched alkylene, and a C3 to C12 cyclic alkylene.

The getter may include at least one binder selected from the group consisting of a polyacetylene-based resin, a silicon-based resin, a polyacetylene-silicon copolymer, a fluorinated resin, a polyethylene-based resin, a polyamide-based resin, a polyester-based resin, a polyolefin-based resin having a hydrophilic group, a polyacryl-based resin, a polyacrylonitrile resin, an epoxy resin, and a UV curable resin.

The getter includes 1 to 99 wt% of the hygroscopic organic metallic compound.

The getter is formed of a thin film having a thickness ranging from 10

to 1000μm.

According to another embodiment, an organic electroluminescent device including the getter is provided.

【Advantageous Effects】

The getter of the present invention includes the highly hygroscopic organic metallic compound and thereby suppresses occurrence and generation of dark spots due to external moisture, and can improve the lifespan of the device. Additionally, the getter can be used for a rear emitting or front emitting device due to good light transmittance.

【Description of Drawings】

FIG. 1 is a cross-sectional view showing organic electroluminescent device according to Examples 14 to 15.

FIG. 2 shows transmittance spectra of the getter according to Examples 1 to 3 and Example 8.

FIG. 3 shows optical microscope photographs of organic electroluminescent devices according to Examples 14 and 15 and Comparative Examples 3 and 4 after operating under a serious condition for 700 hours.

Reference Numbrals of the Drawings

1 ... organic electroluminescent device

11 ... transparent glass substrate

12 ... anode

13 ... hole injection layer

14 ... hole transport layer

15 ... blue emission layer

16 ... electron transport layer 17 ... electron injection layer

18 ... cathode 21 ... metal can

22 ... getter 23 ... sealing member

【Best Mode】

The getter for an organic electroluminescent device according to one embodiment of the present invention includes at least one hygroscopic organic metallic compound selected from the group consisting of the compound represented by the following Formulas 1 and 2:

Formula 1

M^1-$(R^1)_n$

Formula 2

R^2-$(M^2)_m$

wherein, in the above formulas,

M^1 is at least one selected from the group consisting of a Group 1A alkali metal, a Group 2A alkaline-earth metal, and a Group 3A metal;

M^2 is a Group 1A alkali metal;

R^1 is an organic group selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, a linear alkoxy alkyl, a branched alkoxy alkyl, an alkynyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a linear or branched silyl alkyl, an acyl, an ester, an amide, a linear or branched aryl alkyl, a linear or branched heteroaryl alkyl, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^1 independently

include or do not include at least one substituent selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, aldehyde, an acyl, an ester, an amide, an amino, and a silyl;

R^2 is independently an organic group selected from the group consisting of a linear alkylene, a branched alkylene, a cyclic alkylene, a linear alkoxy alkylene, a branched alkoxy alkylene, an alkene, a linear alkylthio alkylene, a branched alkylthio alkylene, an amino alkylene, a linear or branched silyl alkylene, a linear or branched aryl alkylene, a linear or branched hetero aryl alkylene, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^2 independently include or do not include at least one substituent selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, an aldehyde, acyl, an ester, an amide, an amino, and a silyl;

n is an integer ranging from 1 to 3 that is determined depending on M^1; and

m is an integer ranging from 2 to 4 that is determined depending on R^2.

According to one embodiment, R^1 is independently at least one

organic group selected from the group consisting of a C1 to C20 linear alkyl, a C3 to C20 branched alkyl, a C3 to C12 cyclic alkyl, a C2 to C20 linear alkoxy alkyl including 1 to 20 oxygens, a C3 to C20 branched alkoxy alkyl including 1 to 20 oxygens, a C2 to C20 linear alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 branched alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 aminoalkyl including 1 to 20 nitrogens, a C3 to C20 linear or branched silyl alkyl, a linear or branched aryl alkyl including at least one C6 to C14 aromatic group, a linear or branched heteroaryl alkyl including at least one C4 to C16 hetero aromatic group, a C6 to C14 aromatic group, and a C4 to C16 hetero aromatic group.

The aromatic group and hetero aromatic group of R^1 independently include or do not include at least one substituent selected from the group consisting of a C1 to 20 linear alkyl, a C3 to C20 branched alkyl, a C3 to C12 cyclic alkyl, a C1 to C20 alkoxy, a C2 to C20 linear alkoxy alkyl including 1 to 20 oxygens, a C3 to C20 branched alkoxy alkyl including 1 to 20 oxygens, a C2 to C20 linear alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 branched alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 aminoalkyl including 1 to 20 nitrogens, a C2 to C20 amino, and a C3 to C20 silyl.

