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An amount of the compound of Component (D) in the positive resist composition of the present invention is preferably from 0.01 to 10% by weight, more preferably from 0.03 to 5% by weight, and particularly preferably from 0.05 to 3% by weight based on the solid content of the resist composition. The compounds that generate a carboxylic acid upon irradiation of an actinic ray or radiation may be used individually or as a mixture of two or more thereof.

A ratio of the compound of Component (B)/the compound of Component (D) by weight is ordinarily from 99.9/0.1 to 50/50, preferably 99/1 to 60/40, and particularly preferably from 98/2 to 70/30.

[5] Surfactant

In the present invention, a surfactant can be used, and the use of surfactant is preferred from the viewpoint of film forming property, adhesion of pattern, reduction of development defect or the like.

Specific examples of the surfactant include nonionic surfactants, for example, polyoxyethylene alkyl ethers (for example, polyoxyethylene lauryl ether, polyoxyethylene stearyl ether, polyoxyethylene cetyl ether or polyoxyethylene oleyl ether), polyoxyethylene alkylaryl ethers (for example, polyoxyethylene octylphenyl ether or polyoxyethylene nonylphenyl ether), polyoxyethylene-polyoxypropylene block copolymers, sorbitan fatty acid esters (for example, sorbitan monolaurate, sorbitan monopalmitate, sorbitan monostearate, sorbitan monooleate, sorbitan trioleate or sorbitan tristearate) and polyoxyethylene sorbitan fatty acid esters (for example, polyoxyethylene sorbitan monolaurate, polyoxyethylene sorbitan monopalmitate, polyoxyethylene sorbitan mono-stearate, polyoxyethylene sorbitan trioleate or poly-oxyethylene sorbitan tristearate); fluorine based surfactants or silicon based surfactants, for example, Eftop EF301, Eftop EF303 or Eftop EF352 (manufactured by Jemco Inc.), Megafac F171 or Megafac F173 (manufactured by Dainippon Ink and Chemicals, Inc.), Fluorad FC430 or Fluorad FC431 (manufactured by Sumitomo 3M Limited), Asahi Guard AG710, Surfion S-382, Surfion SC101, Surfion SC102, Surfion SC103, Surfion SC104, Surfion SC105 or Surfion SC106 (manufactured by Asahi Glass Co., Ltd.) and Troysol S-366 (manufactured by Troy Chemical Industries, Inc.); organosiloxane polymers (for example, KP341 manufactured by Shin-Etsu Chemical Co., Ltd.) and acrylic acid based or methacrylic acid based (co)polymers (for example, Polyflow No. 75 or Polyflow No. 95 manufactured by Kyoeisha Chemical Co., Ltd.).

An amount of the surfactant is ordinarily not more than 2 parts by weight, and preferably not more than 1 part by weight based on 100 parts by weight of the solid content of the resist composition of the present invention.

The surfactants may be used individually or in combination of two or more thereof.

It is preferred to contain either one or two or more kinds of fluorine based and/or silicon based surfactants (including a fluorine based surfactant, a silicon based surfactant and a surfactant containing both a fluorine atom and a silicon atom) as the surfactant in view of improving film forming property, reducing development defect and increasing wettability of a developing solution on the resist film.

Examples of such surfactants include surfactants described in JP-A-62-36663, JP-A-61-226746, JP-A-61-226745, JP-A-62-170950, JP-A-63-34540, JP-A-7-230165, JP-A-8-62834, JP-A-9-54432, JP-A-9-5988, JP-A-2002-277862 and U.S. Pat. Nos. 5,405,720, 5,360,692, 5,529,881, 5,296,330, 5,436,098, 5,576,143, 5,294,511 and 5,824,451.

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Further, commercially available surfactants as described below can also be used as they are.

Examples of the commercially available surfactant that can be used include fluorine based surfactants or silicon based surfactants, for example, Eftop EF301 or Eftop EF303 (manufactured by Jemco Inc.), Fluorad FC430 or Fluorad FC431 (manufactured by Sumitomo 3M Limited), Megafac F171, Megafac F173, Megafac F176, Megafac F189 or Megafac R08 (manufactured by Dainippon Ink and Chemicals, Inc.), Surfion S-382, Surfion SC101, Surfion SC102, Surfion SC103, Surfion SC104, Surfion SC105 or Surfion SC106 (manufactured by Asahi Glass Co., Ltd.) and Troysol S-366 (manufactured by Troy Chemical Industries, Inc.). Also, Polysiloxane Polymer KP-341 (manufactured by Shin-Etsu Chemical Co., Ltd.) can be used as the silicon based surfactant.

Besides the above-described known surfactants, surfactants using a polymer containing a fluoro aliphatic group derived from a fluoro aliphatic compound produced by a telomerization process (also called a telomer process) or an oligomerization process (also called an oligomer process) can also be used as the surfactant. The fluoro aliphatic compound can be synthesized according to the method described in JP-A-2002-90991.

As the polymer containing a fluoro aliphatic group, copolymers of a fluoro aliphatic group-containing monomer and a (poly(oxyalkylene)) acrylate and/or a (poly(oxyalkylene)) methacrylate are preferred. The copolymer may be in the form of a random copolymer or a block copolymer. Examples of the poly(oxyalkylene) group include a poly(oxyethylene) group, a poly(oxypropylene) group and a poly(oxybutylene) group. Also, units containing alkynes having a different chain length in the same chain, for example, a poly(block connecting body of oxyethylene, oxypropylene and oxyethylene) group and a poly(block connecting body of oxyethylene and oxypropylene) group may be used. Further, the copolymer of a fluoro aliphatic group-containing monomer and a (poly(oxyalkylene)) acrylate (or methacrylate) includes not only binary copolymers but also ternary or multi-component copolymers prepared by copolymerization of two or more different fluoro aliphatic group-containing monomers or two and more different (poly(oxyalkylene)) acrylates (or methacrylates).

Examples of commercially available surfactants include Megafac F178, Megafac F-470, Megafac F-473, Megafac F-475, Megafac F-476 or Megafac F-472 (manufactured by Dainippon Ink and Chemicals, Inc.). Also, copolymers of a C_6F_{13} group-containing acrylate (or methacrylate) and a (poly(oxyalkylene)) acrylate (or methacrylate), copolymers of a C_6F_{13} group-containing acrylate (or methacrylate), (poly(oxyethylene)) acrylate (or methacrylate) and (poly(oxypropylene)) acrylate (or methacrylate), copolymers of a C_8F_{17} group-containing acrylate (or methacrylate) and a (poly(oxyalkylene)) acrylate (or methacrylate), and copolymers of a C_8F_{17} group-containing acrylate (or methacrylate), (poly(oxyethylene)) acrylate (or methacrylate) and (poly(oxypropylene)) acrylate (or methacrylate) can be exemplified.

An amount of the surfactant used is preferably from 0.0001 to 2% by weight, and more preferably from 0.001 to 1% by weight based on the total amount of the positive resist composition (excluding a solvent).

[6] Other Components

The positive resist composition of the present invention may further contain other components, for example, a dye, a photo-base generator or the like, if desired.