Electronic Supplementary Materials

Sulfonimides versus Ketosulfonamides as Epoxidized Imidazolium Counterions: Towards a New Generation of Ionic Liquids Monomers

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I. Epoxidation of imidazolium ketosulfonamides 1a-b or saccharinate 1c

**UPLC**: Acquity UPLC H-Class WATERS
Column: Waters Acquity UPLC CSH C18 1.7 μm

**General procedure:**
- Gradient: H₂O/CH₃CN with 0.1% CH₃CO₂H or H₂O/CH₃CN (95/5 to 0/100).
- Flow: 0.5 mL/min
- Column température: 35 °C
- Sample température: 20 °C

**Mass spectrometry**: Xevo G2-XS QTof WATERS
Positive ion mode (ES+) or negative ion mode (ES-)
- Mass range: 50-1000 m/z
- Source température: 120 °C
- Desolvation température: 550 °C
- Capillary tension: 0.3 kV
- Cone tension: 50 V

I.1 Epoxidation results (NMR)

**¹H NMR of 1a**:

**¹H NMR of 1a after oxidation with DMDO**:

*Presence of side-products in aromatics*  
No traces of alkene

**¹H NMR of 1b**:

**¹H NMR of 1b after oxidation with DMDO**:

*Presence of side-products in aromatics*  
No traces of alkene

I.2 Suggested reactions after HRMS analyses

- R = Me (1a) or Ph (1b)
- R = Me (2a) or Ph (2b)
- R = Me (4a) or Ph (4b)

![Chemical structures](image-url)
- UPLC-MS of compound 1a after oxidation (TOF MS ES⁺ then TOF MS ES⁻)

UPLC-MS (ES⁺) :

HRMS analyses :

Cation of 2a
Cation of 1a

Cation of 5a
UPLC-MS (ES\textsuperscript{+}):
HRMS analyses:
- UPLC-MS of compound 1b after oxidation (TOF MS ES\(^+\) then TOF MS ES\(^-\)):

UPLC-MS (ES\(^+\)):

HRMS analyses:

Cation of 2b
Cation of 1b

Cation of 5a
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**Cation of 4b**

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**N-protonated ketosulfonamide**
UPLC-MS (ES'):

HRMS analyses:
- UPLC-MS of imidazolium saccharinate 1c after oxidation (TOF MS ES$^+$ then TOF MS ES$^-$)

Suggested reactions in accordance with previous analyses:
UPLC-MS (ES⁺):

Cation of 5b

Cation of 4c
UPLC-MS analysis with a gradient 95% H₂O → 100% CH₃CN to separate 4c (m/z = 398):

Cation of 4c

Cation of 5c
Study of the ring opening reaction (saccharinate) in the presence of one equivalent or an excess of mCPBA (direct infusion):

Analyses of these news anions by UPLC-MS:
Reaction between mCPBA and saccharinate (undetermined structure)
II. General experimental and analytical data

All reagents were purchased from Sigma Aldrich, Alfa Aesar or TCI and were used without further purification and used as received: mCPBA (≤77% from Sigma Aldrich), 4-bromo-1-butene (97% from Alfa Aesar), Lithium bis(trifluoromethylsulfonylimide (>98% from Alfa Aesar), Anisole (>99% from Sigma Aldrich), chlorosulfonic acid (99% from Sigma Aldrich), ammonium hydroxide (28% from Sigma Aldrich), sodium hydride (60% from Sigma Aldrich), trifluoromethane sulfonamide (>98% from TCI), 4-fluorobenzenesulfonyl chloride (98% from Alfa Aesar), 4-methoxybenzenesulfonyl chloride (98% from Alfa Aesar), 4-(trifluoromethyl)benzenesulfonyl chloride (98% from Alfa Aesar). Solvents were used in RPE grade without further purification. Anhydrous solvents were obtained from a PURESOV SPS400 apparatus developed by Innovative Technology Inc. All ionic liquids (9, 10, 12a-c, 13a-c, 14a-b, 15a-b) were dried with a vane pump (3 mbar) at room temperature for 1-2 h. $^1$H, $^{19}$F and $^{13}$C NMR spectra were recorded on a Bruker AvanceIII 400 MHz, 500 MHz or AvanceNEO 600 MHz spectrometer. Samples were dissolved in an appropriate deuterated solvent (CDCl$_3$, DMSO-d$_6$, acetone-d$_6$). The chemical shifts (δ) are expressed in ppm relative to internal tetramethylsilane for $^1$H and $^{13}$C nuclei, and coupling constants are indicated in Hz. Abbreviations for signal coupling are as follows: s=singlet; d=doublet; dd=doublet of doublets; t=triplet; q=quartet; quin=quintet; m=multiplet; br=broad signal. To assign the signals to the different proton and carbon atoms, as well as the relative stereochemistry of the cycloadducts, additional 2D NMR experiments (COSY, HSQC, HMBC) and NOESY experiments were performed. High-resolution mass spectra (HRMS) were performed on Acquity UPLC H-Class Xevo G2-XS QTof (WATERS) by electrospray ionization (ESI). Infrared (IR) spectra were recorded with a Perkin Elmer 16 PC FTIR ATR spectrometer, using the pure product (oil or solid). Thin Layer Chromatography (TLC) was run on pre-coated aluminum plates of silica gel 60 F-254 (Merck). Flash chromatography was performed on silica gel column (Merck silica gel, 40-63 mm) using air pressure.

