[0673] E1: Exposure dose (mJ/cm^2) with which a CH pattern having a hole diameter of 76 nm was formed

[0674] E2: Exposure dose (mJ/cm^2) with which a CH pattern, having a hole diameter of 84 nm was formed

[0675] The larger the value of the "EL margin", the smaller the change in the pattern size by the variation of the exposure dose.

[0676] [Evaluation of Mask Error Factor (MEF)]

[0677] The mask error factor (MEF) was evaluated with respect to the CH pattern having a hole diameter of 80 nm (pitch: 140 nm).

[0678] With the above Eop, CH patterns having a pitch of 140 μm were formed using a mask pattern targeting a hole diameter of 75 to 85 nm (11 target sizes at intervals of 1 μm).

[0679] The value of the mask error factor was determined as the gradient of a graph obtained by plotting the target mask size (nm) on the horizontal axis, and the actual hole diameter (nm) of the formed CH patterns on the vertical axis. The results are shown in Table 4.

[0680] [Evaluation of in-Plane Uniformity (CDU) of Pattern Size]

[0681] With respect to each of the CH patterns formed with the above Eop, the hole diameter (CD) of 25 holes were measured. From the results, the value of 3 times the standard deviation σ (i.e., 3σ) was calculated as a yardstick of CD uniformity (CDU). The results are shown in Table 4.

[0682] The smaller this 3σ value is, the higher the level of the in-plane uniformity (CDU) of the holes formed in the resist film.

[0683] [Evaluation of Circularity]

[0684] Each of the CH patterns formed with the above Eop was observed from the upper side thereof using a scanning electron microscope (product name: S-9220, manufactured by Hitachi, Ltd.), and with respect to each of 25 holes, the distance from the center of the hole to the outer periphery thereof was measured in 24 directions. From the results, the value of 3 times the standard deviation σ (i.e., 3σ) was calculated as a yardstick of circularity. The results are shown in Table 4.

[0685] The smaller this 3σ value is, the higher the level of circularity of the holes.

[0686] [Evaluation of Depth of Focus (Doe)]

[0687] The depth of focus (DOE) was evaluated with respect to CH patterns having a hole diameter of 80 nm.

[0688] With the above-mentioned Bop, the focus was appropriately shifted up and down and resist patterns were formed in the same manner as in the "formation of resist pattern (2)", and the depth of focus (DOF; unit: μm) with which a CH pattern was formed within the range where the variation in the target size was ±5% (i.e., 76 to 84 nm) was determined. The results are shown in Table 4.

TABLE 4

	Eop (mJ/cm^2)	EL margin (%)	MEF	CDU	Circularity	DOF (μm)
Ex. 6	24.8	8.17	6.02	7.44	3.50	0.13
Ex. 7	24.0	9.05	6.24	9.56	3.10	0.20

[0689] From the results shown in Table 4, it was confirmed that both, of the positive resist compositions of Examples 6 and 7 according to the present invention exhibited excellent lithography properties.

[0690] While preferred embodiments of the invention have been described and illustrated above, it should be understood that these are exemplary of the invention and are not to be considered as limiting. Additions, omissions, substitutions, and other modifications can be made without departing from the spirit or scope of the present invention. Accordingly, the invention is not to be considered as being limited by the foregoing description, and is only limited by the scope of the appended claims.

What is claimed is:

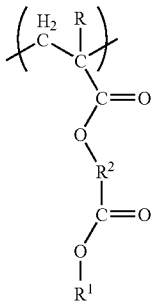
1. A positive resist composition comprising a base component (A) which exhibits increased solubility in an alkali developing solution under action of acid and an acid-generator component (B) which generates acid upon exposure,

the component (A) comprising a polymeric compound (A1) comprised of a structural unit (a0) represented by general formula (a0-1) shown below, and

the acid generator (B) comprising an acid generator (B1) having an anion moiety represented by general formula (1) shown below:

[Chemical Formula 1]

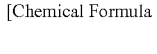
(a0-1)



wherein R represents a hydrogen atom, an alkyl group of 1 to 5 carbon atoms or a halogenated alkyl group of 1 to 5 carbon atoms; R^1 represents an acid dissociable, dissolution inhibiting group; and R^2 represents a divalent hydrocarbon group which may have a substituent; and

[Chemical Formula 2]

(I)



wherein X represents a hydrocarbon group of 3 to 30 carbon atoms which may have a substituent; Q^1 represents a divalent linking group containing an oxygen atom; and Y' represents an alkylene group of 1 to 4 carbon atoms which may have a substituent or a fluorinated alkylene group of 1 to 4 carbon atoms which may have a substituent.

2. The positive resist composition according to claim **1**, wherein the structural unit (a0) is represented by general formula (a0-1-10) shown below: