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Sakamoto et al.

(54) **COLOR CORRECTION FILTER, IMAGE DISPLAY, AND LIQUID CRYSTAL DISPLAY**

(75) Inventors: **Michie Sakamoto**, Ibaraki-shi (JP); **Megumu Nagasawa**, Ibaraki-shi (JP)

Correspondence Address:
WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP
1250 CONNECTICUT AVENUE, NW, SUITE 700
WASHINGTON, DC 20036 (US)

(73) Assignee: **NITTO DENKO CORPORATION**, Ibaraki-shi, Osaka (JP)

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(57) **ABSTRACT**

A color correction filter with excellent durability is provided that can remove intermediate colors of light while preventing brightness of an image display from deteriorating and thereby can improve color tone representation of the image display. A color correction filter **10** of the present invention includes a color correction layer **11** and two protective layers **12**. The color correction layer **11** contains a J aggregate of a dye. The dye is at least one dye selected from the group consisting of cyanine, merocyanine, squarylium, and porphyrin. The half bandwidth at a maximum absorption peak of the color correction layer is in the range of 5 to 30 nm. The two protective layers **12** are formed on both surfaces of the color correction layer **11**, respectively.

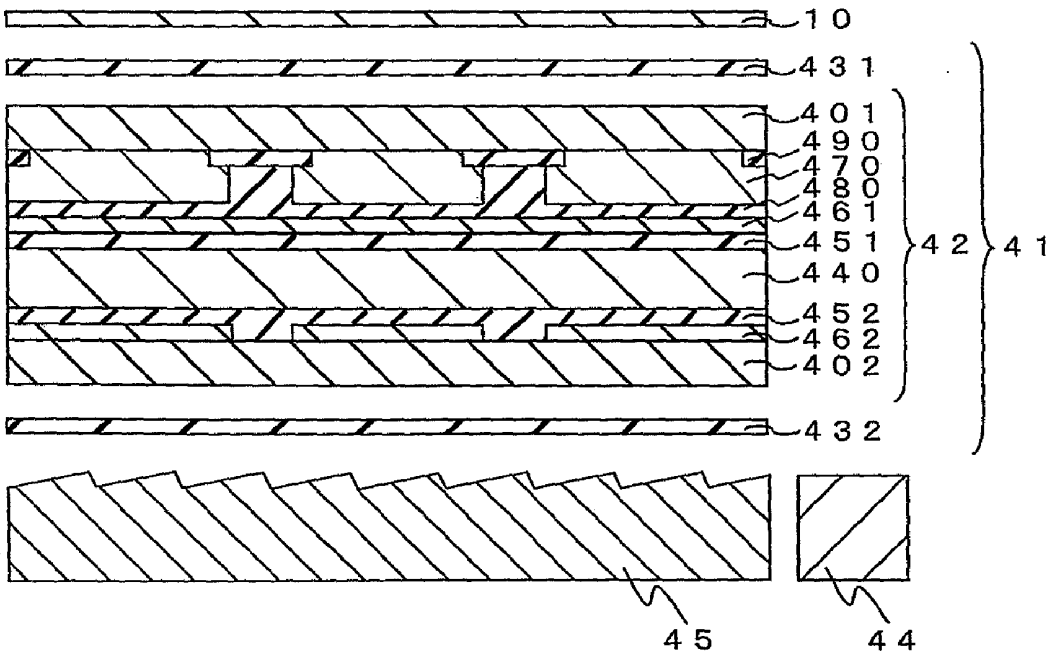


FIG. 1

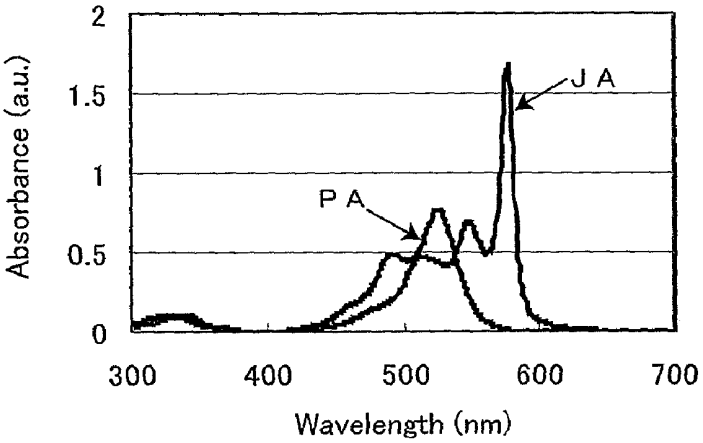

Absorbance (a.u.)
2
1.5
1
0.5
0
300
400
500
600
700
Wavelength (nm)
JA
PA

FIG. 2

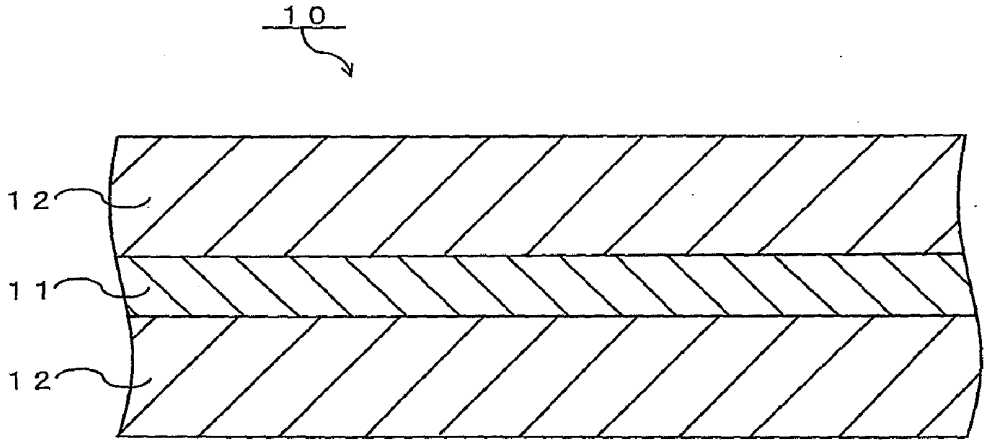

10
12
11
12

FIG. 3

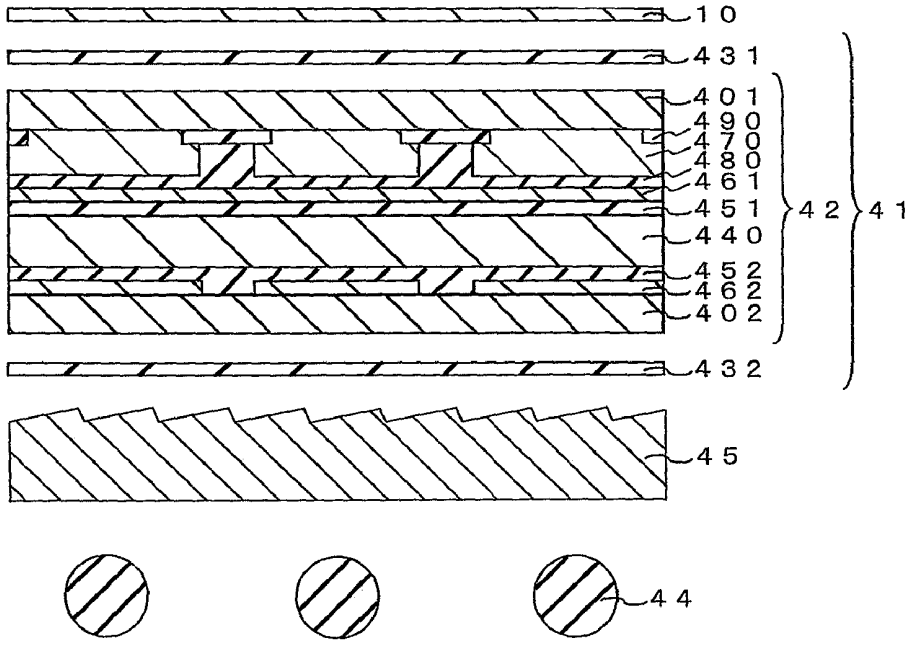
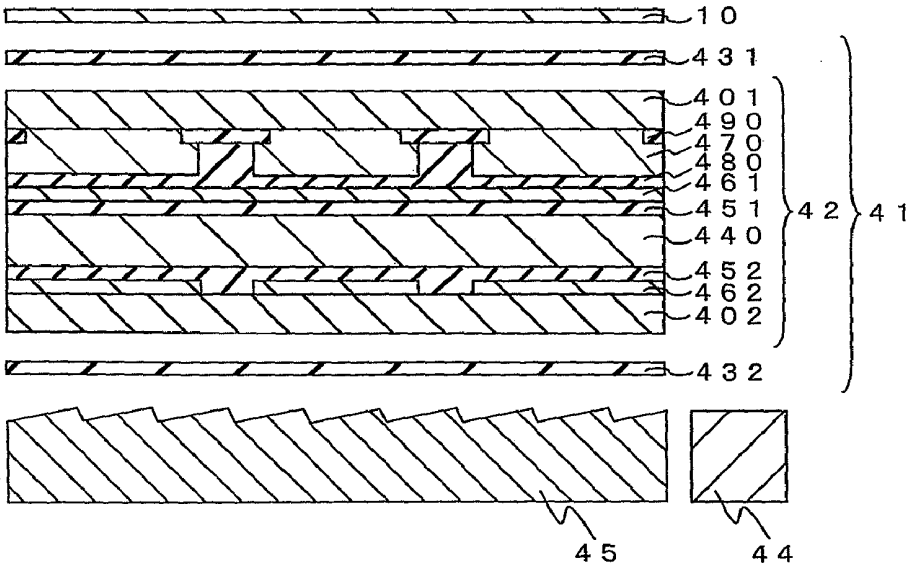

10
431
401
490
470
480
461
451
440
452
462
402
432
42
41
45
44

FIG. 4


10
431
401
490
470
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461
451
440
452
462
402
432
42
41
45
44

