

DESCRIPTION

COLORED RESIN COMPOSITION

TECHNICAL FIELD

[0001]

The present invention relates to a colored resin composition for forming blue pixels, a color filter produced by using the colored resin composition, and an electronic display device, such as a liquid crystal display device, an imaging device (CCD and CMOS), and an organic EL display that are produced by using the color filter.

BACKGROUND ART

[0002]

A color filter is necessary for colorization of a liquid crystal display element used in a liquid crystal display (LCD) such as a laptop PC, a liquid crystal television, a cellular phone, and the like, or for colorization of an imaging device (CCD, CMOS) used as an input device of a digital camera or a color printer. As a method of manufacturing a color filter used for a liquid crystal display device or for a solid-state imaging element, there are many method such as a staining method, an electrode position method, a printing method, and a pigment dispersion method, and the like. In recent days the pigment dispersion method is mostly used. As a method of patterning, photolithography is the most representative method. According to the method, a color filter is produced by using a mixture

of a photosensitive resin composition and a pigment dispersion. Recently, a method of producing a color filter by directly applying a coloring ink to a substrate with an ink jet printer without using a mask is also performed.

[0003]

Improvements in color purity, chroma, brightness, and contrast, that are the characteristics required for a color filter, are particularly important. According to an improvement in brightness, the light amount of a backlight can be lowered and power consumption can be reduced, and therefore it is also an environmentally-required technology. To improve color purity of a color filter, increasing the content of a coloring pigment or choosing a pigment having better spectral waveform is required. Meanwhile, since it is necessary to increase transmission to improve brightness, pigment concentration should be lowered or film thickness should be reduced. To satisfy these two different characteristics at the same time, a pigment micronization is carried out. However, as resistance and dispersion stability are adversely affected in accordance with a progress of micronization, it is currently impossible to improve brightness while maintaining resistance.

[0004]

As another approach to solve the problems described above, an investigation of a color filter employing a dye is carried out. When a dye is used, both the color purity and brightness can be obtained at the same time, which is impossible to achieve by using a pigment, and there is also an advantage that, not

being a particle, it can suppress light scattering so that contrast can be also improved. However, for a display body like TV which requires long term reliability, light resistance or heat resistance is particularly required. In this regard, most blue dyes have significantly lower resistance than pigments. For example, disclosed in Patent Documents 1 and 2 below is a color filter wherein triphenylmethane compounds are used. However, the triphenylmethane compounds have significantly low heat resistance, and therefore they cannot be used at practical level. Further, although it is well known that phthalocyanine-based dye has excellent resistance (Patent Document 3), the color characteristics include a cyan hue generally having red tint instead of a blue color so that it cannot be used for forming distinct blue pixels. For a color filter, it is required to have distinct blue pixels and a colored resin composition containing colorant materials with excellent reliability and high resistance. However, very few compositions are practically available. As such, as a next generation, a high quality color filter having excellent brightness and excellent resistance is in need.

PATENT DOCUMENTS

[0005]

Patent Document 1: Japanese Patent Application
Laid-Open (JP-A) No. 8-94826

Patent Document 2: JP-A No. 2002-14222

Patent Document 3: JP-A No. 60-249102

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0006]

An object of the invention is to provide blue pixels of a color filter having excellent color characteristics of dye and also excellent heat resistance.

MEANS FOR SOLVING PROBLEM

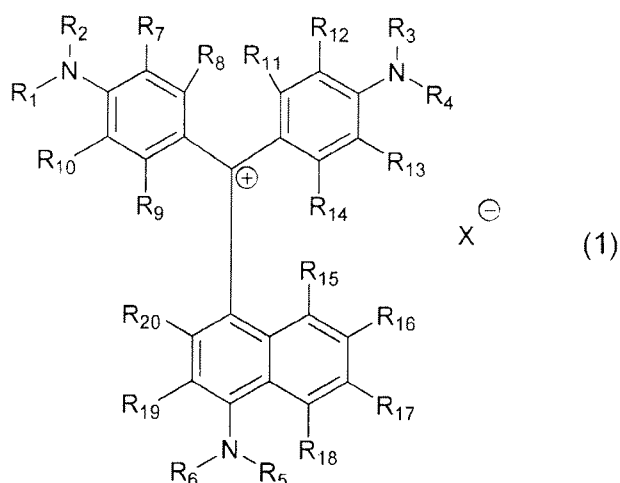
[0007]

The present inventors have made extensive studies in order to solve the problems described above, and as a result, they have found that the problems can be solved by using a colored resin composition containing a specific blue colorant compound for forming blue pixels of a color filter, and thus the invention has been achieved.

[0008]

Specifically, the invention relates to the following:

(1) A colored resin composition for color filters comprising a colorant compound represented by the following formula (1), a binder resin, a solvent, and a curing agent,
[Chemical Formula 1]



(wherein, R_1 to R_6 each independently represent a hydrogen atom, an alkyl group having 1 to 6 carbon atoms, a phenyl group, or a benzyl group, provided that at least one of them is a branched alkyl group or a cyclic alkyl group. R_7 to R_{20} each independently represent a hydrogen atom, an alkyl group having 1 to 6 carbon atoms, or a halogen atom. Anion part X^- represents tristrifluoromethanesulfonyl methide or bistrifluoromethanesulfonyl imide),

(2) The colored resin composition according to the above (1), which contains a copper phthalocyanine pigment,

(3) A colored cured film for color filters obtained by patterning of the colored resin composition according to any one of the above (1) or (2),

(4) A color filter consisting of the colored curable film for color filters according to the above (3),

(5) A liquid crystal display device or an organic EL display device comprising the color filter according to the above (4), and

(6) A solid-state imaging device comprising the color filter according to the above (4).

EFFECT OF THE INVENTION

[0009]

According to the blue colored resin composition of the invention comprising a specific blue colorant compound, high quality blue color pixels for color filters having excellent heat resistance can be provided.

DETAILED DESCRIPTION OF THE INVENTION

[0010]

The blue colored resin composition of the invention contains a binder resin, a solvent, a curing agent, and a specific blue colorant compound, and if necessary, an additional colorant compound like other pigments and dyes and various additives like a surface active agent, a photopolymerization initiator, a thermal curing agent, a polymerization inhibitor, and a UV absorbing agent, but not limited thereto. As for the component other than the specific colorant compound, it can be used without specific limitation.

[0011]

As for the method for manufacturing pixels by using the colored resin composition of the invention, there are photolithography and an ink jet method, etc. For the former, a light sensitive resin composition having excellent developability using a photopolymerization initiator is used.

For the latter, a thermosetting resin composition is used rather than the photopolymerization initiator which is not necessarily required.

[0012]

The specific colorant compound used in the invention is represented by the formula (1) above. With respect to R_1 to R_6 in the formula (1), the alkyl group having 1 to 6 carbon atoms may have a substituent group. Preferred examples of the alkyl group having 1 to 6 carbon atoms include a methyl group, an ethyl group, a propyl group, an iso-propyl group, a butyl group, a 1-methyl propyl group (a sec-butyl group), an iso-butyl group, a pentyl group, 1-ethyl propyl group, 1-methyl butyl group, a cyclopentyl group, a hexyl group, a 1-methyl pentyl group, a 1-ethyl butyl group, a cyclohexyl group, a hydroxypropyl group, a 2-sulfoethyl group, a carboxyethyl group, a cyanoethyl group, a methoxyethyl group, an ethoxyethyl group, a butoxyethyl group, a trifluoromethyl group, and a pentafluoroethyl group.

