Citation List

Patent Document

[0003]

Patent Document 1: Japanese Patent Application Laid-Open No. 2009-179678

Patent Document 2: Japanese Patent Application Laid-Open No. 2008-185683

Patent Document 3: Japanese Patent Application Laid-Open No. 2007-277514

Patent Document 4: Japanese Patent Application Laid-Open No. 2008-239923

Summary of Invention

Problems to be solved

[0004]

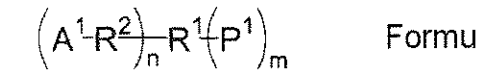
However, the composition for forming a material having a high refractive index as described above is required to contain a high content of inorganic particles from the viewpoint of achieving dispersion stability. In the composition containing a high content of inorganic particles, since it is difficult to maintain dispersity with lapse of time due to aggregation of the organic particles, the dispersion stability may deteriorate, thereby causing troubles to formation of a coating film. There is a demand to develop a dispersant capable of maintaining the dispersion stability of the inorganic particles in the high content.

[0005]

The present ~~invention~~ disclosure has been made in consideration of the aforementioned circumstances, and an object of the present ~~invention~~ disclosure is to provide a dispersion composition which has a high refractive index and has a high dispersion stability, a curable composition using the same, a transparent film, a microlens, and a solid-state imaging device.

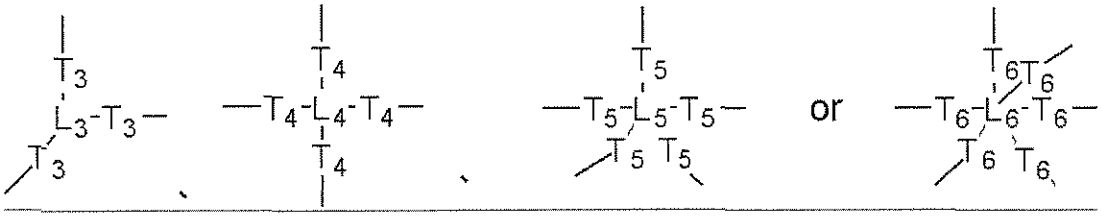
[0005a]

In an aspect, there is provided a dispersion composition comprising: a colorless, white or transparent metal oxide particle (A) having a primary particle diameter of 1 nm to 100 nm, a polymer compound (B) having an acid value of 120 mgKOH/g or more to 400 mgKOH/g or less, which is represented by the following Formula (1); and a solvent (C):



Formula (1)

wherein, in Formula (1), R^1 represents a (m+n)-valent linking group represented by any one of the following Formulae:



wherein, in the above Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be same or different,

L_5 represents a pentavalent group,

T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different,

R^2 represents a single bond or a divalent linking group,

A^1 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^1's and n R^2's may be same or different,

m represents a positive number of 4 or less, n represents 1 to 5, and m+n satisfies 3 to 6, and

P^1 represents a polymer chain, and m P^1's may be same or different.

In another aspect, there is provided a curable composition comprising the dispersion composition described herein and a polymerizable compound (D).

In another aspect, there is provided a transparent film formed by using the curable composition described herein.

In another aspect, there is provided a microlens formed by using the transparent film obtained by the curable composition described herein.

In another aspect, there is provided a solid-state imaging device comprising the microlens described herein.

In yet another aspect, there is provided a method for preparing the dispersion composition described herein.

Means for Solving the Problems

[0006]

Specific means for solving the problems are as follows.

<1> A dispersion composition containing a metal oxide particle (A) having a primary particle diameter of 1 nm to 100 nm, a polymer compound (B) having an acid value of 120 mgKOH/g or more, which is represented by the following Formula (1), and a solvent (C).