Preparation of Dimethyldioxirane (DMDO). This reagent was prepared according to the procedure described by D. F. Taber. $^1$Titration of different solutions prepared by this procedure afforded a DMDO concentration between 0.04 mol/L and 0.09 mol/L. $^2$

In a 1 mL volumetric test tube, a 0.7 M (C$_{sol}$) solution of thioanisole in acetone-d$_6$ is prepared, to a total volume of 1 mL (0.08 mL of thioanisole + 0.92 mL of acetone-d$_6$). A 0.6 mL portion of this solution is transferred to a tube and chilled to ca. 10 °C in a dry ice/water bath. Upon reaching 10 °C, 3.0 mL of the obtained DMDO solution is added to the thioanisole solution. The resulting solution is stirred for 10 min and then a portion of the solution is added directly to an NMR tube.

III. Preparation of the epoxidized salts

General procedure: To a solution of corresponding alkene in acetone (1 mL) was added freshly prepared DMDO. The reaction mixture was stirred at room temperature until the reaction is completed ($^1$H NMR monitoring). Two drops of dimethyl sulfide (DMS) was added to quench
the reaction mixture and neutralized the excess of DMDO. The crude was concentrated under reduced pressure.

3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium bis(trifluoromethanesulfonylimide) (3a)

According to the general procedure, the title compound was prepared with 1-(3-Buten-1-yl)-3-methylimidazolium bis(trifluoromethanesulfonylimide) (100 mg, 0.240 mmol, 1.0 equiv) in acetone (1 mL) and freshly prepared DMDO (0.04 mol/L) (7.99 mL, 0.335 mmol, 1.4 equiv). The reaction mixture was stirred at room temperature for 6 h. The product 3a was obtained as a yellow oil (103 mg, 99 %).

1H NMR (400 MHz, acetone-d6) δ 9.11 (s, 1H), 7.75-7.83 (m, 2H), 4.57 (t, J = 6.9 Hz, 2H), 4.10 (s, 3H), 3.01-3.04 (m, 1H), 2.70-2.72 (m, 1H), 2.47-2.49 (m, 1H), 2.35-2.40 (m, 1H), 1.97-2.05 (m, 1H).

13C NMR (100 MHz, acetone-d6) δ 137.7, 124.9, 123.7, 49.6, 48.0, 46.5, 36.7, 33.7.

19F NMR (376 MHz, acetone-d6) δ -80.0. IR (neat) cm⁻¹ 3159, 3122, 1575, 1348, 1330, 1177, 1132, 1051, 789, 740. HRMS m/z (ESI): calcd. for C₈H₁₃N₂O [M⁺]: 153.1028, found: 153.1029.

3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium hexafluorophosphate (3b)

According to the general procedure, the title compound was prepared with 1-(3-Buten-1-yl)-3-methylimidazolium hexafluorophosphate (100 mg, 0.354 mmol, 1.0 equiv) in acetone (1 mL) and freshly prepared DMDO (0.06 mol/L) (8.27 mL, 0.496 mmol, 1.4 equiv). The reaction mixture was stirred at room temperature for 6 h. The product 3b was obtained as a yellow oil (85 mg, 80 %).

1H NMR (400 MHz, acetone-d6) δ 9.06 (s, 1H), 7.73-7.81 (m, 2H), 4.56 (t, J = 6.9 Hz, 2H), 4.08 (s, 3H), 3.00-3.05 (m, 1H), 2.70-2.72 (m, 1H), 2.47-2.49 (m, 1H), 2.31-2.39 (m, 1H), 1.96-2.10 (m, 1H).

13C NMR (100 MHz, acetone-d6) δ 137.7, 124.9, 123.7, 49.6, 47.9, 46.5, 36.7, 33.7. 19F NMR (376 MHz, acetone-d6) δ -71.6, -73.5. IR (neat) cm⁻¹ 3171, 3125, 2971, 1576, 1464, 1429, 1168, 1024, 817, 749. HRMS m/z (ESI): calcd. for C₈H₁₃N₂O [M⁺]: 153.1028, found: 153.1029.

3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium tetrafluoroborate (3c)

According to the general procedure, the title compound was prepared with 1-(3-Buten-1-yl)-3-methylimidazolium tetrafluoroborate (100 mg, 0.4464 mmol, 1.0 equiv) in acetone (1 mL) and freshly prepared DMDO (0.07 mol/L) (8.93 mL, 0.625 mmol, 1.4 equiv). The reaction mixture was stirred at room temperature for 6 h. The product 3c was obtained as a yellow oil (107 mg, 100 %).

1H NMR (400 MHz, acetone-d6) δ 9.06 (s, 1H), 7.72-7.80 (m, 2H), 4.55 (t, J = 6.9 Hz, 2H), 4.07 (s, 3H), 3.01-3.05 (m, 1H), 2.69-2.71 (m, 1H), 2.47-2.49 (m, 1H), 2.29-2.37 (m, 1H), 1.98-2.09 (m, 1H).

13C NMR (100 MHz, acetone-d6) δ 137.9, 124.8, 123.6, 49.6, 47.9, 46.5, 36.7, 33.7. 19F NMR (376 MHz, acetone-d6) δ -152.5, -152.6. IR (neat) cm⁻¹ 3165, 2935, 1635, 1576, 1463, 1430, 1290, 1168, 1014, 952. HRMS m/z (ESI): calcd. for C₈H₁₃N₂O [M⁺]: 153.1028, found: 153.1025.
4-methoxybenzenesulfonyl chloride (6)  
To a solution of anisole (1.84 g, 17.0 mmol, 1.0 equiv) in CH$_2$Cl$_2$ (40 mL) at -5 °C was added dropwise chlorosulfonic acid (4.95 g, 2.82 mL, 42.5 mmol, 2.5 equiv) in CH$_2$Cl$_2$ (10 mL) over 60 min. The reaction mixture was stirred for 1h then allowed to warm to room temperature. The reaction advancement was monitoring by NMR. After 1 h, the reaction mixture was concentrated under reduced pressure with membrane pump (10-15 mbar) at 40 °C. The product 6 was obtained as a colorless liquid and quickly used without any purification (3.19 g, 91 %).

