CLAIMS

[1] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

(a) a polymer comprising a repeating unit having an amino group,

(b) a solvent, and

(c) an acid in an amount of more than 50 wt% based on the weight of said polymer,

wherein said polymer does not comprise silicon.

[2] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

(a) a polymer A comprising a repeating unit having an amino group,

(b)a solvent,

(c) a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group, and

wherein pH of said composition is 5 to 10 and
HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[3] The fine pattern-forming composition used for miniaturizing a resist pattern as claimed in claim 2 further comprising

an acid in an amount of more than 10 wt% based on the weight of said polymer,
wherein HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[4] The composition according to claim 1, wherein said amino group is a primary amino group or a secondary amino group.

[5] The composition according to claim 2, wherein said amino group is a primary amino group or a secondary amino group.

[6] The composition according to claim 3, wherein said amino group is a primary amino group or a secondary amino group.

[7] The composition according to claim 1, wherein said repeating unit is selected from the group consisting of allylamine unit, diallylamine unit, and ethyleneimine unit.

[8] The composition according to claim 2, wherein said repeating unit is selected from the group consisting of allylamine unit, diallylamine unit, and ethyleneimine unit.

[9] The composition according to claim 3, wherein said repeating unit is selected from the group consisting of allylamine unit, diallylamine unit, and ethyleneimine unit.

[10] The composition according to claim 1, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, polyethyleneimine, and poly(allylamine-co-diallylamine).

[11] The composition according to claim 2, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, polyethyleneimine, and poly(allylamine-co-diallylamine).

[12] The composition according to claim 3, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, polyethyleneimine, and poly(allylamine-co-diallylamine).

[13] The composition according to claim 1, wherein said acid is selected from the group consisting of sulfonic acid, carboxylic acid, sulfuric acid, nitric acid, and mixtures thereof.

[14] The composition according to claim 2, wherein said acid is selected from the group consisting of sulfonic acid, carboxylinc acid, sulfuric acid, nitric acid, and mixtures thereof.

[15] The composition according to claim 3, wherein said acid is selected from the group consisting of sulfonic acid, carboxylic acid, sulfuric acid, nitric acid, and mixtures thereof.

[16] The composition according to any claim 4 to 6, wherein said acid is selected from the group consisting of sulfonic acid, carboxylic acid, sulfuric acid, nitric acid, and mixtures thereof.

[17] The composition according to any of claims 13 to 16, wherein said sulfonic acid is selected from the group consisting of methanesulfonic acid, ethanesulfonic acid, 2-aminomethanesulfonic acid, trifluoromethanesulfonic acid, p-toluenesulfonic acid, and 10-camphorsulfonic acid.

[18] The composition according to any of claims 13 to 16, wherein said carboxylic acid is one selected from the group consisting of acetic acid, methoxyacetic acid, glycolic acid, glutaric acid, and malic acid.

[19] The composition according to claim 17, wherein said solvent contains water.

[20] The composition according to any of claims 1 to 10, which further contains a surfactant.

[21] A method for forming a miniaturized positive resist pattern, comprising the steps of:

(a) coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

(b) exposing said semiconductor substrate coated with said photoresist layer;

(c) developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

(d) coating said photoresist pattern with a fine pattern-forming composition containing a polymer comprising a repeating unit having an amino group, an acid in an amount of more than 50 wt% based on the weight of said polymer, and a solvent, provided the polymer of the fine pattern forming composition does not comprise silicon.

(e) heating the coated photoresist pattern; and

(f) washing to remove excess of the fine pattern-forming composition.

[22] A method for forming a miniaturized positive resist pattern, comprising the steps of:

(a) coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

(b) exposing said semiconductor substrate coated with said photoresist layer;

(c) developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

(d) coating said photoresist pattern with a fine pattern-forming composition;

(e) heating the coated photoresist pattern; and

(f) washing to remove excess of the fine pattern-forming composition,

wherein said fine pattern-forming composition comprises

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group,

a solvent, and

an acid in an amount of more than 10 wt% based on the weight of said polymer,

where HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[23] A method for forming a miniaturized positive resist pattern, comprising the steps of:

coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

exposing said semiconductor substrate coated with said photoresist layer;

developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

coating said photoresist pattern with a fine pattern-forming composition;

heating the coated photoresist pattern; and

washing to remove excess of the fine pattern-forming composition, wherein said fine pattern-forming composition comprises

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group, and

a solvent,

where pH of said composition is 5 to 10 and HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[24] The method according to claim 21 for forming a miniaturized negative resist pattern, wherein said photoresist composition further comprises a photo acid-generating agent.

[25] The method according to claim 22 for forming a miniaturized negative resist pattern, wherein said photoresist composition further comprises a photo acid-generating agent.

[26] The method according to claim 23 for forming a miniaturized negative resist pattern, wherein said photoresist composition further comprises a photo acid-generating agent.

[27] The method according to claim 21 wherein the acid in an amount of more than 50 wt % to 200 wt % or less based on the weight of said polymer.

