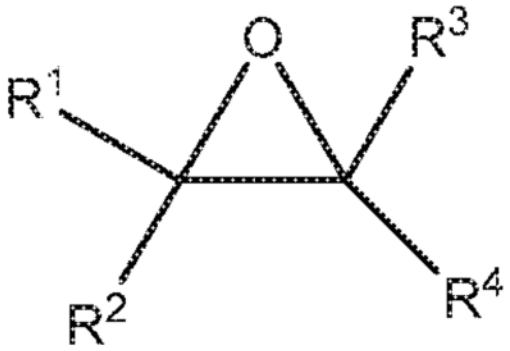
Claims

1. A method for preparing a partially fluorinated alcohol, comprising reacting an epoxide:



wherein R_1, R_2, R_3 and R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl with a fluorinating agent.

2. A method according to claim 1, where the fluorinating agent comprises a nucleophilic fluorinating agent.

3. A method according to claim 1, where the fluorinating agent is selected from HF and complexes of HF with nitrogen containing species, such as Olah's reagent (HF:Pyridine complex), with urea, or with a tertiary amine.

4. A method according to claim 3, where the ratio of HF to pyridine is 7:3 by weight.

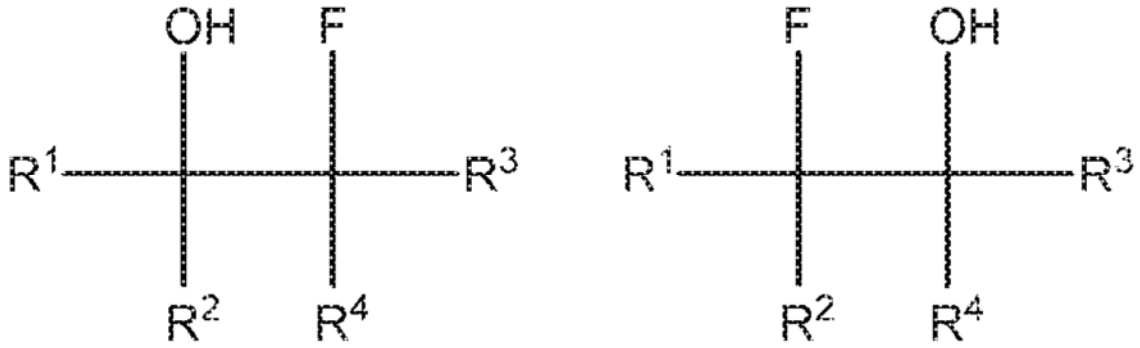
5 . A method according to claim 1, where one of R_1 to R_4 is $-CF_3$, one of R_1 to R_4 is -F and two of R_1 to R_4 are -H; preferably R_1 is -F and R_3 is $-CF_3$, R_2 and R_4 are -H or preferably R_1 is -F and R_2 is $-CF_3$, R_3 and R_4 are -H;or

where two of R_1 to R_4 are $-CF_3$ and two of R_1 to R_4 are -H; preferably R_1 is $-CF_3$ and R_3 is $-CF_3$; R_2 is -H and R_4 are -H; or

where one of R_1 to R_4 is $-CF_3$ and three of R_1 to R_4 are -H; preferably R_1 is $-CF_3$, R_2, R_3 and R_4 are -H; or

where one of R_1 to R_4 is $-CF_3$, one of R_1 to R_4 is -Cl and two of R_1 to R_4 are -H; preferably R_1 is -Cl and R_3 is $-CF_3$, R_2 and R_4 are -H or preferably R_1 is -Cl and R_2 is $-CF_3$, R_3 and R_4 are -H.