The organic group, R^1 of the organic metallic compound of the above Formula 1 is independently selected from the group consisting of a C1 to C20 linear alkyl, a C3 to C20 branched alkyl, and a C3 to C12 cyclic alkyl.

The organic group, R^2 of the above Formula 2 is independently selected from the group consisting of a C1 to C20 linear alkylene, a C3 to C20

branched alkylene, a C3 to C12 cyclic alkylene, a C2 to C20 linear alkoxy alkylene including 1 to 20 oxygens, a C3 to C20 branched alkoxy alkylene including 1 to 20 oxygens, a C2 to C20 linear alkylthio alkylene including 1 to 20 sulfurs, a C3 to C20 branched alkylthio alkylene including 1 to 20 sulfurs, a C3 to C20 amino alkylene including 1 to 20 nitrogens, a C3 to C20 linear or branched silyl alkylene, a linear or branched aryl alkylene including at least one C6 to C14 aromatic group, a linear or branched heteroaryl alkylene including at least one C4 to C16 hetero aromatic group, a C6 to C14 aromatic group, and a C4 to C16 hetero aromatic group.

The aromatic group and hetero aromatic group of R^2 independently include or do not include at least one substituent selected from the group consisting of a C1 to 20 linear alkyl, a C3 to C20 branched alkyl, a C3 to C12 cyclic alkyl, a C1 to C20 alkoxy, a C2 to C20 linear alkoxy alkyl including 1 to 20 oxygens, a C3 to C20 branched alkoxy alkyl including 1 to 20 oxygens, a C2 to C20 linear alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 branched alkylthio alkyl including 1 to 20 sulfurs, a C3 to C20 aminoalkyl including 1 to 20 nitrogens, a C2 to C20 amino, and a C3 to C20 silyl.

The organic group, R^2 of the organic metallic compound of the above Formula 1 is independently selected from the group consisting of a C1 to C20 linear alkylene, a C3 to C20 branched alkylene, and a C3 to C12 cyclic alkylene.

In the organic metallic compound represented by the above Formula 1, n is 1 when M^1 is a Group 1A alkali metal such as Li, Na, and K; n is 2 when

M^1 is a Group 2A alkaline-earth metal such as Mg and Ca; and n is 3 when M^1 is Group 3A metal such as Al.

An M^1-R^1 and a R^2-M^2 bond of the organic metallic compounds represented by the above Formulas 1 and 2 is a direct bond between a metal and carbon.

The getter including an organic metallic compound may be encapsulated by being filled in a recess portion of an encapsulating cap without a binder. Alternatively, the organic metallic compound may be encapsulated with a binder.

The binder used in the getter includes at least one binder selected from the group consisting of a polyacetylene-based resin, a silicon-based resin, a polyacetylene-silicon copolymer, a fluorinated resin, a polyethylene-based resin, a polyamide-based resin, a polyester-based resin, a polyolefin-based resin having a hydrophilic group, a polyacryl-based resin, a polyacrylonitrile resin, an epoxy resin, and a UV curable resin. According to one embodiment, a binder selected from the group consisting of a polyacetylene-based resin, a silicon-based resin, and a polyacetylene-silicon copolymer may be preferable because the binder does not deteriorate hygroscopicity of the organic metallic compound and has excellent gas transmission properties and durability.

The getter for an organic electroluminescent device including the organic metallic compound and the binder includes between 1 wt% and 99 wt% of an organic metallic compound based on the total weight of the getter in

order to ensure performance to remove moisture as well as to provide a thin layer and durability. Further, according to another embodiment of the present invention, it includes 20 to 80 wt% of the organic metallic compound in order to provide an excellent film characteristic and performance to remove moisture.

The getter according to the present invention has a thickness of 10μm or more in order to maintain the performance to remove moisture. If the thickness is more than 40μm, the film can have sufficient durability. However, a thickness of no greater than 1000μm is suitable for preventing unnecessary waste of materials.

The following examples illustrate the present invention in more detail. However, it is understood that the present invention is not limited by these examples.

【Examples】

Example 1: Preparation of n-Octadecyl Lithium Getter

0.2g (28.8mmol) of lithium ribbon was introduced into a 50ml round-bottom flask, and it was heated and dried under vacuum and nitrogen was charged therein. 8ml of anhydrous diethyl ether was added thereto and agitated at 0°C.