[0013]

The phenyl group or benzyl group as R_1 to R_6 in the formula (1) may have a substituent group. Examples of the substituent group include a (C1-C5) alkyl group like a methyl group, an ethyl group, a propyl group, an isopropyl group, a butyl group, an isobutyl group, a t-butyl group, and a pentyl group, a halogen atom like a fluorine atom, a chlorine atom, a bromine atom, and an iodine atom, a sulfonate group, a (C1-C6) alkoxy group like a methoxy group, an ethoxy group, a propoxy group, a butoxy group, a t-butoxy group, and a hexyloxy group, a hydroxy (C1-C5) alkyl

group like a hydroxyethyl group and a hydroxypropyl group, a (C1-C5) alkoxy (C1-C5) alkyl group like a methoxyethyl group, an ethoxyethyl group, an ethoxypropyl group, and a butoxyethyl group, a hydroxy (C1-C5) alkoxy group like a 2-hydroxyethoxy group, an alkoxy (C1-C5) alkoxy group like a 2-methoxyethoxy group and a 2-ethoxyethoxy group, a 2-sulfoethyl group, a carboxyethyl group, and a cyanoethyl group.

[0014]

With respect to R_1 to R_6 in the formula (1), examples of at least one branched alkyl group and cyclic alkyl group include an isopropyl group, a 1-methylpropyl group (a sec-butyl group), a 1-ethylpropyl group, a 1-methylbutyl group, a 1-methylpentyl group, a 1-ethylbutyl group, a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, and a cyclohexyl group.

[0015]

Preferred examples of R_1 to R_6 in the formula (1) include a hydrogen atom, an unsubstituted alkyl group having 1 to 6 carbon atoms, a branched alkyl group, or a cyclic alkyl group.

[0016]

The alkyl group having 1 to 6 carbon atoms as R_7 to R_{20} in the formula (1) may have a substituent group. Preferred examples of the alkyl group having 1 to 6 carbon atoms include a methyl group, an ethyl group, a propyl group, an isopropyl group, a butyl group, an isobutyl group, a pentyl group, a cyclopentyl group, a hexyl group, a cyclohexyl group, a hydroxypropyl group, 2-sulfoethyl group, a carboxyethyl group, a cyanoethyl group, a methoxyethyl group, an ethoxyethyl group,

a butoxyethyl group, a trifluoromethyl group, and a pentafluoroethyl group.

[0017]

Examples of the halogen atom as R₇ to R₂₀ in the formula (1) include a fluorine atom, a chlorine atom, a bromine atom, and an iodine atom.

[0018]

Preferred examples of the R₇ to R₂₀ in the formula (1) include a hydrogen atom, a chlorine atom, and an unsubstituted alkyl group having 1 to 6 carbon atoms.

[0019]

The anion part X⁻ in the formula (1) represents tristrifluoromethanesulfonyl methide or bistrifluoromethanesulfonyl imide.

[0020]

The colorant compound represented by the formula (1) of the invention is obtained by dissolving a salt compound of precursor (for example, X⁻ is a chloride anion), that is obtained by using the synthetic method described in a patent document (Synthetic Example 19 of WO 2009/107734) or a non-patent document (J. Am. Chem. Soc. 1996, 118, 7215), in a reaction solvent (for example, water or a water-soluble polar solvent like methanol, ethanol, isopropanol, acetone, N,N-dimethylformamide (herein below, abbreviated as DMF), N-methyl-2-pyrrolidone, and the solvent may be used either singly or in a mixture thereof), adding a corresponding base or acid in an amount of 0.5 to 3 equivalents thereto, stirring

the mixture at pre-determined temperature (for example 0 to 100°C), and filtering the precipitated crystals.

[0021]

The Content of the colorant compound represented by the formula (1) above in the total solid matter of the blue colored resin composition of the invention (indicating the total amount of a solid matter consisting of a colorant compound, a binder resin, and a curing agent, etc., and the same shall apply herein below) is preferably 1 to 60 parts by weight, and more preferably 5 to 30 parts by weight. When the content is above the range, problems like precipitation and aggregation may occur and adhesiveness to a substrate may decrease due to insufficient curing. On the other hand, when it is below the range, there is a tendency that sufficient color purity cannot be obtained as color characteristics, although it may not cause a serious problem.

[0022]

When the colorant compound represented by the formula (1) has a poor solubility in the colored resin composition, it can be dispersed with a dispersant, similar to a pigment as an optional component described below. The colorant compound represented by the formula (1) above may be used either singly or in combination of two or more, and it may be also mixed with other dye or pigment. As the invention relates to blue pixels, it is preferable that a known blue dye or violet dye, or a blue pigment or violet pigment is admixed therewith.

[0023]

The binder resin used in the invention is preferably soluble in an alkaline developing solution used for a development process for producing a color filter according to photolithographic design and has a sufficient curing property with a photopolymerization initiator or a photopolymerizable monomer to form favorable fine patterns. It is also required for the pigment dispersant resin composition to have good compatibility with a constitutional material like photopolymerization initiator, photopolymerizable monomer, and pigment dispersion and good stability not to cause any precipitation or aggregation. In an ink jet method, alkali solubility is not particularly required, and therefore a resin having good compatibility with other colorant compound or additives can be selected.

[0024]

Any resin known in the art can be used as a binder resin. However, it is preferably a copolymer of an ethylenically unsaturated monomer having at least one carboxyl group or a hydroxy group or an ethylenically unsaturated monomer having other copolymerizable aromatic hydrocarbon group or aliphatic hydrocarbon group described below. Further, a resin having an epoxy group in a side chain or terminal or an epoxy acrylate resin added with acrylate can be also used. The monomer may be used either singly or in combination of two or more.

[0025]

Examples of the unsaturated monomer having carboxyl group that can be used in the invention include unsaturated

monocarboxylic acids like acrylic acid, methacrylic acid, crotonic acid, α -chloroacrylic acid, ethacrylic acid, and cinnamic acid; unsaturated dicarboxylic acids (anhydride) like maleic acid, maleic anhydride, fumaric acid, itaconic acid, itaconic anhydride, citraconic acid, citraconic anhydride, and mesaconic acid; unsaturated polycarboxylic acids (anhydride) having valency of 3 or more, 2-(meth)acryloyloxyethyl hexahydrophthalic acid, 2-methacryloyloxyethyl-2-hydroxypropylphthalate, and 2-acryloyloxyethyl-2-hydroxyethyl phthalic acid. The ethylenically unsaturated monomer having carboxy group may be used either singly or in combination of two or more.

[0026]

Examples of the unsaturated monomer having hydroxy group that can be used in the invention include 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, 3-hydroxybutyl (meth)acrylate, 5-hydroxypentyl (meth)acrylate, 4-hydroxypentyl (meth)acrylate, 3-hydroxypentyl (meth)acrylate, 6-hydroxyhexyl (meth)acrylate, 5-hydroxyhexyl (meth)acrylate, 4-hydroxyhexyl (meth)acrylate, 5-hydroxy-3-methyl-pentyl (meth)acrylate, cyclohexane-1,4-dimethanol mono(meth)acrylate, 2-(2-hydroxyethoxy)ethyl (meth)acrylate, glycerin monomethacrylate, and polyalkylene glycol mono(meth)acrylate having terminal hydroxy group like polyethylene glycol mono(meth)acrylate, polypropylene glycol

mono(meth)acrylate, and poly(ethylene glycol-propylene glycol)monomethacrylate. The ethylenically unsaturated monomer having hydroxy group may be used either singly or in combination of two or more.