FIG. 5

Related Art

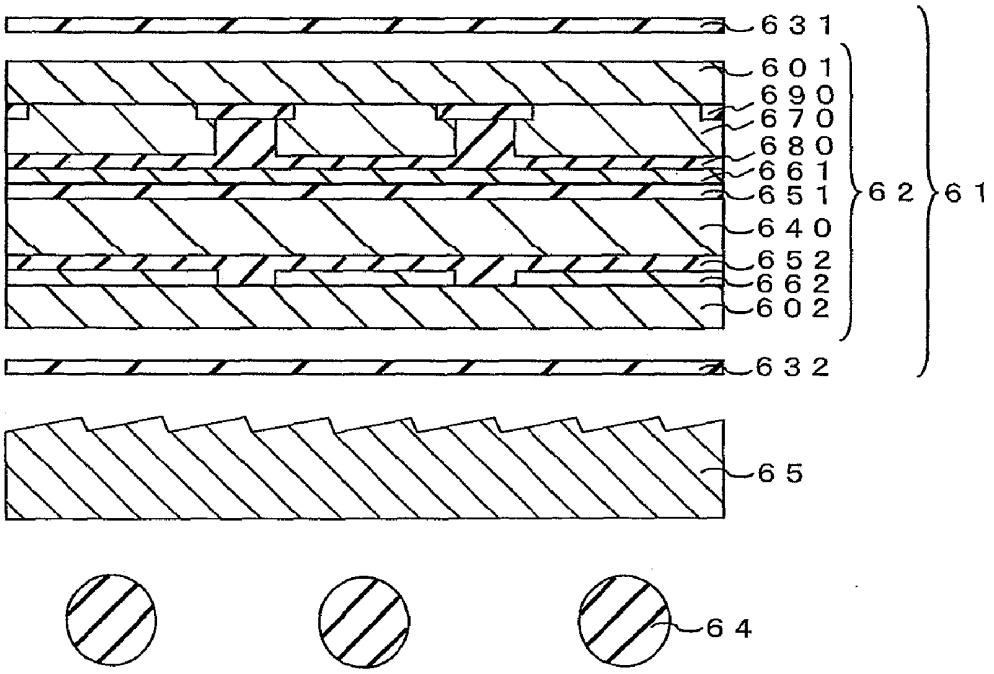


FIG. 6

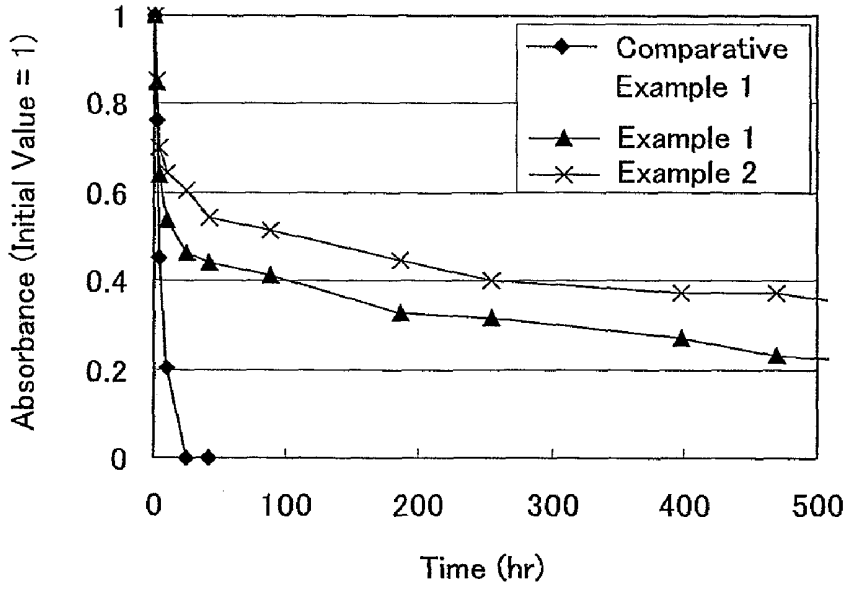
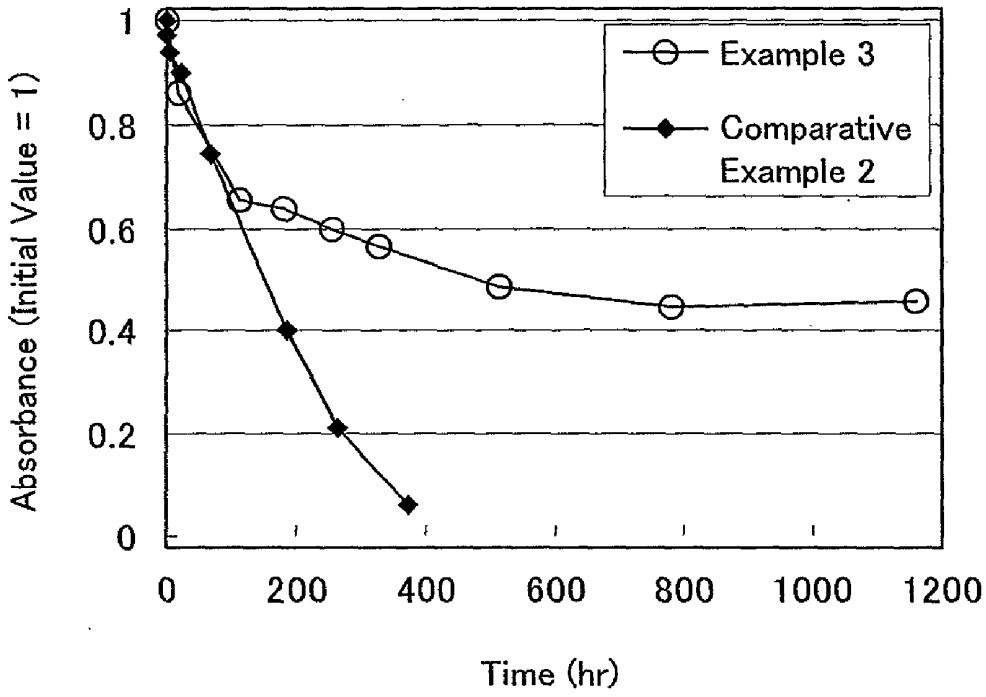


FIG. 7


Absorbance (Initial Value = 1)
1
0.8
0.6
0.4
0.2
0
0
200
400
600
800
1000
1200
Time (hr)
Example 3
Comparative Example 2

COLOR CORRECTION FILTER, IMAGE DISPLAY, AND LIQUID CRYSTAL DISPLAY

TECHNICAL FIELD

[0001] The present invention relates to color correction filters, image displays, and liquid crystal displays.

BACKGROUND ART

[0002] Recently, a liquid crystal display in which light emitted from a light source unit such as a cold cathode tube or a light emitting diode (LED) is controlled by a liquid crystal panel to form images has been developed and has been put into practical use. In the liquid crystal display, in order to distribute the light from the light source unit over the whole display surface equally, a light guide plate is disposed on the optical path extending to the light source unit and in parallel with the liquid crystal panel so as to be placed thereon. The light source unit is disposed beside the light guide plate or on the opposite side of the light guide plate to the liquid crystal panel. The configuration of a conventional liquid crystal display is shown in the cross-sectional view in FIG. **5**. As shown in FIG. **5**, this liquid crystal display has a liquid crystal panel **61**, a cold cathode tube **64**, and a light guide plate **65** as main components. The liquid crystal panel **61** has a structure in which a first polarizing plate **631** and a second polarizing plate **632** are disposed on both sides of a liquid crystal cell **62**, respectively. The liquid crystal cell **62** is provided with a liquid crystal layer **640** in the center thereof. A first alignment film **651** and a second alignment film **652** are disposed on both sides of the liquid crystal layer **640**, respectively. A first transparent electrode **661** and a second transparent electrode **662** are disposed on the outer sides of the first alignment film **651** and the second alignment film **652**, respectively. Black matrices **690** and color filters **670** of, for example, R (red), G (green), and B (blue) with a predetermined arrangement are disposed on the outer side of the first transparent electrode **661**, with a protective film **680** being interposed therebetween. A first substrate **601** and a second substrate **602** are disposed on the outer sides of the color filters **670** and the black matrices **690** and the second transparent electrode **662**, respectively. In the liquid crystal panel **61**, the first polarizing plate **631** side is a display side, and the second polarizing plate **632** side is a back side. The light guide plate **65** is disposed in parallel with the liquid crystal panel **61** so as to be placed thereon on the back side of the liquid crystal panel **61**. The cold cathode tube **64** is disposed on the opposite side of the light guide plate **65** to the liquid crystal panel **61**.

[0003] In this liquid crystal display, the light emitted from the cold cathode tube **64** is adjusted with the light guide plate **65** so that the in-plane brightness distribution may become uniform, and it is then transmitted to the second polarizing plate **632** side. Furthermore, after the outgoing light is controlled per pixel by the liquid crystal layer **640**, only the light in predetermined wavelength ranges (for example, the respective wavelength ranges of R, G, and B) is transmitted through the color filters **670** and thereby a color display is obtained.

[0004] Normally, in order to display a color image in a liquid crystal display, at least three colors of light are required. Many color tones are represented according to the mixing degree of these three colors of light. At present, light of three primary colors of R, G, and B is used commonly for a liquid crystal display. With respect to the wavelength ranges corresponding to the three primary colors of light, R is in the range of about 610 to 750 nm, G in the range of about 500 to 560 nm, and B in the range of about 435 to 480 nm. The liquid crystal display is designed so that in light emitted from the light source unit (for example, a cold cathode tube) having an emission spectrum in a wide wavelength range, light other than that in necessary wavelength ranges is cut with color filters corresponding to the three primary colors of light, respectively, and thereby the three primary colors of light are obtained. The amount of light that enters each color filter is controlled by the respective components of the liquid crystal panel that are disposed on the light source unit side with respect to the color filter, and thereby the amount of light that is transmitted from each color filter is determined. Finally, the emission intensity and color tone per pixel unit of the liquid crystal display are determined through adjustment of the intensity of the three primary colors of light in pixels. Accordingly, an increase in color purity of the three primary colors of light in pixels results in a wider range of color tones formed through mixing of the three primary colors of light and therefore is more preferable.

[0005] However, in the conventional liquid crystal display, intermediate colors of light (for example, yellow light in a wavelength range between the wavelength ranges of R and G as well as light in a wavelength range between the wavelength ranges of G and B) other than R, G, and B are contained in the emission spectrum of the cold cathode tube, and they are not filtered out sufficiently with the color filters. As a result, there has been a problem in that the color tone of display image quality is deteriorated. Furthermore, when LEDs corresponding to three primary colors, R, G, and B, are used for a light source unit, excellent color tone representation is obtained but there have been problems in that a complicated control circuit is required and the cost also increases.

[0006] Furthermore, a liquid crystal display has been proposed in which white light is produced from light emitted from a blue LED and yellow light emitted from yttrium aluminum garnet (YAG), a fluorescent material, and is then used as a light source (pseudo white light source) (for example, see Patent Document 1). In this liquid crystal display, however, light emitted from the pseudo white light source contains more aforementioned intermediate colors of light as compared to a cold cathode tube. Accordingly, the liquid crystal display is poor in color tone representation.

