PHOTOSENSITIVE RESIN COMPOSITION, PATTERN FORMING METHOD, CURED FILM, LAMINATE, AND DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a photosensitive resin composition, a pattern forming method, a cured film, a laminate, and a device.

2. Description of the Related Art

[0002] In the related art, a polyimide resin, a polybenzoxazole resin, or the like, which has excellent heat resistance, electrical properties, mechanical properties, and the like has been used as a protective film and an interlayer insulating film of a semiconductor element. However, as the integration of semiconductor elements and the increase in the size of semiconductor elements progress in recent years, there is a demand for a thinner and smaller sealing resin package, and a method such as surface mounting using lead-on-chip (LOC) or a solder reflow method has been adopted.

[0003] In the manufacturing of such a semiconductor element, a photosensitive resin composition containing at least one precursor selected from the group consisting of a polyimide resin precursor (a polyimide precursor) and a polybenzoxazole resin precursor (a polybenzoxazole precursor) may be used. In a case where the photosensitive resin composition is used, merits such as simplification of the pattern forming step can be conceivable.

[0004] For example, WO2018/025738A discloses a photosensitive resin composition containing a heterocyclic ring-containing polymer precursor, a thermal base generator, and an organic compound containing a Group 4 element.

Further, JP2011-191749A discloses a negative-type photosensitive resin composition containing (A) polyimide precursor having a specific structure; (B) photopolymerization initiator: 1 to 20 parts by mass; and (C) monocarboxylic acid compound having 2 to 30 carbon atoms, which has one or more functional groups selected from the group consisting of a hydroxyl group, an ether group, and an ester group: 0.01 to 10 parts by mass.

SUMMARY

[0005a] In a first aspect, the present disclosure refers to a photosensitive resin composition comprising:

at least one precursor selected from the group consisting of a polyimide precursor and a polybenzoxazole precursor;

a compound having a sulfurous ester structure; and

a photoradical polymerization initiator,

wherein the photosensitive resin composition satisfies at least one of the following conditions 1, ..., or 3;

the condition 1: the precursor contains a radically polymerizable group,

the condition 2: the compound having a sulfurous ester structure contains a radically polymerizable group, and

the condition 3: the photosensitive resin composition further contains a compound containing a radically polymerizable group, other than the precursor and the compound having a sulfurous ester structure.

[0005b] In another aspect, the present disclosure refers to a pattern forming method comprising:

an exposure step of exposing a photosensitive film formed from the photosensitive resin composition as disclosed herein; and

a development step of developing the photosensitive film after the exposure to obtain a pattern.

[0005c] In yet another aspect, the present disclosure refers to a cured film formed from the photosensitive resin composition as disclosed herein.

[0005d] In a further aspect, the present disclosure refers to a laminate comprising two or more layers of the cured films as disclosed herein.

[0005e] In another aspect, the present disclosure refers to a device comprising the cured film as disclosed herein or the laminate as disclosed herein.

[0006] For example, in the pattern formation using a photosensitive film formed from a photosensitive resin composition containing at least one precursor selected from the group consisting of a polyimide precursor and a polybenzoxazole precursor, an exposure method, an

exposure light source, an exposure environment, and the like becomes various.

As a result, it is desired to provide a photosensitive resin composition having a high tolerance to exposure conditions such as exposure energy, that is, a photosensitive resin composition excellent in exposure latitude.

[0007] An object of the present disclosure is to provide a photosensitive resin composition excellent in exposure latitude, a pattern forming method using a photosensitive film formed from the photosensitive resin composition, a cured film formed from the photosensitive resin composition, a laminate containing the cured fllm, and a device having the cured film or the laminate.

[0008] Representative examples of the present disclosure are described below.

<1> A photosensitive resin composition comprising:

at least one precursor selected from the group consisting of a polyimide precursor and a polybenzoxazole precursor;

a compound having a sulfurous ester structure; and

a photoradical polymerization initiator,

in which the photosensitive resin composition satisfies at least one of the following conditions 1, ..., or 3;

the condition 1: the precursor contains a radically polymerizable group,

the condition 2: the compound having a sulfurous ester structure contains a radically polymerizable group, and

the condition 3: the photosensitive resin composition further contains a compound containing a radically polymerizable group, other than the precursor and the compound having a sulfurous ester structure.

<2> The photosensitive resin composition according to <1>, in which the compound having a sulfurous ester structure contains a radically polymerizable group.

<3> The photosensitive resin composition according to <1> or <2>, in which the compound having a sulfurous ester structure contains two or more radically polymerizable groups.

<4> The photosensitive resin composition according to any one of <1> to <3>, further comprising a Group 4 element-containing compound.

<5> The photosensitive resin composition according to <4>, in which the Group 4 element-containing compound is the photoradical polymerization initiator.

<6> The photosensitive resin composition according to <4> or <5>, in which the

curing step of heating the pattern at 120°C to 200°C to obtain a cured pattern, after the development step.

<16> The pattern forming method according to <15>, in which a time taken from a start of the heating to an end of the heating in the curing step is within 15 minutes.

<17> The pattern forming method according to <15> or <16>,

the photosensitive resin composition contains, as an onium salt, a compound that is not decomposed by heating in the curing step.

<18> A cured film formed from the photosensitive resin composition according to any one of <1> to <12>.

<19> The cured film according to <18>, in which the cured film is used as an interlayer insulating film for a rewiring layer.

<20> A laminate comprising two or more layers of the cured films according to <18> or <19>.

<21> The laminate according to <20>, further comprising a metal layer between the cured films.

<22> A device comprising the cured film according to <18> or <19> or the laminate according to <20> or <21>.

[0009] According to the present disclosure, a photosensitive resin composition excellent in exposure latitude, a pattern forming method using a photosensitive film formed from the photosensitive resin composition, a cured film formed from the photosensitive resin composition, a laminate containing the cured film, and a device having the cured film or the laminate are provided.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Hereinafter, the contents of the present invention will be described in detail.

In the present specification, “to” is used to mean that numerical values described before and after “to” are included as a lower limit value and an upper limit value, respectively.

In describing a group (an atomic group) in the present specification, in a case where a description about substitution and non-substitution is not provided, the description means the group includes a group (an atomic group) having a substituent as well as a group (an atomic group) having no substituent. For example, the description “alkyl group” includes not only an alkyl group that does not have a substituent (an unsubstituted alkyl group) but also an alkyl group that has a substituent (a substituted alkyl group).

In the present specification, “exposure” includes not only exposure using light but