[0027]

Examples of an unsaturated monomer other than those described above include an aromatic vinyl compound like styrene, α -methylstyrene, o-vinytoluene, m-vinytoluene, p-vinytoluene, o-chlorostyrene, m-chlorostyrene, p-chlorostyrene, and p-methoxystyrene; unsaturated carboxylic acid esters like methyl (meth)acrylate, ethyl (meth)acrylate, n-propyl (meth)acrylate, i-propyl (meth)acrylate, n-butyl (meth)acrylate, i-butyl (meth)acrylate, sec-butyl (meth)acrylate, t-butyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, benzyl (meth)acrylate, paracumyl phenoxyethylene glycol (meth)acrylate, 2-hydroxy-3-phenoxypropyl (meth)acrylate, o-phenylphenolglycidyl ether (meth)acrylate, hydroxyethyl-o-phenylphenol (meth)acrylate, and phenoxyethyl (meth)acrylate; alicyclic skeletons like cyclopentyl (meth)acrylate, cyclohexyl (meth)acrylate, trimethylcyclohexyl (meth)acrylate, norbornyl (meth)acrylate, norbornylmethyl (meth)acrylate, phenylnorbornyl (meth)acrylate, cyanonorbornyl (meth)acrylate, isobornyl (meth)acrylate, bornyl (meth)acrylate, menthyl (meth)acrylate, pentyl (meth)acrylate, adamantyl (meth)acrylate, dimethyladamantyl (meth)acrylate,

tricyclo[5.2.1.0²,6]deca-8-yl=(meth)acrylate,
 tricyclo[5.2.1.0²,6]deca-4-methyl=(meth)acrylate,
 cyclodecyl (meth)acrylate,
 2-(meth)acryloyloxyethylhexahydrophthalic acid, and
 t-butylcyclohexyl (meth)acrylate; polyalkylene glycol
 mono(meth)acrylates having a terminal hydroxy group like
 polyethylene glycol mono(meth)acrylate, polypropylene glycol
 mono(meth)acrylate, and poly(ethylene glycol-propylene
 glycol)monomethacrylate; polyalkylene glycol
 mono(meth)acrylates having a terminal alkyl group like
 methoxypolyethylene glycol monomethacrylate,
 lauroxypolyethylene glycol mono(meth)acrylate,
 octoxypolyethylene glycol polypropylene glycol
 mono(meth)acrylate, nonylphenoxypolyethylene glycol mono
 acrylate, nonylphenoxypolypropylene glycol mono acrylate, and
 aryloxypolyethylene glycol polypropylene glycol
 mono(meth)acrylate; unsaturated carboxylic acid aminoalkyl
 esters like 2-aminoethyl acrylate, 2-aminoethyl methacrylate,
 2-aminopropyl acrylate, 2-aminopropyl methacrylate,
 3-aminopropyl acrylate, and 3-aminopropyl methacrylate;
 unsaturated carboxylic acid glycidyl esters like glycidyl
 acrylate, glycidyl methacrylate, 3,4-epoxybutyl
 (meth)acrylate, (3,4-epoxycyclohexyl)methyl (meth)acrylate,
 and 4-hydroxybutyl (meth)acrylate glycidyl ether; carboxylic
 acid vinyl esters like vinyl acetate, vinyl propionate, vinyl
 butyrate, and vinyl benzoate; unsaturated ethers like vinyl
 methyl ether, vinyl ethyl ether, aryl glycidyl ether, and

methallyl glycidyl ether; cyano vinyl compounds like acrylonitrile, methacrylonitrile, α -chloroacrylonitrile, and cyano vinylidene; unsaturated amides or unsaturated imides like acrylamide, methacrylamide, α -chloroacrylamide, N-phenyl maleimide, N-cyclohexyl maleimide, N-(meth)acryloylphthalimide, N-(2-hydroxyethyl)acrylamide, N-(2-hydroxyethyl)methacrylamide, and maleimide; aliphatic conjugated dienes like 1,3-butadiene, isoprene, and chloroprene, and; macromonomers having a monoacryloyl group or a monomethacryloyl group at the terminal of a polymer molecular chain like polystyrene, polymethyl acrylate, polymethyl methacrylate, poly n-butyl acrylate, poly n-butyl methacrylate, and polysilicone. The unsaturated monomer may be used either singly or in combination of two or more.

[0028]

Further, a polymer having an additional unsaturated double bond in the copolymer side chain is also useful. Examples thereof include a compound which is obtained by reaction of a maleic anhydride part of a copolymer between maleic anhydride and a copolymerizable styrene, vinyl phenol, acrylic acid, acrylic acid ester, or acrylamide with an acrylate having an alcoholic hydroxy group like hydroxyethyl acrylate or an acrylate having an epoxy group like glycidyl methacrylate followed by half-esterification, or a compound which is obtained by reacting acrylic acid with a hydroxy group of a copolymer between acrylic acid or acrylic acid ester and an acrylate having an alcoholic hydroxy group like hydroxyethyl

acrylate. Further, a urethane resin, a polyamide resin, a polyimide resin, a polyester resin, and commercially available ACA-200M (trade name, manufactured by Daicel), ORGA-3060 (trade name, manufactured by OSAKA ORGANIC CHEMICAL INDUSTRY LTD.), AX3-BNX02 (trade name, manufactured by NIPPON SHOKUBAI CO., LTD.), UXE-3024 (trade name, manufactured by NIPPON KAYAKU CO., LTD.), UXE-3000 (trade name, manufactured by NIPPON KAYAKU CO., LTD.), ZGA-287H (trade name, manufactured by NIPPON KAYAKU CO., LTD.), TCR-1338H (trade name, manufactured by NIPPON KAYAKU CO., LTD.), ZXR-1722H (trade name, manufactured by NIPPON KAYAKU CO., LTD.), ZFR-1401H (trade name, manufactured by NIPPON KAYAKU CO., LTD.), and ZCR-1642 (trade name, manufactured by NIPPON KAYAKU CO., LTD.) can be also used.

[0029]

For producing the binder resin (copolymer) that is used in the invention, a polymerization initiator is used. Specific examples of the polymerization initiator that is used for synthesis of a copolymer include α, α' -azobis (isobutyronitrile), 2,2'-azobis(2-methylbutyronitrile), t-butyl peroctoate, di-t-butyl peroxide peroxy benzoyl methyl ethyl ketone peroxide. The ratio of the polymerization initiator used is 0.01 to 25 parts by weight compared to the total of monomers used for synthesis of a copolymer. Further, it is preferable to use an organic solvent explained below for synthesis of a copolymer. However, a solvent having sufficient dissolving power for a monofunctional monomer or a polymerization initiator used should be employed. The

reaction temperature for synthesis of a copolymer is preferably 50 to 120°C, and particularly preferably 80 to 100°C. Further, the reaction time is preferably 1 to 60 hours, and more preferably 3 to 20 hours. The preferred acid value of the copolymer is 10 to 300 (mgKOH/g), and the preferred hydroxy value is 10 to 200 (mgKOH/g). When the acid value or the hydroxy value is 10 or less, the developability is impaired. The weight average molecular weight (Mw) of the copolymer is preferably 2000 to 400000, and more preferably 3000 to 100000. When the weight average molecular weight is less than or equal to 2000 or more than or equal to 400000, the sensitivity and the developability, etc. are impaired.