[0007] On the other hand, a color correction filter has been proposed in which light in wavelength ranges of the intermediate colors is removed selectively (see Patent Documents 2 and 3). In this color correction filter, the light in the wavelength ranges of the intermediate colors is removed by being absorbed by a dye.

[Patent Document 1] JP 2004-117594 A

[Patent Document 2] JP 2000-321419 A

[Patent Document 3] JP 2000-258624 A

DISCLOSURE OF INVENTION

[0008] However, the dye used in the aforementioned color correction filter is deteriorated and discolored due to, for instance, moisture, oxygen, or light. Accordingly, the color correction filter is poor in durability.

[0009] The present invention is intended to provide a color correction filter with excellent durability that can remove intermediate colors of light while preventing brightness of an

image display from deteriorating and thereby can improve color tone representation of the image display.

[0010] In order to achieve the above-mentioned object, the color correction filter of the present invention includes a color correction layer and two protective layers,

wherein the color correction layer contains a J aggregate of a dye, the dye is at least one dye selected from the group consisting of cyanine, merocyanine, squarylium, and porphyrin,

the half bandwidth at the maximum absorption peak of the color correction layer is in the range of 5 to 30 nm, and

the two protective layers are formed on both surfaces of the color correction layer, respectively.

[0011] An image display of the present invention includes a color correction filter, wherein the color correction filter is the color correction filter of the present invention described above.

[0012] A liquid crystal display of the present invention includes a color correction filter, wherein the color correction filter is the color correction filter of the present invention described above.

[0013] The color correction filter of the present invention includes a color correction layer containing a J aggregate of a dye. The half bandwidth at the maximum absorption peak of the color correction layer is very narrow, specifically in the range of 5 to 30 nm. Therefore, the color correction filter of the present invention can absorb intermediate colors of light selectively to remove them. Accordingly, the use of the color correction filter of the present invention makes it possible to improve color tone representation while preventing brightness of an image display from deteriorating. Furthermore, the color correction filter of the present invention has a configuration in which the two protective layers are stacked on both surfaces of the color correction layer, respectively. Accordingly, in the color correction filter of the present invention, the protective layers protect the dye in the color correction layer from, for example, moisture, oxygen, and light and thereby the dye is prevented from being deteriorated and discolored. Consequently, the color correction filter of the present invention has excellent durability. Therefore, the color correction filter of the present invention allows an improvement in color tone representation to be maintained over a long period of time.

BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. **1** is a graph showing examples of absorption spectra of a coating solution for a color correction layer and the color correction layer according to an example of the present invention.

[0015] FIG. **2** is a cross-sectional view showing an example of the structure of a color correction filter according to the present invention.

[0016] FIG. **3** is a cross-sectional view showing an example of the structure of a liquid crystal display according to the present invention.

[0017] FIG. **4** is a cross-sectional view showing another example of the structure of the liquid crystal display according to the present invention.

[0018] FIG. **5** is a cross-sectional view showing an example of the structure of a conventional liquid crystal display.

[0019] FIG. **6** is a graph showing light resistance evaluation results in examples of the present invention.

[0020] FIG. **7** is a graph showing light resistance evaluation results in other examples of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] In the present invention, the half bandwidth at the maximum absorption peak of the aforementioned color correction layer denotes the difference in wavelength between two points that indicate half values of the maximum absorbance at the maximum absorption peak of the color correction layer. The half bandwidth can be determined, for example, from the maximum absorption peak of the color correction layer that is obtained by measuring the absorption spectrum of the color correction layer with an ultraviolet-visible spectrophotometer as described later in examples.

[0022] In the present invention, the expression "an improvement in color tone representation" embraces, for example, an improvement in color tone representation of R that is achieved by selectively absorbing light of yellow, an intermediate color between R and G, which affects the color tone representation of R, to remove it. This "improvement in color tone representation" results in, for example, an improvement in color purity of light of R.

[0023] In the color correction filter of the present invention, it is preferable that at least one of the two protective layers be a moisture barrier layer.

[0024] In the color correction filter of the present invention, it is preferable that at least one of the two protective layers be an oxygen barrier layer.

[0025] In the color correction filter of the present invention, it is preferable that in the color correction layer, the J aggregate of the dye be formed in a matrix resin. This is because a color correction layer in which the J aggregate of the dye is formed in a matrix resin has an improved stability of the J aggregate of the dye and better durability (for example, heat resistance, dark storage stability at room temperature, and light resistance) as compared to a color correction layer formed of the J aggregate of the dye alone.

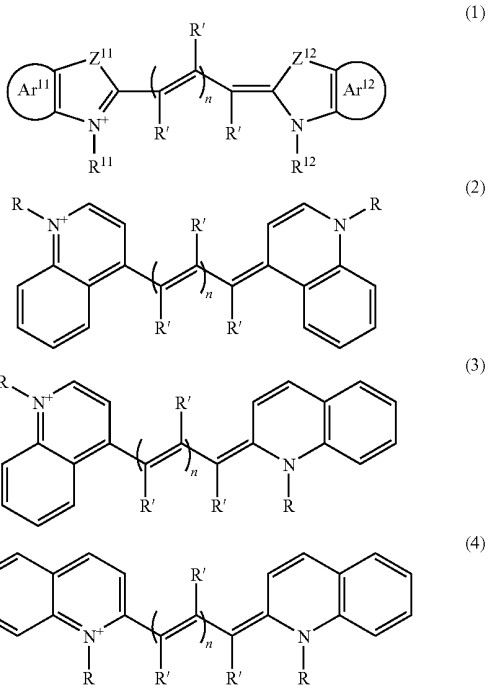
[0026] In the color correction filter of the present invention, it is preferable that the matrix resin have been crosslinked. This is because a color correction layer in which the matrix resin has been crosslinked has higher heat resistance as compared to a color correction layer in which the matrix resin has not been crosslinked.

[0027] In the color correction filter of the present invention, it is preferable that the wavelength of the maximum absorption peak of the color correction layer be in the range of 560 to 610 nm.

[0028] In the color correction filter of the present invention, it is preferable that the maximum absorbance of the color correction layer in the wavelength range of 560 to 610 nm be at least 0.2.

[0029] In the color correction filter of the present invention, it is preferable that the dye be cyanine.

[0030] In the color correction filter of the present invention, it is preferable that the cyanine be represented by at least one formula selected from the group consisting of the following general formulae (1) to (4).



[0031] In general formula (1),

Z^{11} and Z^{12} each are —NH—, —CH_2—, —CH═CH—, or a heteroatom and may or may not have a substituent, and Z^{11} and Z^{12} may be identical to or different from each other. The aforementioned heteroatom is not particularly limited and examples thereof include S, Se, and O. The aforementioned substituent is not particularly limited and examples thereof include an alkyl group, a halogen atom, and an oxo group (═O). In Z^{11} and Z^{12}, for example, at least one of hydrogen atoms (H) of —NH—, —CH_2—, and —CH═CH— may or may not be substituted by at least one of an alkyl group and a halogen atom. Furthermore, in Z^{11} and Z^{12}, for example, the S atom may or may not have an oxo group as a substituent and thereby may be SO or SO_2. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 12.

The rings Ar^{11} and Ar^{12} each may or may not have an unsaturated bond in a region other than a condensation portion formed with a nitrogen-containing ring, may or may not have aromaticity, may or may not have a heteroatom, and further may or may not have a substituent, and the rings Ar^{11} and Ar^{12} may be identical to or different from each other. The substituent is not particularly limited but at least one of, for example, an alkyl group and a halogen atom is preferable. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 12. The rings Ar^{11} and Ar^{12} are not particularly limited but, for example, 5- to 10-membered rings are preferable. More specific examples thereof include a benzene ring, a pyridine ring, and a naphthalene ring.

R^{11} and R^{12} each is a hydrogen atom or a linear or branched alkyl group, the alkyl group further may or may not be substituted by an ionic substituent, and R^{11} and R^{12} may be identical to or different from each other. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 18. The ionic substituent is not particularly limited but an anionic substituent is preferable, and it is preferable that the end of the alkyl group be substituted by the ionic substituent. The anionic substituent is not particularly limited and examples thereof include a sulfonic acid group and a carboxylic acid group. It is preferably a sulfonic acid group. More specifically, the alkyl group may be, for example, a sulfoalkyl group whose end has been substituted by a sulfo group or a carboxyalkyl group whose end has been substituted by a carboxy group. Furthermore, the counter ion of the aforementioned ionic substituent is not particularly limited. When the ionic substituent is an anionic substituent, examples of the counter ion (cation) include a hydrogen ion, a metal ion, and an ammonium ion. Moreover, for example, N^+ itself in formulae (1) to (4) described above may be a counter ion of the anionic substituent. The aforementioned metal ion is not particularly limited and examples thereof include an alkali metal ion, an alkaline earth metal ion, and a transition metal ion. Examples of the alkali metal ion include Li^+, Na^+, K^+, Rb^+, and Cs^+. Examples of the alkaline earth metal ion include Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}. The ammonium ion is not particularly limited and examples thereof include NH_4^+ and an alkylammonium ion. The alkylammonium ion is not particularly limited and examples thereof include a tetramethylammonium ion, a trimethylammonium ion, a tetraethylammonium ion, and a triethylammonium ion.

In general formulae (2) to (4),

R is a hydrogen atom or a linear or branched alkyl group, and the respective Rs may be identical to or different from each other. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 12.

In general formulae (1) to (4);

R' is a hydrogen atom, a linear or branched alkyl group, or an aromatic group, the alkyl group is preferably a linear or branched alkyl group with a carbon atom number of 1 to 18, and the respective R's may be identical to or different from each other, and

n is 0 or any positive integer, n is preferably, for example, 0, 1, or 2.

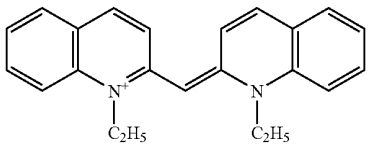
Furthermore, in general formulae (1) to (4), the counter ion (anion) of N^+ is not particularly limited and it may be a monovalent anion or a polyvalent anion and may be of one type or a plurality of types. The monovalent anion is not particularly limited and examples thereof include a halide ion, a hypohalogenous acid ion, a halogenous acid ion, a halogen acid ion, a perhalogen acid ion, a nitric acid ion, a nitrite ion, a hexafluorophosphate ion (PF_6^-), and a trifluoromethanesulfonate ion (CF_3COO^-). At least one selected from the group consisting of F^-, Cl^-, Br^-, I^-, and ClO_4^- is particularly preferable. The polyvalent anion is not particularly limited and examples thereof include a sulfate ion and a sulfite ion.