[28] The method according to claim 22 wherein the acid in an amount of more than 50 wt % to 200 wt % or less based on the weight of said polymer.

[29] The method according to claim 23 wherein the acid in an amount of more than 50 wt % to 200 wt % or less based on the weight of said polymer.

[30] The composition according to claim 21, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine and poly(allylamine-co-diallylamine).

[31] The composition according to claim 22, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine and poly(allylamine-co-diallylamine).

[32] The composition according to claim 23, wherein said polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine and poly(allylamine-co-diallylamine).

[33] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group,

a solvent, and

an acid in an amount of more than 10 wt% based on the weight of said polymer,

wherein HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

CLAIMS

[1] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

(a) a polymer comprising a repeating unit having an amino group,

(b) a solvent,

(c) the polymer comprising a repeating unit having an amino group, wherein the polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

(d) an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer,

wherein said polymer does not comprise silicon.

[2] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

(a) a polymer A comprising a repeating unit having an amino group,

(b)a solvent,

(c) a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group, and

(d) the polymer A selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

(e) an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer

wherein pH of said composition is 5 to 10 and
HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[3] The composition according to claim 1, wherein said acid is

selected from the group consisting of sulfonic acid, carboxylic acid, sulfuric acid, nitric acid, and mixtures thereof.

[4] The composition according to claim 2, wherein said acid is selected from the group consisting of sulfonic acid, carboxylinc acid, sulfuric acid, nitric acid, and mixtures thereof.

[5] The composition according to any of claims 1 to 4, wherein said sulfonic acid is selected from the group consisting of methanesulfonic acid, ethanesulfonic acid, 2-aminomethanesulfonic acid, trifluoromethanesulfonic acid, p-toluenesulfonic acid, and 10-camphorsulfonic acid.

[6] The composition according to any of claims 1 to 4, wherein said carboxylic acid is one selected from the group consisting of acetic acid, methoxyacetic acid, glycolic acid, glutaric acid, and malic acid.

[7] The composition according to claim 1 or claim 2, wherein said solvent contains water.

[8] The composition according to any of claims 1 to 7, which further contains a surfactant.

[9] A method for forming a miniaturized positive resist pattern, comprising the steps of:

(a) coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

(b) exposing said semiconductor substrate coated with said photoresist layer;

(c) developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

(d) coating said photoresist pattern with a fine pattern-forming composition containing a polymer comprising a repeating unit having an amino group, and a solvent,

wherein in the fine pattern-forming composition, the polymer comprising a repeating unit having an amino group, wherein the polymer is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer

provided the polymer of the fine pattern forming composition does not comprise silicon.

(e) heating the coated photoresist pattern; and

(f) washing to remove excess of the fine pattern-forming composition.

[10] A method for forming a miniaturized positive resist pattern, comprising the steps of:

(a) coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

(b) exposing said semiconductor substrate coated with said photoresist layer;

(c) developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

(d) coating said photoresist pattern with a fine pattern-forming composition;

(e) heating the coated photoresist pattern; and

(f) washing to remove excess of the fine pattern-forming composition,

wherein said fine pattern-forming composition comprises

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group,

wherein in the fine pattern-forming composition, the polymer A is selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer

a solvent, and

where HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[11] A method for forming a miniaturized positive resist pattern, comprising the steps of:

coating a semiconductor substrate with a chemically amplified photoresist composition, to form a photoresist layer;

exposing said semiconductor substrate coated with said photoresist layer;

developing said photoresist layer with an organic solvent developer after said exposing step, to form a photoresist pattern;

coating said photoresist pattern with a fine pattern-forming composition;

heating the coated photoresist pattern; and

washing to remove excess of the fine pattern-forming composition,

wherein said fine pattern-forming composition comprises

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group, and

the polymer A selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer

a solvent,

where pH of said composition is 5 to 10 and HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.

[12] The method according to claim 9 for forming a miniaturized negative resist pattern, wherein said photoresist composition further comprises a photo acid-generating agent.

[13] The method according to claim 10 for forming a miniaturized negative resist pattern, wherein said photoresist composition further comprises a photo acid-generating agent.

[14] The method according to claim 11 for forming a miniaturized negative resist pattern, wherein said photoresist composition further

comprises a photo acid-generating agent.

[15] A fine pattern-forming composition used for miniaturizing a resist pattern by applying to a negative resist pattern formed by using a chemically amplified resist composition and fattening the resist pattern, comprising

a polymer A comprising a repeating unit having an amino group,

a polymer B, which is different from said polymer A and may or may not comprise repeating unit having an amino group,

the polymer A selected from the group consisting of polyvinylamine, polyallylamine, polydiallylamine, and poly(allylamine-co-diallylamine), and

a solvent, and

an acid in an amount of more than 50 wt% to 200 wt% or less based on the weight of said polymer

wherein HSP distance, which is determined from Hansen solubility parameter of said polymer A and said polymer B, is 3 or more.