[0007]

Patent Document 1: JP-A-2012-22028

Patent Document 2: JP-A-2002-348568

Patent Document 3: JP-A-2007-273440

Patent Document 4: JP-A-2002-317175

Patent Document 5: JP-A-2001-164245

Patent Document 6: JP-A-2011-241160

Patent Document 7: JP-A-2014-136771

Patent Document 8: JP-A-2011-149028

SUMMARY

PROBLEM TO BE SOLVED

[0008]

The stabilizer described in Patent Document 8 is effective in enhancing the durability but is not satisfied. Furthermore, such a stabilizer has relatively strong absorption in the visible region and absorbs light emitted by the luminescent material, and thus a problem of reduced efficiency arises. In this way, the technique using an organic luminescent material capable of satisfying both high color purity and high durability, as a component of a color conversion composition, is still insufficient.

[0009]

The problem to be solved by the present disclosure is to achieve both enhanced color reproducibility and durability, particularly, both high-color-purity emission and durability, in a color conversion composition used for a liquid crystal display or LED lighting.

MEANS FOR SOLVING THE PROBLEMS

[0010]

There is provided a color conversion composition for converting

incident light into light having longer wavelength than the incident light, in which the color conversion composition includes the following components (A) to (C):

(A) at least one luminescent material,

(B) a binder resin, and

(C) at least one of a tertiary amine, a catechol derivative and a nickel compound, and

in which the tertiary amine, catechol derivative and nickel compound have a molar extinction coefficient ε of 100 or less in the whole wavelength region from 400 nm to 800 nm.

[0010a]

In an aspect, there is provided a color conversion composition for converting incident light into light having longer wavelength than the incident light,

wherein the color conversion composition comprises the following components (A) to (C):

(A) at least one luminescent material,

(B) a binder resin, and

(C) at least one of a tertiary amine, a catechol derivative and a nickel compound, and wherein the tertiary amine, catechol derivative and nickel compound have a molar extinction coefficient ε of 100 or less in the whole wavelength region from 400 nm to 800 nm,

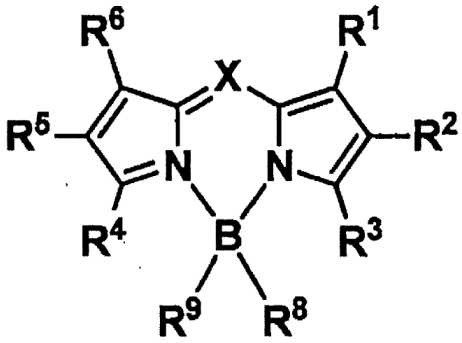
wherein the tertiary amine is a compound in which the substituent on a nitrogen atom is selected from the group consisting of an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, an aryl group, a heteroaryl group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, and a fused ring and an aliphatic ring each formed between adjacent substituents;

the catechol derivative is a compound having two or more hydroxyl groups on a

benzene ring, and

wherein the component (C) contains the nickel compound and the nickel compound is at least one of a nickel salt of an organic acid, an acetylacetonate-based nickel complex, and a thiobisphenolate-based nickel complex; and

wherein the luminescent material contains a compound represented by formula (1):



(1)

wherein X is C-R^7 or N, and each of R^1 to R^9, which may be the same as or different from one another, is selected from hydrogen, an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a thiol group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heteroaryl group, a halogen, a cyano group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, an amino group, a nitro group, a silyl group, a siloxanyl group, a boryl group, a phosphine oxide group, and a fused ring and an aliphatic ring each formed between adjacent substituents.

[0010b]

In another aspect, there is provided a color conversion composition for converting incident light into light having longer wavelength than the incident light,

wherein the color conversion composition comprises the following components (A) to (C):

(A) at least one luminescent material,

(B) a binder resin, and

(C) at least one of a tertiary amine, a catechol derivative and a nickel compound, and

wherein the tertiary amine, catechol derivative and nickel compound have a molar extinction coefficient ε of 100 or less in the whole wavelength region from 400 nm to 800 nm,

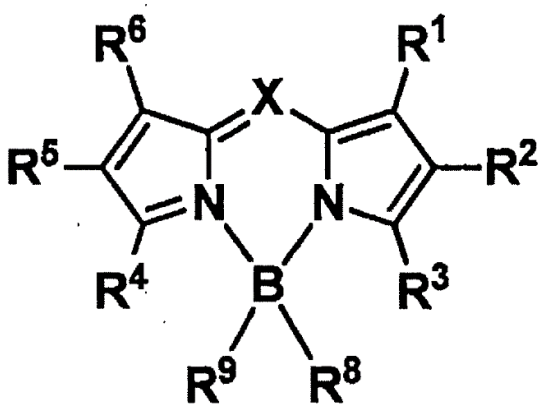
the catechol derivative is a compound having two or more hydroxyl groups on a benzene ring, and

the nickel compound is a nickel complex or an organic acid salt of nickel;

wherein the component (C) contains the tertiary amine and at least one substituent on a nitrogen atom of the tertiary amine is a substituted or unsubstituted alkyl group; and

wherein the luminescent material contains a compound represented by formula (1):