In the present invention, the "halogen" refers to any halogen element and examples thereof include fluorine, chlorine, bromine, and iodine. In the present invention, the "alkyl group" is not particularly limited. Examples of the alkyl group include a methyl group, an ethyl group, an n-propyl group, an isopropyl group, an n-butyl group, an isobutyl group, a sec-butyl group, a tert-butyl group, a pentyl group, a hexyl group, a heptyl group, an octyl group, a nonyl group, a decyl group, an undecyl group, a dodecyl group, a tridecyl group, a tetradecyl group, a pentadecyl group, a hexadecyl group, a hep-

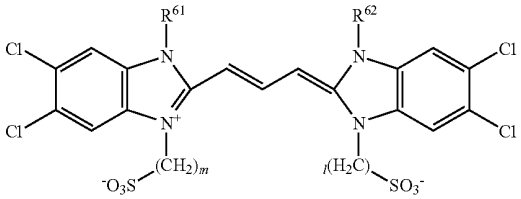
tadecyl group, an octadecyl group, a nonadecyl group, and an icosyl group. The same applies to a group including an alkyl group in its structure or a group derived from an alkyl group (a sulfoalkyl group, a carboxyalkyl group, or an alkoxy group). Furthermore, when, for example, a substituent is a group having a chain structure (for example, an alkyl group, a sulfoalkyl group, a carboxyalkyl group, or an alkoxy group), it may be in the linear or branched form unless it is particularly limited. Moreover, when, for example, a substituent has an isomer, it can be any isomer unless it is particularly limited. For example, in the case where simply the term "propyl group" is used, it may be either an n-propyl group or an isopropyl group. In the case where simply the term "butyl group" is used, it may be any one of an n-butyl group, an isobutyl group, a sec-butyl group, and a tert-butyl group. In the case where simply the term "naphthyl group" is used, it may be either a 1-naphthyl group or a 2-naphthyl group.

[0032] In the color correction filter of the present invention, it is preferable that the cyanine be represented by at least one selected from the group consisting of the following structural formulae (5) to (7).

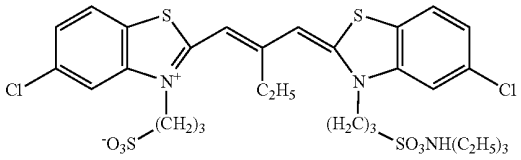
(5)



(6)



(7)



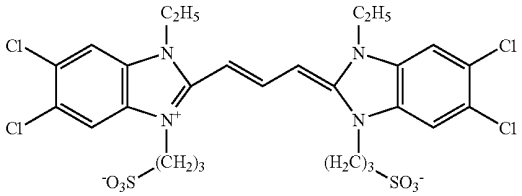
In structural formula (6),

R^{61} and R^{62} each is a hydrogen atom or a linear or branched alkyl group, the alkyl group is preferably a linear or branched alkyl group with a carbon number of 4 or less, and R^{61} and R^{62} may be identical to or different from each other.

Furthermore, m and l each are any positive integer, preferably 1 to 4, and m and l may be identical to or different from each other.

Structural formula (5) is a preferable form of general formula (4) described above, and structural formulae (6) and (7) are preferable forms of general formula (1) described above. Accordingly, in structural formulae (5) and (6), for example, the counter ion is the same as in general formulae (1) to (4). In structural formula (6), the counter ion of one sulfonate ion ($—SO_3^-$) is N^+ in structural formula (6). The counter ion of the other sulfonate ion ($—SO_3^-$) is not particularly limited but preferably, for example, an alkali metal ion, and at least one selected from the group consisting of Li^+, Na^+, and K^+ is particularly preferable. Furthermore, a compound (ion) represented by structural formula (6) described above is particularly preferably a compound (ion) represented by the following structural formula (8).

(8)



[0033] In the color correction filter of the present invention, the thickness of the color correction layer be preferably in the range of 10 to 500 nm, more preferably in the range of 30 to 400 nm, and further preferably in the range of 50 to 300 nm.

[0034] Hereinafter, the present invention is described in detail.

[0035] In the present invention, the planar shape of the color correction filter is, for example, a rectangular shape. It may be a square or a rectangle but is preferably a rectangle. The color correction filter includes a color correction layer and two protective layers.

[0036] The color correction layer contains a J aggregate of a dye. As described above, the half bandwidth at the maximum absorption peak of the color correction layer is in the range of 5 to 30 nm. Since the half bandwidth is in the above-mentioned range, the color correction layer can remove intermediate colors of light selectively without absorbing light (for instance, light of R) in the wavelength ranges that are required for color tone representation. The half bandwidth is preferably in the range of 7 to 28 nm, more preferably in the range of 8 to 27 nm, and further preferably in the range of 8 to 15 nm.

[0037] As described above, the wavelength of the maximum absorption peak of the color correction layer is preferably in the range of 560 to 610 nm. When the wavelength of the maximum absorption peak is in the above-mentioned range, for example, the relative emission intensity of light (for example, light of R) required for color tone representation can be prevented from decreasing.

[0038] As described above, the maximum absorbance of the color correction layer in a wavelength range of 560 to 610 nm is preferably at least 0.2. The maximum absorbance is more preferably at least 0.8 and further preferably at least 0.9. A person skilled in the art can obtain the maximum absorbance easily by, for example, adjusting the thickness of the color correction layer without requiring excessive trial and error. Furthermore, the absorbance of the color correction layer in the whole wavelength range of 560 to 610 nm is more preferably at least 0.2, further preferably at least 0.8, and particularly preferably at least 0.9. The thickness of the color correction layer is as described above.

[0039] The "J aggregate" has a one-dimensional structure in which, for example, a plurality of dye molecules aggregate perpendicularly to the direction of transition moment thereof (head-to-tail) and the deviation angle between the dye molecules is small (approximately 80° or smaller). The J aggregate of the dye is characterized in that the light absorption band in the visible light range shifts to the longer wavelength

side and has a reduced width as compared to the case where the dye is one molecule. The shift amount is in the range of, for example, 30 to 60 nm. Furthermore, the half bandwidth at the maximum absorption peak of the aforementioned J aggregate is, for example, 30 nm or less. The "J aggregate" refers to, for example, one described in T. Kobayashi, "J-Aggregates", World Scientific (1996).

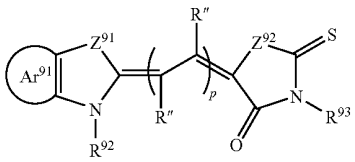
[0040] Examples of the dye that forms the "J aggregate" include cyanine, merocyanine, squarylium, and porphyrin.

[0041] The aforementioned cyanine is a dye having a structure in which two nitrogen-containing heterocycles are bonded to each other with an odd number of methine groups. Nitrogen contained in one of the aforementioned two nitrogen-containing heterocycles is tertiary amine, and nitrogen contained in the other nitrogen-containing heterocycle is quaternary ammonium. The cyanine is represented by, for example, general formulae (1) to (4) described above. In a narrow sense, for example, a compound where n=0 in formula (2) may be referred to as "cyanine", a compound where n=0 in formula (3) as "isocyanine", and a compound where n=0 in formula (4) as "pseudocyanine". In the present invention, however, as described above, the "cyanine" is a generic term for dyes in which two nitrogen-containing heterocycles are bonded to each other with an odd number of methine groups, and nitrogen contained in one nitrogen-containing heterocycle is tertiary amine, and nitrogen contained in the other nitrogen-containing heterocycle is quaternary ammonium.

[0042] Specific examples of cyanine represented by general formula (1) are indicated in Table 1 below. Cyanines of this example are represented by general formula (1-2) indicated above Table 1, and more specifically, they are represented by Compound Nos. 1-2-1 to 1-2-8 indicated in Table 1.

[0043] The merocyanine is a nonionic dye and is represented by, for example, the following general formula (9).

(9)

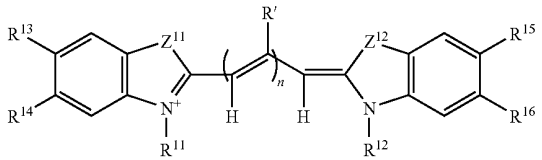


In general formula (9),

Z^{91} and Z^{92} each are —NH—, —CH_2—, —CH═CH—, or a heteroatom and may or may not have a substituent, and Z^{91} and Z^{92} may be identical to or different from each other. The aforementioned heteroatom is not particularly limited and examples thereof include S, Se, and O. The aforementioned substituent is not particularly limited and examples thereof include an alkyl group, a halogen atom, and an oxo group (═O). In Z^{91} and Z^{92}, for example, at least one of hydrogen atoms (H) of —NH—, —CH_2—, or —CH═CH— may be substituted by at least one of an alkyl group and a halogen atom. Furthermore, in Z^{91} and Z^{92}, for example, the S atom may have an oxo group as a substituent and thereby may be SO or SO_2. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 10. The ring Ar^{91} may or may not have an unsaturated bond in a region other than a condensation portion formed with a nitrogen-containing ring, may or may not have aromaticity, may or may not have a heteroatom, and further may or may not have

TABLE 1

(1-2)



Compound No.	Z^{11}	Z^{12}	R^{11}	R^{12}	R^{13}	R^{14}	R^{15}	R^{16}	R'	n	Counter Ion
1-2-1	O	O	—$(CH_2)_2COO^-$	—$(CH_2)_2COOH$	H	H	H	H	H	1	None
1-2-2	O	O	—$(CH_2)_2COOH$	—$(CH_2)_2COOH$	H	H	H	H	H	1	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-
1-2-3	O	O	—$(CH_2)_2COO^-$	—$(CH_2)_2COOH$	H	H	H	H	H	2	None
1-2-4	O	O	—$(CH_2)_2COOH$	—$(CH_2)_2COOH$	H	H	H	H	H	2	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-
1-2-5	S	S	—$(CH_2)_2COOH$	—$(CH_2)_2COOH$	H	H	H	H	—CH_2CH_3	1	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-
1-2-6	S	S	—CH_2COOH	—CH_2COOH	H	H	H	H	—CH_2CH_3	1	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-
1-2-7	S	S	—$(CH_2)_2COOH$	—$(CH_2)_2COOH$	H	H	H	H	H	2	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-
1-2-8	$C(CH_3)_2$	$C(CH_3)_2$	—$(CH_2)_2COOH$	—$(CH_2)_2COOH$	H	H	H	H	—CH_2CH_3	1	F^-, Cl^-, Br^-, I^-, CF_3COO^-, or PF_6^-

a substituent. The substituent is not particularly limited but at least one of, for example, an alkyl group and a halogen atom is preferable. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 12. The ring Ar^{91} is not particularly limited but, for example, 5- to 10-membered rings are preferable. More specific examples thereof include a benzene ring, a pyridine ring, and a naphthalene ring.