4ml of anhydrous diethyl ether was dissolved in 4.0g (12.0mmol) of n-1-bromooctadecane to prepare a solution. Then, the solution was slowly added to the flask with a syringe at 0°C for 10 minutes, agitated at 0°C for 6 hours, and reaction was continued at room temperature (about 25°C) for 6

hours.

After completing the reaction, the reactant was filtered under an anhydrous nitrogen atmosphere and residual lithium and produced lithium bromide were removed. The filtrate was concentrated under a reduced pressure.

The provided n-octadecyl lithium was a light brown solid, and the yield was 2.5g (81%). The obtained reactant was dissolved in 9.7ml of anhydrous n-hexane, and frozen under an anhydrous nitrogen atmosphere. The structure of the compound was confirmed via ^{1}H-NMR.

^{1}H-NMR (300MHz, $(C_2D_5)_2O$) : δ 0.96(t, 3H), δ 1.33(m, 2H), δ 1.28 - 1.30(m, 28H), δ 1.31 - 1.32(m, 4H)

Example 2: Preparation of Trioctadecyl Aluminum Getter

0.2g of an Al/Mg alloy (15% Al) was introduced into a 25ml round-bottom flask and was heated and dried under vacuum, and nitrogen was charged therein. Then it was connected to a reflux condenser. 8ml of anhydrous diethyl ether was added thereto and agitated at room temperate.

The resulting reactant was slowly refluxed, and had a solution in which n-1-bromooctadecane (4.6g, 13.8mmol) was dissolved in 6ml of anhydrous diethyl ether slowly added thereto with a syringe. After completing the reaction between n-1-bromooctadecane and metal, diethyl ether was distillated and removed. The product was obtained by distilling it under a reduced pressure.

The obtained trioctadecyl aluminum was a white solid and the yield

was 2.7g (75%). The structure of the compound was confirmed via ^{1}H-NMR.

^{1}H-NMR (300MHz, $(C_2D_5)_2O$) : δ 0.97(t, 9H), δ 1.34(m, 6H), δ 1.26 - 1.31(m, 84H), δ 1.31 - 1.33 (m, 12H)

Example 3: Preparation of Dioctadecyl Magnesium Getter

0.30g of magnesium hydride (MgH_2) was introduced into a 25ml round-bottom flask and heated and dried under vacuum, and nitrogen was charged therein. Then, 13ml of anhydrous tetrahydrofuran was added thereto. A solution in which 5.90g of 1-octadecene was dissolved in 12ml of anhydrous tetrahydrofuran was slowly added thereto, and heated and refluxed for 4 hours.

The reactant was cooled to room temperature and distillated under a reduced pressure to remove tetrahydrofuran. Anhydrous n-hexane was added thereto and melted. The residual solid was filtered under a nitrogen atmosphere and the filtrate was concentrated under reduced pressure.

The obtained dioctadecyl magnesium was a light brown solid and the yield was 4.78g (79%). The structure of the compound was confirmed via ^{1}H-NMR.

^{1}H-NMR (300MHz, $(C_2D_5)_2O$) : δ 0.96(t, 6H), δ 1.34(m, 4H), δ 1.27 - 1.30(m, 56H), δ 1.31-1.33(m, 8H)

Example 4: Preparation of 1,18-Dilithiumoctadecane Getter

0.2g (28.8mmol) of lithium granules was introduced into a 50ml round-bottom flask and heated and dried under vacuum, and nitrogen was charged therein. 8 ml of anhydrous diethyl ether was added thereto and

agitated at 0°C.

2.38g (6.00mmol) of 1,18-dibromooctadecane was dissolved in 4ml of anhydrous diethylether to provide a solution. The solution was slowly added to the flask at 0°C for 10 minutes via a syringe, and agitated at 0°C for 6 hours. The reaction was continued at room temperature (about 25°C) for 6 hours.

After completing the reaction, the resultant was filtered under an anhydrous nitrogen atmosphere and the residual lithium and the produced lithium bromide were removed. Then, the filtrate was concentrated under reduced pressure.

The obtained 1,18-dilithiumoctadecane was a light brown solid and the yield was 1.2g (72 %). The structure of the compound was ^{1}H-NMR.