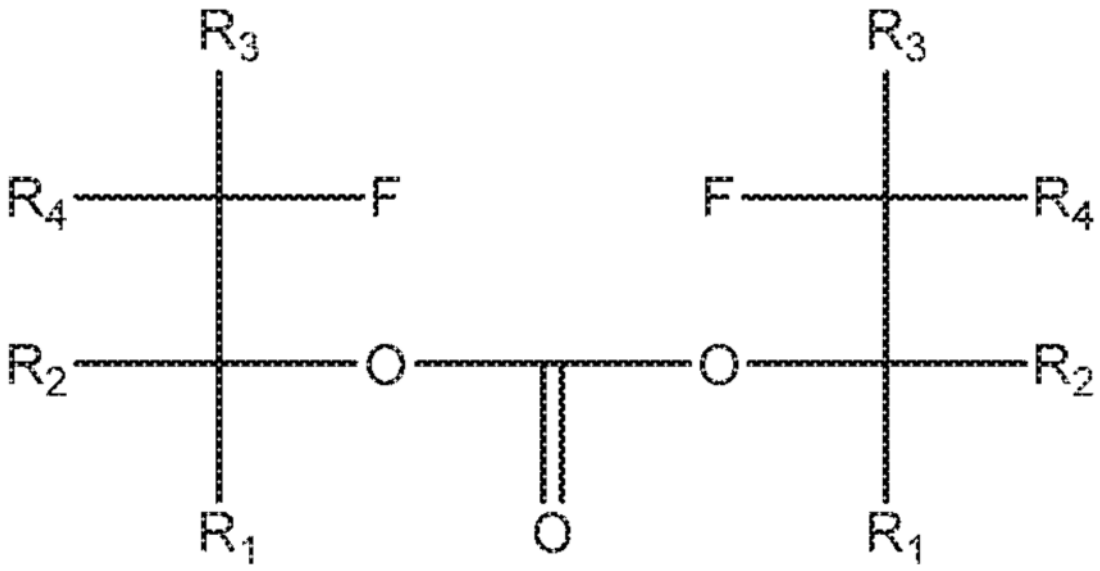
6. Compounds with the structure



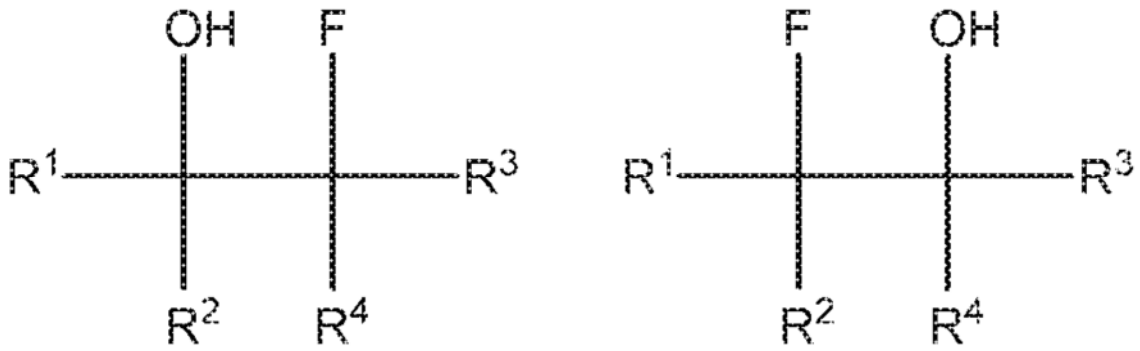
wherein R_1, R_2, R_3 and R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl, with the provision that the compound is not 1,1,1,3-tetrafluoropropan-2-ol.