$^1$H NMR (500 MHz, CDCl$_3$) δ 7.98 (d, $J = 9.1$ Hz, 2H), 7.05 (d, $J = 9.1$ Hz, 2H), 3.92 (s, 3H).  
$^{13}$C NMR (126 MHz, CDCl$_3$) δ 165.0, 136.2, 129.7, 114.8, 56.1. IR (neat) cm$^{-1}$: 3102, 2947, 2845, 1591, 1495, 1369, 1264, 1160, 1083, 1020. HRMS m/z (ASAP): calcd. for C$_7$H$_7$O$_3$SCl [M$^+$]: 205.9804, found: 205.9801.

4-methoxybenzenesulfonamide (7)  
A mixture of compound 6 (302 mg, 1.46 mmol, 1.0 equiv) and 28-30 % aqueous ammonium hydroxide (4 mL) with dichloromethane (3 mL) added to solubilize the mixture was prepared at 0 °C and stirred for 3-4 h. The reaction advancement was monitoring by TLC with cyclohexane/ethyl acetate (9/1). When the reaction was completed, the reaction mixture was warmed to room temperature and concentrated under reduced pressure with membrane pump (10-15 mbar). The product 7 was obtained as a white solid and was used without any purification (273 mg, 100 %).

$^1$H NMR (600 MHz, CDCl$_3$) δ 7.86 (d, $J = 8.9$ Hz, 2H), 6.98 (d, $J = 8.9$ Hz, 2H), 4.84 (bs, 2H), 3.87 (s, 3H). $^{13}$C NMR (151 MHz, CDCl$_3$) δ 163.1, 133.7, 128.8, 114.4, 55.8. IR (neat) cm$^{-1}$: 3343, 3266, 2983, 2923, 2850, 1596, 1499, 1300, 1255, 1102. Mp: 111.9 °C. HRMS m/z (ESI): calcd. for C$_7$H$_8$NO$_3$S [M-H$^-$]: 186.0225, found: 186.0222.

Bis(4-methoxybenzene)sulfonimide (8)  
To a solution of compound 7 (374.44 mg, 2.00 mmol, 1.0 equiv) in anhydrous THF (10 mL) was added sodium hydride (168 mg, 4.2 mmol, 2.1 equiv) and the reaction mixture was stirred for 1 h at room temperature. 4-methoxybenzenesulfonyl chloride 6 (413.3 mg, 2.0 mmol, 1.0 equiv) in anhydrous THF (10 mL) was added dropwise to the reaction mixture followed by DMF (20 mL). The reaction advancement was monitored by TLC for 48 h with cyclohexane/ethyl acetate (4/6). The white precipitate formed was filtered and washed with diethyl ether. The filtrate was concentrated under vacuum. The product 8 was obtained as a white solid (411 mg, 58 %).

$^1$H NMR (500 MHz, CDCl$_3$) δ 7.89 (d, $J = 8.9$ Hz, 4H), 6.97 (d, $J = 8.9$ Hz, 4H), 3.89 (s, 6H). $^{13}$C NMR (126 MHz, CDCl$_3$) δ 164.1, 131.1, 130.4, 114.4, 55.9. IR (neat) cm$^{-1}$: 3100, 2976, 2923, 1593, 1497, 1365, 1261, 1150, 1086, 1020. Mp: 99.9 °C. HRMS m/z (ESI): calcd. for C$_{14}$H$_{14}$NO$_6$S$_2$ [M-H]$^-$: 356.0263, found: 356.0256.
1-Phenyl-(3-buten-1-yl)imidazolium bis(4-methoxybenzene)sulfonimide (9)

To a solution of compound 8 (367 mg, 1.027 mmol, 1.0 equiv) in H₂O (100 mL) and CH₃CN (10 mL) was added NaOH (41.07 mg, 1.027 mmol, 1.0 equiv) and the reaction mixture was stirred for 1 h. Then, 3-(3-Buten-1-yl)-1-phenylimidazolium bromide (287 mg, 1.027 mmol, 1.0 equiv) in H₂O (2 mL) was added and the solution was stirred at room temperature for 24 h. CH₃CN was removed under reduced pressure and the reaction mixture was extracted with dichloromethane. The organic layer was washed several times with water, dried with MgSO₄ and then concentrated under reduced pressure. The product 9 was obtained as a yellow oil (360 mg, 63 %).

1H NMR (500 MHz, CDCl₃) δ 9.99 (s, 1H), 7.67-7.73 (m, 3H), 7.61-7.63 (m, 1H), 7.56 (d, J = 8.9 Hz, 4H), 7.42-7.53 (m, 3H), 6.65 (d, J = 8.9 Hz, 4H), 5.80 (ddt, J = 17.7, 10.8, 6.8 Hz, 1H), 5.00-5.07 (m, 2H), 4.56 (t, J = 6.8 Hz, 2H), 3.75 (s, 6H), 2.65 (q, J = 6.8 Hz, 2H).

