

DESCRIPTION
PHOTOSENSITIVE BLACK RESIN COMPOSITION AND RESIN BLACK
MATRIX SUBSTRATE

5 TECHNICAL FIELD

[0001]

The present invention relates to a photosensitive black resin composition and a resin black matrix substrate.

BACKGROUND ART

10 [0002]

Conventionally, metal thin films utilizing chromium-based materials have been used as black matrix materials. In recent years, however, a resin black matrix composed of a resin and a light-shielding material is used in terms of costs and environmental pollution. The resin black matrix is obtained by applying a black resin composition containing a resin and a light-shielding material such as carbon black on a substrate, and drying it to form a black coated film, followed by forming a grid-like micropattern by photolithography.

[0003]

20 With recent downsizing of liquid crystal display devices and diversification of displayed contents from texts to images, color filters having a higher performance and a higher definition are required, and there is a growing demand for a resin black matrix having a higher light-shielding performance (OD value), a further thinness and fine line forming property. Although increasing the volume ratio of the light-shielding material serves to achieve a higher OD value and to provide a thinner film, it results in a decreased ratio of the resin in the black matrix, causing problems such as lower adhesion between the resin black matrix and a glass, and peeling of the resin black matrix during alkaline development. Therefore, a resin black matrix having a good adhesion during development to a glass substrate and capable of high-definition patterning is needed.

30 [0004]

A light-shielding film is also formed as a flame at the peripheral portion in substrates for touch panels, and even in the case where the volume ratio of the light-shielding material is increased as in color filters, a high adhesion during development

and high-definition patterning are required.

[0005]

In a photosensitive resin black matrix, however, photocuring by exposure is not easily initiated near the interface with the substrate, because the black matrix is light-shieldable by itself. As the light-shielding performance of the resin black matrix increases, the adhesion to the glass substrate during development becomes poorer, and hence, the light-shielding performance and the adhesion during development were in a trade-off relationship.

[0006]

Further, since a black resin composition having a high optical density contains a large number of inorganic particles as pigments, there were problems such as poor incompatibility with alkaline developers and missing of micropatterns during development.

[0007]

To solve these problems, tertiary amine compounds, trivalent phosphorus compounds, epoxy silane and the like are known as additives to increase the sensitivity of the resin black matrix and to initiate photopolymerization reaction even in the vicinity of the interface with the substrate (Patent Documents 1 to 3). However, it has been difficult to obtain a high-definition patterning substrate.

[0008]

On the other hand, as systems containing no pigment, a photosensitive resin composition containing an oxetane compound as an additive is known (Patent Documents 4 and 5). Further, with respect to the photosensitive resin composition containing pigments, it has been reported that a cured film composed of a resin of copolymer containing an oxetanyl group as a structural unit is effective in improving the physical adhesion to the substrate (Patent Document 6).

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0009]

Patent Document 1: JP 10-282325 A

Patent Document 2: JP 10-246955 A

Patent Document 3: JP 2004-347916 A

Patent Document 4: JP 2005-258460 A

Patent Document 5: JP 2001-228610 A

Patent Document 6: JP 2007-316506 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0010]

The present inventors have first focused on the adhesion during development, which serves as an index representing unlikelihood of peeling of micropatterns during development. The inventors have suspected that, in a film having a high optical density of the resin black matrix, the methods disclosed in Patent Documents 1 to 3 might be insufficient to initiate curing reaction at the substrate interface, possibly influencing the adhesion during development. In addition, since the adhesion during development is easily influenced by the underlying substrate, and the film has a poor adhesion to a soda-lime glass commonly used in touch panel applications, in particular, they have considered that it might be difficult to obtain a high-definition patterning substrate.

[0011]

Further, in the black resin composition having a high optical density of the resin black matrix and containing a large number of pigment particles, its compatibility with a developer has been insufficient and peeling of micropatterns has occurred during development. Therefore, the inventors have also focused on the compatibility.

[0012]

Embodiments of the present invention provide a black resin composition which, when a resin black matrix is formed on a glass substrate, has a good adhesion to the substrate during its development and a good compatibility with a developer, and is capable of high-definition patterning; as well as to provide a resin black matrix substrate using such a photosensitive black resin composition, and a light-shielding film for a color filter and a touch panel.

MEANS FOR SOLVING THE PROBLEMS

[0013]

Patent Documents 4 and 5 describe an oxetane compound, and disclose that a cured film after post-bake has an excellent physical adhesion to a substrate, an

excellent resolution and an excellent sensitivity. However, there is no disclosure regarding the adhesion to the substrate during development, and the application thereof to the black resin composition having a high optical density of the resin black matrix and containing a large number of pigment particles.

[0014]

On the other hand, Patent Document 6 discloses that, in the photosensitive resin composition containing pigments, a cured film after post-bake composed of a resin of copolymer having an oxetanyl group as a structural unit is effective in improving physical adhesion to a substrate. However, the disclosure is directed to the use of a copolymer, and no observation has been made regarding the adhesion to the substrate during development, and regarding the compatibility with a developer, which is often an issue in the black resin composition containing a large number of pigment particles.

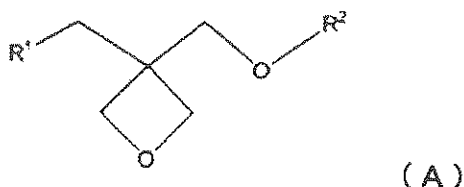
[0015]

Here, the present inventors have found that an addition of a specific oxetane compound in appropriate amount serves to solve the problems described above.

[0016]

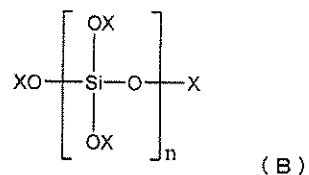
Embodiments of the present invention are achieved by the following constitution.

According to a first aspect, there is provided a photosensitive black resin composition comprising at least a light-shielding material, an alkali-soluble resin, a photopolymerization initiator and a solvent, wherein the photosensitive black resin composition comprises at least an oxetane compound having a structure represented by General Formula (A) below as an additive, wherein the oxetane compound comprises a silyl group and wherein the amount of the oxetane compound contained in the composition is 1.5 to 10.0% by weight relative to the total amount of the light-shielding material and the alkali-soluble resin:

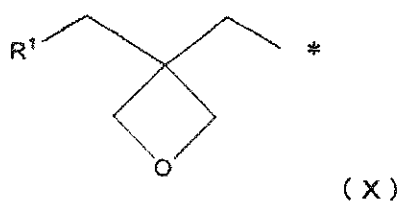


wherein R^1 and R^2 may be the same or different; R^1 represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent; and R^2 represents a hydrogen atom, a silyl group or an alkyl group having 1 to 10 carbon atoms, wherein the silyl group and the alkyl group may further comprise a substituent.

In an embodiment, the oxetane compound is represented by Structural Formula (B) below;



wherein X represents the oxetane compound below and n represents a natural number of 10 or less



wherein * represents a linking site; and R¹ represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent.