R^{92} and R^{93} each is a hydrogen atom or a linear or branched alkyl group, the alkyl group further may or may not be substituted by an ionic substituent, and R^{92} and R^{93} may be identical to or different from each other. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 20. The ionic substituent is not particularly limited but an anionic substituent is preferable, and it is preferable that the end of the alkyl group be substituted by the ionic substituent. The anionic substituent is not particularly limited and examples thereof include a sulfonic acid group and a carboxylic acid group. More specifically, the alkyl group may be, for example, a sulfoalkyl group whose end has been substituted by a sulfo group or a carboxyalkyl group whose end has been substituted by a carboxy group. Furthermore, the counter ion of the aforementioned ionic substituent is not particularly limited. When the ionic substituent is an anionic substituent, examples of the counter ion (cation) include a hydrogen ion, a metal ion, and an ammonium ion. The aforementioned metal ion is not particularly limited and examples thereof include an alkali metal ion, an alkaline earth metal ion, and a transition metal ion. Examples of the alkali metal ion include Li^+, Na^+, Rb^+, and Cs^+. Examples of the alkaline earth metal ion include Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}. The ammonium ion is not particularly limited and examples thereof include NH_4^+ and an alkylammonium ion. The alkylammonium ion is not particularly limited and examples thereof include a tetramethylammonium ion, a trimethylammonium ion, a tetraethylammonium ion, and a triethylammonium ion.

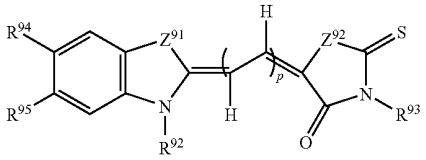
R" is a hydrogen atom, a halogen atom, or a linear or branched alkyl group, the alkyl group is preferably a linear or branched alkyl group with a carbon atom number of 1 to 10, and the respective R"s may be identical to or different from each other.

Furthermore, p is any positive integer, for example, 1 to 3.

[0044] Specific examples of merocyanine represented by general formula (9) are indicated in Table 2 below. Merocyanines of this example are represented by general formula (9-2) indicated above Table 2, and more specifically, they are represented by Compound Nos. 9-2-1 to 9-2-16 indicated in Table 2.

TABLE 2

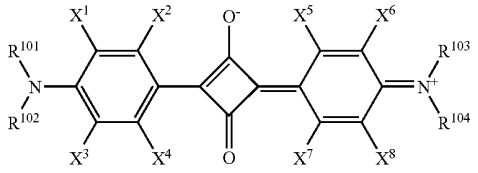
(9-2)



Compound No.	Z^{91}	Z^{92}	R^{92}	R^{93}	R^{94}	R^{95}	p
9-2-1	S	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	H	H	1
9-2-2	S	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-CH_3$	H	1
9-2-3	S	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-CH_2CH_3$	H	1
9-2-4	S	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-(CH_2)_2CH_3$	H	1
9-2-5	Se	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	H	H	1
9-2-6	Se	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-CH_3$	H	1
9-2-7	Se	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-CH_2CH_3$	H	1
9-2-8	Se	S	$-(CH_2)_{17}CH_3$	$-CH_2COOH$	$-(CH_2)_2CH_3$	H	1
9-2-9	S	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	H	H	1
9-2-10	S	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-CH_3$	H	1
9-2-11	S	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-CH_2CH_3$	H	1
9-2-12	S	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-(CH_2)_2CH_3$	H	1
9-2-13	Se	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	H	H	1
9-2-14	Se	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-CH_3$	H	1
9-2-15	Se	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-CH_2CH_3$	H	1
9-2-16	Se	S	$-(CH_2)_{17}CH_3$	$-(CH_2)_2COOH$	$-(CH_2)_2CH_3$	H	1

[0045] The aforementioned squarylium is represented by the following general formula (10).

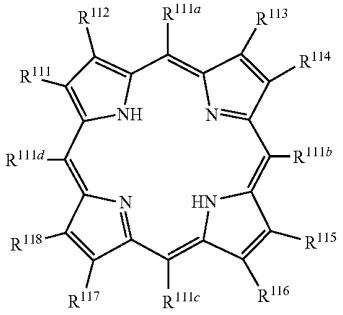
(10)



In general formula (10), R^{101} to R^{104} each are an alkyl group and is preferably a linear or branched alkyl group with a carbon number of 6 or less, and R^{101} to R^{104} may be identical to or different from each other. X^1 to X^8 each are a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group, or a hydroxyl group, the alkyl group is particularly preferably a methyl group or an ethyl group, and the alkoxy group is particularly preferably a methoxy group. X^1 to X^8 may be identical to or different from each other.

[0046] The aforementioned porphyrin is a macrocyclic compound in which four pyrrole rings are bonded to four methine groups alternately at the site α, and a derivative thereof. It is represented by, for example, the following general formula (11).

(11)



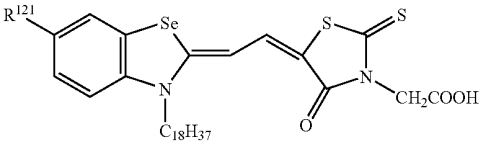
In formula (11), R^{111} to R^{118} and R^{111a} to R^{111d} each are an alkyl group, a hydrogen atom, or a phenyl group, the alkyl group is preferably a linear or branched alkyl group with a carbon number of 4 or less, and R^{111} R^{118} may be identical to or different from one another. In R^{111} to R^{118}, the phenyl group may or may not have a substituent. The substituent is not particularly limited but is preferably at least one selected from the group consisting of an alkyl group, a halogen atom, a sulfo group, and a carboxyl group. The alkyl group is more preferably, for example, a linear or branched alkyl group with a carbon atom number of 1 to 12.

[0047] Furthermore, the porphyrin may be a porphyrin complex having coordination metal in its center. The coordination metal is not particularly limited and examples thereof include ions of zinc, iron, cobalt, ruthenium, or gallium, more specifically, for example, Zn(II), Ga(III), Fe(II), Fe(III), Co(II), Ru(II), and Ru(III). The coordination metal is not limited to only metal ions but may be, for example, metal halide, metal oxide, metal hydroxide, Si, Ge, or P.

[0048] One of those dyes above may be used independently or two or more of them may be used in combination. Furthermore, those dyes may be used as a complex of, for example, nickel, copper, cobalt, or iron in order to improve fastness thereof.

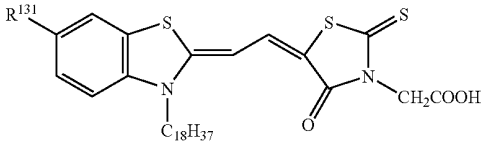
[0049] Particularly preferably, the dye of the present invention is at least one selected from the group consisting of, for example, cyanine represented by any one of structural formulae (5) to (8) described above and merocyanine represented by the following structural formula (12) or (13).

(12)



-continued

(13)

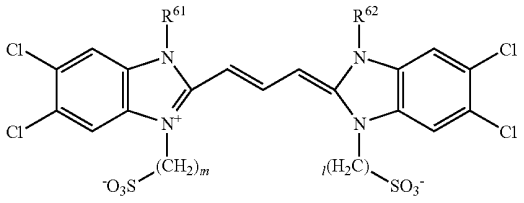


[0050] In formulae (12) and (13), R^{121} and R^{131} each is a hydrogen atom or a linear or branched alkyl group. A preferable example of the alkyl group is a linear or branched alkyl group with a carbon atom number of 1 to 12. Furthermore, in structural formulae (12) and (13), each $—C_{18}H_{37}$ (octadecyl group) may be in the linear or branched form but is preferably in the linear form.

[0051] Specific examples of cyanines represented by structural formula (6) are indicated in Table 3 below. Cyanines of this example are represented by Compound Nos. 6-1 to 6-8 indicated in Table 3.

TABLE 3

(6)



Compound No.	R^{61}	R^{62}	m	l	Counter Ion
6-1	$—CH_3$	$—CH_3$	1	1	Li^{30}, Na^{30}, or K^+
6-2	$—CH_3$	$—CH_3$	2	2	Li^{30}, Na^{30}, or K^+
6-3	$—CH_3$	$—CH_3$	3	3	Li^{30}, Na^{30}, or K^+
6-4	$—CH_2CH_3$	$—CH_2CH_3$	1	1	Li^{30}, Na^{30}, or K^+
6-5	$—CH_2CH_3$	$—CH_2CH_3$	2	2	Li^{30}, Na^{30}, or K^+
6-6	$—(CH_2)_2CH_3$	$—(CH_2)_2CH_3$	1	1	Li^{30}, Na^{30}, or K^+
6-7	$—(CH_2)_2CH_3$	$—(CH_2)_2CH_3$	2	2	Li^{30}, Na^{30}, or K^+
6-8	$—(CH_2)_2CH_3$	$—(CH_2)_2CH_3$	3	3	Li^{30}, Na^{30}, or K^+

[0052] As described above, in the color correction layer, it is preferable that the J aggregate of the dye be formed in a matrix resin. The matrix resin is not particularly limited but is preferably one with excellent visible light transmittance (preferably with a light transmittance of at least 90%) and excellent transparency (preferably with a haze value of 1% or lower). Furthermore, the matrix resin is preferably a polymer that includes a hydroxyl group. When the matrix resin is a polymer that includes a hydroxyl group, the stability of the J aggregate of the dye further can be improved. Examples of the matrix resin include polyvinyl alcohol (PVA), a polyethylene-PVA copolymer, a polyvinyl acetate-PVA copolymer, and derivatives of PVA. Examples of the derivatives of PVA include polyvinyl butyral, polyvinyl ethylal, polyvinyl formal, and polyvinyl benzoyl.

[0053] The PVA can be obtained by, for example, saponifying a vinyl ester polymer that is obtained by polymerizing vinyl ester monomers. The saponification degree of the PVA is preferably in the range of 95 to 99.9 mol %. The use of PVA whose saponification degree is in the above-mentioned range

makes it possible to obtain a color correction filter that has better durability. With respect to the average degree of polymerization of the PVA, a suitable value can be selected suitably according to the intended use. The average degree of polymerization is preferably in the range of 1200 to 3600. The average degree of polymerization can be determined according to, for example, JIS K 6726 (1994 version).