[0007]

CLAIMS

1. A dispersion composition comprising:

a colorless, white or transparent metal oxide particle (A) having a primary particle diameter of 1 nm to 100 nm,

a polymer compound (B) having an acid value of 120 mgKOH/g or more to 400 mgKOH/g or less, which is represented by the following Formula (1), and

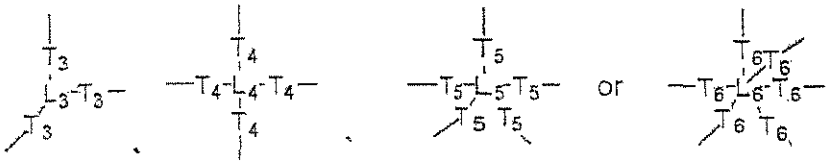
a solvent (C):



Formula (1)

wherein, in Formula (1),

R^1 represents a (m+n)-valent linking group represented by any one of the following Formulae:



wherein, in the above Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be same or different.

L_5 represents a pentavalent group,

T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different,

R^2 represents a single bond or a divalent linking group,

A^1 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a

coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^1's and n R^2's may be same or different,

m represents a positive number of 4 or less, n represents 1 to 5, and m+n satisfies 3 to 6, and

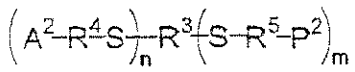
P^1 represents a polymer chain, and m P^1's may be same or different.

2. The dispersion composition according to claim 1,

wherein a content of the metal oxide particle (A) is 65% by mass or more to 90% by mass or less with respect to a total solid content of the dispersion composition.

3. The dispersion composition according to claim 1,

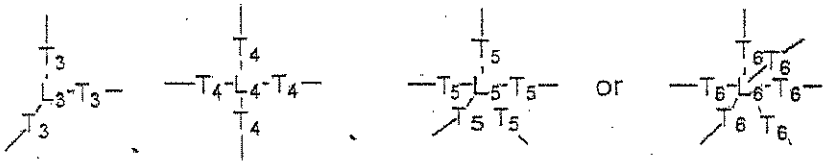
wherein the polymer compound (B) is a polymer compound represented by the following Formula (2):



Formula (2)

wherein, in Formula (2),

R^3 represents a (m+n)-valent linking group represented by any one of the Formulae:



wherein, in the Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be

same or different.

L_5 represents a pentavalent group,

T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different,

R^4 and R^5 each independently represent a single bond or a divalent linking group,

A^2 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^2's and n R^4's may be same or different,

m represents a positive number of 4 or less, n represents 1 to 5, and m+n satisfies 3 to 6, and

P^2 represents a polymer chain, and m P^2's and m R^5's may be same or different.

4. The dispersion composition according to claim 3,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one group selected from the group consisting of an acid group, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, a hydroxyl group, a urea group, a urethane group, a sulfonamide group, an imide group and a group having a coordinating oxygen atom.

5. The dispersion composition according to claim 3,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one functional group with a pKa of 5 or more selected from a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, a urea group, a urethane group, an alkyl group, an aryl group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a group having an alkyleneoxy chain, an imide group, a carboxylate

group, a sulfonamide group, a hydroxyl group or a heterocyclic group.

6. The dispersion composition according to claim 3,

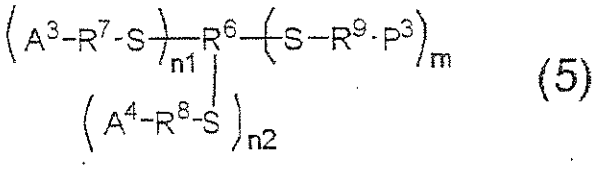
wherein the polymer chain represented by P^1 or P^2 is a polymer chain derived from at least one selected from a polymer or copolymer of vinyl monomers, an ester-based polymer, an ether-based polymer, a urethane-based polymer, an amide-based polymer, an epoxy-based polymer, a silicone-based polymer and a modified product or copolymer thereof.

7. The dispersion composition according to claim 3,

wherein the polymer chain represented by P^1 or P^2 contains at least one repeating unit, and a repeating number k of the at least one repeating unit is 3 to 140.