According to a second aspect, there is provided a resin black matrix substrate obtained by applying the above photosensitive black resin composition on a transparent substrate and then by forming a pattern.

EFFECT OF THE INVENTION

[0017]

The black resin composition as per embodiments of the present invention provide a resin black matrix substrate having an excellent adhesion during development and patterning accuracy.

MODE FOR CARRYING OUT THE INVENTION

[0018]

It is necessary that the photosensitive black resin composition of the present invention contains at least a light-shielding material, an alkali-soluble resin, a photopolymerization initiator and a solvent. The desirable properties thereof are described below.

[0019]

The photosensitive black resin composition of the present invention can be used to produce printing inks, ink jet inks, materials for photomask production, materials for proof printing production, etching resists, solder resists, bulkheads of plasma display panel (PDP), dielectric patterns, electrode (conductor circuit) patterns, circuit patterns of electronic components, conductive pastes, conductive films, light-shielding images such as black matrix (hereinafter referred to as "BM") or the like. Preferably, the black resin composition can be suitably used to set a light-shielding image (including BM), e.g., in a gap of a coloring pattern, vicinity portions, and in the side of the outside light of TFT to improve the display property of color filters for color liquid crystal display devices and the like, and can be suitably used for light-shielding films for touch panels.

[0020]

Especially preferably, the black resin composition is used in liquid crystal display devices, plasma display devices, EL display devices equipped with inorganic EL, CRT display devices, and display devices comprising a touch panel, as a BM such as black edges formed on the peripheral portion, grid-like or stripe-like black portions between color pixels of red, blue, and green, and, more preferably, as a BM such as dotted and linear black patterns for TFT light shielding.

[0021]

Examples of the light-shielding material used in the present invention include black pigments such as carbon black, titanium black, chromium oxide, iron oxide, aniline black, perylene pigments and C.I. Solvent Black 123; inorganic black

pigments such as composite oxides of carbon black, titanium, manganese, iron, copper, cobalt and the like coated with a resin; and mixtures of organic pigments and black pigments. Carbon black or titanium nitride is preferred for its high light-shielding performance.

5 [0022]

Examples of the alkali-soluble resin used in the present invention include epoxy resins, acrylic resins, siloxane polymer resins and polyimide resins. Acrylic resins or polyimide resins are preferred because they are excellent in storage stability of the composition and heat resistance of the coated film.

10 [0023]

As the acrylic resin, an acrylic resin having a carboxyl group is preferably used. The acrylic resin having a carboxyl group is preferably a copolymer of an unsaturated carboxylic acid and an ethylenically unsaturated compound. Examples of the unsaturated carboxylic acid include acrylic acid, methacrylic acid, itaconic acid, crotonic acid, maleic acid, fumaric acid and vinyl acetic acid. These may be used individually or in combination with another copolymerizable ethylenically unsaturated compound.

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[0024]

Examples of the copolymerizable ethylenically unsaturated compound include unsaturated carboxylic acid alkyl esters such as methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, *n*-propyl acrylate, isopropyl acrylate, *n*-propyl methacrylate, isopropyl methacrylate, *n*-butyl acrylate, *n*-butyl methacrylate, *sec*-butyl acrylate, *sec*-butyl methacrylate, *iso*-butyl acrylate, *iso*-butyl methacrylate, *tert*-butyl acrylate, *tert*-butyl methacrylate, *n*-pentyl acrylate, *n*-pentyl methacrylate, 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, benzyl acrylate, and benzyl methacrylate; aromatic vinyl compounds such as styrene, *p*-methylstyrene, *o*-methylstyrene, *m*-methylstyrene, and α -methylstyrene; unsaturated carboxylic acid aminoalkyl esters such as aminoethyl acrylate; unsaturated carboxylic acid glycidyl esters such as glycidyl acrylate and glycidyl methacrylate; carboxylic acid vinyl esters such as vinyl acetate and vinyl propionate; vinyl cyanide compounds such as acrylonitrile, methacrylonitrile, and α -chloroacrylonitrile; aliphatic conjugated dienes such as 1,3-butadiene and isoprene; and polystyrene, polymethylacrylate, polymethylmethacrylate, polybutylacrylate, and polybutylmethacrylate, each of

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which having an acryloyl group or a methacryloyl group at its terminal. In terms of solubility in alkaline developers, binary to quarternary copolymers having an average molecular weight (Mw) of from 2,000 to 100,000 and with an acid value of from 70 to 150 (mgKOH/g) selected from methacrylic acid, acrylic acid, methyl methacrylate, 2-hydroxyethyl methacrylate, benzyl methacrylate and styrene are preferred. If the values are outside these ranges, the dissolution rate of the polymer in an alkaline developer will be decreased or be too fast.

[0025]

Use of an acrylic resin having an ethylenically unsaturated group in the side chain is preferred, because the sensitivity during exposure and development will be improved. The ethylenically unsaturated group is preferably an acrylic group or a methacrylate group. Such an acrylic resin can be obtained by an addition reaction between the carboxyl group of an acrylic (co)polymer having a carboxyl group and an ethylenically unsaturated compound having a glycidyl group or an alicyclic epoxy group.

[0026]

Examples of the acrylic resin having an ethylenically unsaturated group in the side chain include an acrylic resin as described in known literature (JP 3120476 B and JP 8-262221 A), a photocurable resin "Cyclomer (registered trademark) P" (Daicel Chemical Industries, Ltd.), which is a commercially available acrylic resin, and an alkali soluble cardo resin. Among these, an acrylic resin having an ethylenically unsaturated group in the side chain with an average molecular weight (Mw) of from 2,000 to 100,000 (measured by gel permeation chromatography using tetrahydrofuran as an carrier, and calculated using a calibration curve of a standard polystyrene) and an acid value of from 70 to 150 (mgKOH/g) is preferred in terms of photosensitive properties, solubility in ester solvents and in alkaline developers.

[0027]

A monomer(s) can further be added to the photosensitive black resin composition of the present invention. Examples of the monomer include multifunctional or monofunctional acrylic monomers and oligomers. Examples of the multifunctional acrylic monomer include bisphenol A diglycidyl ether (meth)acrylate, poly (meth)acrylatecarbamate, denatured bisphenol A epoxy (meth)acrylate, adipic acid 1,6-hexanediol (meth)acrylic ester, phthalic anhydride

propylene oxide (meth)acrylic ester, trimellitic acid diethylene glycol (meth)acrylic ester, rosin-modified epoxydi(meth)acrylate, alkyd-modified (meth)acrylate, fluorene diacrylate-based oligomers as described in known literature (JP 3621533 B and JP 8-278630 A), tripropylene glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, 5 bisphenol A diglycidyl ether di(meth)acrylate, trimethylolpropane tri(meth)acrylate, pentaerythritol tri(meth)acrylate, triacrylformal, pentaerythritol tetra(meth)acrylate, dipentaerythritol hexa(meth)acrylate, dipentaerythritol penta(meth)acrylate, 2,2-bis[4-(3-acryloxy-2-hydroxypropoxy)phenyl]propane, bis[4-(3-acryloxy-2-hydroxypropoxy)phenyl]methane, bis[4-(3-acryloxy-2-10 hydroxypropoxy)phenyl]sulfone, bis[4-(3-acryloxy-2-hydroxypropoxy)phenyl]ether, 4,4'-bis[4-(3-acryloxy-2-hydroxypropoxy)phenyl]cyclohexane, 9,9-bis[4-(3-acryloxy-2-hydroxypropoxy)phenyl]fluorene, 9,9-bis[3-methyl-4-(3-acryloxy-2-hydroxypropoxy)phenyl]fluorene, 9,9-bis[3-chloro-4-(3-acryloxy-2-hydroxypropoxy)phenyl]fluorene, bisphenoxyethanol fluorene diacrylate, 15 bisphenoxyethanol fluorene dimethacrylate, bisresol fluorene diacrylate, and bisresol fluorene dimethacrylate. These may be used individually or in combination.

