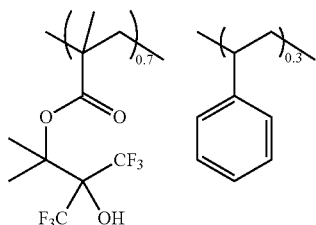


**85**

Reference Polymer 1

Mw=8,200

Mw/Mn=1.69



Reference Polymer 1

## Examples and Comparative Examples

## Preparation of Resist Composition

A positive resist composition in solution form was prepared by dissolving a resist film surface-modifying polymer (Polymers 1 to 7, shown above), a polymer obtained by conventional radical polymerization (Resist Polymers 1 to 5, shown below) and components in a solvent in accordance with the formulation of Table 1 and filtering through a filter with a pore size of 0.2  $\mu\text{m}$ .

## EUV Lithography Patterning Test

On a silicon substrate having a diameter of 4 inches, a silicon-containing SOG film of SHB-A940 (Shin-Etsu Chemical Co., Ltd.) was formed to a thickness of 35 nm. The positive resist composition was coated on the SOG film and prebaked on a hot plate at 110° C. for 60 seconds to form a resist film of 35 nm thick. The resist film was exposed to EUV through a pseudo phase-shift-mask (PSM) in an exposure tool (NA 0.3), baked (PEB) at the temperature shown in Table 2, developed in 0.20N tetrabutylammonium hydroxide (TBAH) aqueous solution for 30 seconds, rinsed with deionized water, and spin dried, forming a resist pattern. Sensitivity is the dose at which a 20-nm line-and-space pattern was formed. Maximum resolution is the minimum size which was resolved at that dose. The pattern was measured for edge roughness (LWR) under SEM. The results are shown in Table 2.

## Outgassing Test Simulated for EUV Lithography

The resist composition (see Table 3) was coated onto a HMDS-primed 12-inch wafer to form a resist film of 60 nm thick. Using a resist outgassing tool (EUV Tech), the resist film was exposed to EB in a varying dose, baked (PEB) at the temperature shown in Table 3, and developed in an alkaline developer (2.38 wt % TMAH aqueous solution). E0 is the dose at which the film thickness became 0 nm. After the wafer was subjected to flood exposure at the dose of E0, the thickness of contaminants deposited on Witness Plate was measured by spectral ellipsometry. The results are shown in Table 3.

**86**

Resist Polymer 1

Mw=6,700

Mw/Mn=1.58

5

Resist Polymer 1

10

15

20

25

30

35

40

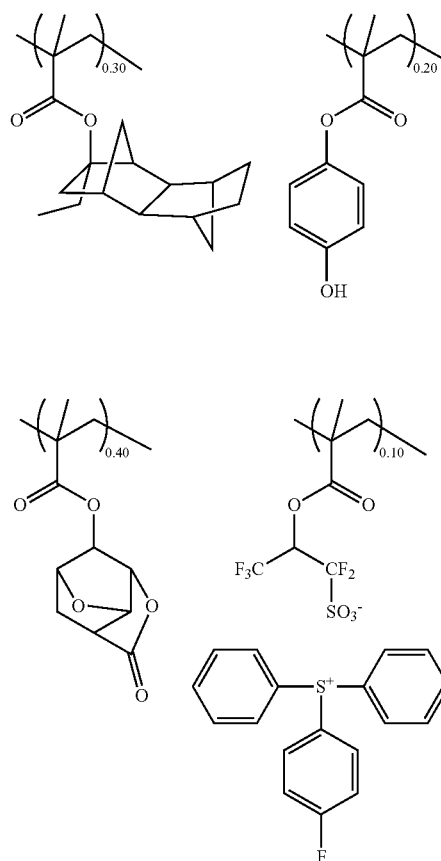
45

50

55

60

65



Resist Polymer 2

Mw=6,900

Mw/Mn=1.68

Resist Polymer 2