7. A compound of claim 6, formed by the process of one of claims 1 to 5.

8. A method for preparing a partially fluorinated carbonate ester with the structure

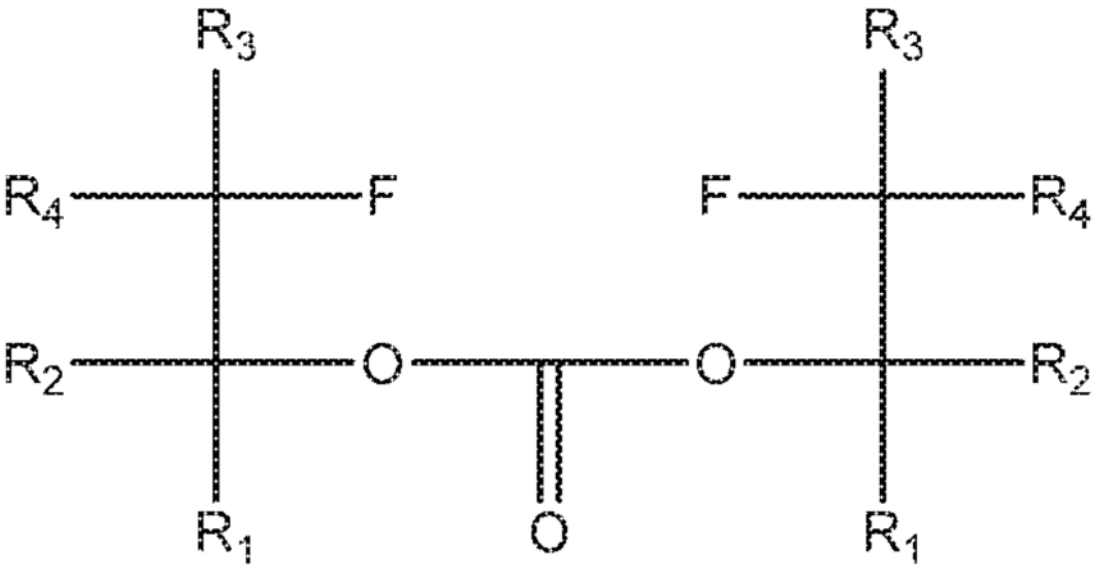


comprising reacting a fluorohydrin with the structure

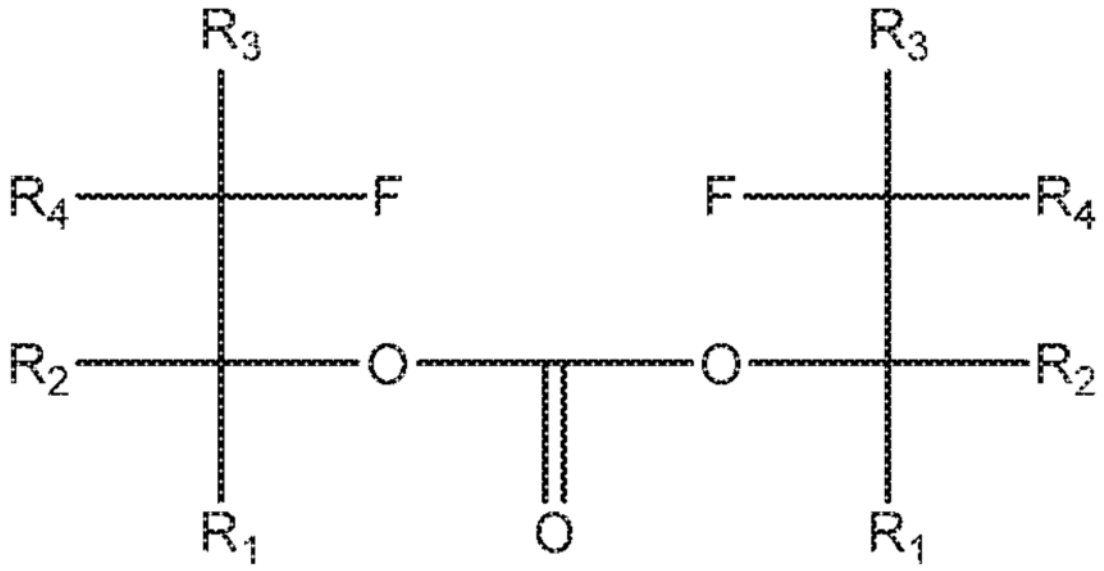


wherein R_1, R_2, R_3 and R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl with COX_2, wherein X is selected from the group comprising -F, -Cl, -OCH_3, -$OCCl_3$, imidazole, succinimidyl.

9. A compound with the structure



10. A composition comprising a compound with the structure

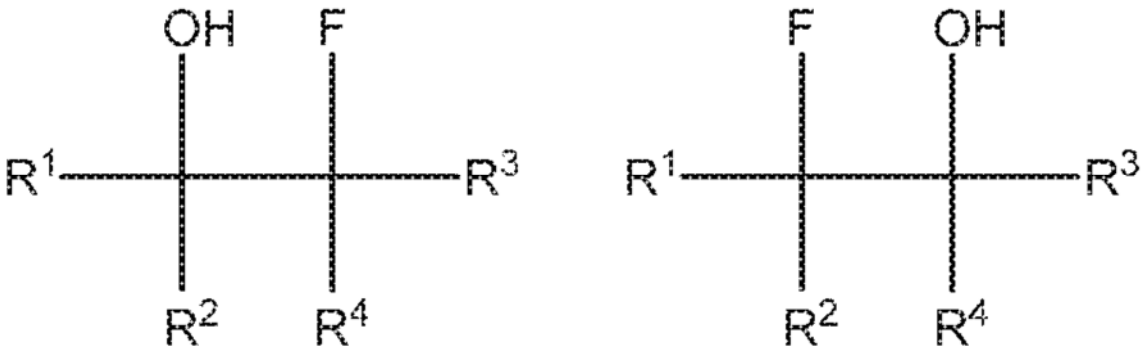


11. The use of a compound according to claim 9 or a composition according to claim 10 as a solvent, for example, in battery applications.