[0028]

Selection and combination of these multifunctional or monofunctional acrylic 20 monomers or oligomers enable control of resist sensitivity and workability. In order to increase the sensitivity, in particular, use of a compound having 3 or more functional groups is preferred. More preferred is a compound having 5 or more functional groups, and still more preferred is dipentaerythritol hexa(meth)acrylate or dipentaerythritol penta(meth)acrylate.

25 [0029]

In cases where pigments such as black pigments which absorb ultraviolet light effective for photo-crosslinking are used, combined use of (meth)acrylate containing a large number of aromatic rings and having a highly water-repellent fluorene ring in its molecule, with dipentaerythritol hexa(meth)acrylate or 30 dipentaerythritol penta(meth)acrylate is preferred, because a pattern can be controlled to a desired shape during development. Among these, using a mixture of 10 to 60 parts by weight of dipentaerythritol hexa(meth)acrylate and/or dipentaerythritol penta(meth)acrylate and 90 to 40 parts by weight of (meth)acrylate

having a fluorene ring, as the monomers, is preferred.

[0030]

Examples of the photopolymerization initiator include inorganic photopolymerization initiators such as benzophenone compounds, acetophenone compounds, oxanthone compounds, imidazole compounds, benzothiazole compounds, benzooxazole compounds, oxime ester compounds, carbazole compounds, triazine compounds, phosphorus compounds, and titanates.

[0031]

Specific examples include benzophenone, N,N'-tetraethyl-4,4'-diaminobenzophenone, 4-methoxy-4'-dimethylaminobenzophenone, 2,2-diethoxyacetophenone, benzoin, benzoin methyl ether, benzoin isobutyl ether, benzyldimethyl ketal, α -hydroxyisobutylphenone, thioxanthone, 2-chlorothioxanthone, 1-hydroxycyclohexyl phenyl ketone, 2-methyl-1-[4-(methylthio)phenyl]-2-morpholino-1-propane, 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butanone which is "Irgacure (registered trademark)" 369 (manufactured by Ciba Specialty Chemicals K. K.), 2-(dimethylamino)-2-[(4-methylphenyl)methyl]-1-[4-(4-morpholinyl)phenyl]-1-butanone which is "Irgacure (registered trademark)" 379 (manufactured by Ciba Specialty Chemicals K. K.), 2-[4-methylbenzyl]-2-dimethylamino-1-(4-morpholinophenyl)-butanone which is CGI-113 (manufactured by Ciba Specialty Chemicals K. K.), t-butylanthraquinone, 1-chloroanthraquinone, 2,3-dichloroanthraquinone, 3-chloro-2-methylanthraquinone, 2-ethylanthraquinone, 1,4-naphthoquinone, 9,10-phenanthraquinone, 1,2-benzoanthraquinone, 1,4-dimethylanthraquinone, 2-phenylanthraquinone, 2-(o-chlorophenyl)-4,5-diphenylimidazole dimer, 2-mercaptobenzothiazole, 2-mercaptobenzooxazole, 1,2-octanedione, 1-[4-(phenylthio)-2-(O-benzoyloxime)] which is "Irgacure (registered trademark)" OXE01 (manufactured by Ciba Specialty Chemicals K. K.), ethanone, 1-[9-ethyl-6-(2-methylbenzoyl)-9H-carbazol-3-yl]-, 1-(O-acetyloxime) which is "Irgacure (registered trademark)" OXE02, ethanone, 1-[9-ethyl-6-(2-methylbenzoyl)-9H-carbazol-3-yl]-, 1-(O-acetyloxime) which is CGI-242, 4-(p-methoxyphenyl)-2,6-di-(trichloromethyl)-s-triazine (manufactured by Ciba Specialty Chemicals K. K.), and carbazole compounds such as "ADEKA (registered trademark) OPTOMER" N-1818, N-1919 and "ADEKA (registered trademark) ARKLS" NCI-831 (above 3 manufactured by Asahi Denka Kogyo K.K.).

[0032]

Two or more types of these photopolymerization initiators can be used in combination. Among these, a combined use of two types selected from the group consisting of "Irgacure (registered trademark)" 379, "Irgacure (registered trademark)" OXE02, "ADEKA (registered trademark) OPTOMER" N-1919 and "ADEKA (registered trademark) ARKLS" NCI-831 is preferred, because a photosensitive black resin composition having a high sensitivity and a good property of pattern shape can be obtained.

[0033]

Further, an adhesion promoter can be added in order to improve the adhesion to inorganics such as a glass plate or a silicon wafer. As the adhesion promoter, for example, a silane coupling agent or a titanium coupling agent can be used. The amount of the adhesion promoter added is usually about 0.2 to 20% by weight based on the weight of the polyimide resin or the acrylic resin.

[0034]

In addition, a polymeric dispersant can be added to the photosensitive black resin composition of the present invention, for the purpose of improving the dispersion stability of the light-shielding material. Examples of the polymeric dispersant include polyethyleneimine polymeric dispersant, polyurethane polymeric dispersant and polyallylamine polymeric dispersant. It is preferable that such a polymeric dispersant be added to the extent that the photosensitivity and the adhesion do not decrease. The amount to be added is usually about 1 to 40% by mass relative to the light shielding material.

[0035]

In the photosensitive black resin composition of the present invention, the weight ratio of the light-shielding material/resin component is preferably within the range of 80/20 to 40/60, more preferably within the range of 75/25 to 50/50, in terms of the balance among adhesion, ease of patterning and OD value. The resin component herein refers to the total weight of the polymers, monomers, oligomers and polymeric dispersant. While too low an amount of the resin component results in a poor adhesion of the black coated film to the substrate, too low an amount of the light-shielding material results in a decrease in the optical density per thickness (OD value/ μm), both of which pose problems.

[0036]

As the solvent used in the black resin composition of the present invention, water or an organic solvent can be used depending on the dispersion stability of the pigments to be dispersed and the solubility of the resin to be added and the like.

5 Examples of the organic solvent include esters, aliphatic alcohols, (poly)alkylene glycol ether solvents, ketones, amide polar solvents and lactone polar solvents. A mixed solvent of two or more of these is also preferred. A mixed solvent with an organic solvent(s) other than these is also preferred.