8. The dispersion composition according to claim 1,

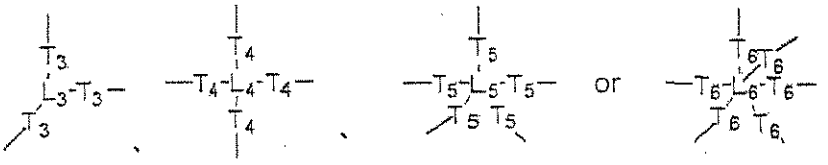
wherein the polymer compound (B) is a polymer compound represented by the following Formula (5):



(5)

wherein, in Formula (5),

R^6 represents a (m+n1+n2)-valent linking group represented by any one of the following Formulae:



wherein, in the above Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be same or different.

L_5 represents a pentavalent group,

T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different,

R^7 to R^9 each independently represent a single bond or a divalent linking group,

A^3 represents a monovalent substituent having at least one acid group,

A^4 represents a monovalent substituent different from A^3,

n1 A^3's and n1 R^7's may be same or different,

n2 A^4's and n2 R^8's may be same or different,

m represents a positive number of 4 or less, n1 represents 1 to 4, n2 represents 1 to 4, and m+n1+n2 satisfies 3 to 6, and

P^3 represents a polymer chain, and m P^3's and m R^9's may be same or different.

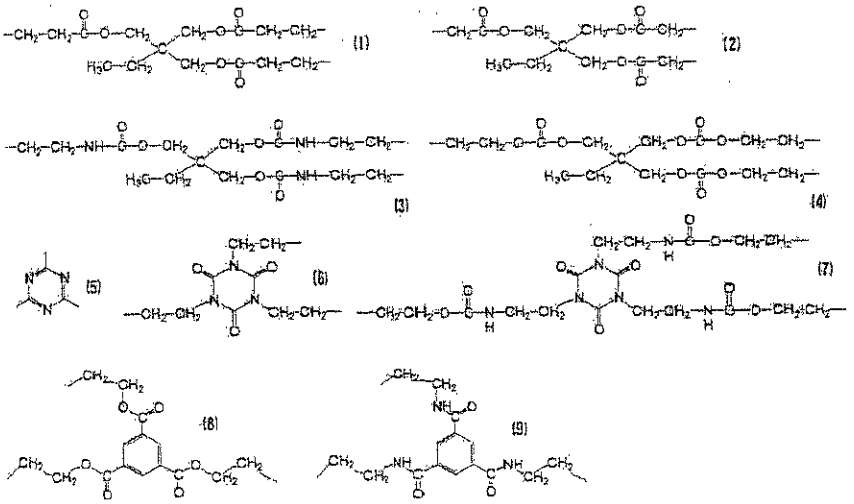
9. The dispersion composition according to claim 1,

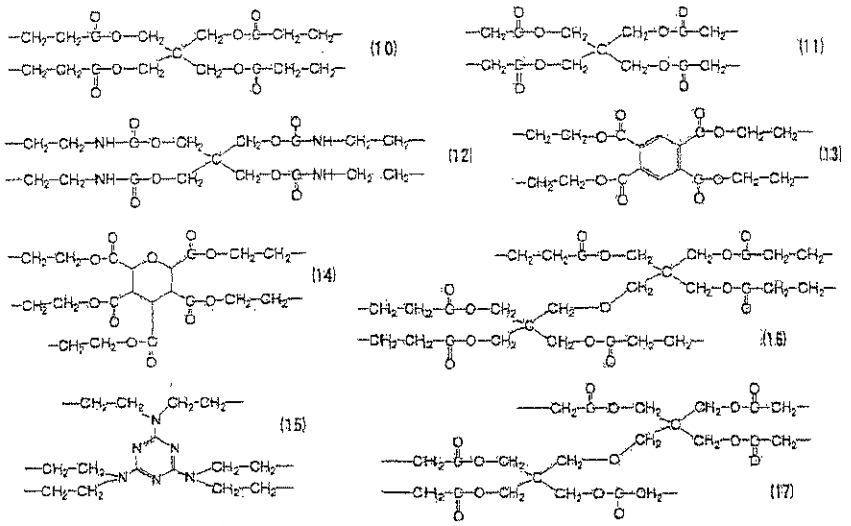
wherein the metal oxide particle (A) is a titanium dioxide (TiO_2) particle, a zirconium dioxide (ZrO_2) particle or a silicon dioxide (SiO_2) particle.