13C NMR (126 MHz, CDCl₃) δ 161.4, 136.3, 135.8, 134.7, 133.0, 130.6, 130.1, 128.8, 123.6, 122.0, 120.9, 119.5, 113.1, 55.5, 49.8, 34.5. IR (neat) cm⁻¹ 3137, 3097, 2927, 2840, 1596, 1496, 1250, 1146, 1128, 1076. HRMS m/z (ESI): calcd. for C₁₄H₁₄NO₆S₂ [M]⁻: 356.0263, found: 356.0264; calcd. for C₁₃H₁₅N₂O [M]⁺: 199.1235, found: 199.1234.

3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium bis(4-methoxybenzene)sulfonimide (10)

To a solution of compound 9 (50 mg, 0.090 mmol, 1.0 equiv) in acetone (0.50 mL) was added freshly prepared DMDO (0.05 mol/L) (4.32 mL, 0.216 mmol, 2.4 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 7 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 10 was obtained as a yellow oil (51 mg, 100 %).

1H NMR (500 MHz, acetone-d₆) δ 10.09 (s, 1H), 8.21-8.25 (m, 1H), 8.06-8.09 (m, 1H), 7.87-7.92 (m, 2H), 7.57-7.75 (m, 7H), 6.78-6.85 (m, 4H), 4.72 (t, J = 6.8 Hz, 2H), 3.81 (s, 6H), 3.10-3.16 (m, 1H), 2.67-2.71 (m, 1H), 2.50-2.54 (m, 1H), 2.37-2.45 (m, 1H), 2.09-2.15 (m, 1H). 13C NMR (126 MHz, acetone-d₆) δ 161.0, 138.6, 136.2, 136.1, 130.3, 130.2, 129.8, 128.5, 123.8, 122.1, 121.2, 112.7, 55.4, 49.0, 47.5, 45.6, 32.8. IR (neat) cm⁻¹ 3141, 3097, 3098, 3007, 2841, 1595, 1496, 1251, 1129, 1079, 1023. HRMS m/z (ESI): calcd. for C₁₄H₁₄NO₆S₂ [M]⁻: 356.0263, found: 356.0272; calcd. for C₁₃H₁₅N₂O [M]⁺: 215.1184, found: 215.1189.

1-Phenyl-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-methoxybenzenesulfonyl)imide (12a)

To a solution of trifluoromethanesulfonyamide (721.5 mg, 4.84 mmol, 1.0 equiv) in anhydrous THF (20 mL) and DMF (2 mL) was added sodium hydride (406.5 mg, 10.16 mmol, 2.1 equiv) and the reaction mixture was stirred for 1 h and a solution of 4-methoxybenzenesulfonyl chloride 6 (1.0 g, 4.84 mmol, 1.0 equiv) in anhydrous THF (20 mL) was added dropwise. The reaction mixture was stirred for 48 h. The
white precipitate formed was filtered, washed with diethyl ether and the filtrate was concentrated under vacuum. The sulfonamide 11a was obtained as a white solid (1.65 g, 100 %) and was used without any purification. To a solution of sulfonamide 11a (1.65 g, 4.835 mmol, 1.0 equiv) in H2O (100 mL) was added 3-(3-Buten-1-yl)-1-phenylimidazolium bromide3 (1.35 g, 4.835 mmol, 1.0 equiv). The solution was stirred at room temperature for 24 h and then extracted with dichloromethane. The organic layer was washed several times with water, dried over MgSO4, filtered and concentrated under vacuum. The product 12a was obtained as a yellow oil (1.54 g, 62 %).

1H NMR (500 MHz, CDCl3) δ 9.53 (s, 1H), 7.82 (d, J = 8.9 Hz, 2H), 7.56-7.65 (m, 4H), 7.47-7.55 (m, 3H), 6.85 (d, J = 8.9 Hz, 2H), 5.78 (ddt, J = 17.1, 10.4, 6.8 Hz, 1H), 5.02-5.11 (m, 2H), 4.47 (t, J = 6.8 Hz, 2H), 3.79 (s, 3H), 2.65 (q, J = 6.8 Hz, 2H). 13C NMR (126 MHz, CDCl3) δ 162.0, 136.4, 135.1, 134.5, 132.6, 130.7, 130.5, 128.7, 123.5, 122.1, 121.2, 120.5 (q, JCF = 322.4 Hz), 119.8, 113.6, 55.6, 49.8, 34.4. 19F NMR (471 MHz, CDCl3) δ -78.2. IR (neat) cm⁻¹ 3140, 3102, 2922, 2846, 1597, 1497, 1318, 1172, 1132, 1045. HRMS m/z (ESI): calcd. for C13H15NO3S2F2 [M]⁺: 317.9718, found: 317.9720; calcd. for C13H13N2 [M]⁺: 199.1235, found: 199.1237.

1-Phenyl-(3-butyl-1-yl)imidazolium To a solution of trifluoromethane sulfonamide (300 mg, 2.01 mmol, 1.0 equiv) in anhydrous THF (9 mL) and DMF (1 mL) was added NaH (169 mg, 4.22 mmol, 2.1 equiv) and the reaction mixture was stirred at room temperature for 1 h. Then, a solution of 4-fluorobenzenesulfonyl chloride (391 mg, 2.01 mmol, 1.0 equiv) in THF (9 mL) was added dropwise. The reaction was monitoring by CCM in cyclohexane/ethyl acetate (4/6). After the reaction was completed (12 h), the reaction mixture was concentrated under reduced pressure. The sulfonamide 11b was obtained as a colorless liquid (662 mg, 100 %) and was used without any purification. To a solution of 3-(3-Buten-1-yl)-1-phenylimidazolium bromide3 (560 mg, 2.01 mmol, 1.0 equiv) in distilled water (20 mL) was added sulfonamide 11b (662 mg, 2.01 mmol, 1.0 equiv). The solution was stirred at room temperature for 24 h. The reaction mixture was extracted with dichloromethane and the organic layer was washed several times with water, dried with MgSO4 and then concentrated under reduced pressure. The product 12b was obtained as a yellow oil (709 mg, 72 %).