[0037]

10 Since an acrylic resin is preferably used as the alkali-soluble resin, the organic solvent is preferably an organic solvent which dissolves the acrylic resin. Specific examples include benzyl acetate (boiling point 214°C), ethyl benzoate (boiling point 213°C), methyl benzoate (boiling point 200°C), diethyl malonate (boiling point 199°C), 2-ethylhexyl acetate (boiling point 199°C), 2-butoxyethyl acetate (boiling point 192°C), propylene glycol monoethyl ether acetate (boiling point 188°C), diethyl oxalate (boiling point 185°C), ethyl acetoacetate (boiling point 181°C), cyclohexyl acetate (boiling point 174°C), 3-methoxy-butyl acetate (boiling point 173°C), methyl acetoacetate (boiling point 172°C), ethyl-3-ethoxy propionate (boiling point 170°C), 2-ethyl butyl acetate (boiling point 162°C), isopentyl propionate (boiling point 160°C), propylene glycol monomethyl ether propionate (boiling point 160°C), propylene glycol monoethyl ether acetate (boiling point 158°C), pentyl acetate (boiling point 150°C) and propylene glycol monomethyl ether acetate (boiling point 146°C).

[0038]

25 Examples of the solvent other than those described above include: (poly)alkylene glycol ether solvents such as ethylene glycol monomethyl ether (boiling point 124°C), ethylene glycol monoethyl ether (boiling point 135°C), propylene glycol monoethyl ether (boiling point 133°C), diethylene glycol monomethyl ether (boiling point 193°C), monoethyl ether (boiling point 135°C), methyl carbitol (boiling point 194°C), ethyl carbitol (202°C), propylene glycol monomethyl ether (boiling point 120°C), propylene glycol monoethyl ether (boiling point 133°C), propylene glycol tertiary butyl ether (boiling point 153°C) and dipropylene glycol monomethyl ether (boiling point 188°C); aliphatic esters such as

ethyl acetate (boiling point 77°C), butyl acetate (boiling point 126°C) and isopentyl acetate (boiling point 142°C); aliphatic alcohols such as butanol (boiling point 118°C), 3-methyl-2-butanol (boiling point 112°C) and 3-methyl-3-methoxybutanol (boiling point 174°C); ketones such as cyclopentanone and cyclohexanone; xylene (boiling point 144°C), ethylbenzene (boiling point 136°C) and solvent naphtha (petroleum fraction: boiling point 165 to 178°C).

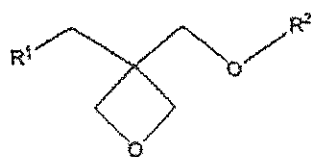
[0039]

As the size of substrates increases, coating with a die coating apparatus is becoming predominant. Therefore, the solvent is preferably a mixed solvent of two or more components in order to achieve an appropriate volatility and drying properties. In cases where the boiling points of all the solvents constituting the mixed solvent are 150°C or less, many problems arise such as inability to obtain a uniform film thickness; an increase in film thickness after coating; and occurrence of streaking in the coated film due to aggregation of pigments at a nozzle part from where the coating solution is ejected through a slit. On the other hand, in cases where the mixed solvent contains many solvents having a boiling point of 200°C or more, the surface of the coated film becomes adhesive, and sticking occurs. Therefore, a mixed solvent containing 30 to 75% by mass of solvents having a boiling point of 150°C to 200°C is preferred.

[0040]

The oxetane compound which is the additive of the present invention has a structure represented by General Formula (A) below:

[0041]



(A)

[0042]

(wherein R^1 and R^2 may be the same or different; R^1 represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent; and R^2 represents a hydrogen atom, a silyl group or an alkyl group having 1 to 10 carbon atoms, wherein the silyl group and the alkyl group may

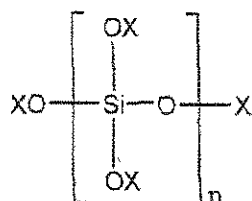
further comprise a substituent).

In General Formula (A) above, examples of the substituent in cases where the alkyl group further comprises a substituent include an alkoxy group, an acryloyl group, an acetoxyl group and a silyl group. In cases where R^2 is an alkyl group having 1 to 10 carbon atoms, R^2 preferably contains an oxetanyl group. In cases where the silyl group further comprises a substituent, examples of the substituent include an alkyl group, an alkoxy group, an acryloyl group and an acetoxyl group, and they preferably contain an oxetanyl group.

[0043]

Further, in order to obtain sufficient effect of the invention, R^2 is preferably a silyl group, and more preferably, the oxetane compound is an oxetane compound represented by Structural Formula (B) below:

[0044]

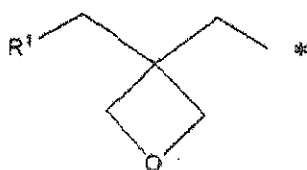


(B)

[0045]

(wherein X represents the oxetane compound below and n represents a natural number of 10 or less).

[0046]



(X)

[0047]

(wherein * represents a linking site; and R^1 represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent).

Among the oxetane compounds represented by Structural Formula (B) above,

an oxetane compound wherein n is within the range of 3 to 6 is preferred. Also in Structural Formula (B) above, examples of the substituent in cases where the alkyl group further comprises a substituent include an alkoxy group, an acryloyl group and an acetoxy group.

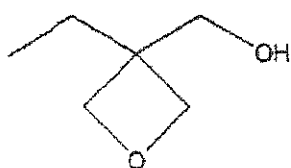
[0048]

The added amount of such an oxetane compound is preferably from 1.5 to 10.0% by weight relative to the total amount of the light-shielding material and the alkali-soluble resin. The amount is more preferably from 1.5 to 5.0% by weight so that the solubility in alkaline developers will not be too high.

[0049]

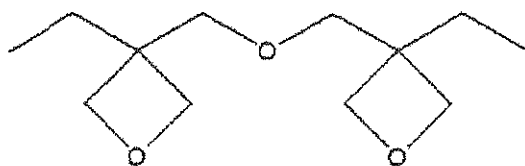
Examples of oxetane compounds having no silicon atom include "ARONE OXETANE (registered trademark)" OXT-101 (3-ethyl-3-hydroxymethyloxetane) represented by General Formula (C) below, "ARONE OXETANE (registered trademark)" OXT-221 (3-ethyl-3-[(3-ethyloxetane-3-yl)methoxy]methyl}oxetane) represented by General Formula (D) below, "ARONE OXETANE (registered trademark)" OXT-121 (principal component: 1,4-bis{[(3-ethyl-3-oxetanyl)methoxy]methyl}benzene) (all of the above manufactured by TOAGOSEI CO., LTD.), "ETERNACOLL (registered trademark)" OXBP (bis[(3-ethyl-3-oxetanyl)methyl]biphenyl-4,4'-dicarboxylate) and "ETERNACOLL" OXTP (bis[(3-ethyl-3-oxetanyl)methyl]terephthalate) (the above two manufactured by Ube Industries, Ltd.):

[0050]



(C)

[0051]

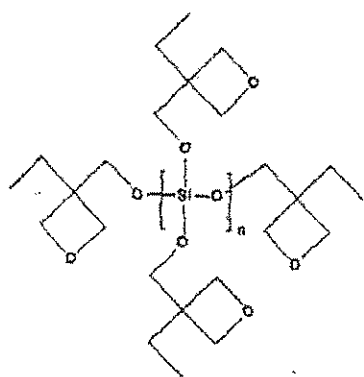


(D).