[0054] As described above, it is preferable that in the color correction filter, the matrix resin have been crosslinked. In this case, it is preferable that the matrix resin be a polymer that includes a hydroxyl group and the matrix resin have been crosslinked with the hydroxyl group and a crosslinker. Preferable crosslinkers to be used are one that salt-bridges the hydroxyl group and one that forms a chemical bond with the hydroxyl group. The crosslinker is preferably at least one crosslinker selected from the group consisting of metal salt, boric acid, and a silane compound. Examples of the metal salt include halide (for instance, chloride and iodide) of metal, sulfate of metal, acetate of metal, and metal alkoxide. Examples of the alkoxide include methoxide, ethoxide, n-propoxide, isopropoxide, and sec-butoxide. Examples of the silane compound include tetraethoxysilane, tetramethoxysilane, and tetraphenoxysilane. Examples of the metal include zinc, titanium, zirconium, iron, aluminum, and tin. Particularly preferably, the metal is zinc. That is, it is particularly preferable that the crosslinker be zinc salt and specific examples of the zinc salt include zinc halides such as zinc chloride and zinc iodide, zinc sulfate, and zinc acetate.

[0055] The color correction filter of the present invention may be in the form of a composite member in which, for example, the color correction layer is formed on an optical element of the liquid crystal display (LCD) to be described later, for example, a polarizing plate, a retardation plate, or a light guide plate, and a protective layer is stacked on the surface of the color correction layer located on the opposite side to the optical element, or may be in the form of a member (independent member) that is independent and separate from those optical elements. In the form of the composite member, the optical element serves as one of the two protective layers. In the form of the composite member, when consideration is given to handleability and thickness of the whole liquid crystal display, the thickness of the whole color correction filter of the present invention is preferably in the range of 0.1 to 1000 μm. When the color correction layer is to be formed on the optical element, the color correction layer may be formed directly on the optical element, or the color correction layer may be formed on another base material and may then be bonded to the optical element with, for example, a pressure sensitive adhesive used therebetween. Furthermore, in the form of the independent member, the color correction filter of the present invention is formed with the color correction layer sandwiched between two protective layers. When the color correction filter that is in the form of the independent member is to be produced, the color correction layer may be formed directly on a first protective layer and thereafter a second protective layer may be bonded to the surface of the color correction layer located on the opposite side to the first protective layer. Furthermore, after the color correction layer may be formed on another base material, the color correction layer may be bonded to the first protective layer with, for example, a pressure sensitive adhesive used therebetween, thereafter the aforementioned another base material may be removed, and the second protective layer may be bonded to the surface of the color correction layer located on the opposite side to the first protective layer.

[0056] Each protective layer described above provides effects of protecting the color correction layer from, for example, moisture, oxygen, and light and preventing the dye from being deteriorated and discolored. The protective layer that is not the optical element is preferably one with excellent visible light transmittance (preferably with a light transmittance of at least 90%) and excellent transparency (preferably with a haze value of 1% or lower). The protective layer may be formed of an organic material or may be formed of an inorganic material. Examples of the organic material include polyester resin, polyvinyl alcohol resin, polyolefin resin, nylon, polyacrylic resin, polycarbonate resin, polyarylate resin, cellulose resin, ionic polymer, and gelatin. Examples of the polyester resin include polyethylene terephthalate (PET), polybutylene terephthalate, and polytetramethyl terephthalate. Examples of the polyvinyl alcohol resin include polyvinyl formal, polyvinyl acetal, polyvinyl butyral, polyvinyl alcohol (PVA), and an ethylene-vinylalcohol copolymer. Examples of the polyolefin resin include polyethylene and polypropylene. Examples of the polyacrylic resin include polymethylmethacrylate, poly(methyl acrylate), and poly (butyl acrylate). Examples of the polycarbonate resin include polyoxycarbonyloxyhexamethylene and polyoxycarbonyloxy-1,4-isopropylidene-1,4-phenylene. Examples of the polyarylate resin include polyamide and polyetherimide. Examples of the cellulose resin include methylcellulose, ethylcellulose, and derivatives thereof. Examples of the ionic polymer include polydimethyldiallylammonium chloride. Examples of the inorganic material include silicon oxide glass, titanium oxide, aluminum oxide, zinc oxide, vapor-deposited layers formed of various ceramics, vapor-deposited layers formed of various metal oxides, and vapor-deposited layers formed of hydrolytic condensates of various metal alkoxides. Particularly, among these, polyvinyl alcohol resin, polyacrylic resin, ionic polymer, and gelatin are preferred. The protective layer may be formed of one of the above-mentioned materials or may be formed of two or more of them.

[0057] For the protective layer, for instance, a commercial product can be used directly. Examples of the commercial protective layer include "SOARNOL® 25" (trade name) and "SOARNOL® 29" (trade name) manufactured by The Nippon Synthetic Chemical Industry Co., Ltd. as well as "CELLEL®" (trade name) manufactured by Kureha Corporation.

[0058] The thickness of the protective layer is not particularly limited. It is, for example, in the range of 10 to 100 μm, preferably in the range of 20 to 70 μm, and more preferably in the range of 20 to 50 μm.

[0059] The surface shape of the protective layer may be flat and smooth or may be a shape processed for providing it with a certain function. Examples of the shape processed for providing it with a certain function include a prism or lens array shape for improving brightness.

[0060] Next, a method of producing the color correction filter is described using an example. However, the method of producing the color correction filter is not limited to this example.

[0061] First, the aforementioned dye is dissolved in a solvent and thereby a coating solution for the color correction layer is prepared. Examples of the solvent include water, alcohol, ketone, a chlorinated solvent, a fluorinated solvent, and mixed solvents thereof. The coating solution may contain

the matrix resin. In this case, the solid content weight ratio between the dye and the matrix resin is not particularly limited. The coating solution may be prepared by separately dissolving the dye and the matrix resin in the solvent to prepare a dye solution and a resin solution and then mixing them together in proper proportions. In this case, the mixing ratio between the dye solution and the resin solution is not particularly limited and may be, for example, one based on the solid content weight ratio between the dye and the matrix resin. When the coating solution contains the matrix resin, the coating solution further may contain the aforementioned crosslinker. When the crosslinker is the aforementioned metal alkoxide, it is preferable from the viewpoint of the rate of crosslinking the matrix resin that alcohol be used as the solvent. When alcohol is used as the solvent, for example, an exchange reaction between a hydroxyl group of the matrix resin and the metal alkoxide proceeds as the solvent is removed in the drying step to be described later. As a result, the crosslinking of the matrix resin does not hinder the formation of the J aggregate of the dye, which is preferable. In this case, in order to adjust the reaction rate of the exchange reaction, a small amount of acid, alkaline compound, or water may be added to the coating solution. In the coating solution, the amount of the crosslinker to be mixed is not particularly limited, and it is, for example, in the range of 1 to 200 parts by weight with respect to 100 parts by weight of the matrix resin. When the amount of crosslinker to be mixed is set in the aforementioned range, the crosslinker can be dissolved uniformly in the coating solution, and thereby a sufficiently high effect of crosslinking the matrix resin can be obtained. The amount of the crosslinker to be mixed is preferably in the range of 5 to 150 parts by weight with respect to 100 parts by weight of the matrix resin.

[0062] Subsequently, the coating solution is applied onto the optical element, the aforementioned another base material, or the first protective layer, and thereby a coating film is formed and is then dried. Thus the color correction layer can be formed. The method of applying the coating solution can be selected suitably according to, for example, the desired thickness and shape of the color correction layer and the material of the base material. Examples of the method include a spin coating method, a coating method, an adsorption method, and a vapor deposition method. When the coating solution contains the matrix resin and the crosslinker, the matrix resin is crosslinked, for example, during the drying step or after the drying step. Preferably, the matrix resin is crosslinked after formation of the J aggregate of the dye. Furthermore, it is preferable that the matrix resin be crosslinked at a temperature that is equal to or lower than the pyrolysis temperature of the J aggregate of the dye. Since the pyrolysis temperature generally exceeds 100° C., the temperature at which the matrix resin is crosslinked is preferably 100° C. or lower, more preferably 60° C. or lower, and further preferably 30° C. or lower. When the color correction layer is formed on the aforementioned another base material, the color correction layer is bonded to the optical element or the first protective layer with, for example, a pressure sensitive adhesive used therebetween and the aforementioned another base material is then removed.

[0063] Finally, the protective layer (second protective layer) is bonded to the surface of the color correction layer located on the opposite side to the optical element or the first protective layer. Thus, a color correction filter of the present invention can be produced. The color correction layer and the protective layer (second protective layer) can be bonded to each other with, for example, a pressure sensitive adhesive used therebetween. The pressure sensitive adhesive is not particularly limited and can be, for example, a conventionally known acrylic pressure sensitive adhesive.

[0064] In the color correction layer, when the J aggregate of the dye is formed, the light absorption band of the color correction layer shifts to the longer wavelength side and has a reduced width as compared to the case of being free of the J aggregate of the dye contained in the color correction layer (for example, solution state). Thus, it can be judged that the J aggregate of the dye has been formed in the color correction layer.

[0065] The color correction layer further may contain various additives. Examples of the additives include an antioxidant, ultraviolet absorber, and singlet oxygen scavenger for preventing the dye from deteriorating, or refractive index modifiers for providing various functions. One of the abovementioned additives may be used independently or two or more of them may be used in combination. When consideration is given to the ease of formation of the J aggregate, the amount of the additives to be added is, for example, 50 wt % or less, preferably 30 wt % or less, and more preferably 20 wt % or less with respect to the dye. Furthermore, in addition to or instead of the color correction layer, at least one of the protective layers may contain the additives.

[0066] An example of a color correction filter of the present invention that is in the form of the independent member is shown in the cross-sectional view in FIG. **2**. As shown in FIG. **2**, this color correction filter **10** includes a color correction layer **11** and two protective layers **12** as main components. The two protective layers **12** are stacked on both surfaces of the color correction layer **11**, respectively. The two protective layers may be formed of the same material or may be formed of different materials from each other. The absorption spectrum, wavelength of the maximum absorption peak, half bandwidth at the maximum absorption peak, and absorbance at the wavelength of the maximum absorption peak of the color correction filter according to the present invention are equal to or nearly equal to the absorption spectrum, wavelength of the maximum absorption peak, half bandwidth at the maximum absorption peak, and absorbance at the wavelength of the maximum absorption peak of the aforementioned color correction layer. Therefore, when the aforementioned characteristics of the color correction layer are measured, the characteristics of the color correction filter including the correction layer can be found out. Similarly, when the aforementioned characteristics of the color correction filter of the present invention are measured, the characteristics of the color correction layer included in the correction filter can be found out.