1H NMR (500 MHz, CDCl3) δ 9.49 (s, 1H), 7.87-7.93 (m, 2H), 7.49-7.66 (m, 7H), 7.01-7.08 (m, 2H), 5.80 (ddt, J = 17.0, 10.0, 7.0 Hz, 1H), 5.04-5.14 (m, 2H), 4.50 (t, J = 7.0 Hz, 2H), 2.68 (q, J = 7.0 Hz, 2H). 13C NMR (126 MHz, CDCl3) δ 164.4 (d, JCF = 252.6 Hz), 140.2, 135.1, 134.4, 132.4, 130.7, 130.5, 129.3 (d, JCF = 9.2 Hz), 123.4, 122.2, 121.2, 120.2 (CF3, hidden peaks), 119.8, 115.3 (d, JCF = 22.3 Hz), 49.8, 34.3. 19F NMR (471 MHz, CDCl3) δ -78.3, -107.9. IR (neat) cm⁻¹ 2955, 2922, 2853, 1460, 1377, 1320, 1132, 1087, 1045, 819. HRMS m/z (ESI): calcd. for C13H14NO3S2F4 [M]⁺: 305.9518, found: 305.9528; calcd. for C13H13N2 [M]⁺: 199.1235, found: 199.1238.
1-Phenyl-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (12c)

To a solution of trifluoromethane sulfonamide (300 mg, 2.01 mmol, 1.0 equiv) in anhydrous THF (9 mL) and DMF (1 mL) was added NaH (169 mg, 4.22 mmol, 2.1 equiv) and the reaction mixture was stirred at room temperature for 1 h. Then, a solution of 4-(trifluoromethyl)benzenesulfonyl chloride (491 mg, 2.01 mmol, 1.0 equiv) in THF (9 mL) was added dropwise. The reaction was monitoring by CCM in cyclohexane/ethyl acetate (4/6). After the reaction was completed (12 h), the reaction mixture was concentrated under vacuum. The sulfonamide 11c was obtained as a white solid (762 mg, 100 %) and was used without any purification.

To a solution of 3-(3-buten-1-yl)-1-phenylimidazolium bromide (560 mg, 2.01 mmol, 1.0 equiv) in distilled water (20 mL) was added sulfonamide 11c (762 mg, 2.01 mmol, 1.0 equiv). The solution was stirred at room temperature for 24 h. The reaction mixture was extracted with dichloromethane and the organic layer was washed several times with water, dried with MgSO₄ and then concentrated under reduced pressure. The product 12c was obtained as a yellow oil (803 mg, 71 %).

1H NMR (500 MHz, CDCl₃) δ 9.63 (s, 1H), 7.99-8.06 (m, 3H), 7.51-7.66 (m, 8H), 5.81 (ddt, J = 17.0, 10.1, 6.8 Hz, 1H), 5.05-5.16 (m, 2H), 4.54 (t, J = 6.8 Hz, 2H), 2.70 (q, J = 6.8 Hz, 2H).

13C NMR (126 MHz, CDCl₃) δ 147.6, 135.3, 133.0 (Cq, hidden peaks), 132.3, 130.7, 130.6, 127.2, 125.4 (q, JCF = 3.7 Hz), 123.2, 122.2, 121.1, 120-125 (2*CF₃, hidden peaks) 119.8, 49.9, 34.3.

19F NMR (471 MHz, CDCl₃) δ -62.9, -78.8.

IR (neat) cm⁻¹ 3141, 3104, 2928, 1668, 1553, 1404, 1321, 1175, 1131, 1091.


3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-methoxybenzenesulfonyl)imide (13a)

To a solution of compound 12a (50 mg, 0.0966 mmol, 1.0 equiv) in acetone (0.5 mL) was added freshly prepared DMDO (0.026 mol/L) (8.92 mL, 0.232 mmol, 2.4 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 2 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 13a was obtained as a yellow oil (52 mg, 100 %).

1H NMR (500 MHz, acetone-d₆) δ 9.70 (s, 1H), 8.21-8.24 (m, 1H), 8.06-8.09 (m, 1H), 7.78-7.86 (m, 4H), 7.61-7.71 (m, 3H), 6.92 (d, J = 8.9 Hz, 2H), 4.70 (t, J = 6.8 Hz, 2H), 3.83 (s, 3H), 3.10-3.15 (m, 1H), 2.71-2.75 (m, 1H), 2.52-2.55 (m, 1H), 2.43-2.51 (m, 1H), 2.08-2.18 (m, 1H).