[0052]

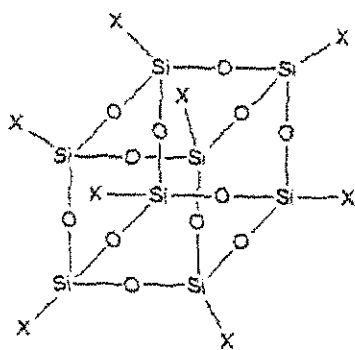
Examples of oxetane compounds having a silyl group include "ARONE OXETANE (registered trademark)" OXT-191 (a condensation reaction product of 3-ethyloxetane-3-yl methanol and a silane tetraol polycondensate; manufactured by TOAGOSEI CO., LTD.) represented by General Formula (E) below, wherein the average of n in the above Structural Formula (B) is 5; an oxetane compound having a silsesquioxane structure (for example, OX-SQ TX-100 and OX-SQ SI-20; manufactured by TOAGOSEI CO., LTD.) represented by Structural Formula (F1) or (F2) below; "ARONE OXETANE (registered trademark)" TMSOX (3-ethyl-3-((3-(trimethoxycyrl)propoxy)methyl)oxetane) (manufactured by TOAGOSEI CO., LTD.) represented by General Formula (G) below, (oxetane-3-yl)methyltrimethoxysilane, (oxetane-3-yl)methyltriethoxysilane, (oxetane-3-yl)methyltriacetoxysilane, [(oxetane-3-yl)methyl]methyldimethoxysilane, [(oxetane-3-yl)methyl]methyldiethoxysilane, [(oxetane-3-yl)methyl]methyldiacetoxysilane, [(oxetane-3-yl)methyl]ethyldimethoxysilane, [(oxetane-3-yl)methyl]ethyldiethoxysilane, [(oxetane-3-yl)methyl]ethyldiacetoxysilane, [(oxetane-3-yl)methyl]phenyldimethoxysilane, [(oxetane-3-yl)methyl]phenyldiethoxysilane, [(oxetane-3-yl)methyl]phenyldiacetoxysilane, di[(oxetane-3-yl)methyl]dimethoxysilane, di[(oxetane-3-yl)methyl]diethoxysilane, di[(oxetane-3-yl)methyl]diacetoxysilane, di[(oxetane-3-yl)methyl]methoxysilane, di[(oxetane-3-yl)methyl]methylethoxysilane, di[(oxetane-3-yl)methyl]methylacetoxysilane, di[(oxetane-3-yl)methyl]ethylmethoxysilane, di[(oxetane-3-yl)methyl]ethylethoxysilane, di[(oxetane-3-yl)methyl]ethylacetoxysilane, di[(oxetane-3-yl)methyl]phenylmethoxysilane, di[(oxetane-3-yl)methyl]phenylethoxysilane, di[(oxetane-3-yl)methyl]phenylacetoxysilane, tri[(oxetane-3-yl)methyl]methoxysilane, tri[(oxetane-3-yl)methyl]ethoxysilane and tri[(oxetane-3-yl)methyl]acetoxysilane. A mixture of two or more types of these oxetane compounds can be used in the present invention.

[0053]



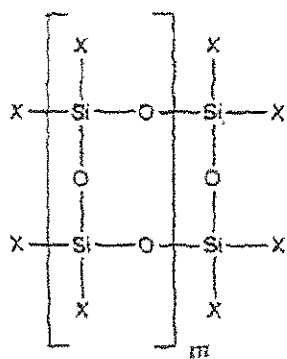
(E)

[0054]



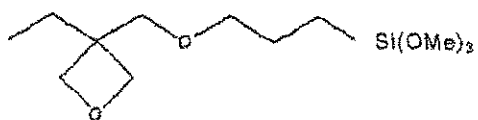
(F1)

5



(F2)

[0055]



(G)

[0056]

Further, a surfactant can also be added to the photosensitive black resin composition of the present invention in order to improve the coating properties and the smoothness of the colored coated film while preventing occurrence of Benard cells. The amount of the surfactant added is preferably from 0.001 to 10% by weight, more preferably from 0.01 to 1% by weight relative to the amount of the pigment. If the added amount is too small, the effect of improving the coating properties and the smoothness of the colored coated film and of preventing occurrence of Benard cells cannot be attained. If the added amount is too large, on the other hand, physical properties of the coated film may be deteriorated.

Examples of the surfactant include anionic surfactants such as ammonium lauryl sulfate and polyoxyethylene alkyl ether sulfate triethanolamine; cationic surfactants such as stearylamine acetate and lauryltrimethyl ammonium chloride; amphoteric surfactants such as lauryldimethyl amine oxide and lauryl carboxymethyl hydroxyethyl imidazolium betaine; nonionic surfactants such as polyoxyethylene lauryl ether, polyoxyethylene stearyl ether, and sorbitan monostearate; silicone surfactants having polydimethylsiloxane and the like as the main skeleton; and fluorochemical surfactants. One or more than one types of these surfactants can be used in the present invention.

[0057]

The total solids concentration of the resin component (including monomers, oligomers, and additives such as a photopolymerization initiator) and the light-shielding material in the photosensitive black resin composition of the present invention is preferably from 2 to 30%, more preferably from 5 to 20%, in terms of coating properties and drying properties. Accordingly, the photosensitive black resin composition of the present invention preferably consists essentially of a solvent, a resin component and a light-shielding material, and the total amount of the resin component and the light-shielding material is preferably from 2 to 30%, more preferably from 5 to 20%. The balance excluding the solids is the solvent, which may further include a surfactant as described above.

[0058]

Examples of methods for producing the photosensitive black resin

composition of the present invention include a method in which pigments are dispersed directly in a resin solution using a disperser, and a method in which pigments are dispersed in water or an organic solvent using a disperser to produce a pigment dispersion liquid, which is then mixed with a resin solution. Examples of methods for dispersing pigments include those using a ball mill, a sand grinder, a triple roll mill, and a high speed impact mill. A method using a bead mill is preferred in terms of dispersion efficiency and microdispersion performance. Examples of the bead mill include a co-ball mill, a basket mill, a pin mill and a DYNO mill. Examples of beads for the bead mill include titania beads, zirconia beads and zircon beads. The diameter of the beads used for dispersion is preferably from 0.01 to 5.0 mm, more preferably from 0.03 to 1.0 mm. In cases where the primary particle size of the pigments and the size of secondary particles formed by aggregation of the primary particles are small, use of fine dispersion beads of 0.03 to 0.10 mm is preferred. In this case, it is preferred that dispersion be carried out by using a bead mill equipped with a centrifugal separator capable of separating the fine dispersion beads from a dispersion liquid. In cases where pigments containing larger submicron particles are dispersed, use of dispersion beads with a size of 0.10 mm or more is preferred because sufficient grinding strength can be attained to finely disperse the pigments.