^{1}H-NMR (300MHz, $(C_2D_5)_2O$): δ 1.33(m, 4H), δ 1.28 - 1.30(m, 28H), δ 1.32(m, 4H)

Example 5: Preparation of N-butyl Lithium Getter

0.1g of a poly acetylene binder was completely dissolved in 1.0g of anhydrous toluene while agitating under an anhydrous high purity nitrogen (99.9999%) atmosphere to remove bubbles and to provide a binder solution.

0.98ml of a 1.6M n-butyl lithium solution in n-Hexane (Aldrich) was added to the binder solution to provide a coating slurry.

The prepared slurry was coated by a screen printer coating method to provide a getter thin film with a thickness of 80μm, and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Example 6: Preparation of Dibutyl Magnesium Getter

A getter thin film with a thickness of 80μm was prepared in accordance with the same procedure as in Example 5 using 0.72ml of a 1.0M dibutyl magnesium solution in heptane (Aldrich), and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Example 7: Preparation of Triethyl Aluminum Getter

A getter thin film with a thickness of 80μm was prepared in accordance with the same procedure as in Example 5 using 0.88ml of 1.0M triethyl aluminum solution in hexane (Aldrich), and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Example 8 to 11 (Preparation of Film Getter Including Organic Metallic Compounds According to Examples 1 to 4)

Each getter thin film with a thickness of 80μm was prepared in accordance with the same procedure as in Example 5 using the compounds obtained from Examples 1 to 4, and the getter thin films were cut to a size of 1cm × 1cm to provide samples.

Example 12 (Preparation of Getter Including Calcium Oxide and Octadecyl Aluminum)

A getter thin film with a thickness of 80μm was prepared in accordance with the same procedure as in Example 5 using 0.13ml of a 1.0M octadecyl aluminum solution in hexane and 0.1g of calcium oxide (CaO), and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Example 13 (Preparation of Getter Including Calcium Oxide and 1,18-Dilithiumoctadecane Lithium)

A getter thin film with a thickness of 80μm was prepared in accordance with the same procedure as in Example 5 using 0.38ml of 1.0M 1,18-dilithiumoctadecane lithium solution and 0.1 g of calcium oxide (CaO), and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Transparency Test for Getter

The getters prepared from Examples 1 to 3 and 8 were measured to determine the transparency thereof with a UV/VIS spectrophotometer (Model name: V-550) manufactured by JASCO. The getters prepared from Examples 1 to 3 were prepared by coating the organic metal compounds on quartz membranes in a thickness of 80 μm, and that of Example 8 was prepared by coating the thin film sample on a quartz membrane.

The transmittance (%T) of getters prepared from Examples 1 to 3 and 8 are shown in FIG. 2.

As shown in FIG. 2, the getter including the organic metallic compound of the present invention had a transmittance of 95% or more in the whole visible light spectrum ranging from 400 nm to 800 nm. In particular, the getter of Example 1 had a transmittance of 98% or greater and the film getter of Example 8 had a transmittance of 95% or greater.

Comparative Example 1 (Preparation of Getter Including Inorganic Oxide)

A slurry was prepared by mixing 1g of a poly acetylene binder and 1.5g of calcium oxide using an agitator under an anhydrous high purity nitrogen (99.9999%) atmosphere.

The prepared slurry was used for providing a getter thin film with a thickness of 100μm, and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Comparative Example 2 (Preparation of Getter Using Inorganic Oxide)

1g of polyacrylonitrile resin and 1.5g of calcium oxide were used for providing a getter thin film with a thickness of 100μm in accordance with the same procedure as in Comparative Example 1, and the getter thin film was cut to a size of 1cm × 1cm to provide a sample.

Moisture Absorption Amount of Getter

The moisture absorption amount of getter samples according to Comparative Examples 1 and 2 and Examples 5 to 11 was measured by DVS (Dynamic Vapor Sorption) [Model name: Advantage 1] manufactured by SMS (Surface Measurement Systems).

The ratio of the moisture absorption amount of the getter to the theoretical moisture absorption amount of the hygroscopic active material is shown in Table 1. Table 1 shows the quantitative relationship between the moisture absorption amount of getters according to Examples 5 to 11 and those according to Comparative Examples 1 and 2.

The theoretic hygroscopic mechanism of the hygroscopic organic metallic compound in the getter according to one embodiment of the present invention is represented by the following Reaction Schemes 1 and 2. Since the hygroscopic organic metallic compound and the water molecules reacts with eath other in equivalent as many as the coordination numbers of the

compound, the theoretical hygroscopic amount of the hygroscopic organic metallic compound in the getter can be calculated by the protocol multiplying the mole of the water molecules with the molecular weight of water determined from the Reaction Schemes 1 and 2. Such calculation protocol is applied to that of CaO according to the comparative examples in the same manner.