10. The dispersion composition according to claim 1,

wherein in Formula (1),

R^1 is represented by any one of the following Formulae (1) to (17).

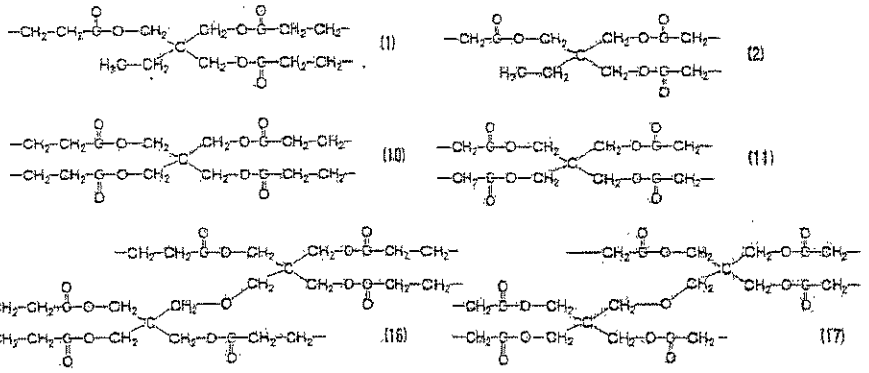




11. The dispersion composition according to claim 1,

wherein in Formula (1),

R^1 is represented by any one of the following Formulae (1), (2), (10), (11), (16) and (17).



12. A curable composition comprising the dispersion composition according to any one of claims 1 to 11 and a polymerizable compound (D).

13. The curable composition according to claim 12,

wherein the polymerizable compound (D) is at least one selected from the group consisting of a compound having two or more epoxy groups or oxetanyl groups in a molecule and a compound having two or more terminal ethylenically unsaturated bonds in a molecule.

14. The curable composition according to claim 12,

wherein the polymerizable compound (D) is a compound having two or more epoxy groups or oxetanyl groups in a molecule.

15. The curable composition according to claim 12, further comprising at least one selected from the group consisting of a polymerization initiator (E) and a binder polymer.

16. The curable composition according to claim 15,

wherein the polymerization initiator (E) is an oxime-based polymerization initiator.

17. The curable composition according to claim 12,

wherein the curable composition is for forming a microlens or for forming an undercoat film of a color filter.

18. A transparent film formed by using the curable composition according to claim 12.

19. A microlens formed by using the transparent film obtained by the curable composition according to claim 17.

20. A solid-state imaging device comprising the microlens according to claim 19.

21. A method for preparing the dispersion composition according to any one of claims 1 to 11.

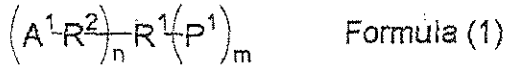
CLAIMS

1. A dispersion composition comprising:

a metal oxide particle (A) having a primary particle diameter of 1 nm to 100 nm,

a polymer compound (B) having an acid value of 120 mgKOH/g or more, which is represented by the following Formula (1), and

a solvent (C):



Formula (1)

wherein, in Formula (1),

R^1 represents a (m+n)-valent linking group,

R^2 represents a single bond or a divalent linking group,

A^1 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^1's and n R^2's may be same or different,

m represents a positive number of 8 or less, n represents 1 to 9, and m+n satisfies 3 to 10, and

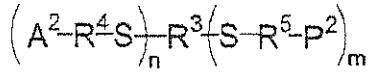
P^1 represents a polymer chain, and m P^1's may be same or different.

2. The dispersion composition according to claim 1,

wherein a content of the metal oxide particle (A) is 65% by mass or more with respect to a total solid content of the dispersion composition.

3. The dispersion composition according to claim 1 or 2,

wherein the polymer compound (B) is a polymer compound represented by Formula (2):



Formula (2)

wherein, in Formula (2),

R^3 represents a (m+n)-valent linking group,

R^4 and R^5 each independently represent a single bond or a divalent linking group,

A^2 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^2's and n R^4's may be same or different,

m represents a positive number of 8 or less, n represents 1 to 9, and m+n satisfies 3 to 10, and

P^2 represents a polymer chain, and m P^2's and m R^5's may be same or different.