[Chem. 1]



(1)

wherein X is C-R^7 or N, and each of R^1 to R^9, which may be the same as or different from one another, is selected from hydrogen, an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a thiol group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heteroaryl group, a halogen, a cyano group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, an amino group, a nitro group, a silyl group, a siloxanyl group, a boryl group, a phosphine oxide group, and a fused ring and an aliphatic ring each formed between adjacent substituents.

[0010c]

In another aspect, there is provided a color conversion film comprising a layer obtained by curing the color conversion composition as defined above.

[0010d]

In another aspect, there is provided a light source unit comprising a light source and the color conversion film as defined above.

[0010e]

In another aspect, there is provided a display comprising the light source unit as defined above.

[0010f]

In another aspect, there is provided a lighting comprising the light source unit as defined above.

ADVANTAGE OF THE EMBODIMENTS DISCLOSED HEREIN

[0011]

The color conversion composition of the present disclosure and the color conversion film using the same can achieve both high color purity and durability, so that both color reproducibility and durability can be satisfied.

BRIEFDESCRIPTION OF THE DRAWINGS

[0012]

[Fig. 1] Fig. 1 is a schematic cross-sectional view illustrating one example of the color conversion film of the present invention.

[Fig. 2] Fig. 2 is a schematic cross-sectional view illustrating one example of the color conversion film of the present invention.

[Fig. 3] Fig. 3 is a schematic cross-sectional view illustrating one example of the color conversion film of the present invention.

[Fig. 4] Fig. 4 is an absorption spectrum of the compound of Synthesis Example 1.

[Fig. 5] Fig. 5 is an emission spectrum of the compound of Synthesis Example 1.

[Fig. 6] Fig. 6 is an absorption spectrum of the compound of Synthesis Example

CLAIMS

[Claim 1]

A color conversion composition for converting incident light into light having longer wavelength than the incident light,

wherein the color conversion composition comprises the following components (A) to (C):

(A) at least one luminescent material,

(B) a binder resin, and

(C) at least one of a tertiary amine, a catechol derivative and a nickel compound, and

wherein the tertiary amine, catechol derivative and nickel compound have a molar extinction coefficient ε of 100 or less in the whole wavelength region from 400 nm to 800 nm,

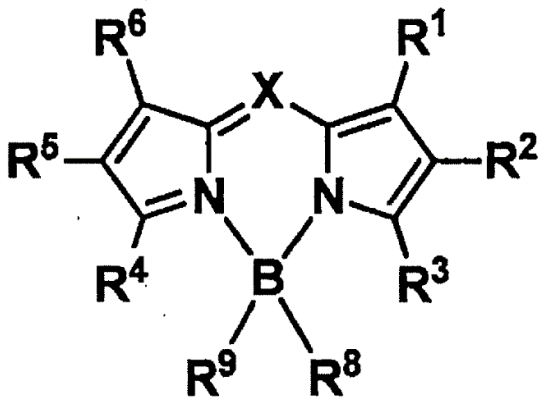
wherein the tertiary amine is a compound in which the substituent on a nitrogen atom is selected from the group consisting of an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, an aryl group, a heteroaryl group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, and a fused ring and an aliphatic ring each formed between adjacent substituents;

the catechol derivative is a compound having two or more hydroxyl groups on a benzene ring, and

wherein the component (C) contains the nickel compound and the nickel compound is at least one of a nickel salt of an organic acid, an acetylacetonate-based nickel complex, and a thiobisphenolate-based nickel complex; and

wherein the luminescent material contains a compound represented by formula (1):

[Chem. 1]



(1)

wherein X is C-R^7 or N, and each of R^1 to R^9, which may be the same as or different from one another, is selected from hydrogen, an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a thiol group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heteroaryl group, a halogen, a cyano group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, an amino group, a nitro group, a silyl group, a siloxanyl group, a boryl group, a phosphine oxide group, and a fused ring and an aliphatic ring each formed between adjacent substituents.