Reaction Scheme 1

$M^1\text{-}(R^1)_n + nH_2O \rightarrow M^1(OH)_n + nR^1H$

Reaction Scheme 2

$R^2\text{-}(M^2)_m + mH_2O \rightarrow mM^2OH + R^2(H)_m$

Table 1

Getter	Thick-ness (μm)	Width (㎠)	Total weight (㎎)	Absorbent		Actual absorption amount (㎎)	Theoretical absorption amount (㎎)	Absorption ratio (%)
				kind	weight (㎎)			
Ex. 5	80	1×1	8.10	M-R	4.86	1.39	1.37	101
Ex. 6	80	1×1	8.32	M-R	4.99	1.29	1.30	99
Ex. 7	80	1×1	8.21	M-R	4.92	2.28	2.33	98
Ex. 8	80	1×1	8.16	M-R	4.90	0.37	0.34	108
Ex. 9	80	1×1	8.23	M-R	4.94	0.32	0.33	97
Ex. 10	80	1×1	8.19	M-R	4.91	0.33	0.34	97
Ex. 11	80	1×1	8.29	M-R	4.97	0.71	0.67	106
Ex. 12	80	1×1	8.17	CaO+M-R	5.47	1.01	1.07	95

Ex. 13	80	1×1	8.15	CaO+M-R	5.46	1.186	1.25	95
Comp. Ex. 1	100	1×1	9.96	CaO	5.97	1.55	1.92	80.7
Comp. Ex. 2	100	1×1	5.92	CaO	3.55	0.25	1.14	21.9

In the Table 1, M-R refers to the organic metallic compound.

As shown in Table 1, the absorption ratio showing the ratio of the actual absorption amount to that of the theoretic absorption amount of the getter according to the present invention is 95% or more, indicating that the getter according to the present invention is superior to the conventional getter including the inorganic filler.

Example 14 (Production of Organic Electroluminescent Device Including Getter of Example 5)

The characteristics of the getter according to Example 5 as shown in Table 1 were checked by applying it to an organic electroluminescent device.

FIG. 1 shows a cross-sectional view of the organic electroluminescent device 1. Referring FIG. 1, the anode 12 is formed by sputtering an indium tin oxide (ITO) electrode to a thickness of 1800 Å on a transparent glass substrate 11 and patterning the anode in a desired shape by photolithography.

Subsequently, a hole injection layer (HIL) 13 of 4,4',4"-tris(N-3-methylphenyl-N-phenyl-amino)-triphenylamine (m-MTDATA) with a thickness of 600Å, a hole transport layer (HTL) 14 of N,N'-bis(naphthalene-1-yl)-N,N'-bis(phenyl)benzidine (NPB) with a thickness of 150Å, a blue emission layer 15 of 4,4-bis

(2,2-diphenyl-ethene-1-yl)-diphenyl (4,4'-bis (2,2- diphenyl-ethene -1-yl)-diphenyl : DPVBi) with a thickness of 300Å, and an electron transport layer (ETL) 16 of tris-(8-hydroxy-quinolinolato)-aluminum (Alq3) with a thickness of 250Å were formed on the upper part of the anode 12.

Then, lithium fluoride (LiF) was deposited with a thickness of 10Å as an electron injection layer (EIL) 17, and aluminum was deposited with a thickness of 2000Å as a cathode 18 to provide an organic ELD with a light emitting area of 2mm×3mm.

A stainless metal can 21 attached with the getter 22 obtained from Example 5 was sealed on the substrate of the organic electroluminescent device by the epoxy resin sealing member 23 using an ultraviolet (UV) hardening method under a dry high purity nitrogen (99.9999%) atmosphere to provide an organic electroluminescent device mounted with a getter.

Example 15 (Production of Organic Electroluminescent Device Including Getter according to Example 8)

An organic electroluminescent device was manufactured with the same structure as in Example 14 except that the getter according to Example 8 was used.

Comparative Example 3 (Production of Organic Electroluminescent Device Including Getter according to Comparative Example 1)

An organic electroluminescent device was manufactured with the same structure as in Example 14 except that the getter according to Comparative Example 1 was used.

Comparative Example 4 (Production of Organic Electroluminescent Device including Getter according to Comparative Example 2)

An organic electroluminescent device was manufactured in the same structure as in Example 14 except that the getter according to Comparative Example 2 was used.