13C NMR (126 MHz, acetone-d₆) δ 161.4, 138.7, 135.6, 135.2, 130.3, 130.2, 128.5, 123.9, 122.4, 121.8, 120.7 (q, JCF = 324.0 Hz), 112.9, 54.9, 48.8, 47.7, 45.6, 32.6. 19F NMR (471 MHz, acetone-d₆) δ -78.9. IR (neat) cm⁻¹ 3142, 3104, 2931, 1599, 1497, 1319, 1173, 1133, 1089, 1045. HRMS m/z (ESI): calcd. for C₈H₇NO₅S₂F₃ [M]⁻: 317.9718, found: 317.9718; calcd. for C₁₃H₁₅N₂O [M]⁺: 215.1184, found: 215.1186.
3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (13b)

**Procedure I.** To a solution of compound 12b (200 mg, 0.405 mmol, 1.0 equiv) in CH$_3$CN (20 mL), was added mCPBA (181 mg, 0.810 mmol, 2.0 equiv). The reaction mixture was stirred at 40 °C for 24 h. The crude was concentrated under reduced pressure and ether was added to extract the excess of mCPBA and 3-chlorobenzoic acid. The product 13b was obtained as a colorless oil (187 mg, 89%).

**Procedure II.** To a solution of compound 12b (50 mg, 0.101 mmol, 1.0 equiv) in acetone (1 mL) was added freshly prepared DMDO (0.02 mol/L) (12 mL, 0.243 mmol, 2.4 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 2 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 13b was obtained as a colorless oil (53 mg, 100%).

$^1$H NMR (500 MHz, acetone-$d_6$) $\delta$ 9.69 (s, 1H), 8.23-8.26 (m, 1H), 8.07-8.10 (m, 1H), 7.89-7.95 (m, 2H), 7.81-7.87 (m, 2H), 7.66-7.72 (m, 3H), 7.14-7.21 (m, 2H), 4.68-4.74 (t, $J$ = 7.0 Hz, 2H), 3.09-3.15 (m, 1H), 2.72-2.76 (m, 1H), 2.53-2.55 (m, 1H), 2.45-2.52 (m, 1H), 2.08-2.17 (m, 1H). $^{13}$C NMR (126 MHz, acetone-$d_6$) $\delta$ 163.6 (d, $J_{CF}$ = 247.9 Hz), 142.7, 135.5, 135.2, 130.4, 130.2, 129.3 (d, $J_{CF}$ = 9.0 Hz), 123.8, 122.4, 121.8, 120.5 (CF$_3$, hidden peaks), 114.6 (d, $J_{CF}$ = 22.5 Hz), 48.8, 47.7, 45.6, 32.6. $^{19}$F NMR (471 MHz, acetone-$d_6$) $\delta$ -79.1, -111.7. IR (neat) cm$^{-1}$: 3143, 3067, 2930, 1592, 1554, 1495, 1320, 1298, 1181, 1132. HRMS m/z (ESI): calcd. for C$_{12}$H$_{15}$N$_2$O [M$^+$]: 215.1184, found: 215.1185.

3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (13c)

**Procedure I.** To a solution of compound 12c (200 mg, 0.368 mmol, 1.0 equiv) in CH$_3$CN (20 mL), was added mCPBA (165 mg, 0.736 mmol, 2.0 equiv). The reaction mixture was stirred at 40 °C for 24 h. The crude was concentrated under reduced pressure and ether was added to extract the excess of mCPBA and 3-chlorobenzoic acid. The product 13c was obtained as a white solid (143 mg, 68%).

**Procedure II.** To a solution of compound 12c (50 mg, 0.092 mmol, 1.0 equiv) in acetone (1 mL) was added freshly prepared DMDO (0.02 mol/L) (12 mL, 0.220 mmol, 2.4 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 2 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 13c was obtained as a white solid (52 mg, 100%).

$^1$H NMR (500 MHz, acetone-$d_6$) $\delta$ 9.72 (s, 1H), 8.22-8.26 (m, 1H), 8.04-8.10 (m, 3H), 7.76-7.86 (m, 4H), 7.61-7.72 (m, 3H), 4.71 (t, $J$ = 6.8 Hz, 2H), 3.09-3.15 (m, 1H), 2.72-2.76 (m, 1H), 2.52-2.55 (m, 1H), 2.45-2.52 (m, 1H), 2.09-2.16 (m, 1H). $^{13}$C NMR (126 MHz, acetone-$d_6$) $\delta$ 151.0, 136.5, 136.1, 132.5 (Cq, hidden peaks), 130.4, 130.2, 127.5, 125.1 (q, $J_{CF}$ = 3.8 Hz), 123.8, 122.4, 121.8, 120-125 (2*CF$_3$, hidden peaks), 49.7, 48.6, 46.5, 33.5. $^{19}$F NMR (471

1-[4-(3-Buten-1-yl)phenyl]-3-(3-buten-1-yl)imidazolium bromide (diIm-Br)

To a solution of 1-[4-(3-Buten-1-yl)phenyl]-1H-Imidazole³ (1.05 g, 5.27 mmol, 1.0 equiv) in CH₂CN (35 mL) was added 4-bromo-1-butene (1.06 mL, 10.54 mmol, 2.0 eq). The mixture was refluxed at 80 °C for 48 h. After cooled to room temperature, the reaction mixture was concentrated under reduced pressure to obtain the product diIm-Br as a yellow oil (1.75 g, 100 %).

¹H NMR (400 MHz, CDCl₃) δ 10.94 (s, 1H), 7.63-7.72 (m, 4H), 7.34 (d, J = 8.3 Hz, 2H), 5.72-5.94 (m, 2H), 4.95-5.12 (m, 4H), 4.71 (t, J = 6.7 Hz, 2H), 2.73-2.77 (m, 4H), 2.35 (q, J = 7.3 Hz, 2H).¹³C NMR (100 MHz, CDCl₃) δ 144.7, 137.1, 136.1, 132.7, 132.5, 130.7, 123.2, 121.8, 120.4, 119.7, 115.8, 49.6, 35.1, 34.9, 34.7. IR (neat) cm⁻¹ 3049, 2855, 1640, 1566, 1550, 1515, 1438, 1198, 1071, 914. HRMS m/z (ESI): calcd. for C₁₇H₂₁N₂ [M⁺]: 253.1705, found: 253.1704.