[0067] The color correction filter can be used suitably for various types of image displays, such as a liquid crystal display (LCD) and an EL display (ELD). An example of the configuration of a liquid crystal display including the aforementioned color correction filter used therein is shown in the cross-sectional view in FIG. **3**. In FIG. **3**, in order to make it clearly understandable, for example, the sizes and ratios of respective components differ from actual ones. As shown in FIG. **3**, this liquid crystal display includes the aforementioned color correction filter **10**, a liquid crystal panel **41**, a light source unit (cold cathode tube) **44**, and a light guide plate **45** as main components. The liquid crystal panel **41** is configured with a first polarizing plate **431** and a second polarizing plate

432 that are disposed on the respective sides of a liquid crystal cell **42**. The liquid crystal cell **42** includes a liquid crystal layer **440** in the center thereof. A first alignment film **451** and a second alignment film **452** are disposed on both sides of the liquid crystal layer **440**, respectively. A first transparent electrode **461** and a second transparent electrode **462** are disposed on the outer sides of the first alignment film **451** and the second alignment film **452**, respectively. Color filters **470** with a predetermined arrangement of, for example, R, G, and B, and black matrices **490** are disposed via a protective film **480** on the outer side of the first transparent electrode **461**. A first substrate **401** and a second substrate **402** are disposed on the outer sides of the color filters **470** and the black matrices **490**, and the second transparent electrode **462**, respectively. In the liquid crystal panel **41**, the first polarizing plate **431** side is a display side, and the second polarizing plate **432** side is the back side. The light guide plate **45** is disposed, on the back side of the liquid crystal panel **41**, in parallel with the liquid crystal panel **41** to lie on top thereof. The light source unit **44** is disposed on the opposite side of the light guide plate **45** to the liquid crystal panel **41**. The color correction filter **10** is disposed on the outer side of the first polarizing plate **431** (on the upper side in FIG. **3**). However, in the liquid crystal display of the present invention, the position where the color correction filter is disposed is not limited to this example. In the present invention, the color correction filter **10** can be disposed in any position between the light source unit **44** and the surface of the liquid crystal display located on the display side (on the upper side in FIG. **3**). The position where the color correction filter **10** is disposed is located preferably between the light source unit **44** and the light guide plate **45**, between the light guide plate **45** and the liquid crystal panel **41**, between the second polarizing plate **432** and the liquid crystal cell **42**, or on the outer side (on the upper side in FIG. **3**) of the first polarizing plate **431**, and more preferably between the light guide plate **45** and the liquid crystal panel **41** or on the outer side (on the upper side in FIG. **3**) of the first polarizing plate **431**. Furthermore, the liquid crystal display of this example includes one color correction filter **10**. However, the present invention is not limited thereto.

[0068] A liquid crystal display of the present invention may include a plurality of the color correction filters.

[0069] In the liquid crystal display of this example, color tone representation is improved, for example, as follows. The cold cathode tube **44** has an emission peak of B around a wavelength 435 to 480 nm, that of G around a wavelength of 500 to 560 nm, and that of R around a wavelength of 610 to 750 nm. In this case, the color correction filter **10** of the present invention used herein is one in which the wavelength of the maximum absorption peak of the color correction layer is in the range of 560 to 610 nm. This allows light with wavelengths in the range of 560 to 610 nm to be absorbed selectively by the color correction filter **10** of the present invention to be removed. Accordingly, the color tone representation of light (particularly, light of R) emitted from the cold cathode tube **44** can be improved. Furthermore, in the liquid crystal display of this example, the half bandwidth at the maximum absorption peak of the color correction layer is very narrow, specifically, in the range of 5 to 30 nm. Therefore, light (for example, light of R) in a wavelength range required for color tone representation is not absorbed, and thereby a decrease in brightness is prevented. Moreover, the color correction filter **10** of the present invention has a configuration in which the two protective layers are stacked on both surfaces of the color correction layer, respectively. Accordingly, in the color correction filter **10** of the present invention, the protective layers protect the dye in the color correction layer from, for example, moisture, oxygen, and light, and thereby the dye is prevented from being deteriorated and discolored. Consequently, the color correction filter **10** of the present invention has excellent durability. Therefore, the color correction filter **10** of the present invention allows an improved in color tone representation to be maintained over a long period of time.

[0070] Another example of the configuration of a liquid crystal display including the color correction filter used therein is shown in the cross-sectional view in FIG. **4**. In FIG. **4**, the identical parts to those shown in FIG. **3** are indicated with identical numerals. In the liquid crystal display of this example, the light source unit **44** is a pseudo white light source that produces white light from light emitted from a blue LED and yellow light emitted from YAG. The light source unit **44** is disposed beside the light guide plate **45** (on the right side thereof in FIG. **4**). Except for these, the liquid crystal display of this example has the same configuration as that of the liquid crystal display shown in FIG. **3**. As described above, the pseudo white light source contains more intermediate colors of light as compared to the cold cathode tube. However, in the liquid crystal display of the present invention, even in the case of using the pseudo white light source, since the color correction filter **10** absorbs the intermediate colors of light selectively to remove them, it is possible to improve color tone representation while preventing brightness from deteriorating.

[0071] The liquid crystal display of the present invention is not limited to the examples shown in FIGS. **3** and **4**. For instance, the liquid crystal display of the present invention further may include various optical elements such as a retardation film, a diffuser plate, an antiglare layer, an antireflection layer, a protective plate, a prism array, and a lens array sheet. The optical elements may be, for example, optical elements of the present invention.

[0072] The image display of the present invention is used for any suitable applications. Non-limiting examples of the applications include office equipment such as a desktop PC, a notebook PC, and a copy machine, portable devices such as a mobile phone, a watch, a digital camera, a personal digital assistant (PDA), and a handheld game machine, home electric appliances such as a video camera, a television set, and a microwave oven, vehicle equipment such as a back monitor, a monitor for a car-navigation system, and a car audio, display equipment such as an information monitor for stores, security equipment such as a surveillance monitor, and nursing and medical equipment such as a monitor for nursing care and a monitor for medical use.

EXAMPLES

[0073] Next, examples of the present invention are described together with comparative examples. The present invention is neither limited nor restricted by the following examples or comparative examples.

[0074] Measurement and evaluation of various characteristics and physical properties in the respective examples and comparative examples were carried out by the following methods.

(1) Absorption Spectra, Wavelengths of Maximum Absorption Peaks, and Half Bandwidths at Maximum Absorption Peaks of Coating Solution for Color Correction Layer, Color Correction Layer, and Color Correction Filter

[0075] Absorption spectra of the coating solution for the color correction layer, the color correction layer, and the color

correction filter were measured using an ultraviolet-visible spectrophotometer ("V-560" (trade name), manufactured by Jasco Corporation). From the absorption spectra thus measured, the wavelengths of the maximum absorption peaks and the half bandwidths at the maximum absorption peaks of the coating solution for the color correction layer, the color correction layer, and the color correction filter were determined.

(2) Light Resistance of Color Correction Filter

[0076] The light resistance of the color correction filter was evaluated by measuring the change in absorbance of the color correction filter with time when it is irradiated continuously with a backlight equipped with a cold cathode tube (LIGHT VIEWER 700PRO, manufactured by Hakuba Photo Industry Co., Ltd.). The ultraviolet-visible spectrophotometer was used for the measurement of the absorbance. The light resistance of the color correction filter was evaluated, with the first protective layer (glass sheet) of the color correction filter being located on the backlight side.

Example 1

[0077] A color correction filter with a structure shown in FIG. **2** was produced.

<Preparation of Coating Solution for Color Correction Layer>

[0078] That is, first, a dye (1-ethyl-2-[(1-ethyl-2(1H)-quinolinylidene)methyl]quinolinium bromide (manufactured by Hayashibara Biochemical Labs., Inc.), Br^- salt of an ion represented by the aforementioned structural formula (5), was dissolved in ethanol and thereby 1.2 g/L of coating solution for a color correction layer was obtained.

<Production of Color Correction Layer>

[0079] Next, with the coating solution being allowed to drip onto a first protective layer (glass sheet), the coating solution was applied by the spin coating method under a condition of 1000 times/min×30 sec, and thereby a coating film was formed and was then dried. Thus, a color correction layer containing a J aggregate of the dye was formed on the first protective layer. The wavelength of the maximum absorption peak of the color correction layer was 577 nm, the half bandwidth at the maximum absorption peak was 10 nm, and the absorbance at the wavelength of the maximum absorption peak was 0.3. Furthermore, the thickness of this color correction layer was 10 nm.

[0080] The absorption spectra of the coating solution for the color correction layer and the color correction layer are shown in the graph in FIG. **1**. In FIG. **1**, PA indicates the absorption spectrum of the coating solution for the color correction layer, and JA the absorption spectrum of the color correction layer. As can be seen from FIG. **1**, the wavelength (577 nm) of the maximum absorption peak of the color correction layer was located on the longer wavelength side than the wavelength (523 nm) of the maximum absorption peak of the coating solution for the color correction layer. Furthermore, the half bandwidth (10 nm) at the maximum absorption peak of the color correction layer was narrower than the half bandwidth (34 nm) at the maximum absorption peak of the coating solution for the color correction layer. Thus, it was judged that the J aggregate of the dye had been formed in the color correction layer.

<Production of Color Correction Filter>

[0081] Next, a second protective layer (a laminate film containing PET, with a thickness of 80 μm, "CELLEL®" (trade name) manufactured by Kureha Corporation) having a moisture barrier function and an oxygen barrier function was bonded to the surface of the color correction layer located on the opposite side to the first protective layer with an acrylic pressure sensitive adhesive used therebetween. Thus, the color correction filter of this example was obtained.

Example 2

[0082] A color correction filter of this example was obtained in the same manner as in Example 1 except that an ethylene-vinylalcohol copolymer film (with a thickness of 30 μm, "SOARNOL® 29" (trade name), manufactured by The Nippon Synthetic Chemical Industry Co., Ltd.) having a moisture barrier function and an oxygen barrier function was used as the second protective layer.

Example 3

[0083] A color correction filter having a structure shown in FIG. **2** was produced.

<Preparation of Coating Solution for Color Correction Layer>

[0084] That is, first, a dye that was identical to that used in Example 1 was used, and PVA (manufactured by The Nippon Synthetic Chemical Industry Co., Ltd., with a polymerization degree of 1800 and a saponification degree of 98.0 to 99.0 mol %) was used as the matrix resin. The dye, PVA, and zinc chloride (crosslinker) were dissolved in water at a weight ratio of dye:PVA:zinc chloride=10:56:34, and thereby a coating solution for the color correction layer was obtained in which the dye concentration was 1.1 g/L.