[Measurement of Characteristics of Organic Electroluminescent Device at High Temperature and Humidity]

The organic electroluminescent devices obtained from Examples 14 to 15 and Comparative Examples 3 and 4 were allowed to stand under the severe conditions of 60°C, 85% humidity for 700 hours. The severe conditions correspond to allowing the devices to stand at room temperature for tens of thousands of hours.

The light emitting part was observed by an optical microscope at a magnification of 50X to determine non-light-emitting parts (hereinafter, referred to as "dark spots") due to a lapse of time, and the results are shown in FIG. 3.

As shown in FIG. 3, a dark spot was not generated on the light-emitting part of the organic electroluminescent devices obtained from Examples 14 and 15. However, in the organic electroluminescent device according to Comparative Example 3, although no dark spots were generated up to 300 hours, minute dark spots were was generated after 500 hours, and a significant number of dark spots were generated after 700 hours. Before 500 hours, both organic electroluminescent devices of Examples 14 and 15

and Comparative Example 3 showed good hygroscopic characteristics. However, after a lapse of 500 hours, the organic electroluminescent device of Comparative Example 3 started to generate the dark spots since the inorganic filler used as a hygroscopic active material was saturated with moisture and thus could not absorb more. That shows that the getter according to one embodiment of the present invention had excellent hygroscopic activity and high hygroscopic capacity.

On the other hand, dark spots were found on the light emitting part of the organic electroluminescent device according to Comparative Example 4 due to micro-moisture, and more were generated and the size increased with the lapse of time. After 700 hours, dark spots were generated on most of the light emitting part and thus the light-emitting characteristics were deteriorated.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

【CLAIMS】

[claim 1]

A getter for an organic electroluminescent device, comprising:

at least one hygroscopic organic metallic compound selected from the group consisting of the compounds represented by the following Formulas 1 and 2:

Formula 1

M^1-$(R^1)_n$

Formula 2

R^2-$(M^2)_m$

wherein, in the above formulas,

M^1 is at least one selected from the group consisting of a Group 1A alkali metal, a Group 2A alkaline-earth metal, and a Group 3A metal;

M^2 is a Group 1A alkali metal;

R^1 is an organic group selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, a linear alkoxy alkyl, a branched alkoxy alkyl, alkynyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a linear or branched silyl alkyl, an acyl, an ester, an amide, a linear or branched aryl alkyl, a linear or branched heteroaryl alkyl, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^1 independently include or do not include at least one substituent selected from the group

consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, an aldehyde, an acyl, an ester, an amide, an amino, and a silyl;

R^2 is independently an organic group selected from the group consisting of a linear alkylene, a branched alkylene, a cyclic alkylene, a linear alkoxy alkylene, a branched alkoxy alkylene, an alkene, a linear alkylthio alkylene, a branched alkylthio alkylene, an amino alkylene, a linear or branched silyl alkylene, a linear or branched aryl alkylene, a linear or branched hetero aryl alkylene, an aromatic group, and a hetero aromatic group;

the aromatic group and hetero aromatic group of R^2 independently include or do not include at least one substituent selected from the group consisting of a linear alkyl, a branched alkyl, a cyclic alkyl, an alkoxy, a linear alkoxy alkyl, a branched alkoxy alkyl, a linear alkylthio alkyl, a branched alkylthio alkyl, an aminoalkyl, a halogen, a cyano, a nitro, an aldehyde, an acyl, an ester, an amide, an amino, and a silyl;

n is an integer ranging from 1 to 3 that is determined depending on M^1; and

m is an integer ranging from 2 to 4 that is determined depending on R^2.

[claim 2]

The getter of claim 1, wherein the M^1-R^1 and R^2-M^2 bond of the organic metallic compounds represented by the above Formulas 1 and 2 is a direct bond between a metal and carbon.

[claim 3]

The getter of claim 1, wherein the organic group R^1 of the above Formula 1 is independently selected from the group consisting of a C1 to C20 linear alkyl, a C3 to C20 branched alkyl, and a C3 to C12 cyclic alkyl.

[claim 4]

The getter of claim 1, wherein the organic group R^2 of the above Formula 2 is independently selected from the group consisting of a C1 to C20 linear alkylene, a C3 to C20 branched alkylene, and a C3 to C12 cyclic alkylene.