12. A solvent composition comprising a compound according to claim 9 or a composition according to claim 10, optionally

wherein the composition comprises an electrolyte comprising a lithium salt, selected from the group comprising lithium hexafluorophosphate ($LiPF_6$), lithium triflate ($LiSO_3CF_3$), lithium bis(fluorosulfonyl)imide ($Li(FSO_2)_2N$) and lithium bis(trifluoromethanesulfonyl)imide ($Li(CF_3SO_2)_2N$).

13. A method for preparing a fluorinated compound, comprising reacting a compound:



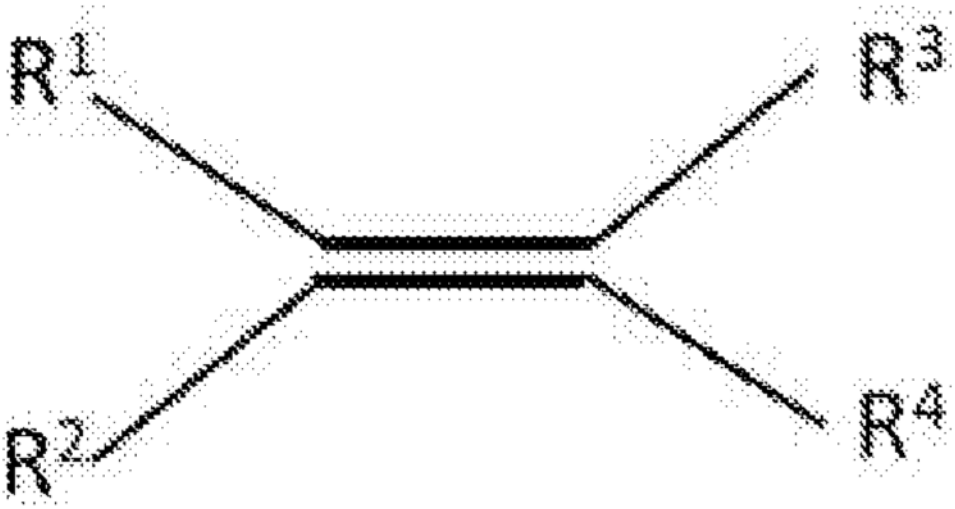
wherein at least 2 of R_1 to R_4 independently comprise H, Cl, Br, I with a fluorinating agent

14. A method according to claim 13, wherein in the fluorinated compound at least 2 of R_1 to R_4 independently comprise F, CF_3 or a fluoroalkyl; or

wherein in the fluorinated compound at least 1 of R_1 to R_4 comprises H.

15. A method according to claim 13, wherein the fluorinated compound comprises hexfluroroisopropanol.

16. A method for preparing a partially fluorinated epoxide, comprising reacting a partially fluorinated alkene:



wherein R_1, R_2, R_3 and R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl with an oxidising agent.

17. A method according to claim 16, wherein the oxidising agent is selected from the group comprising air, oxygen and oxygen containing compounds such as peroxides, per-salts and compounds of oxygen with other elements such as hypohalites.

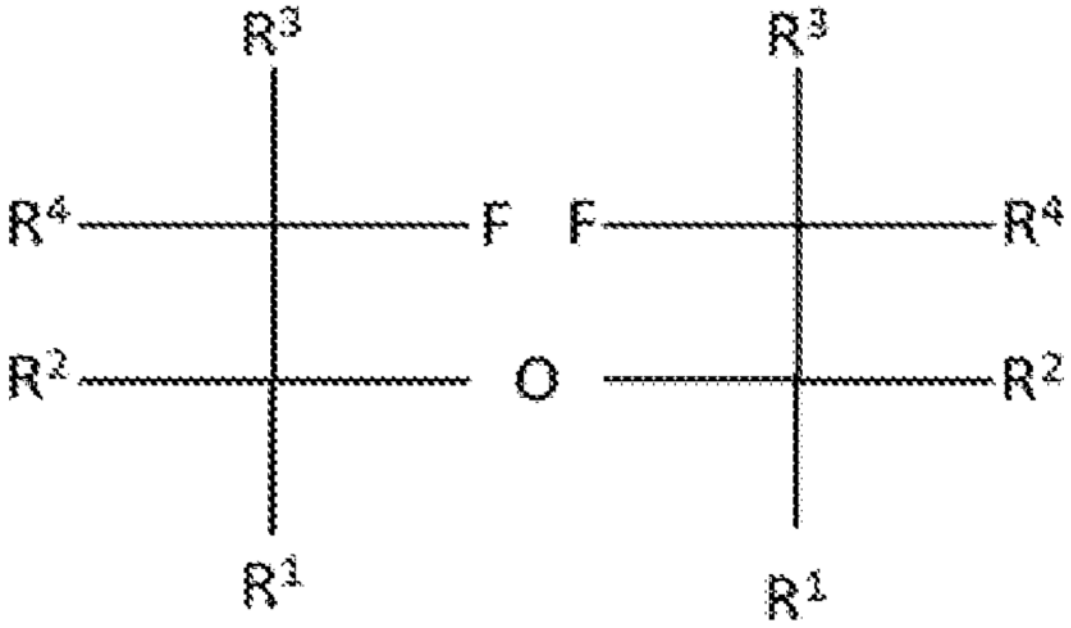
18. A method according to claim 16, wherein the oxidising agent comprises a hypohalite such as chlorite.

