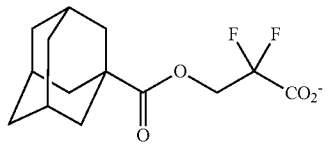
bon groups are as exemplified for R^0. When R^{01} and R^{02} bond together to form a ring with the carbon atom to which they are attached, suitable cyclic substituent groups thus formed include cyclopentyl, cyclohexyl, norbornyl and adamantyl. In these groups, one or more hydrogen atom may be replaced by a heteroatom such as oxygen, sulfur, nitrogen, or halogen, or a heteroatom such as oxygen, sulfur or nitrogen may intervene, and as a result, a hydroxyl group, cyano group, carbonyl group, ether bond, ester bond, sulfonate bond, carbonate bond, lactone ring, sultone ring, carboxylic anhydride or haloalkyl group may form or intervene.

It is noted that at least one of R^0, R^{01} and R^{02} has a cyclic structure. Suitable cyclic groups include cyclopentyl, cyclohexyl, norbornyl, tricyclo[5.2.1.$0^{2,6}$]decanyl, adamantyl, phenyl, naphthyl, and anthracenyl. In these groups, one or more hydrogen atom may be replaced by a heteroatom such as oxygen, sulfur, nitrogen, or halogen, or a heteroatom such as oxygen, sulfur or nitrogen may intervene, and as a result, a hydroxyl group, cyano group, carbonyl group, ether bond, ester bond, sulfonate bond, carbonate bond, lactone ring, sultone ring, carboxylic anhydride or haloalkyl group may form or intervene. Of the cyclic groups exemplified above, aliphatic hydrocarbon groups are preferred.

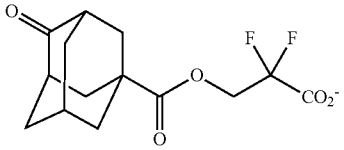
In formula (1), L is a single bond or forms an ester bond, sulfonate (sulfonic acid ester) bond, carbonate bond or carbamate bond with the vicinal oxygen atom.

Preferred structures for the anion moiety of the sulfonium salt having formula (1) are shown below although the invention is not limited thereto. Sulfonium salts having these structures as the anion have properly controlled hydrophilicity despite carboxylic acid salts and are least leachable in water during immersion lithography.

(A-1)



(A-2)



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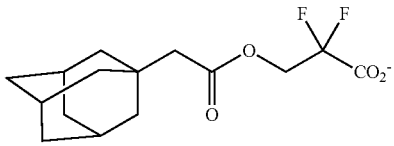

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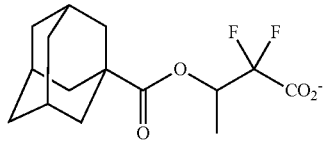
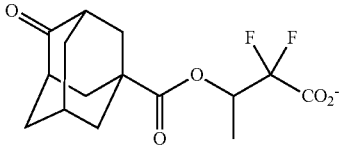


(A-5)



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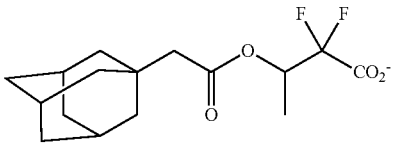
(A-6)



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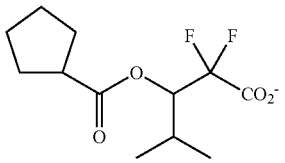
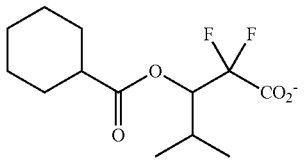
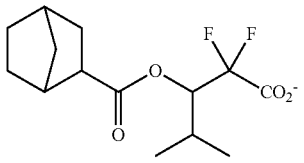


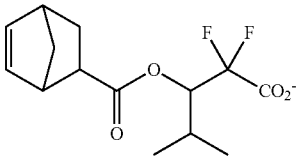
(A-8)



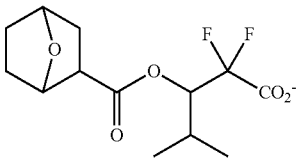
(A-9)



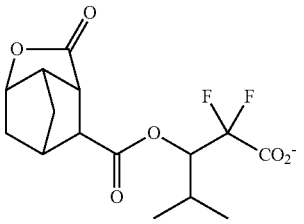
(A-10)



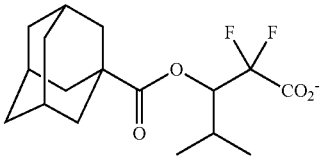
(A-11)



(A-12)



(A-13)



(A-14)