4. The dispersion composition according to any one of claims 1 to 3,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one group selected from the group consisting of an acid group, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, a hydroxyl group, a urea group, a urethane group, a sulfonamide group, an imide group and a group having a coordinating oxygen atom.

5. The dispersion composition according to any one of claims 1 to 3,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one functional group with a pKa of 5 or more.

6. The dispersion composition according to claim 5,

wherein the functional group with a pKa of 5 or more is a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, a urea group, a urethane group, an alkyl group, an aryl group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a group having an alkyleneoxy chain, an imide group, a carboxylate group, a

sulfonamide group, a hydroxyl group or a heterocyclic group.

7. The dispersion composition according to any one of claims 1 to 6,

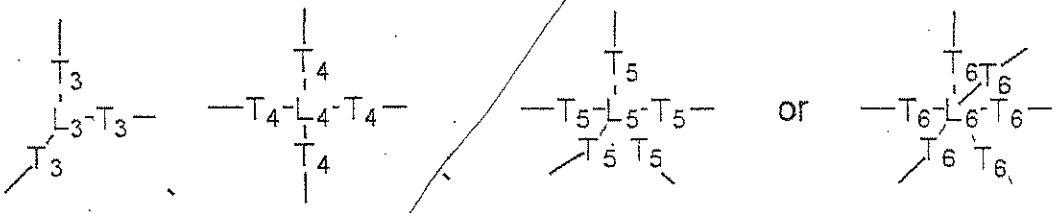
wherein the polymer chain represented by P^1 or P^2 is a polymer chain derived from at least one selected from a polymer or copolymer of vinyl monomers, an ester-based polymer, an ether-based polymer, a urethane-based polymer, an amide-based polymer, an epoxy-based polymer, a silicone-based polymer and a modified product or copolymer thereof.

8. The dispersion composition according to any one of claims 1 to 7,

wherein the polymer chain represented by P^1 or P^2 contains at least one repeating unit, and a repeating number k of the at least one repeating unit is 3 to 140.

9. The dispersion composition according to any one of claims 1 to 8,

whrerein R^1 in Formula (1) or R^3 in Formula (2) is a group represented by any one of the Formulae.



wherein, in the Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be same or different.

L_5 represents a pentavalent group,

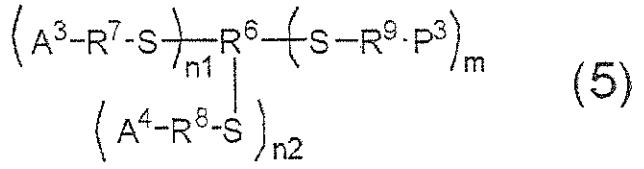
T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different.

10. The dispersion composition according to any one of claims 1 to 9,

wherein the polymer compound (B) is a polymer compound represented by Formula (5):



(5)

wherein, in Formula (5),

R^6 represents a (m+n1+n2)-valent linking group, and R^7 to R^9 each independently represent a single bond or a divalent linking group,

A^3 represents a monovalent substituent having at least one acid group,

A^4 represents a monovalent substituent different from A^3,

n1 A^3's and n1 R^7's may be same or different,

n2 A^4's and n2 R^8's may be same or different,

m represents a positive number of 8 or less, n1 represents 1 to 8, n2 represents 1 to 8, and m+n1+n2 satisfies 3 to 10, and

P^3 represents a polymer chain, and P^3's and m R^9's may be same or different.

11. A curable composition comprising the dispersion composition according to any one of claims 1 to 10 and a polymerizable compound (D).

12. The curable composition according to claim 11,

wherein the polymerizable compound (D) is at least one selected from the group consisting of a compound having two or more epoxy groups or oxetanyl groups in a molecule and a compound having two or more terminal ethylenically unsaturated bonds, in a molecule.

13. The curable composition according to claim 11, further comprising at least one selected from the group consisting of a polymerization initiator (E) and a binder polymer.