[0030]

According to the invention, the binder resin may be used either singly or in combination of two or more. The content of the binder resin of the invention is 0.5 to 99 parts by weight, and preferably 5 to 50 parts by weight compared to the 100 parts by weight of the total solid matter in the colored resin composition. When the content of the binder resin is less than 0.5 parts by weight, problems may arise that alkali developability is impaired or surface contamination or film residue occurs in an area other than a pixel-forming part.

[0031]

In case of radical polymerization, examples of the curing agent used in the invention include a photopolymerization monomer. In case of ion curing, examples include an epoxy resin as well as a melamine curing agent. Specific examples thereof

include 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, ethylene glycol di(meth)acrylate, diethylene glycol di(meth)acrylate, triethylene glycol (meth)acrylate, tetraethylene glycol (meth)acrylate, trimethylol propane tri(meth)acrylate, pentaerythritol di(meth)acrylate, pentaerythritol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol hexa(meth)acrylate, glycerol (meth)acrylate, bisphenol-A type epoxy di(meth)acrylate, bisphenol-F type epoxy di(meth)acrylate, bisphenol-fluorene type epoxy di(meth)acrylate, ethoxylated trimethylol propane tri(meth)acrylate, propoxylated trimethylol propane tri(meth)acrylate, ethoxylated glycerin tri(meth)acrylate, ethoxylated isocyanuric acid tri(meth)acrylate, ditrimethylol propane tetra(meth)acrylate, ethoxylated pentaerythritol tetra(meth)acrylate, 9,9-bis[4-(2-acryloyloxyethoxy)phenyl]fluorene, KAYARAD RP-1040 (trade name, manufactured by NIPPON KAYAKU CO., LTD.), KAYARAD DPCA-30 (trade name, manufactured by NIPPON KAYAKU CO., LTD.), UA-33H (trade name, manufactured by Shin-Nakamura Chemical Co., Ltd.), UA-53H (trade name, manufactured by Shin-Nakamura Chemical Co., Ltd.), M-8060 (trade name, manufactured by TOAGOSEI CO., LTD.); as a thiol-based monomer for polymerization, TEMPIC (trade name, manufactured by Sakai Chemical Industry Co., Ltd.), TMMP (trade name, manufactured by Sakai Chemical Industry Co., Ltd.), PEMP (trade name, manufactured by Sakai Chemical Industry Co., Ltd.), and DPMP

(trade name, manufactured by Sakai Chemical Industry Co., Ltd.); as an epoxy resin, NC-6000, NC-3000, EOCN-1020, XD-1000, EPPN-501H, BREN-S, and NC-7300L, all manufactured by NIPPON KAYAKU CO., LTD., CELLOXIDE 2021P, EHPE3150, CYCLOMER M100, and EPOLEAD PB3600, all manufactured by DAICEL CHEMICAL INDUSTRIES, LTD., EPICOAT 828, EPICOAT YX8000, and EPICOAT YX4000, all manufactured by Japan Epoxy Resins Co., Ltd., Sila-Ace S510 (trade name, manufactured by Chisso Corporation), and TEPIC (trade name, manufactured by Nissan Chemical Industries, Ltd.), etc., and; as a melamine curing agent, methylolated melamine and Mw-30 (trade name, manufactured by SANWA Chemical Co., Ltd.). It may be used either singly or in combination of two or more. The content is 1 to 80 parts by weight, and preferably 5 to 30 parts by weight compared to the 100 parts by weight of the total solid matter in the colored resin composition.

[0032]

The additional colorant which can be used in combination in the colored resin composition of the invention preferably has spectral characteristics that are suitable for color filters. It may be suitably selected from a dye, an organic pigment and an inorganic pigment. If necessary, it may be used either singly or in combination of two or more. The content is 0 to 60 parts by weight, and preferably 5 to 30 parts by weight compared to the 100 parts by weight of the total solid matter in the colored resin composition. Various pigments and dyes are described herein under.

[0033]

The organic pigment that can be used in the invention is not specifically limited, and the examples thereof include a pigment like an anthraquinone-based pigment, a phthalocyanine-based pigment, a triphenylmethane-based pigment, a benzimidazolone-based pigment, a quinacridone-based pigment, an azo chelate-based pigment, an azo-based pigment, an isoindoline-based pigment, an isoindolinone-based pigment, a pyranthrone-based pigment, an indanthrone-based pigment, an anthrapyrimidine-based pigment, a dibromoanthanthrone-based pigment, a flavanthrone-based pigment, a perylene-based pigment, a perinone-based pigment, a quinophthalone-based pigment, a thioindigo-based pigment, a dioxazine-based pigment, a quinacridone-based pigment, and a xanthene-based pigment, and; a lake pigment and a dyed lake pigment which is obtained by insolubilization of an acidic dye, a basic dye, or a direct dye with a precipitating agent therefor. More specific examples include, in terms of Color Index, Pigment Blue 1, 1:2, 9, 14, 15, 15:1, 15:2, 15:3, 15:4, 15:6, 16, 17, 19, 25, 27, 28, 29, 33, 35, 36, 56, 56:1, 60, 61, 61:1, 62, 63, 66, 67, 68, 71, 72, 73, 74, 75, 76, 78, 79; Pigment Violet 1, 1:1, 2, 2:2, 3, 3:1, 3:3, 5, 5:1, 14, 15, 16, 19, 23, 25, 27, 29, 31, 32, 37, 39, 42, 44, 47, 49, 50 and; Pigment Violet 3, 4, 27, 39. Pigment Blue 15:6 and Pigment Violet 23 are particularly preferable as they have favorable color and resistance, etc.

[0034]

Examples of the inorganic pigment that can be used in the

invention are not specifically limited, and the examples thereof include a metal oxide, a metal sulfide, a sulfate salt, a metal hydroxide, and a metal carbonate like complex metal oxide pigment, carbon black, lowly oxidized black titan, titan oxide, barium sulfate, zinc oxide, lead sulfate, yellow-colored lead, bengara, deep navy, navy, chromium oxide, antimony white, black iron, red lead, zinc sulfide, cadmium yellow, cadmium red, zinc, manganese purple, cobalt purple, barium sulfate, and magnesium carbonate.

[0035]

The dye which can be used in the invention is not specifically limited and examples thereof include an acidic dye, a basic dye, a direct dye, a sulfide dye, a dye for dry-dyeing, a naphthol dye, a reactive dye and a dispersion dye. Of these, any dye soluble in an organic solvent can be suitably used. However, a dye insoluble in an organic solvent can be also suitably used after it is prepared as a dispersion.

[0036]

It is well known that a dye insoluble in an organic solvent, for example an acidic dye or a basic dye, can be modified to an amine salt dye by reacting with an organic amine compound (for example, n-propylamine and ethylhexyl propionic acid amine) or to a dye having a sulfonamide group by reacting the sulfonic acid with the same organic amine compound. The amine-modified dyes can be also used for the colored resin composition of the invention. More specific examples of the dye include, in terms of Color Index, Solvent Blue 2, 3, 4, 5,

6, 23, 35, 36, 37, 38, 43, 48, 58, 59, 67, 70, 78, 98, 102, 104; Basic Blue 7; Acid Blue 80, 83, 90; and, as a violet dye, Solvent Violet 8, 9; Violet 4, 5, 14 and; Basic Violet 10.