19. A method according to claim 16 , wherein the alkene comprises a tetrafluoropropene, such as 1,3,3,3-Tetrafluoropropene (1234ze) or 2,3,3,3-Tetrafluoropropene (1234yf); or a pentafluoropropene, such as 1,1,3,3,3-Pentafluoropropene (1225zc).

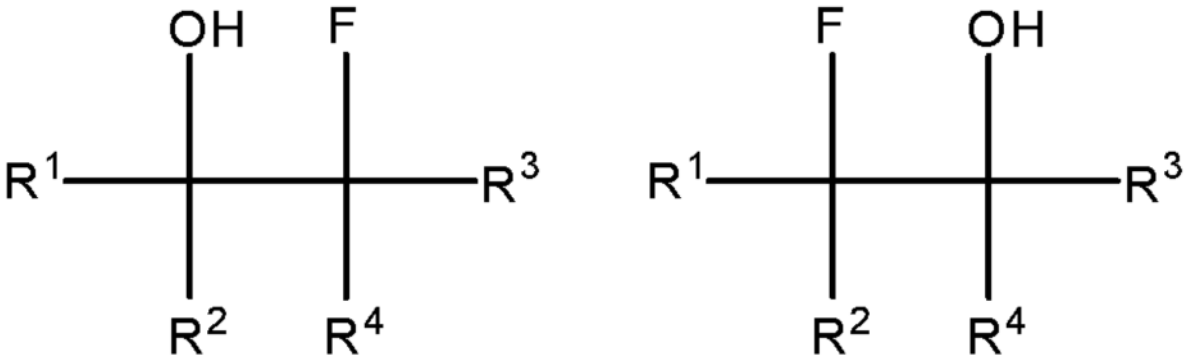
20. A method for preparing a partially fluorinated alcohol, comprising a method for preparing a partially fluorinated epoxide according to claim 16 and a method comprising reacting an epoxide according to claim 1.

21. A method for preparing a partially fluorinated alcohol, comprising a method for preparing a partially fluorinated epoxide according to claim 16, a method comprising reacting an epoxide according to claim 1, and a method for preparing a fluorinated compound according to claim 13.