14. The curable composition according to claim 13,

wherein the polymerization initiator (E) is an oxime-based polymerization initiator.

15. The curable composition according to any one of claims 11 to 14,

wherein the curable composition is for forming a microlens or for forming an

undercoat film of a color filter.

16. A transparent film formed by using the curable composition according to any one of claims 11 to 15.

17. A microlens formed by using the transparent film obtained by the curable composition according to claim 15.

18. A solid-state imaging device comprising the microlens according to claim 17.

19. A method for preparing the dispersion composition according to any one of claims 1 to 10.

CLAIMS of Article 34 PCT Amendment

1. A curable composition comprising:

a polymerizable compound (D) containing two or more oxetanyl groups in a molecule; and

a dispersion composition containing:

a metal oxide particle (A) having a primary particle diameter of 1 nm to 100 nm;

a polymer compound (B) having an acid value of 120 mgKOH/g or more, which is represented by the following Formula (1); and

a solvent (C):

$$\left(A^1\text{-}R^2\right)_n\text{-}R^1\left(P^1\right)_m \qquad \text{Formula (1)}$$

wherein, in Formula (1),

R^1 represents a (m+n)-valent linking group,

R^2 represents a single bond or a divalent linking group,

A^1 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^1's and n R^2's may be same or different,

m represents a positive number of 8 or less, n represents 1 to 9, and m+n satisfies 3 to 10, and

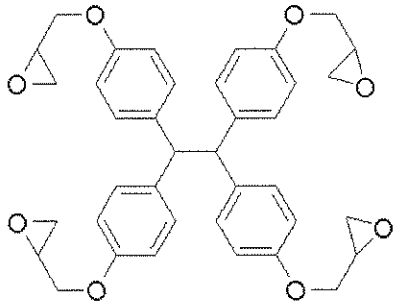
P^1 represents a polymer chain, and m P^1's may be same or different.

2. The curable composition according to claim 1,

wherein the polymerizable compound (D) contains two or more epoxy groups in a molecule.

3. The curable composition according to claim 1 or 2,

wherein the polymerizable compound (D) is a bisphenol A-type epoxy group, a bisphenol F-type epoxy resin, a phenol novolac-type epoxy resin, a cresol novolac-type epoxy resin, an aliphatic epoxy resin or a compound represented by the following structure:

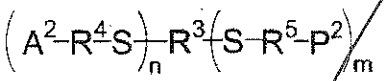


4. The curable composition according to any one of claims 1 to 3,

wherein a content of the metal oxide particle (A) is 65% by mass or more with respect to a total solid content of the dispersion composition.

5. The curable composition according to any one of claims 1 to 4,

wherein the polymer compound (B) is a polymer compound represented by Formula (2):



Formula (2)

wherein, in Formula (2),

R^3 represents a (m+n)-valent linking group,

R^4 and R^5 each independently represent a single bond or a divalent linking group,

A^2 represents a monovalent substituent having at least one group selected from the group consisting of an acid group, a urea group, a urethane group, a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, an imide group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a carboxylate group, a sulfonamide group, a heterocyclic group, an alkoxysilyl group, an epoxy group, an isocyanate group, and a hydroxyl group,

n A^2's and n R^4's may be same or different,

m represents a positive number of 8 or less, n represents 1 to 9, and m+n satisfies 3 to

10; and

P^2 represents a polymer chain, and m P^2's and m R^5's may be same or different.

6. The curable composition according to any one of claims 1 to 5,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one group selected from the group consisting of an acid group, a phenol group, an alkyl group, an aryl group, a group having an alkyleneoxy chain, a hydroxyl group, a urea group, a urethane group, a sulfonamide group, an imide group and a group having a coordinating oxygen atom.

7. The curable composition according to any one of claims 1 to 6,

wherein A^1 in Formula (1) or A^2 in Formula (2) is a monovalent substituent having at least one functional group with a pKa of 5 or more.

8. The curable composition according to claim 7,

wherein the functional group with a pKa of 5 or more is a group having a coordinating oxygen atom, a group having a basic nitrogen atom, a phenol group, a urea group, a urethane group, an alkyl group, an aryl group, an alkyloxycarbonyl group, an alkyl amino carbonyl group, a group having an alkyleneoxy chain, an imide group, a carboxylate group, a sulfonamide group, a hydroxyl group or a heterocyclic group.