[0037]

As for the photopolymerization initiator added to the colored resin composition of the invention, that is used for photography method, an initiator having sufficient sensitivity toward UV light emitted from a ultrahigh pressure mercury lamp generally used as a light source for exposure is preferable. Examples thereof include a radical polymerizable photoradical initiator and an ion curable photo-acid generator or a photo-base generator. For the photopolymerization, a polymerization promoter component, which is called as a sensitizer to cause curing even with small exposure energy, can be used in combination. Examples of the photopolymerization initiator that can be used include, although not specifically limited, benzil, benzoin ether, benzoin butyl ether, benzoin propyl ether, benzophenone, 3,3'-dimethyl-4-methoxybenzophenone, benzoyl benzoate, ester product of benzoyl benzoate, 4-benzoyl-4'-methyl diphenyl sulfide, benzyl dimethyl ketal, 2-butoxyethyl-4-methylaminobenzoate, chlorothioxantone, methyl thioxantone, ethyl thioxantone, isopropyl thioxantone, dimethyl thioxantone, diethyl thioxantone, diisopropyl thioxantone, dimethylaminomethylbenzoate, 1-(4-dodecylphenyl)-2-hydroxy-2-methylpropan-1-one, 1-hydroxycyclohexylphenyl ketone,

2-hydroxy-2-methyl-1-phenylpropan-1-one,
 1-(4-isopropylphenyl)-2-hydroxy-2-methylpropane-1-one,
 methylbenzoyl formate,
 2-methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one,
 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butanone-1,
 2,4-bis(trichloromethyl)-6-(4-methoxyphenyl)-1,3,5-s-triazine,
 2,4,6-tris(trichloromethyl)-1,3,5-s-triazine,
 2,4-bis(tribromomethyl)-6-(4'-methoxyphenyl)-1,3,5-s-triazine,
 2,4,6-tris(tribromomethyl)-1,3,5-s-triazine,
 2,4-bis(trichloromethyl)-6-(1,3-benzodioxolan-5-yl)-1,3,5-s-triazine,
 benzophenone, benzoyl benzoate,
 1-(4-phenylsulfanylphenyl)butane-1,2-dione-2-oxime-o-benzoate,
 1-(4-methylsulfanylphenyl)butane-1,2-dione-2-oxime-o-acetate,
 1-(4-methylsulfanylphenyl)butan-1-one-oxime-o-acetate,
 4,4'-bis(diethylamino)benzophenone, p-dimethylamino benzoic acid isoamyl ester,
 p-dimethylamino benzoic acid ethyl ester,
 2,2'-bis(o-chlorophenyl)-4,4',5,5'-tetraphenyl-1,2'-biimidazole,
 diazonaphthoquinone-based initiator, and commercially available KAYACURE-DMBI, KAYACURE-BDMK, KAYACURE-BP-100, KAYACURE-BMBI,
 KAYACURE-DETX-S, KAYACURE-EPA (trade names, all manufactured by NIPPON KAYAKU CO., LTD.),
 DAROCURE 1173, DAROCURE 1116 (trade names, all manufactured by Merck Japan Co. Ltd.),
 IRGACURE 907, IRGACURE 369 (trade name, manufactured by BASF Japan Ltd.),
 IRGACURE 379 EG (trade name, manufactured by BASF Japan Ltd.),
 IRGACURE OXE-01 (trade name, manufactured by BASF Japan Ltd.),
 IRGACURE OXE-02 (trade name, manufactured by

BASF Japan Ltd.), IRGACURE PAG103 (trade name, manufactured by BASF Japan Ltd.), TME-triazine (trade name, manufactured by SANWA Chemical Co., Ltd.), biimidazole (manufactured by Kurogane Kasei Co., Ltd.), and STR-110 and STR-1 (trade names, all manufactured by Respe Chemical Co., Ltd.).

[0038]

For a thermosetting resin composition employed in an ink jet method, etc. a thermo-polymerization initiator is generally used. However, if necessary, a photopolymerization initiator can be also used in combination. Examples of the thermo-polymerization initiator include an azo-based compound and an organic peroxide compound, such as

2,2'-azobisisobutyronitrile,
2,2'-azobis(2,4-dimethylvaleronitrile),
2,2'-azobis(2-methylbutyronitrile), di-t-butyl peroxide,
dibenzoyl peroxide, and cumyl peroxyneodecanoate.

[0039]

The polymerization initiator may be used either singly or in combination of two or more, if necessary. The content is 0.5 to 50 parts by weight, and preferably 1 to 25 parts by weight compared to the 100 parts by weight of the total solid matter in the colored resin composition.

[0040]

As for the organic solvent used in the invention, a solvent having sufficient solubility for the constitutional components of the colored resin composition, such as a binder resin, a photopolymerizable monomer, and a photopolymerization

initiator, and also for the monofunctional monomer or the polymerization initiator used for the synthesis of a binder resin can be used. In addition, a solvent capable of maintaining the dispersion stability even when a pigment dispersion is prepared can be used.

[0041]

The organic solvent used in the invention is not specifically limited. Specific examples thereof include benzenes like benzene, toluene, and xylene; cellosolves like methyl cellosolve, ethyl cellosolve, and butyl cellosolve; cellosolve acetic acid esters like methyl cellosolve acetate, ethyl cellosolve acetate, and butyl cellosolve acetate; propylene glycol monoalkyl ether acetic acid esters like propylene glycol monomethyl ether acetate, propylene glycol monoethyl ether acetate, and propylene glycol monobutyl ether acetate; propionic acid esters like methyl methoxypropionic acid, ethyl methoxypropionic acid, methyl ethoxypropionic acid, and ethyl ethoxypropionic acid; lactic acid esters like methyl lactate, ethyl lactate, and butyl lactate; diethylene glycols like diethylene glycol monomethyl ether and diethylene glycol monoethyl ether; acetic acid esters like methyl acetate, ethyl acetate, and butyl acetate; ethers like dimethyl ether, diethyl ether, tetrahydrofuran, and dioxane; ketones like acetone, methyl ethyl ketone, methyl butyl ketone, and cyclohexanone, and; alcohols like methanol, ethanol, butanol, isopropyl alcohol, and benzyl alcohol.

[0042]

The organic solvent may be used either singly or in combination of two or more. The use amount thereof is preferably 40 to 10000 parts by weight, and preferably 100 to 1000 parts by weight compared to the 100 parts by weight of the total solid matter in the colored resin composition.

[0043]

The colored resin composition of the invention is produced by mixing and stirring of a binder resin, a curing agent, a photopolymerization initiator, a specific colorant compound, and an organic solvent, etc. using a dissolver or a homomixer. In addition, other pigments or dyes can be added, if necessary. However, a pigment or a dye having low solubility is first converted into a dispersion by using an appropriate dispersant with a disperser like paint shaker, and then added and mixed with the colored resin composition.

[0044]

To the colored resin composition of the invention, various additives, for example, a filler, a surface active agent, a thermal polymerization inhibitor, an adhesion promoter, an anti-oxidant, a UV absorbing agent, and an aggregation inhibitor, can be further added, if necessary. Further, to remove impurities, etc. the colored resin composition of the invention may be subjected to microfiltration using a filter, etc. after production.