[0059]

The resin BM substrate of the present invention is produced by methods described below. Examples of methods for applying the photosensitive black resin composition on a transparent substrate include dip method, roll coater method, spinner method, die coating method, a method using a wire bar, a method in which a transparent substrate is immersed in a solution of the photosensitive black resin composition, and a method in which a solution of the photosensitive black resin composition is nebulized to a transparent substrate. Examples of the transparent substrate include inorganic glasses such as quartz glass, borosilicate glass, aluminosilicate glass, and soda-lime glass whose surface is coated with silica; and organic plastic films and sheets. When coating on a substrate, treatment of the substrate surface with an adhesive promoter such as silane coupling agent, aluminum chelating agent or titanium chelating agent can improve the adhesion between the BM coated film and the substrate.

[0060]

After applying the photosensitive black resin composition on a transparent substrate, the resultant is heat dried and cured by air drying, heat drying, vacuum drying or the like to form a dried coated film. In order to prevent drying
5 unevenness or conveyance unevenness during the film formation, it is preferable that the transparent substrate applied with the coating solution is dried under reduced pressure with a reduced pressure drying apparatus equipped with a heater, followed by heat drying and curing.

[0061]

10 The dried coated film thus obtained is usually patterned using a method such as photolithography. The dried coated film obtained from the photosensitive resin can be subjected to exposure and development as it is or after forming an oxygen-impermeable film on its surface, to form a desired pattern. Then the resultant is heat-cured after removing the oxygen-impermeable film as required, to obtain a resin
15 BM substrate. The heat-curing conditions vary depending on the resin. In cases where an acrylic resin is used, heat treatment is usually carried out at 200 to 250°C for 1 to 60 minutes.

[0062]

The resin BM substrate of the present invention can be used to produce a
20 color filter substrate for a liquid crystal display or a light-shielding film for a touch panel. Specifically, the present invention can provide a color filter substrate for a liquid crystal display and a light-shielding film for a touch panel comprising the resin BM substrate of the present invention. The above mentioned color filter is a color filter comprising at least a resin BM substrate in which a resin BM is formed on a
25 partial region of a transparent substrate; and pixels formed on the region of the substrate where the resin BM is not formed; wherein the resin BM substrate is the resin BM substrate of the present invention.

EXAMPLES

[0063]

30 The present invention will now be described in further detail with reference to Examples and Comparative Examples, but the present invention is not limited thereto.

[0064]

Example 1

To titanium nitride particles (manufactured by Nisshin Engineering Inc.; 400 g) produced by thermal plasma method and a methyl methacrylate/methacrylic acid/styrene copolymer (weight ratio: 30/40/30) as an acrylic resin synthesized according to the method described in a known literature (JP 3120476 B), 40 parts by weight of glycidyl methacrylate were added. The resulting mixture was redeposited with purified water, filtered, and dried to obtain acrylic resin (P-1) having an average molecular weight (Mw) of 15,000 and an acid value of 110 (mgKOH/g). A 40% by weight solution of the resulting acrylic resin (P-1) in propylene glycol monomethyl ether acetate (187.5 g), a polymeric dispersant (BYK21116; manufactured by BYK-Chemie; 62.5 g), and propylene glycol monoethyl ether acetate (890g) were charged into a tank, and stirred with a homomixer (manufactured by Tokusyu Kika Kogyo) for 1 hour to obtain pre-dispersion liquid 1. Then pre-dispersion liquid 1 was supplied to Ultra Apex Mill (manufactured by KOTOBUKI INDUSTRIES CO., LTD.) equipped with a centrifugal separator 70% filled with zirconia beads with a diameter of 0.10 mm (manufactured by Toray Industries, Inc.), and dispersion was carried out at a rotational speed of 8 m/s for 2 hours, to obtain titanium black pigment dispersion liquid TB-1 with a solids concentration of 25% by weight and pigment/resin (weight ratio) = 80/20.

[0065]

Carbon black (TPX1291; manufactured by Cabot Corporation, 400 g), a 40% by weight solution of acrylic resin (P-1) in propylene glycol monomethyl ether acetate (187.5g), a polymeric dispersant (BYK21116; 62.5 g) and propylene glycol monoethyl ether acetate (890g) were charged into a tank, and stirred with a homomixer for 1 hour to obtain pre-dispersion liquid 2. Then pre-dispersion liquid 2 was supplied to Ultra Apex Mill equipped with a centrifugal separator 70% filled with zirconia beads with a diameter of 0.10 mm, and dispersion was carried out at a rotational speed of 8 m/s for 2 hours, to obtain carbon black pigment dispersion liquid CB-1 with a solids concentration of 20% by weight and pigment/resin (weight ratio) = 80/20.

[0066]

To propylene glycol monoethyl ether acetate (14.31 g), "ADEKA (registered trademark) ARKLS" NCI-831 (1.69g) was added as a photopolymerization initiator, and the resulting mixture was stirred until solids were dissolved.

[0067]

Further, a 40% by weight solution of acrylic polymer (P-1) in propylene glycol monomethyl ether acetate (5.50 g), a 50% by weight solution of dipentaerythritol hexaacrylate (manufactured by Nippon Kayaku Co., Ltd.) in propylene glycol monoethyl ether acetate (3.61 g) as a multifunctional monomer, a 50% by weight solution of "ARONE OXETANE" OXT-191, which is an oxetane compound, (hereinafter referred to as "oxetane compound 1"; manufactured by TOAGOSEI CO., LTD.) in propylene glycol monoethyl ether acetate (0.41 g) as an adhesion promoter, KBM5103 (manufactured by Shin-Etsu Chemical Co., Ltd.; 0.41 g), and a 10% by weight solution of silicone surfactant BYK333 in propylene glycol monoethyl ether acetate (0.24 g) as a surfactant were added, and the resulting mixture was stirred at room temperature for 1 hour to obtain a photosensitive resist. To the photosensitive resist were added 13.93 g of pigment dispersion liquid 1 and 19.90 g of pigment dispersion liquid 2 described above to obtain photosensitive black resin composition 1 having a total solids concentration of 23% and pigment/resin (weight ratio) = 46/54.

[0068]

The obtained photosensitive black resin composition 1 was filtered through a 2 μ m Teflon (registered trademark) filter, and the filtrate was then applied on a soda-lime glass substrate with a spin-coating apparatus (1H-DS; manufactured by MIKASA CO., LTD.) so as to achieve a film thickness of 1 μ m (after post-bake). The coated substrate was heat treated with a pin-like protrusion on a hot plate at a temperature of 90°C for 2 minutes. Then the substrate was directly placed on a hot plate and pre-baked for another 2 minutes. The resulting coated film was exposed to ultraviolet light at a light exposure of 200 mJ/cm² through a mask for resolution test, using a mask aligner (PEM-6M; manufactured by UNION OPTICAL CO., LTD.).