9. The curable composition according to any one of claims 1 to 8,

wherein the polymer chain represented by P^1 or P^2 is a polymer chain derived from at least one selected from a polymer or copolymer of vinyl monomers, an ester-based polymer, an ether-based polymer, a urethane-based polymer, an amide-based polymer, an epoxy-based polymer, a silicone-based polymer and a modified product or copolymer thereof.

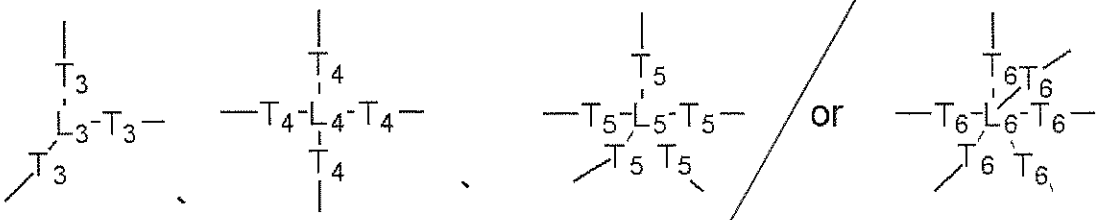
10. The curable composition according to any one of claims 1 to 9,

wherein the polymer chain represented by P^1 or P^2 contains at least one repeating unit,

and a repeating number k of the at least one repeating unit is 3 to 140.

11. The curable composition according to any one of claims 1 to 10,

whrerein R^1 in Formula (1) or R^3 in Formula (2) is a group represented by any one of the Formulae.



wherein, in the Formulae,

L_3 represents a trivalent group,

T_3 represents a single bond or a divalent linking group, and three T_3's may be same or different,

L_4 represents a tetravalent group,

T_4 represents a single bond or a divalent linking group, and four T_4's may be same or different.

L_5 represents a pentavalent group,

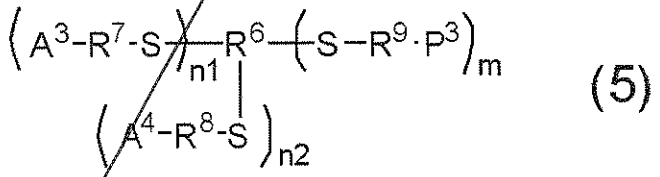
T_5 represents a single bond or a divalent linking group, and five T_5's may be same or different,

L_6 represents a hexavalent group, and

T_6 represents a single bond or a divalent linking group, and six T_6's may be same or different.

12. The curable composition according to any one of claims 1 to 11,

wherein the polymer compound (B) is a polymer compound represented by Formula (5):



(5)

wherein, in Formula (5),

R^6 represents a (m+n1+n2)-valent linking group, and R^7 to R^9 each independently

represent a single bond or a divalent linking group,

A^3 represents a monovalent substituent having at least one acid group,

A^4 represents a monovalent substituent different from A^3,

n1 A^3's and n1 R^7's may be same or different,

n2 A^4's and n2 R^8's may be same or different,

m represents a positive number of 8 or less, n1 represents 1 to 8, n2 represents 1 to 8, and m+n1+n2 satisfies 3 to 10, and

P^3 represents a polymer chain, and P^3's and m R^9's may be same or different.

13. The curable composition according to any one of claims 1 to 12, further comprising at least one selected from the group consisting of a polymerization initiator (E) and a binder polymer.

14. The curable composition according to claim 13,

wherein the polymerization initiator (E) is an oxime-based polymerization initiator.

15. The curable composition according to any one of claims 1 to 14,

wherein the curable composition is for forming a microlens or for forming an undercoat film of a color filter.

16. A transparent film formed by using the curable composition according to any one of claims 1 to 15.

17. A microlens formed by using the transparent film obtained by the curable

composition according to claim 15.

18. A solid-state imaging device comprising the microlens according to claim 17.