22. A method for preparing a partially fluorinated ether with the structure

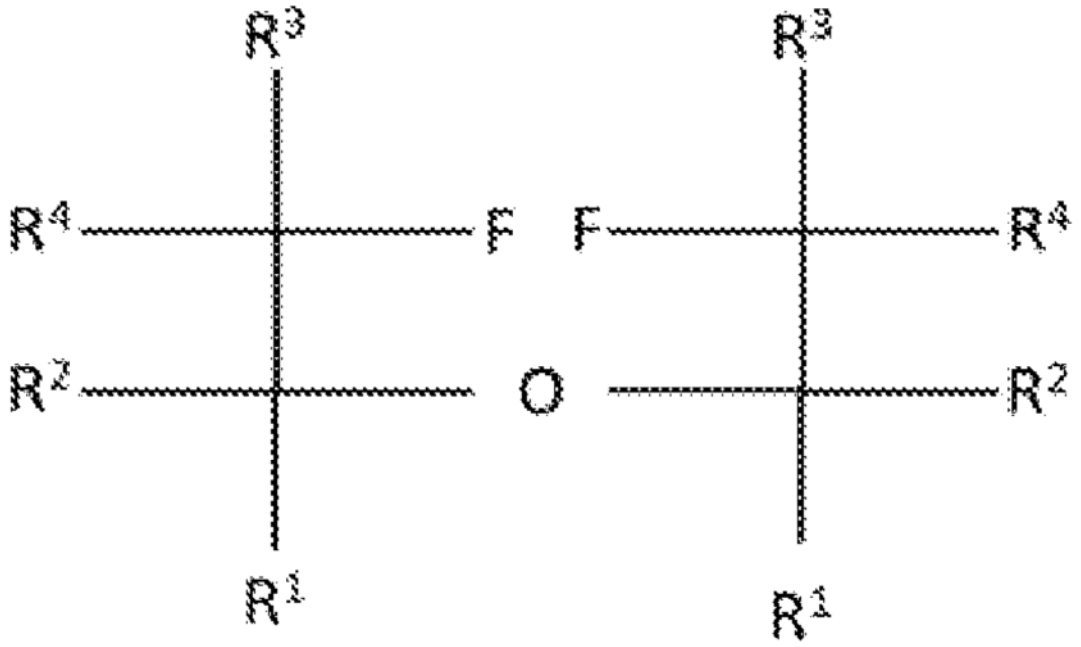


comprising reacting a fluorohydrin with the structure

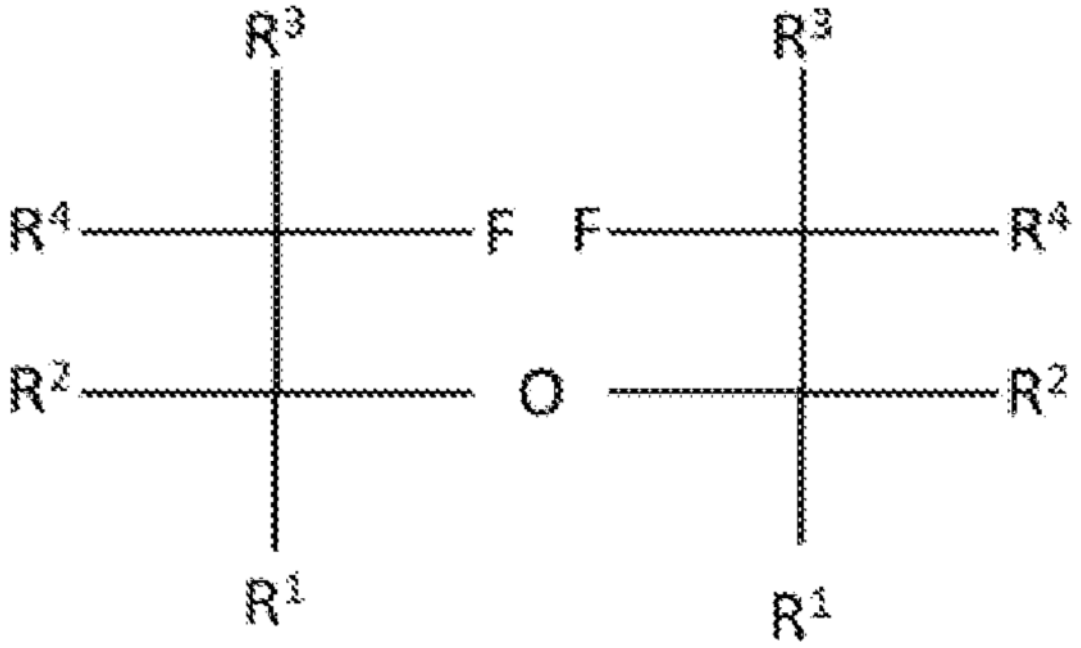


wherein R_1, R_2, R_3 and R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl.