[0045]

Herein below, a method of producing a cured product from the colored resin composition of the invention is explained.

First, the colored resin composition of the invention is coated on a substrate such as a glass substrate and a silicon plate to the film thickness of about 0.1 to 20 μm , and preferably 0.5 to 5 μm according to a method such as a spin coating, a roll coating, a slit and spinning, a die coating, and a bar coating. Then, drying under reduced pressure is carried out according to the drying condition under the temperature of 23 to 150°C for 1 to 60 min, more preferably temperature of 60 to 120°C for 1 to 10 min, in a reduced pressure chamber, if necessary. Further, a pre-baking treatment is carried out by using a hot plate or a clean oven, etc. to form a film. Next, radiation (for example, electronic beam or UV light can be considered, and UV light is preferable) is applied through a certain mask pattern by a commonly-used photolithography method, and development using an aqueous solution of surface active agent, an aqueous alkali solution, or an aqueous mixture solution of a surface active agent and an alkali agent is carried out. Development method includes a dipping method, a spraying method, a shower method, a paddle method, and an ultrasonication method, and a combination thereof can be also employed. Non-exposed area is removed by the development process, rinsed with water, and post-baking treatment, for example, at the temperature of 130 to 300°C for 1 to 120 min, and more preferably at the temperature of 150 to 250°C for 1 to 30 min, is carried out to obtain the pixels consisting of the colored curable film of the invention.

[0046]

Examples of the surface active agent that can be used include polyoxyethylene alkyl ether and polyoxyalkylene alkyl ether. Examples of the alkali agent that can be used include sodium carbonate, potassium carbonate, sodium hydroxide, potassium hydroxide, diethanolamine, and tetramethylammonium hydroxide. In the invention, use of an aqueous solution containing both the alkali agent and surface active agent is preferable. Development process is typically carried out at the treatment temperature of 10 to 50°C, preferably 20 to 40°C, for treatment time of 30 to 600 sec, more preferably 30 to 120 sec.

[0047]

The cured product of the colored resin composition of the invention is useful for color filters of a liquid crystal display device, an organic EL display, or a solid-state imaging device used in a digital camera, etc., and the color filters have patterned blue pixels consisting of the cured product of the colored resin composition of the invention that is produced as described above.

[0048]

The liquid crystal display device of the invention is produced to have a structure in which a back light, a polarizing film, a display electrode, a liquid crystal, an alignment film, a common electrode, the color filter of the invention, an a polarizing film are laminated in the order. Further, the organic EL display is produced by disposing the color filter either above or below a multilayered organic light emitting

device. For example, the solid-state imaging device is produced by forming the color filter layer of the invention on a silicon wafer on which a transport electrode and a photodiode are formed, and then laminating a micro lens thereon.

EXAMPLES

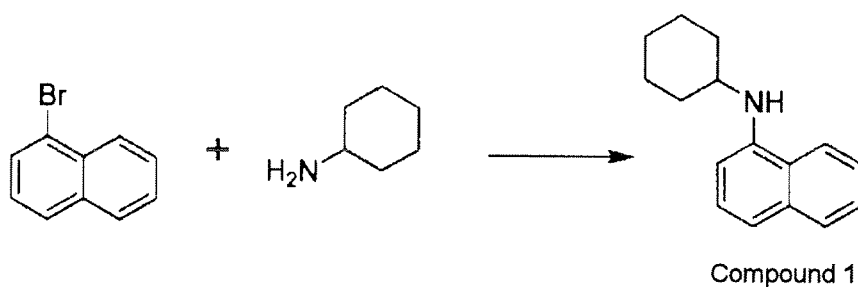
[0049]

The invention is explained in greater detail in view of the following Examples, but it is not limited by the Examples. Further, "%" in the Examples indicates "% by weight", unless specifically described otherwise. As spectroscopic characteristics, spectral transmission ratio was measured by using a spectrophotometer "Shimadzu Corporation UV-3150" and chromaticity was estimated based on the XYZ Color System. Accordingly, the resistance of the colored material was evaluated.

[0050]

Synthetic Example 1 (synthesis of Compound 2-A)

[Chemical Formula 2]

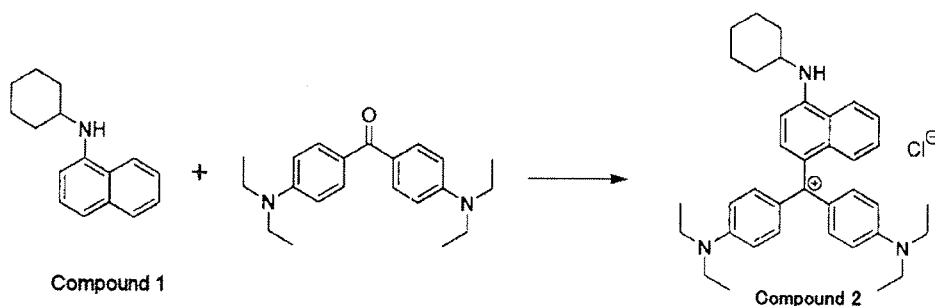


(1) 1-Bromonaphthalene (12.42 g, 0.06 mol), cyclohexylamine (6.55 g, 0.06 mol), sodium t-butoxide (8.07 g, 0.08 mol), Pd₂(dba)₃ ((tris(dibenzylidene acetone) dipalladium

(0), manufactured by Tokyo Chemical Industry Co., Ltd., 0.003 eq. compared to 1-bromonaphthalene), and BINAP ((±)-2,2'-bis(diphenylphosphino)-1,1'-binaphthyl, manufactured by Tokyo Chemical Industry Co., Ltd., 0.008 eq. compared to 1-bromonaphthalene) were dissolved in 120 mL toluene and stirred at 65°C for 3 hours. After that, the temperature was brought back to the room temperature. The reaction solution was filtered using a column and the filtered solution was distilled under reduced pressure to obtain the Compound 1 (12.8 g, 94%).

[0051]

[Chemical Formula 3]



(2) Compound 1 (4.51 g, 0.02 mol) obtained from the Synthetic Example 1-(1), 4,4'-bis(diethylamino)benzophenone (6.49 g, 0.02 mol), and oxyphosphorus chloride (3.37 g, 0.022 mol) were dissolved in 8 mL toluene, and the mixture solution was reacted for 4 hours at 60°C. The temperature was brought back to the room temperature, and then liquid separation was carried out by adding water. The organic layer was concentrated under reduced pressure to obtain the Compound 2 (11.3 g, 99%).

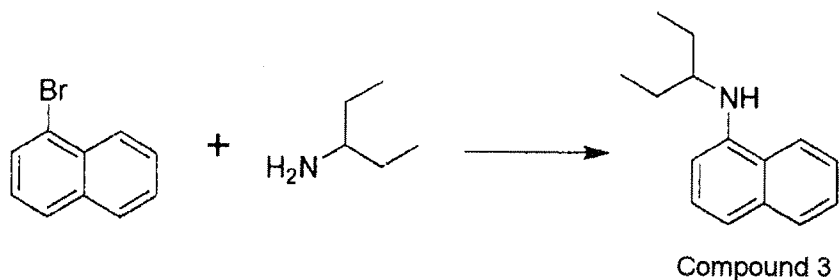
[0052]

(3) Compound 2 (2.5 g, 0.004 mol) obtained from the Synthetic Example 1-(2) was dissolved in a mixture solution of water (2 mL) and methanol (30 mL). Under stirring for dissolving, a solution in which 2.87 g of tristrifluoromethanesulfonyl methide cesium salt is dissolved in a mixture solution of DMF (2 mL) and methanol (10 mL) was added thereto. After stirring for three hours under heating at 60°C, the precipitated crystals were filtered, washed with water, and dried to obtain 2.8 g of tristrifluoromethanesulfonyl methide salt of the Compound 2 as a blue crystal (i.e., triarylmethane compound 2-A).

