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POLYMER, RESIST COMPOSITION CONTAINING POLYMER, AND METHOD FOR MANUFACTURING DEVICE USING SAME

TECHNICAL FIELD

Some aspects of the present invention relate to a polymer used for a resist composition. Some embodiments of the present invention relate to a resist composition comprising the polymer and a method of manufacturing a device using the resist composition.

BACKGROUND ART

In recent years, by making full use of a photolithography technique using a photoresist, manufacturing of a display device such as a liquid crystal display (LCD) and an organic EL display (OLED), and a formation of semiconductor elements are active. As an active energy ray, i-line having a wavelength of 365 nm, and light such as h-line (405 nm) and g-line (436 nm) having a longer wavelength than i-line are widely used for the packaging of the electronic component and the electronic product.

Since a device integration has developed, the demand for miniaturization of lithography technology has been increased, a light having a very short wavelength such as KrF excimer laser (wavelength 248 nm), ArF excimer laser (wavelength 193 nm), extreme ultraviolet (EUV, wavelength 13.5 nm) and an electron beam (EB) tends to be used for exposure. Since these lithography techniques using short wavelength light, especially EUV or electron beam, can allow manufacturing by single patterning, a demand for a resist composition having high sensitivity to EUV, the electron beam or the like may further increase in the future.

Due to shortening the wavelength of the exposure light source, it is required for the resist composition to improve the sensitivity to the exposure light source and the resolution property of lithography which can reproduce a pattern of fine dimensions. A chemically amplified resist is known as a resist composition satisfying such requirements (Patent Literature 1).

However, with conventional chemically amplified resists, it is difficult to sufficiently suppress reduction in resist pattern collapse and line edge roughness (LER) of a line pattern as resolution width of resist becomes finer. In order to suppress the resist pattern collapse, it has been proposed to increase a crosslinking density in a negative chemically amplified resist. However, swelling occurs during development and defects such as bridges may occur. Although it is strongly required to prevent the resist pattern collapse and the bridge formation, since conventional chemically amplified resist compositions for EUV, electron beam or the like have low EUV or electron beam absorption, it is difficult to simultaneously satisfy the required characteristics in sensitivity, resolution and pattern performance.

CITATION LIST

Patent Literature

Patent Literature 1: JPH9-90637

SUMMARY OF INVENTION

Technical Problem

An object of some aspects of the present invention is to provide a polymer used for a resist composition having high

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absorption efficiency for a particle beam or an electromagnetic wave, especially electron beam or EUV, and excellence in sensitivity, resolution and pattern performance characteristics.

An object of some aspects of the present invention is to provide a resist composition comprising the polymer and a method of manufacturing a device using the resist composition.

Solution to Problem

As a result of intensive investigation to solve the above problems, the inventors of the present invention found that when a polymer comprising a unit A having an onium salt structure and a unit B having a specific multiple bond is used as a polymer of a resist composition, an intramolecular crosslinking reaction occurs between the unit A and the unit B by irradiation with a particle beam, an electromagnetic wave or the like, so that high sensitivity can be achieved and pattern collapse can be suppressed. Then, the inventors completed some aspects of the present invention.

One aspect of the present invention to solve the above problems is a polymer, comprising: a unit A; and a unit B, wherein the unit A has an onium salt structure and generates a first radical by irradiation with a particle beam or an electromagnetic wave, the unit B has a radical generating structure containing at least one multiple bond selected from the group consisting of: a multiple bond between a carbon atom and a carbon atom; a multiple bond between a carbon atom and a heteroatom, and generates a second radical by irradiation with a particle beam or an electromagnetic wave, and the multiple bond in the radical generating structure is not a multiple bond contained in a benzenoid aromatic.

An embodiment of the present invention is a resist composition comprising the polymer.

Moreover, an embodiment of the present invention is a method of manufacturing a device, comprising: a resist film forming step of forming the resist film on a substrate using the resist composition; a photolithography step of exposing the resist film to the particle beam or the electromagnetic wave; and a pattern forming step of developing the exposed resist film to obtain a photoresist pattern.

Advantageous Effects of Invention

A polymer of some aspects of the present invention has high absorption efficiency for the particle beam, the electromagnetic wave or the like, and is excellent in sensitivity, resolution and pattern performance characteristics when the polymer is used for the resist composition.

DESCRIPTION OF EMBODIMENTS

In the present invention, "a particle beam or an electromagnetic wave" includes an electron beam, an extreme ultraviolet radiation and the like.

In the present invention, "by irradiation with a particle beam or an electromagnetic wave" means exposing at least one part of the polymer to the particle beam or the electromagnetic wave. Exposing one part of the polymer to the particle beam or the electromagnetic wave excites or ionizes a certain part of the polymer, and an active species is generated. A secondary reaction such as decomposing one part of the unit by the active species, adding the active species to the unit and eliminating a hydrogen atom from the