[Claim 2]

A color conversion composition for converting incident light into light having longer wavelength than the incident light,

wherein the color conversion composition comprises the following components (A) to (C):

(A) at least one luminescent material,

(B) a binder resin, and

(C) at least one of a tertiary amine, a catechol derivative and a nickel compound, and

wherein the tertiary amine, catechol derivative and nickel compound have a molar extinction coefficient ε of 100 or less in the whole wavelength region from 400 nm to 800 nm,

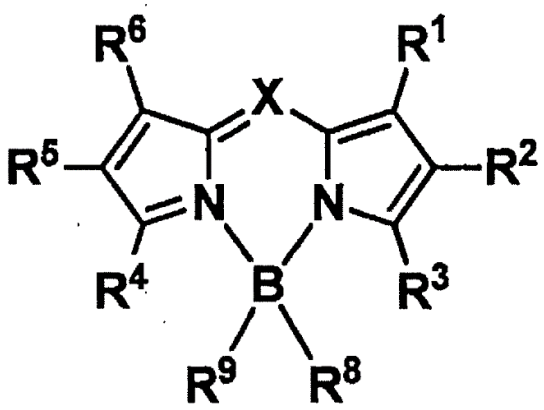
the catechol derivative is a compound having two or more hydroxyl groups on a benzene ring, and

the nickel compound is a nickel complex or an organic acid salt of nickel;

wherein the component (C) contains the tertiary amine and at least one substituent on a nitrogen atom of the tertiary amine is a substituted or unsubstituted alkyl group; and

wherein the luminescent material contains a compound represented by formula (1):

[Chem. 1]



(1)

wherein X is C-R^7 or N, and each of R^1 to R^9, which may be the same as or different from one another, is selected from hydrogen, an alkyl group, a cycloalkyl group, a heterocyclic group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a thiol group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heteroaryl group, a halogen, a cyano group, an aldehyde group, a carbonyl group, a carboxyl group, an oxycarbonyl group, a carbamoyl group, an amino group, a nitro group, a silyl group, a siloxanyl group, a boryl group, a phosphine oxide group, and a fused ring and an aliphatic ring each formed between adjacent substituents.

[Claim 3]

The color conversion composition according to claim 1 or 2, wherein the component (C) contains the nickel compound and a content of the nickel compound is from 1.0×10^{-2} to 10 parts by weight per 100 parts by weight of the component (B).

[Claim 4]

The color conversion composition according to any one of claims 1 to 3, wherein the content of the component (C) is from 10^{-2} to 15 parts by weight per 100 parts by weight of the component (B).

[Claim 5]

The color conversion composition according to any one of claims 1 to 4, wherein the luminescent material contains a luminescent material (a) which emits light having a peak wavelength of 500 to 580 nm by use of excitation light having a wavelength of 430 to 500 nm.

[Claim 6]

The color conversion composition according to any one of claims 1 to 5, wherein the luminescent material contains the following luminescent materials (a) and (b):

(a) a luminescent material that emits light having a peak wavelength of 500 to 580 nm by use of excitation light having a wavelength of 430 to 500 nm, and

(b) a luminescent material that emits light having a peak wavelength of 580 to 750 nm upon being excited by either one or both of excitation light having a wavelength of 430 to 500 nm and light emitted by the luminescent material (a).

[Claim 7]

The color conversion composition according to claim 6, wherein a content w_a of the luminescent material (a) and a content w_b of the luminescent material (b) are in the relationship of $w_a \geq w_b$.

[Claim 8]

The color conversion composition according to any one of claims 1 to 7, wherein in the formula (1), X is C-R^7 and R^7 is a substituted or unsubstituted aryl group.

[Claim 9]

The color conversion composition according to any one of claims 1 to 8, wherein in the formula (1), X is C-R^7 and R^7 is a substituted or unsubstituted phenyl group.

[Claim 10]

The color conversion composition according to any one of claims 6 to 9, wherein

the luminescent material (a) is a compound represented by the formula (1).

[Claim 11]

The color conversion composition according to any one of claims 7 to 10, wherein the luminescent material (b) is a compound represented by the formula (1).

[Claim 12]

The color conversion composition according to any one of claims 1 to 11, further comprising a solvent.

[Claim 13]

The color conversion composition according to claims 1 to 12, wherein the binder resin is a thermosetting resin.

[Claim 14]

A color conversion film comprising a layer obtained by curing the color conversion composition according to any one of claims 1 to 13.

[Claim 15]

The color conversion film according to claim 14, which is coated with a gas barrier layer.

[Claim 16]

A light source unit comprising a light source and the color conversion film according to claim 14 or 15.

[Claim 17]

The light source unit according to claim 16, wherein the light source is a light-emitting diode having a maximum light emission in the range of 430 to 500 nm.

[Claim 18]

A display comprising the light source unit according to claim 16 or 17.

[Claim 19]

A lighting comprising the light source unit according to claim 16 or 17.