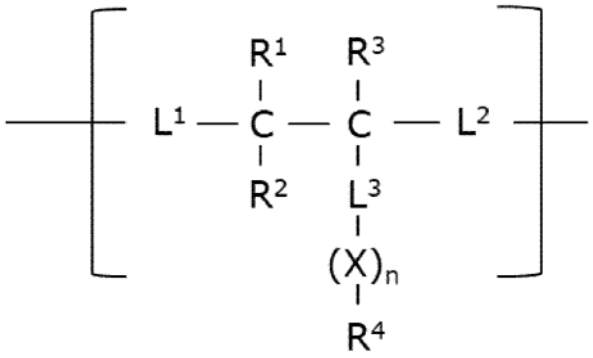
Patent Claims

1. A thickening composition comprising

a polymer (A) comprising a repeating unit (A1) represented by the formula (a1) and a solvent (B):



(a1)

wherein

L^1, L^2 and L^3 are each independently a single bond, C_{1-10} linear alkylene, C_{3-10} branched alkylene or C_{3-10} cyclic alkylene;

R^1, R^2 and R^3 are each independently H, C_{1-10} linear alkyl, C_{3-10} branched alkyl, C_{3-10} cyclic alkyl, C_{6-15} aryl or C_{6-15} aralkyl;

R^4 is C_{1-15} linear alkyl, C_{3-15} branched alkyl, C_{3-15} cyclic alkyl, C_{6-15} aryl, C_{6-15} aralkyl or a combination of any of these;

where, at least one of hydrogen atoms in R^4 can be replaced with C_{1-5} linear alkyl -COOH or -OH;

where, at least one of non-adjacent methylene ($-CH_2-$) in L^1, L^2, L^3, R^1, R^2, R^3 and R^4 can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -O-CO-O-, $-CR^5=CR^6-$ or -C≡C-;

R^5 and R^6 are each independently H or C_{1-6} linear alkyl;

X is O or S; and

n is 0 or 1,

wherein the solvent (B) comprises a solvent (B1) represented by the formula (b1):

R^{21}-O-R^{22} (b1)

wherein

R^{21} and R^{22} are each independently linear, branched or cyclic C_{1-8} alkyl.

2. The thickening composition according to claim 1, wherein R^4 is represented by the formula (a2):

-$(R^7)_p$-$(R^8)_q$-R^9 (a2)

wherein

R^7 is C_{1-15} linear alkylene, C_{3-15} branched alkylene, C_{3-15} cyclic alkylene or phenylene;

R^8 is C_{1-15} linear alkylene, C_{3-15} branched alkylene, C_{3-15} cyclic alkylene or phenylene;

R^9 is C_{1-15} linear alkyl, C_{3-15} branched alkyl, C_{3-15} cyclic alkyl, phenyl or benzyl;

where, at least one of hydrogen atoms in any of R^7, R^8 or R^9 can be replaced with C_{1-5} linear alkyl, -COOH or -OH; and

p and q are each independently 0 or 1.

3. The thickening composition according to claim 1 or 2, wherein the polymer (A) has a mass average molecular weight of 500 to 20,000.

4. The thickening composition according to one or more of claims 1 to 3, wherein the amount having a molecular weight in terms of polystyrene of 500 to 10,000 is 60% or more of the total amount of the polymer (A) in the molecular weight distribution curve obtained by gel permeation chromatography of the polymer (A).

5. The thickening composition according to one or more of claims 1 to 4, wherein the carbon atom parameter represented by the formula (I) is 2.0 to 5.0:

Carbon atom parameter = (total number of atoms in the repeating unit (A1)) / (number of C in the repeating unit (A1) - number of O in the repeating unit (A1)) (I)

6. The thickening composition according to one or more of claims 1 to 5, wherein the cyclic structure ratio represented by the formula (II) is 5 to 80%:

Cyclic structure ratio = (sum of atomic weights of all atoms constituting the cyclic structure included in the repeating unit (A1)) / (sum of atomic weights of all atoms constituting the repeating unit (A1)) x 100 (II)

7. The thickening composition according to one or more of claims 1 to 6, wherein L^1, L^2 and L^3 are single bonds.

8. The thickening composition according to one or more of claims 1 to 7, wherein R^1, R^2 and R^3 are H.

9. The thickening composition according to one or more of claims 1 to 8, wherein the content of the polymer (A) is 0.01 to 30 mass % based on the total mass of the thickening composition.

10. A method for manufacturing a thickened resist pattern comprising the following steps:

(1) applying a resist composition above a substrate to form a resist layer from the resist composition (preferably by heating);

(2a) exposing the resist layer (preferably with EUV light);

(2b) applying the thickening composition according to one or more of claims 1 to 9 to the resist layer to form a thickening layer (preferably by heating or spin drying); and

(2c) developing the resist layer and the thickening layer (preferably developing with an alkaline aqueous solution or an organic solvent; more preferably developing with an alkaline aqueous solution).

11. The method according to claim 10, further comprising removing the upper part of the thickening layer by rinsing after forming the thickening layer in the step (2b).

12. The method according to claim 10 or 11, wherein the resist composition is a chemically amplified resist composition.

13. The method according to one or more of claims 10 to 12, wherein the resist composition further comprises a photoacid generator.

14. A method for manufacturing a processed substrate comprising the following steps:

forming a thickened resist pattern according to one or more of claims 10 to 13; and

(3) processing using the thickened resist pattern as a mask.

15. A method for manufacturing a device comprising the method according to claim 14:

optionally further comprising a step of forming a wiring on the processed substrate; or

optionally the device is a semiconductor device.