units for a purpose of adjusting (1) the solubility with respect to a coating solvent, (2) the film-forming property (glass transition point), (3) the developing property (particularly the alkali developing property, and the like.

Examples of the repeating structure units include repeating units which are derived from the monomers which will be described below.

Examples of the monomers include a compound and the like which have one addition polymerizable unsaturated bond selected from (meth)acrylic acid, (meth)acrylic acid esters, vinyl esters (for example, vinyl acetate), styrenes (for example, styrene, p-hydroxystyrene), vinylpyrrolidone, (meth)acrylamides, an aryl compound, vinyl ethers, crotonical esters, and the like; however, the present invention is not limited thereto.

In addition, copolymerization may be carried out as long as the compound is an addition polymerizable unsaturated compound which is able to be copolymerized with monomers which are equivalent to the various types of the repeating structure units described above.

In the present invention, particularly when performing EUV exposure, from the viewpoint of functioning as a filter of out-of-band light, the resin (T) preferably has a repeating unit which has an aromatic ring.

From this viewpoint, as described above, L_{51} in General Formulas (I-1) to (I-5) is preferably a group which includes an arylene group, and more preferably an arylene group. In addition, the resin (T) also preferably contains a repeating unit which has an aromatic ring other than the repeating unit which is represented by General Formulas (I-1) to (I-5). Examples of the repeating unit which has an aromatic ring include repeating units which are derived from monomers such as styrene, p-hydroxystyrene, phenyl acrylate, and phenyl methacrylate. It is preferable to have a repeating unit (d) which has a plurality of aromatic ring among these.

Examples of the repeating units (d) which have a plurality of aromatic rings include the same repeating units as for the repeating unit (d) which has a plurality of aromatic rings which is represented by General Formula (d1) which the resin (A) may have.

Among these, the repeating unit which is represented by General Formula (d2) is also preferable in the same manner.

Here, with regard to extreme ultraviolet ray (EUV light) exposure, leaking light (out-of-band light) which is generated in an ultraviolet ray region with a wavelength of 100 nm to 400 nm deteriorates surface roughness and, as a result, there is a tendency for the resolution or LWR performance to be decreased due to bridges between patterns or broken lines in the patterns.

However, the aromatic ring in the repeating unit (d) may function as an inner filter which is able to absorb the out-of-band light described above.

Specific examples of the repeating unit (d) are the same as the specific examples of the repeating unit (d) which the resin (A) may have.

The resin (T) may or may not contain the repeating unit (d); however, when contained, the content ratio of the repeating unit (d) is preferably in a range of 1 mol % to 30 mol % with respect to all of the repeating units of the resin (T) and more preferably in a range of 1 mol % to 20 mol %. The repeating units (d) which are included in the resin (T) may be included in a combination of two or more types.

It is possible to use the resin (C) described in the actinic ray-sensitive or radiation-sensitive resin composition as the resin (T) which is contained in the top coat composition. In particular, this is favorable in a case where the solvent in the top coat composition is an organic solvent.

The resin (T) which is contained in the top coat composition other than the resin (T) may be a water-soluble resin. In particular, this is favorable in a case where the solvent in the top coat composition is water or an alcohol-based solvent. It is considered that it is possible to increase the uniformity of the solubility due to the developer by the resin (T) being a water-soluble resin.

Examples of a preferable water-soluble resin include polyacrylic acid, polymethacrylic acid, polyhydroxystyrene, polyvinylpyrrolidone, polyvinyl alcohol, polyvinyl ether, polyvinyl acetal, polyacrylimide, polyethylene glycol, polyethylene oxide, polyethylene imine, polyester polyol, polyether polyol, polysaccharide, and the like. Polyacrylic acid, polymethacrylic acid, polyhydroxystyrene, polyvinylprrolidone, and polyvinyl alcohol are particularly preferable. Here, the water-soluble resin is not limited to a homopolymer and may be a copolymer. For example, the water-soluble resin may be a copolymer which has a monomer which is equivalent to the repeating unit of the homopolymer described above and other monomer units than this. In detail, it is also possible to use an acrylic acid-methacrylic acid copolymer, an acrylic acid-hydroxystyrene copolymer, and the like for the present invention.

It is possible to obtain commercially available water-soluble resins which may be used for the present invention and specific examples thereof include polyacrylic acid Julymer AC-10L (manufactured by Nihon Junyaku Corp.), poly (N-vinylpyrrolidone) Luviskol K90 (manufactured by BASF Corp.), (vinyl alcohol 60/vinyl acetate 40) copolymer SMR-8M (manufactured by Shin-Etsu Chemical Co., Ltd.), and the like.

In addition, the resin (T) may be used as one type or a plurality thereof may be used together.

The weight average weight molecular of the resin (T) is not particularly limited, but is preferably 2000 to 1000000, more preferably 5000 to 100000, and particularly preferably 6000 to 50000. Here, the weight average molecular weight of the resin indicates a polystyrene conversion molecular weight which is measured by GPC (carrier: THF or N-methyl-2-pyrrolidone (NMP)).

In addition, the dispersity (Mw/Mn) is preferably 1.00 to 5.00, more preferably 1.00 to 3.50, and even more preferably 1.00 to 2.50.

Other components than the resin (T) may be included in the top coat composition; however, the ratio of the resin (T) in the solid content of the top coat composition is preferably 80 mass % to 100 mass %, more preferably 90 mass % to 100 mass %, and particularly preferably 95 mass % to 100 mass %.

Specific examples of the resin (T) which is contained in the top coat composition will be shown below; however, the present invention is not limited thereto. The compositional ratio of each of the repeating units in each of the specific examples is represented by a mol ratio.

T-1