[0053]

Synthetic Example 2 (synthesis of Compound 4-A)

[Chemical Formula 4]



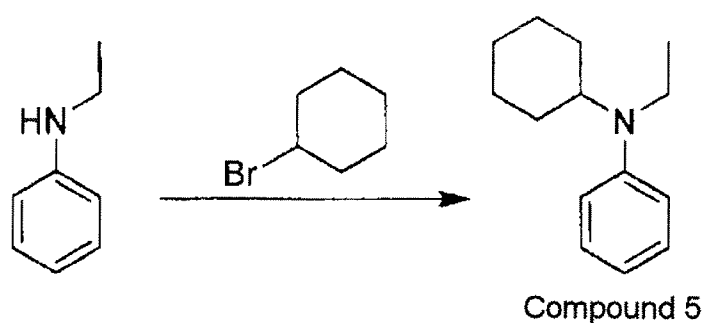
(1) 1-Bromonaphthalene (12.42 g, 0.06 mol), 3-aminopentane (5.75 g, 0.06 mol), sodium t-butoxide (8.07 g, 0.08 mol), $\text{Pd}_2(\text{dba})_3$ (0.003 eq. compared to 1-bromonaphthalene), and BINAP (0.008 eq. compared to 1-bromonaphthalene) were dissolved in 120 mL toluene and stirred at 70°C for 5 hours. After that, the temperature was brought back to the room

at 60°C, the precipitated crystals were filtered, washed with water, and dried to obtain 3.5 g of tristrifluoromethanesulfonyl methide salt of the Compound 4 as a blue crystal (i.e., triarylmethane compound 4-A).

[0056]

Synthetic Example 3 (synthesis of Compound 8-A)

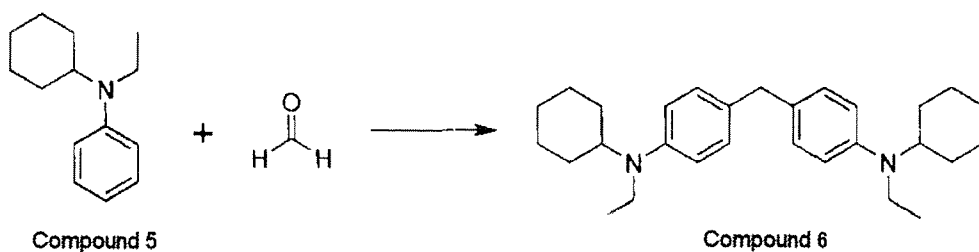
[Chemical Formula 6]



(1) N-Ethylaniline (12.12 g, 0.10 mol), bromocyclohexane (97.83 g, 0.60 mol), potassium carbonate (48.37 g, 0.35 mol), and copper iodide (1.90 g, 0.01 mol) were dissolved in DMF (10 mL) and reacted for 3 days at 120°C. After that, the temperature was brought back to the room temperature. The inorganic salt obtained after filtration was washed with dichloromethane. The filtrate was concentrated under reduced pressure to obtain a crude product, which was then purified by distillation under reduced pressure to obtain the Compound 5 as a target compound (11.45 g, 56%).

[0057]

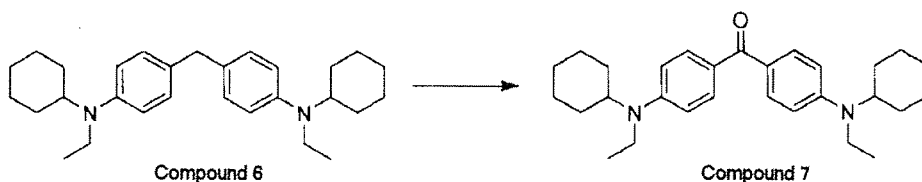
[Chemical Formula 7]



(2) To a mixture of the Compound 5 (11.20 g, 0.06 mol) obtained from the Synthetic Example 3-(1) and conc. hydrochloric acid (2.54 g, 0.07 mol), formalin (2.35 g, 0.03 mol) was slowly added dropwise and reacted for 12 hours at 80°C. 10 mL of dichloromethane and 50 mL of water were added thereto and neutralized by adding an aqueous solution of sodium hydroxide. The dichloromethane layer was extracted and concentrated under reduced pressure to obtain the Compound 6 (12.09 g, 96%).

[0058]

[Chemical Formula 8]

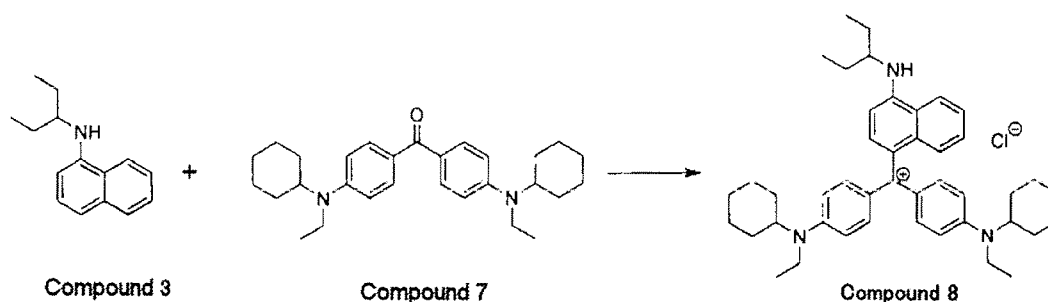


(3) Compound 6 (4.27 g, 0.02 mol) obtained from the Synthetic Example 3-(2) was dissolved in 140 mL of isopropyl alcohol, added with chloranil (3.16 g, 0.013 mol) and a 25% aqueous solution of sodium hypochlorite (9.35 g), and reacted for 7 hours at 75°C. The temperature was brought back to the room temperature, and the reaction solution was filtered under reduced pressure to remove the precipitates. The filtrate was

concentrated under reduced pressure and the residues were dissolved in toluene and washed four times with an aqueous solution of sodium hydroxide. The toluene layer was concentrated under reduced pressure to obtain the Compound 7 (7.12 g, 55%).

[0059]

[Chemical Formula 9]



(4) Compound 3 (1.26 g, 0.006 mol) obtained from the Synthetic Example 2-(1), Compound 7 (2.55 g, 0.006 mol) obtained from the Synthetic Example 3-(3), and oxyphosphorus chloride (1.0 g, 0.0065 mol) were dissolved in 3 mL toluene, and the mixture solution was reacted for 7 hours at 60°C. The temperature was brought back to the room temperature, and then liquid separation was carried out by adding water. The organic layer was concentrated under reduced pressure to obtain the Compound 8 (3.86 g, 98%).