1-[4-(3-Buten-1-yl)phenyl]-3-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imidide (14a)

To a solution of trifluoromethane sulfonamide (300 mg, 2.01 mmol, 1.0 equiv) in anhydrous THF (9 mL) and DMF (1 mL) was added NaH (169 mg, 4.22 mmol, 2.1 equiv) and the reaction mixture was stirred at room temperature for 1 h. Then, a solution of 4-fluorobenzenesulfonyl chloride (391 mg, 2.01 mmol, 1.0 eq) in THF (9 mL) was added dropwise. The reaction was monitoring by CCM in cyclohexane/ethyl acetate (4/6). After the reaction was completed (12 h), the reaction mixture was concentrated under reduced pressure. The sulfonamide 11b was obtained as a colorless liquid (662 mg, 100 %) and was used without any purification. To a solution of diIm-Br (670 mg, 2.01 mmol, 1.0 equiv) in distilled water (20 mL) was added sulfonamide 11b (662 mg, 2.01 mmol, 1.0 equiv). The solution was stirred at room temperature for 24 h. The reaction mixture was extracted with dichloromethane and the organic layer was washed several times with water, dried with MgSO₄ and then concentrated under reduced pressure. The product 14a was obtained as a yellow oil (702 mg, 63 %).

¹H NMR (500 MHz, CDCl₃) δ 9.61 (s, 1H), 7.89-7.94 (m, 2H), 7.50-7.58 (m, 4H), 7.33-7.38 (m, 2H), 7.02-7.08 (m, 2H), 5.76-5.86 (m, 2H), 4.97-5.15 (m, 4H), 4.53 (t, J = 6.7 Hz, 2H), 2.77 (t, J = 7.3 Hz, 2H), 2.69 (q, J = 6.7 Hz, 2H), 2.38 (q, J = 7.3 Hz, 2H).¹³C NMR (126 MHz, CDCl₃) δ 164.5 (d, J₉F = 251.7 Hz), 145.0, 140.5, 137.2, 135.3, 132.5, 132.4, 130.7, 129.4 (d, J₉F = 8.7 Hz), 123.2, 122.1, 121.1, 120.3 (CF₃, hidden peaks), 119.9, 115.9, 115.4 (d, J₉F = 22.7 Hz), 49.2, 35.1, 34.9, 34.4.¹⁹F NMR (471 MHz, CDCl₃) δ -78.2, -108.0. IR (neat) cm⁻¹ 2955, 2922, 2853, 1459, 1377, 1322, 1178, 1134, 1087, 1050. HRMS m/z (ESI): calcd. for C₁₇H₂₁N₂O₂F₂ [M⁺]: 305.9518, found: 305.9529; calcd. for C₁₇H₂₁N₂ [M⁺]: 253.1705, found: 253.1706.
1-[4-(3-Buten-1-yl)phenyl]-3-(3-butyl-1-yl)imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (14b)

To a solution of trifluoromethane sulfonamide (300 mg, 2.01 mmol, 1.0 equiv) in anhydrous THF (9 mL) and DMF (1 mL) was added NaH (169 mg, 4.22 mmol, 2.1 equiv) and the reaction mixture was stirred at room temperature for 1 h. Then, a solution of 4-(trifluoromethyl)benzenesulfonyl chloride (491 mg, 2.01 mmol, 1.0 equiv) in THF (9 mL) was added dropwise. The reaction was monitoring by CCM in cyclohexane/ethyl acetate (4/6). After the reaction was completed (12 h), the reaction mixture was concentrated under vacuum and the sulfonamide 11c was obtained as a white solid (762 mg, 100 %). To a solution of diIm-Br (670 mg, 2.01 mmol, 1.0 equiv) in distilled water (20 mL) was added sulfonamide 11c (762 mg, 2.01 mmol, 1.0 equiv). The solution was stirred at room temperature for 24 h. The reaction mixture was extracted with dichloromethane and the organic layer was washed several times with water, dried with MgSO₄ and then concentrated under reduced pressure. The product 14b was obtained as a yellow oil (594 mg, 48 %).

³¹H NMR (500 MHz, CDCl₃) δ 9.47 (s, 1H), 8.04 (d, J = 8.2 Hz, 2H), 7.65 (d, J = 8.2 Hz, 2H), 7.49-7.56 (m, 4H), 7.37 (d, J = 8.2 Hz, 2H), 5.75-5.88 (m, 2H), 4.96-5.18 (m, 4H), 4.53 (t, J = 6.7 Hz, 2H), 2.78 (t, J = 7.3 Hz, 2H), 2.70 (q, J = 6.7 Hz, 2H), 2.39 (q, J = 7.3 Hz, 2H). ¹³C NMR (126 MHz, CDCl₃) δ 147.7, 145.2, 137.1, 135.2, 133.2 (Cq, J₇₈ = 32.8 Hz), 132.4, 132.4, 130.8, 127.4, 124.7, 124.5 (q, J₁₂ = 3.7 Hz), 123.2, 122.2, 121.2, 120-125 (2³CF₃, hidden peaks), 120.0, 115.9, 50.0, 35.1, 34.9, 34.4. ¹⁹F NMR (471 MHz, CDCl₃) δ -62.9, -78.3. IR (neat) cm⁻¹ 3140, 3112, 2924, 2855, 1553, 1515, 1316, 1189, 1131, 1043. HRMS m/z (ESI): calcd. for C₉H₄NO₃S₂F₆ [M⁺]: 355.9486, found: 355.9492; calcd. for C₁₇H₂₁N₂ [M⁺]: 253.1705, found: 253.1707.