[claim 5]

The getter of claim 1, wherein the getter comprises at least one binder selected from the group consisting of a polyacetylene-based resin, a silicon-based resin, a polyacetylene-silicon copolymer, a fluorinated resin, a polyethylene-based resin, a polyamide-based resin, a polyester-based resin, a polyolefin-based resin having a hydrophilic group, a polyacryl-based resin, a polyacrylonitrile resin, an epoxy resin, and a UV curable resin.

[claim 6]

The getter of claim 5, wherein the getter comprises 1 to 99 wt% of the hygroscopic organic metallic compound.

[claim 7]

The getter of claim 1, wherein the getter is formed of a thin film having a thickness ranging from 10 to 1000μm.

[claim 8]

An organic electroluminescent device comprising the getter according to claim 1.

FIG. 1

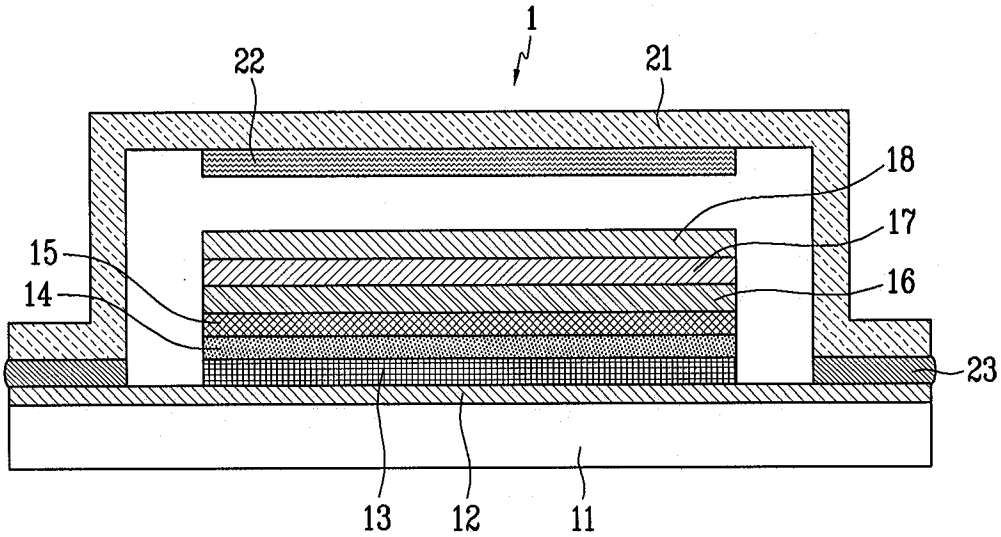


FIG. 2

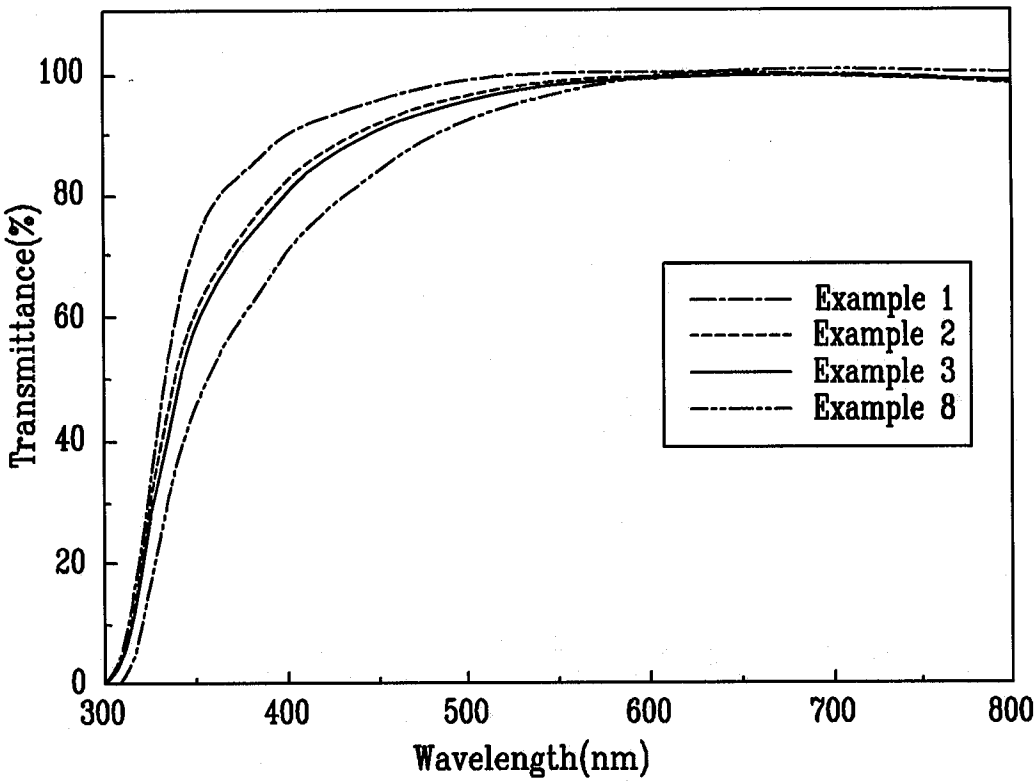
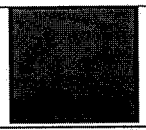
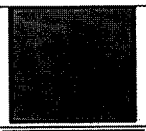
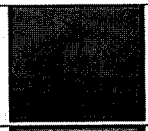
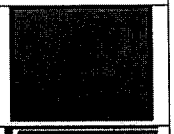
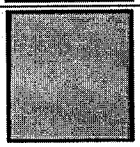
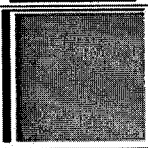
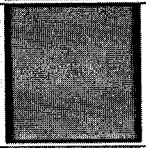
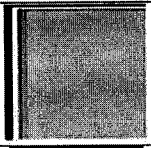
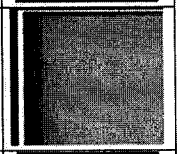
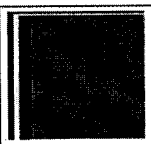
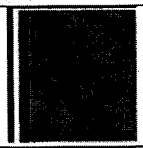
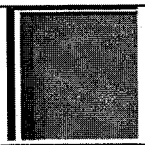
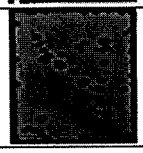
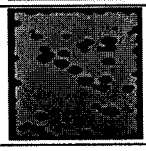
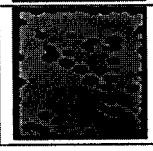
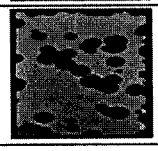

Transmittance(%)
100
80
60
40
20
0
300
400
500
600
700
800
Wavelength(nm)
Example 1
Example 2
Example 3
Example 8

FIG. 3

Hours	0	100	300	500	700
Example 14					
Example 15					
Comparative Example 3					
Comparative Example 4					