[0060]

(5) Compound 8 (3.93 g, 0.006 mol) obtained from the Synthetic Example 3-(4) was dissolved in a mixture solution of water (10 mL) and methanol (40 mL). Under stirring for dissolving, a solution in which 3.21 g of tris(trifluoromethanesulfonyl)methylidene cesium salt is dissolved

in a mixture solution of DMF (3 mL) and methanol (20 mL) was added thereto. After stirring for three hours, the precipitated crystals were filtered, washed with water, and dried to obtain 1.62 g of the tristrifluoromethanesulfonyl methide salt of the Compound 8 as a blue crystal (i.e., triarylmethane compound 8-A).

[0061]

Synthetic Example 4 (production of binder resin (copolymer))

To a 500 mL four neck flask, 160 g of methyl ethyl ketone, 10 g of methacrylic acid, 33 g of benzyl methacrylate, and 1 g of α, α' -azobis(isobutyronitrile) were added and nitrogen gas was introduced to the flask for 30 min under stirring. The temperature was then raised to 80°C and the stirring was continued for four hours at 80 to 85°C. Once the reaction is completed, the mixture was cooled to the room temperature to obtain a colorless, transparent, and homogeneous copolymer solution. The copolymer solution was then precipitated in 1 : 1 mixture solution containing isopropyl alcohol and water and filtered. The solid matter was extracted and dried to obtain the copolymer (A). Weight average molecular weight of the copolymer (A) obtained as converted to polystyrene was 18000 and the acid value was 152.

[0062]

Example 1

5.4 g of the copolymer (A) as a binder resin, 6 g of KAYARAD DPHA (trade name: manufactured by NIPPON KAYAKU CO., LTD.) as

a photopolymerizable monomer, 1.5 g of IRGACURE 907 (trade name: manufactured by BASF Japan Ltd.) and 0.6 g of KAYACURE-DETX-S (trade name: manufactured by NIPPON KAYAKU CO., LTD.) as a photopolymerization initiator, 1.2 g of the Compound 2-A obtained from the Synthetic Example 1-(3) as a dye, and 20 g of cyclohexanone and 8.6 g of propylene glycol monomethyl ether acetate as solvents were admixed with one another to obtain the blue colored resin composition of the invention.

[0063]

Examples 2 to 4 were performed as follows.

Example 2: It has the same composition as the Example 1 except that the Compound 2-A is changed to the Compound 4-A of the Synthetic Example 2-(3).

Example 3: It has the same composition as the Example 1 except that the Compound 2-A is changed to the Compound 8-A of the Synthetic Example 3-(5).

Example 4: To the Example 2, 19 g of the blue pigment dispersion of the Comparative Example 1 below was added to obtain the blue colored resin composition of the invention.

[0064]

Comparative Example 1

After mixing with composition ratio of C. I. Pigment Blue 15:6/AJISPER-PB821/SOLSPERSE 5000/PGMEA = 15.0/6.0/1.0/78.0 (weight ratio), 400 parts by weight of zirconia beads (0.3 mm) were added. After treating for 60 min using a paint shaker followed by filtration, the blue pigment dispersion was obtained.

[0065]

Comparative Example 2: It has the same composition as the Example 1 except that the Compound 2-A is changed to Basic Blue 7.

[0066]

The colored resin composition obtained from the above (Example 1 to 4) was coated on the substrate and subjected to pre-baking under condition of 80°C × 100 sec. After that, it was cured by light exposure through a mask, developed with an aqueous alkali solution containing a surface active agent, rinsed with water, and heated at 200°C to obtain a blue colored pattern. The blue colored pattern obtained is a line and space pattern with resolution of 5 μm and residues or peeling of pixels were not identified. Thus, it was found that it can be applied for color filters for a solid-state imaging device wherein high resolution is required.

[0067]

Evaluation of heat resistance

Similar to those described above, the substrate for evaluation of heat resistance was prepared by coating each composition on a glass substrate, carrying out whole exposure, and treating the substrate at 200°C for 5 min for post-baking. Thereafter, each evaluation was carried out as described below.

First, spectral transmission ratio of the substrate for evaluation was determined by using a spectrophotometer and chromaticity was estimated based on the XYZ Color System. Thereafter, the substrate for evaluation was treated at 200°C

for 60 min and spectral transmission ratio was measured again. Finally, the color difference (ΔE_{ab}) was estimated for evaluation of heat resistance.

Results of heat resistance are given in the Table 1.

[0068]

[Table 1]

Table 1 Evaluation results of heat resistance

	(ΔE_{ab})
Example 1	2.6
Example 2	2.9
Example 3	2.5
Example 4	1.7
Comparative Example 1	0.7
Comparative Example 2	41.9

[0069]

According to the Table 1 in which results of the heat resistance evaluation are given, it was found that the Examples 1 to 4 of the invention show better results than the Comparative Example 2 using the same dye. It can be a natural result with respect to the Comparative Example 1, as it contains a pigment. The Example 4, in which a mixture with a pigment is used, also showed good resistance. The good results are maintained even when it is admixed with a pigment without yielding any precipitation, and therefore the dye-based colorant compound of the invention is shown to have a wide-range applicability.

[0070]

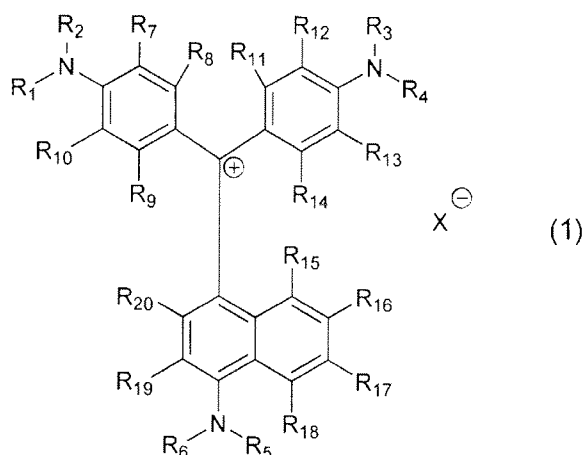
Based on the results obtained above, it was found that

the blue colored resin composition of the invention in which a specific blue colorant compound is used can be used for producing a color filter having high brightness and sufficient resistance, and therefore it can be also used for obtaining high quality blue pixels with high reliability. Further, depending on specific use, it can be also easily mixed and used with a pigment, showing a wide-range applicability. Thus, it is found to be industrially very useful.

CLAIMS

1. A colored resin composition for color filters comprising a colorant compound represented by the following formula (1), a binder resin, a solvent, and a curing agent.

[Chemical Formula 1]



(wherein, R_1 to R_6 each independently represent a hydrogen atom, an alkyl group having 1 to 6 carbon atoms, a phenyl group, or a benzyl group, provided that at least one of them is a branched alkyl group or a cyclic alkyl group; R_7 to R_{20} each independently represent a hydrogen atom, an alkyl group having 1 to 6 carbon atoms, or a halogen atom; and, anion part X^- represents tris(trifluoromethanesulfonyl)methide or bis(trifluoromethanesulfonyl)imide.)

2. The colored resin composition according to Claim 1, which comprises a copper phthalocyanine-based pigment.
3. A colored cured film for color filters obtained by patterning of the colored resin composition according to Claim

1 or 2.

4. A color filter comprising the colored curable film for color filters according to Claim 3.

5. A liquid crystal display device or an organic EL display device comprising the color filter according to Claim 4.

6. A solid-state imaging device comprising the color filter according to Claim 4.