[0069]

The resultant was then developed with a 0.1% by weight aqueous TMAH solution as an alkaline developer, and washed with pure water to obtain a patterning substrate. The resulting patterning substrate was kept in a hot air oven at 230°C for 30 minutes to perform post-bake to obtain resin BM substrate 1.

[0070]

Example 2

The same operation as in Example 1 was carried out except that OX-SQ TX-100 (hereinafter referred to as "oxetane compound 2"; manufactured by TOAGOSEI CO., LTD.), which is an oxetane compound having a silsesquioxane structure, was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 2. Using the obtained photosensitive black resin composition 2, resin BM substrate 2 was obtained in the same manner as in Example 1.

[0071]

Example 3

The same operation as in Example 1 was carried out except that OX-SQ SI-20 (hereinafter referred to as "oxetane compound 3"; manufactured by TOAGOSEI CO., LTD.), which is an oxetane compound having a silsesquioxane structure, was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 3. Using the obtained photosensitive black resin composition 3, resin BM substrate 3 was obtained in the same manner as in Example 1.

[0072]

Example 4

The same operation as in Example 1 was carried out except that "ARONE OXETANE (registered trademark)" TMSOX (hereinafter referred to as "oxetane compound 4"; manufactured by TOAGOSEI CO., LTD.) was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 4. Using the obtained photosensitive black resin composition 4, resin BM substrate 4 was obtained in the same manner as in Example 1.

[0073]

Example 5

The same operation as in Example 1 was carried out except that "ARONE OXETANE (registered trademark)" OXT-101 (hereinafter referred to as "oxetane compound 5"; manufactured by TOAGOSEI CO., LTD.) was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 5. Using the obtained photosensitive black resin

composition 5, resin BM substrate 5 was obtained in the same manner as in Example 1.

[0074]

Example 6

5 The same operation as in Example 1 was carried out except that "ARONE OXETANE (registered trademark)" OXT-221 (hereinafter referred to as "oxetane compound 6"; manufactured by TOAGOSEI CO., LTD.) was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 6. Using the obtained photosensitive black resin
10 composition 6, resin BM substrate 6 was obtained in the same manner as in Example 1.

[0075]

Example 7

15 The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to 3.0% to obtain photosensitive black resin composition 7. Using the obtained photosensitive black resin composition 7, resin BM substrate 7 was obtained in the same manner as in Example 1.

[0076]

20 Example 8

 The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to 5.0% to obtain photosensitive black resin composition 8. Using the obtained photosensitive black resin composition 8, resin BM substrate 8 was obtained in the
25 same manner as in Example 1.

[0077]

Example 9

 The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to
30 7.0% to obtain photosensitive black resin composition 9. Using the obtained photosensitive black resin composition 9, resin BM substrate 9 was obtained in the same manner as in Example 1.

[0078]

Example 10

The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to 10.0% to obtain photosensitive black resin composition 10. Using the obtained
5 photosensitive black resin composition 10, resin BM substrate 10 was obtained in the same manner as in Example 1.

[0079]

Example 11

To propylene glycol monoethyl ether acetate (19.05 g), "ADEKA (registered
10 trademark) ARKLS" NCI-831 (1.69g) was added as a photopolymerization initiator, and the resulting mixture was stirred until solids were dissolved. Further, a 40% by weight solution of acrylic polymer (P-1) in propylene glycol monomethyl ether acetate (6.73 g), a 50% by weight solution of dipentaerythritol hexaacrylate (manufactured by Nippon Kayaku Co., Ltd.) in propylene glycol monoethyl ether
15 acetate (3.62g) as a multifunctional monomer, a 50% by weight solution of OXT-191 (manufactured by TOAGOSEI CO., LTD.), which is an oxetane compound, in propylene glycol monoethyl ether acetate (0.41 g) as an adhesion promoter, KBM5103 manufactured by Shin-Etsu Chemical Co., Ltd. (0.41 g), and a 10% by weight solution of silicone surfactant BYK333 in propylene glycol monoethyl ether
20 acetate (0.24g) as a surfactant were added, and the resulting mixture was stirred at room temperature for 1 hour to obtain a photosensitive resist. To the photosensitive resist was added 27.84 g of titanium black pigment dispersion liquid TB-1 described above to obtain photosensitive black resin composition 11 having a total solids concentration of 23% and pigment/resin (weight ratio) = 46/54. Using the obtained
25 photosensitive black resin composition 11, resin BM substrate 11 was obtained in the same manner as in Example 1.

[0080]

Example 12

To propylene glycol monoethyl ether acetate (9.57 g), "ADEKA (registered
30 trademark) ARKLS" NCI-831 (1.69 g) was added as a photopolymerization initiator, and the resulting mixture was stirred until solids were dissolved. Further, a 40% by weight solution of acrylic resin (P-1) in propylene glycol monomethyl ether acetate (4.28 g), a 50% by weight solution of dipentaerythritol hexaacrylate (manufactured

by Nippon Kayaku Co., Ltd.) in propylene glycol monoethyl ether acetate (3.60g) as a multifunctional monomer, a 50% by weight solution of OXT-191 (manufactured by TOAGOSEI CO., LTD.), which is an oxetane compound, in propylene glycol monoethyl ether acetate (0.41 g) as an adhesion promoter, KBM5103 (0.41 g), and a 10% by weight solution of silicone surfactant BYK333 in propylene glycol monoethyl ether acetate (0.24g) as a surfactant were added, and the resulting mixture was stirred at room temperature for 1 hour to obtain a photosensitive resist. To the photosensitive resist was added 19.9 g of carbon black pigment dispersion liquid CB-1 to obtain photosensitive black resin composition 12 having a total solids concentration of 23% and pigment/resin (weight ratio) = 46/54. Using the obtained photosensitive black resin composition 12, resin BM substrate 12 was obtained in the same manner as in Example 1.

[0081]

Comparative Example 1

The same operation as in Example 1 was carried out except that tetramethyl orthosilicate was used instead of oxetane compound 1 as the adhesion promoter to be used, to obtain photosensitive black resin composition 13. Using the obtained photosensitive black resin composition 13, resin BM substrate 13 was obtained in the same manner as in Example 1.

[0082]

Comparative Example 2

The same operation as in Example 1 was carried out except that oxetane compound was not added as the adhesion promoter to be used to obtain photosensitive black resin composition 14. Using the obtained photosensitive black resin composition 14, resin BM substrate 14 was obtained in the same manner as in Example 1.

[0083]

Comparative Example 3

The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to 0.5% to obtain photosensitive black resin composition 15. Using the obtained photosensitive black resin composition 15, resin BM substrate 15 was obtained in the same manner as in Example 1.

[0084]

Comparative Example 4

The same operation as in Example 1 was carried out except that the added amount of oxetane compound 1 as the adhesion promoter to be used was changed to 13.0% to obtain photosensitive black resin composition 16. Using the obtained photosensitive black resin composition 16, resin BM substrate 16 was obtained in the same manner as in Example 1. The pattern shape, adhesion during development and OD value of the resulting resin BM substrate 16 were evaluated according to the method below. The results are shown in Table 1.