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/005716

A. CLASSIFICATION OF SUBJECT MATTER

C09K 11/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC8 C09K, H05B, H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean patents and applications for inventions

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS, USPAT, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03/96751 A1 (KONINKLIJKE PHILIPS ELECTRONICS N.V.) 20 November 2003 See abstract, claims	1-8
A	US 5629952 A (BARTHOLOMEW et al.) 13 May 1997 See abstract, claims	1-8
A	JP 2000-195661 A (TDK CORP) 14 July 2000 See the whole document	1-8
A	JP 09-307146 A (MATSUSHITA ELECTRIC WORKS LTD) 28 November 1997 See the whole document	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 MARCH 2007 (29.03.2007)	**29 MARCH 2007 (29.03.2007)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer SOHN, Chang Ho Telephone No. 82-42-481-8398

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/005716

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
W003096751A1	20.11.2003	AT341183E	15.10.2006
		AU2003219382A1	11.11.2003
		CN1653853A	10.08.2005
		DE60308676C0	09.11.2006
		EP01506693A1	16.02.2005
		EP01506693B1	27.09.2006
		JP2005525685T2	25.08.2005
		KR1020040106514	17.12.2004
		US2005238908AA	27.10.2005
US5629952A	13.05.1997	AU672705B2	10.10.1996
		AU6744094A1	27.01.1995
		CA2128068AA	15.01.1995
		CA2128068C	15.12.1998
		CN1063587C	21.03.2001
		CN1103373	07.06.1995
		DE6940958 6C0	20.05.1998
		DE69409586T2	15.10.1998
		EP00634822A1	18.01.1995
		EP634822B1	15.04.1998
		JP3452214B2	29.09.2003
		JP7147457A2	06.06.1995
		KR1019960016028	22.05.1996
		US5392305A	21.02.1995
		US5513198A	30.04.1996
		US5770473A	23.06.1998
JP12195661	14.07.2000	EP01014757A2	28.06.2000
		EP01014757A3	28.03.2001
JP09307146	28.11.1997	None	