<Production of Color Correction Layer>

[0085] Next, with the coating solution being allowed to drip onto a first protective layer (glass sheet), the coating solution was applied by the spin coating method under a condition of 1000 times/min×30 sec, and thereby a coating film was formed. It was then dried and PVA was crosslinked. In this color correction layer, the wavelength of the maximum absorption peak was 574 nm, the half bandwidth at the maximum absorption peak was 8 nm, and the absorbance at the wavelength of the maximum absorption peak was 0.3. Furthermore, the thickness of this color correction layer was 200 nm.

[0086] The wavelength of the maximum absorption peak of the color correction layer was located on the longer wavelength side than the wavelength (523 nm) of the maximum absorption peak of the coating solution for the color correction layer. Furthermore, the half bandwidth at the maximum absorption peak of the color correction layer was narrower than the half bandwidth (34 nm) at the maximum absorption peak of the coating solution for the color correction layer.

Thus, it was judged that the J aggregate of the dye had been formed in the color correction layer.

<Production of Color Correction Filter>

[0087] Next, a second protective layer (an ethylene-vinylalcohol copolymer film, with a thickness of 40 μm, "SOARNOL® 25" (trade name), manufactured by The Nippon Synthetic Chemical Industry Co., Ltd.) was bonded to the surface of the color correction layer located on the opposite side to the first protective layer with an acrylic pressure sensitive adhesive used therebetween. Thus, the color correction filter of this example was obtained.

Comparative Example 1

[0088] A color correction filter of this comparative example was obtained in the same manner as in Example 1 except that the second protective layer was not provided.

Comparative Example 2

[0089] A color correction filter of this comparative example was obtained in the same manner as in Example 3 except that the second protective layer was not provided.

[0090] The light resistance evaluation results of Examples 1 and 2 as well as Comparative Example 1 are indicated in the graph shown in FIG. **6**. Furthermore, the light resistance evaluation results of Example 3 and Comparative Example 2 were indicated in the graph shown in FIG. **7**. In FIGS. **6** and **7**, the initial value (0 hour) of the absorbance at the wavelength of the maximum absorption peak of the color correction filter is taken as a reference (1). As can be seen from FIG. **6**, in Examples 1 and 2, the color of the dye remained even after a lapse of 500 hours, and light absorption by the J aggregate of the dye was observed. On the other hand, in Comparative Example 1, the dye was discolored completely before a lapse of 50 hours, and light absorption by the J aggregate of the dye was no longer observed. Furthermore, as can be seen from FIG. **7**, in Example 3, the color of the dye remained even after a lapse of 1200 hours, and light absorption by the J aggregate of the dye was observed. On the other hand, in Comparative Example 2, the dye was discolored completely before a lapse of 400 hours, and light absorption by the J aggregate of the dye was substantially no longer observed.

INDUSTRIAL APPLICABILITY

[0091] As described above, the color correction filter of the present invention can remove intermediate colors of light while preventing brightness of the image display from deteriorating, can improve color tone representation of the image display, and has excellent durability. Examples of the applications of the color correction filter of the present invention and the image display using the same include office equipment such as a desktop PC, a notebook PC, and a copy machine, portable devices such as a mobile phone, a watch, a digital camera, a personal digital assistant (PDA), and a handheld game machine, home electric appliances such as a video camera, a television set, and a microwave oven, vehicle equipment such as a back monitor, a monitor for a car-navigation system, and a car audio, display equipment such as an information monitor for stores, security equipment such as a surveillance monitor, and nursing and medical equipment such as a monitor for nursing care and a monitor for medical use. However, the applications thereof are not limited and they are applicable to a wide range of fields.

1. A color correction filter, comprising a color correction layer and two protective layers,

wherein the color correction layer contains a J aggregate of a dye,

the dye is at least one dye selected from the group consisting of cyanine, merocyanine, squarylium, and porphyrin,

a half bandwidth at a maximum absorption peak of the color correction layer is in a range of 5 to 30 nm, and

the two protective layers are formed on both surfaces of the color correction layer, respectively.

2. The color correction filter according to claim **1**, wherein at least one of the two protective layers is a moisture barrier layer.

3. The color correction filter according to claim **1**, wherein at least one of the two protective layers is an oxygen barrier layer.

4. The color correction filter according to claim **1**, wherein in the color correction layer the J aggregate of the dye is formed in a matrix resin.

5. The color correction filter according to claim **4**, wherein the matrix resin has been crosslinked.

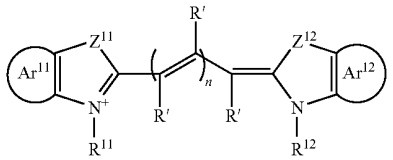
6. The color correction filter according to claim **1**, wherein the wavelength of the maximum absorption peak of the color correction layer is in a range of 560 to 610 nm.

7. The color correction filter according to claim **1**, wherein the maximum absorbance of the color correction layer in a wavelength range of 560 to 610 nm is at least 0.2.

8. The color correction filter according to claim **1**, wherein the dye is cyanine.

9. The color correction filter according to claim **8**, wherein the cyanine is represented by at least one formula selected from the group consisting of the following general formulae (1) to (4):

(1)



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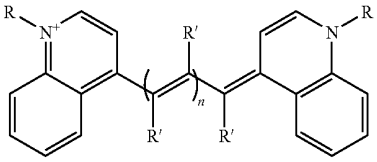

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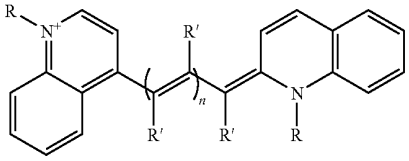

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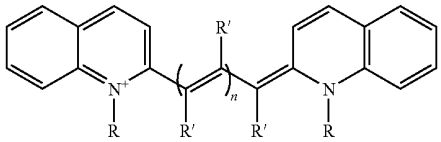
(4)



where in general formula (1), Z^{11} and Z^{12} each are —NH—, —CH_2—, —CH═CH—, or a heteroatom and optionally have a substituent, and Z^{11} and Z^{12} are identical to or different from each other,

the rings Ar^{11} and Ar^{12} each optionally have an unsaturated bond in a region other than a condensation portion formed with a nitrogen-containing ring, optionally have aromaticity, optionally have a heteroatom, and further optionally have a substituent, and the rings Ar^{11} and Ar^{12} are identical to or different from each other,

R^{11} and R^{12} each are a hydrogen atom or a linear or branched alkyl group, the alkyl group is further optionally substituted by an ionic substituent, and R^{11} and R^{12} are identical to or different from each other,

in general formulae (2) to (4),

R is a hydrogen atom or a linear or branched alkyl group, and the respective Rs are identical to or different from each other, and

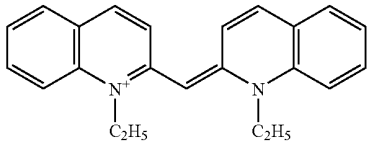
in general formulae (1) to (4),

R' is a hydrogen atom, a linear or branched alkyl group, or an aromatic group, and the respective R's are identical to or different from each other, and

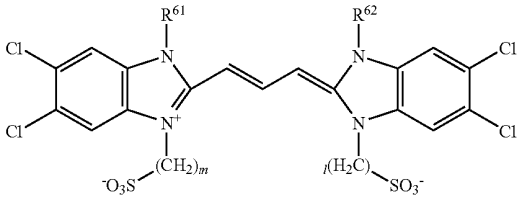
n is 0 or a positive integer.

10. The color correction filter according to claim **9**, wherein the cyanine is represented by at least one formula selected from the group consisting of the following structural formulae (5) to (7):

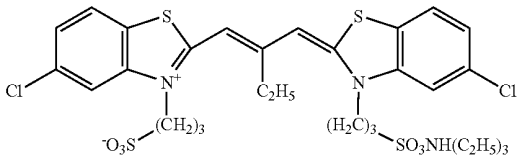
(5)



(6)



(7)



in structural formula (6),

R^{61} and R^{62} each are a hydrogen atom or a linear or branched alkyl group, and R^{61} and R^{62} are identical to or different from each other, and

m and l each are a positive integer and they may be identical to or different from each other.

11. The color correction filter according to claim **1**, wherein the color correction layer has a thickness in a range of 10 to 500 nm.

12. An image display, comprising the color correction filter according to claim **1**.

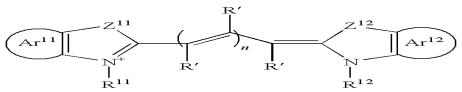
13. A liquid crystal display, comprising the color correction filter according to claim **1**.

* * * * *

专利名称(译)	色彩校正滤镜，图像显示和液晶显示		
公开(公告)号	US20100103355A1	公开(公告)日	2010-04-29
申请号	US12/526594	申请日	2008-02-25
[标]申请(专利权)人(译)	日东电工株式会社		
申请(专利权)人(译)	日东电工株式会社		
当前申请(专利权)人(译)	日东电工株式会社		
[标]发明人	SAKAMOTO MICHIE NAGASAWA MEGUMU		
发明人	SAKAMOTO, MICHIE NAGASAWA, MEGUMU		
IPC分类号	G02F1/1335 G02B5/22 C09K19/00		
CPC分类号	G02B5/223 Y10T428/1041 G02F1/133509		
优先权	2007174002 2007-07-02 JP		
外部链接	Espacenet USPTO		

摘要(译)

提供一种具有优异耐久性的色彩校正滤光器，其可以在防止图像显示器的亮度劣化的同时去除中间色光，从而可以改善图像显示器的色调表示。本发明的色彩校正滤光器10包括色彩校正层11和两个保护层12.色彩校正层11包含染料的J聚集体。染料是至少一种选自花青，部花青，方酸卟啉和卟啉的染料。在颜色校正层的最大吸收峰处的半带宽在5至30nm的范围内。两个保护层12分别形成在颜色校正层11的两个表面上。



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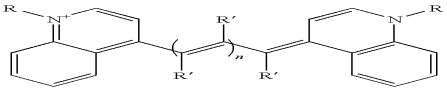

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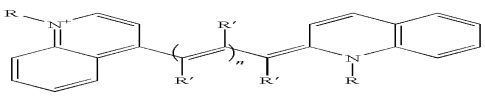

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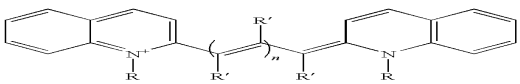

(4)