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In the formula,

R⁴¹ represents a hydrogen atom or a methyl group;

Ar⁴¹ represents an arylene group;

L⁴¹ represents a single bond or a divalent linking group; and

S represents a structural moiety that generates an acid on a side chain by being degraded by actinic ray irradiation or radiation irradiation.

(10) The composition according to any one of (1) to (9), which is exposed with at least one of an electron beam, X-rays, and EUV light.

(11) An actinic ray-sensitive or radiation-sensitive film formed using the composition according to any one of (1) to (10).

(12) Mask blanks on which the actinic ray-sensitive or radiation-sensitive film according to (11) is formed.

(13) A mask for producing semiconductors that is obtained by exposing and developing the mask blanks according to (12).

(14) A pattern forming method including exposing the film according to (11), and developing the exposed film.

(15) A pattern forming method including exposing the mask blanks according to (12), and developing the exposed mask blanks.

(16) The method according to (14) or (15), wherein the exposing is performed using at least one of an electron beam, X-rays, and EUV light.

According to the present invention, an actinic ray-sensitive or radiation-sensitive resin composition that can form independent line patterns with high resolution and excellent shapes and shows excellent resist performances including roughness characteristics, and an actinic ray-sensitive or radiation-sensitive film and a pattern forming method using the composition can be provided.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinbelow, embodiments of the present invention will be described in detail.

Regarding the description for a group (atomic group) in the present specification, if a group is not described in regard to whether the group is substituted or unsubstituted, this group includes not only those not having a substituent but also those having a substituent. For example, an “alkyl group” includes not only an alkyl group (unsubstituted alkyl group) not having a substituent but also an alkyl group (substituted alkyl group) having a substituent.

In the present invention, the term “actinic rays” or “radiation” refers to, for example, a bright line spectrum of a mercury lamp, far-ultraviolet rays represented by an excimer laser, extreme ultraviolet rays (EUV light), X-rays, or an electron beam. In addition, the “light” in the present invention refers to the actinic rays or the radiation. The term “exposure” in this specification includes not only the exposure performed using a mercury lamp, far-ultraviolet rays represented by an excimer laser, X-rays, EUV light, and the like, but also drawing performed using particle beams such as an electron beam and an ion beam, unless otherwise specified.

The actinic ray-sensitive or radiation-sensitive resin composition according to the present invention is, for example, a positive composition, and typically is a positive resist composition. The constitution of this composition will be described below.

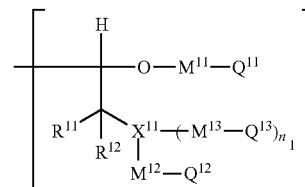
[1] Compound (P)

The composition according to the present invention contains a compound (P) that contains at least one phenolic

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hydroxyl group and at least one group in which a hydrogen atom of a phenolic hydroxyl group is substituted with a group (hereinbelow, also referred to as an “acid labile group”) represented by the following General Formula (1). The “acid labile group” refers to a group eliminated when a chemical bond is broken by the action of an acid. In addition, the “phenolic hydroxyl group” refers to a hydroxyl group directly binding to an aromatic ring.

[Chem. 6]



(1)

In General Formula (1),

each of R¹¹ and R¹² independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, or an aralkyl group;

n₁ represents 0 or 1;

X¹¹ represents an oxygen atom or a sulfur atom when n₁ is 1; and represents a nitrogen atom when n₁ is 0;

M¹¹ m represents a single bond, an alkylene group, a cycloalkylene group, —S—, —O—, —CO—, —CS—, —SO₂—, —N(R₀)—, or a combination of two or more kinds of the same, herein, R₀ represents a hydrogen atom or an alkyl group;

each of M¹² and M¹³ independently represents a single bond or a divalent linking group;

Q¹¹ represents an alkyl group, an aralkyl group, a cycloalkyl group, or an aryl group when M¹¹ is a group other than a single bond, and represents an alkyl group, an aralkyl group, or a cycloalkyl group when M¹¹ is a single bond;

Q¹² represents an organic group;

Q¹³ represents an organic group or a hydrogen atom; and at least two of R¹¹, R¹², Q¹², and Q¹³ may form a ring by binding to each other.

The General Formula (1) will be described in more detail.

As described above, each of R¹¹ and R¹² independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, or an aralkyl group.

In an embodiment, the alkyl group preferably has 20 or less carbon atoms, and more preferably has 8 or less carbon atoms. Examples of the alkyl group include a methyl group, an ethyl group, a propyl group, an isopropyl group, an n-butyl group, a sec-butyl group, a t-butyl group, a hexyl group, a 2-ethylhexyl group, an octyl group, and a dodecyl group. Among these, a methyl group, an ethyl group, a propyl group, an isopropyl group, and a t-butyl group are particularly preferable.

The cycloalkyl group may be monocyclic or polycyclic. The cycloalkyl group preferably has 3 to 10 carbon atoms. Examples of the cycloalkyl group include a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, a cyclohexyl group, a cycloheptyl group, a cyclooctyl group, a 1-adamantyl group, a 2-adamantyl group, a 1-norbornyl group, and a 2-norbornyl group. Among these, a cyclopentyl group and a cyclohexyl group are preferable.

The aryl group may contain a hetero atom; alternatively, the aryl group may also contain a structure (for example, a biphenyl group or a terphenyl group) in which a plurality of