23. A compound with the structure



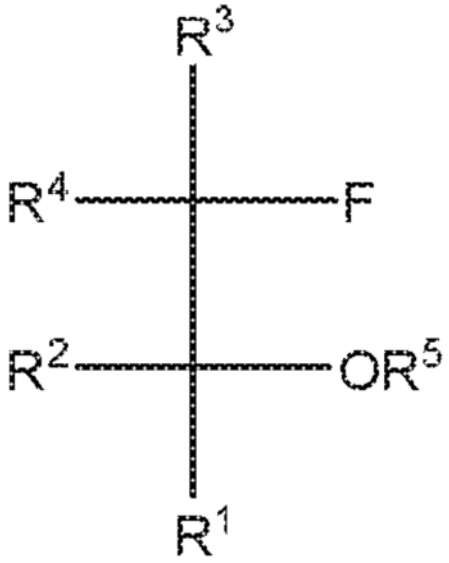
24. A composition comprising a compound with the structure



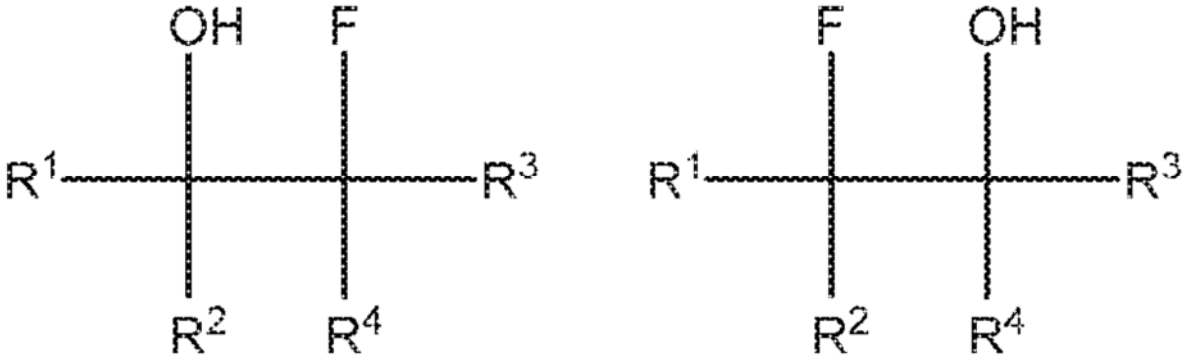
25. The use of a compound according to claim 23 or a composition according to claim 24 as a solvent, for example, in battery applications.

26. The use of a compound according to claim 23 or a composition according to claim 24 as a coolant, for example, as an immersive coolant.

27. A method for preparing a partially fluorinated ether with the structure

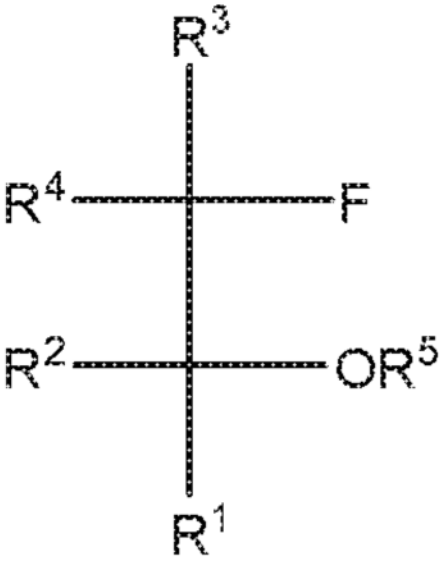


comprising reacting a fluorohydrin with the structure

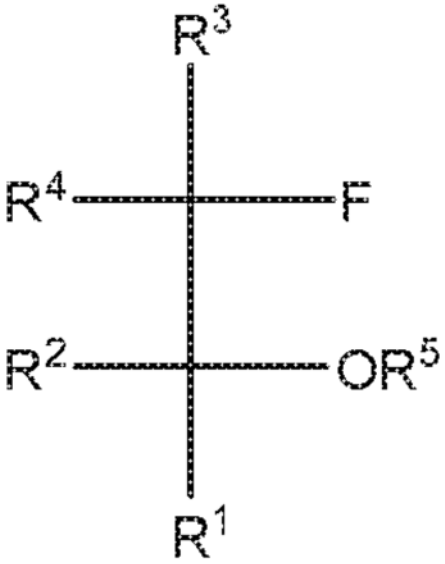


wherein R_1, R_2, R_3, R_4 are independently selected from the group comprising H, F, Cl, Br, I, CF_3, alkyl, fluoroalkyl, haloalkyl and R_5 is independently selected from the group CF_3, alkyl, fluoroalkyl, perfluoroalkyl, haloalkyl perfluorohaloalkyl.

28. A compound with the structure



29. A composition comprising a compound with the structure



30. The use of a compound according to claim 28 or a composition according to claim 29 as a solvent, for example, in battery applications.

31. The use of a compound according to claim 28 or a composition according to claim 29 as a coolant, for example, as an immersive coolant.