[0085]

[Adhesion during development]

Resin BMs having different line widths were prepared in the same manner as described above, and visual assessment was performed for each line width if any peeling or chip has occurred. Those having no chip or peeling were determined as ○, those having a chip(s) and/or a peeling(s) were determined as ×.

[0086]

[Pattern linearity]

The linearity of the patterned portions was evaluated using BH-C1410 (manufactured by Olympus Corporation). Those having a good linearity were determined as ○, those having a tortuosity or a chip(s) at the edge of the shape were determined as either Δ or × depending on the degree.

[0087]

[OD value]

The OD value is a value calculated using X-rite 361T (visual) densitometer according to the equation below:

$$\text{OD value} = \log_{10} (I_0/I)$$

wherein I_0 represents the incident light intensity, and I represents the transmitted light intensity. Since the OD value correlates to the film thickness, and the level of the light-shielding performance correlates to the film thickness, the OD value per 1.0 μm is used as the OD value of the present invention.

[0088]

As shown in Table 1, addition of an oxetane compound as an adhesion promoter improved the pattern linearity regardless of the types of the substituent in

the side chain. Further, addition of an oxetane compound containing a silyl group enabled to provide a photosensitive black resin composition excellent in both the adhesion during development and the pattern linearity.

[0089]

- 5 The addition of the oxetane compound in amount of 1.5% or less or 10.0% or more relative to the paste solids resulted in a poor adhesion during development. Therefore, the appropriate amount to be added is preferably from 1.5 to 10.0%.

[0090]

- 10 In Comparative Example 1, tetramethyl orthosilicate having no oxetane ring and having a silyl group alone was added, and no improvement in both the adhesion during development and pattern linearity was observed. Thus, it has been revealed that the oxetane compound having a silyl group, which is the requirement of the present invention, serves to improve the developability and the pattern linearity of the photosensitive black resin composition.

- 15 [0091]

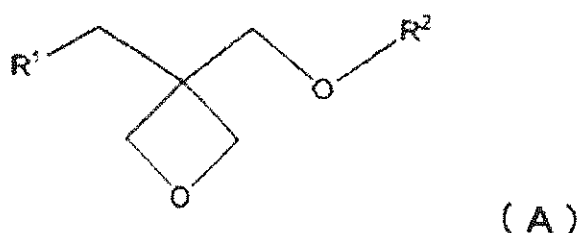
[Table 1]

	Pigment dispersion liquid	Adhesion promoter	Added amount	Adhesion during development	Linearity	OD value
Example 1	TB-1/CB-1	oxetane compound 1	1.5%	○	◎	3.12
Example 2	TB-1/CB-1	oxetane compound 2	1.5%	○	○	3.20
Example 3	TB-1/CB-1	oxetane compound 3	1.5%	○	○	3.15
Example 4	TB-1/CB-1	oxetane compound 4	1.5%	○	○	3.18
Example 5	TB-1/CB-1	oxetane compound 5	1.5%	△	○	3.17
Example 6	TB-1/CB-1	oxetane compound 6	1.5%	○	△	3.27
Example 7	TB-1/CB-1	oxetane compound 1	3.0%	○	◎	3.15
Example 8	TB-1/CB-1	oxetane compound 1	5.0%	○	◎	3.27

Example 9	TB-1/CB-1	oxetane compound 1	7.0%	○	⊙	3.32
Example 10	TB-1/CB-1	oxetane compound 1	10.0%	△	△	3.37
Example 11	TB-1	oxetane compound 1	1.5%	⊙	⊙	3.10
Example 12	CB-1	oxetane compound 1	1.5%	○	○	3.32
Comparative Example 1	TB-1/CB-1	tetramethyl orthosilicate	1.5%	×	×	3.22
Comparative Example 2	TB-1/CB-1	none	-	×	×	2.99
Comparative Example 3	TB-1/CB-1	oxetane compound 1	0.5%	△	×	2.99
Comparative Example 4	TB-1/CB-1	oxetane compound 1	13.0%	×	×	3.43

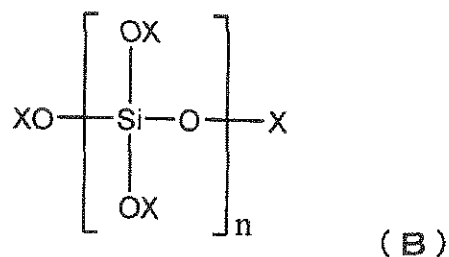
CLAIMS

1. A photosensitive black resin composition comprising at least a light-shielding material, an alkali-soluble resin, a photopolymerization initiator and a solvent, wherein said photosensitive black resin composition comprises at least an oxetane compound having a structure represented by General Formula (A) below as an additive, wherein said oxetane compound comprises a silyl group and wherein the amount of said oxetane compound contained in said composition is 1.5 to 10.0% by weight relative to the total amount of the light-shielding material and the alkali-soluble resin:

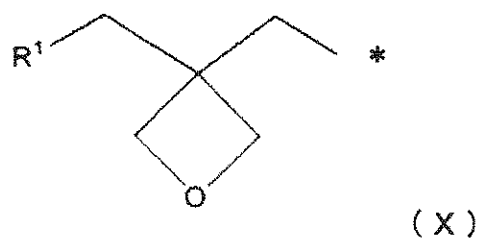


wherein R^1 and R^2 may be the same or different; R^1 represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent; and R^2 represents a hydrogen atom, a silyl group or an alkyl group having 1 to 10 carbon atoms, wherein the silyl group and the alkyl group may further comprise a substituent.

2. The photosensitive black resin composition according to claim 1, wherein said oxetane compound is represented by Structural Formula (B) below:



wherein X represents the oxetane compound below and n represents a natural number of 10 or less



wherein * represents a linking site; and R¹ represents a hydrogen atom or an alkyl group having 1 to 10 carbon atoms, wherein the alkyl group may further comprise a substituent.

3. A resin black matrix substrate obtained by applying the photosensitive black resin composition according to claim 1 or 2 on a transparent substrate and then by forming a pattern.

PHOTOSENSITIVE BLACK RESIN COMPOSITION AND RESIN BLACK
MATRIX SUBSTRATE

ABSTRACT

The present invention aims to provide a black resin composition which, when a resin black matrix is formed on a glass substrate, has a good adhesion to the substrate during its development and a good compatibility with a developer, and is capable of high-definition patterning; as well as to provide a resin black matrix substrate using such a photosensitive black resin composition, and a light-shielding film for a color filter and a touch panel. The present invention provides a photosensitive black resin composition comprising at least a light-shielding material, an alkali-soluble resin, a photopolymerization initiator and a solvent, wherein the photosensitive black resin composition comprises at least an oxetane compound having a specified structure as an additive, and wherein the amount of the oxetane compound contained in the composition is 1.5 to 10.0% by weight relative to the total amount of the light-shielding material and the alkali-soluble resin.