3-[2-(Oxiran-2-yl)ethyl]-1-[4-[2-(oxiran-2-yl)ethyl]phenyl]imidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (15a)

To a solution of compound 14a (200 mg, 0.357 mmol, 1.0 equiv) in acetone (1 mL) was added freshly prepared DMDO (0.05 mol/L) (23.6 mL, 1.179 mmol, 3.3 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 7 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 15a was obtained as a yellow oil (211 mg, 100 %).

¹¹H NMR (500 MHz, acetone-d₆) δ 9.70 (s, 1H), 8.19-8.24 (m, 1H), 8.05-8.09 (m, 1H), 7.89-7.95 (m, 2H), 7.75 (d, J = 8.2 Hz, 2H), 7.56 (d, J = 8.2 Hz, 2H), 7.14-7.20 (m, 2H), 4.70 (t, J = 6.7 Hz, 2H), 3.09-3.15 (m, 1H), 2.85-2.95 (m, 3H), 2.71-2.76 (m, 1H), 2.65-2.69 (m, 1H), 2.52-2.55 (m, 1H), 2.42-2.52 (m, 2H), 2.07-2.17 (m, 1H), 1.86-1.96 (m, 1H), 1.77-1.86 (m, 1H). ¹³C NMR (126 MHz, acetone-d₆) δ 164.6 (d, JCF = 248.1 Hz), 145.3, 143.7, 136.4, 134.1, 131.1, 130.3 (d, JCF = 9.1 Hz), 124.6, 123.2, 122.7, 121.5 (q, JCF = 323.7 Hz), 115.6 (d, JCF = 22.3 Hz), 51.7, 49.7, 48.5, 47.0, 46.5, 34.9, 33.5, 32.3. ¹⁹F NMR (471 MHz, acetone-d₆) δ -79.1, -111.8. IR (neat) cm⁻¹ 3140, 3071, 2999, 2930, 1591, 1494, 1321, 1180, 1138, 1048. HRMS m/z (ESI): calcd. for C₁₉H₂₁N₂O₂F [M⁺]: 305.9518, found: 305.9522; calcd. for C₁₇H₂₁N₂O [M⁺]: 285.1603, found: 285.1602.
3-[2-(Oxiran-2-yl)ethyl]-1-{4-[2-(oxiran-2-yl)ethyl]phenyl}imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (15b)

To a solution of compound 14b (200 mg, 0.328 mmol, 1.0 equiv) in acetone (1 mL) was added freshly prepared DMDO (0.057 mol/L) (19 mL, 1.082 mmol, 3.3 equiv) also at -20 °C and the reaction mixture was stirred at room temperature for 7 h. Two drops of dimethyl sulfide (DMS) was added to quench the reaction mixture and neutralized the excess of DMDO. The reaction mixture was concentrated under reduced pressure and the product 15b was obtained as a colorless oil (210 mg, 100%).

$^1$H NMR (500 MHz, acetone-d$_6$) δ 9.67 (s, 1H), 8.20-8.23 (m, 1H), 8.05-8.10 (m, 3H), 7.80 (d, $J = 8.2$ Hz, 2H), 7.74 (d, $J = 8.2$ Hz, 2H), 7.56 (d, $J = 8.2$ Hz, 2H), 4.70 (m, 2H), 3.09-3.15 (m, 1H), 2.85-2.95 (m, 3H), 2.72-2.76 (m, 1H), 2.66-2.69 (m, 1H), 2.52-2.55 (m, 1H), 2.46-2.52 (m, 1H), 2.43-2.46 (m, 1H), 2.07-2.16 (m, 1H), 1.87-1.97 (m, 1H), 1.76-1.86 (m, 1H). $^{13}$C NMR (126 MHz, acetone-d$_6$) δ 150.9, 145.3, 136.3, 134.1, 132.5 (q, $J_{CF} = 31.8$ Hz), 131.1, 128.4, 126.0 (q, $J_{CF} = 3.8$ Hz), 124.6, 123.2, 122.7, 120-125 (2*CF$_3$, hidden peaks), 51.7, 49.7, 48.6, 47.0, 46.5, 34.9, 33.5, 32.3. $^{19}$F NMR (471 MHz, acetone-d$_6$) δ -63.2, -79.1. IR (neat) cm$^{-1}$ 3141, 3104, 2999, 2929, 1554, 1404, 1321, 1178, 1131, 1053. HRMS m/z (ESI): calcd. for C$_8$H$_4$NO$_3$S$_2$F$_6$ [M$^-$]: 355.9486, found: 355.9494; calcd. for C$_{17}$H$_{21}$N$_2$O$_2$ [M$^+$]: 285.1603, found: 285.1601.
IV. NMR spectrum

1-[2-(Oxiran-2-yl)ethyl]-3-methylimidazolium bis(trifluoromethanesulfonyl)imide (3a)
1-[2-(Oxiran-2-yl)ethyl]-3-methylimidazolium hexafluorophosphate (3b)
3-[2-(Oxiran-2-yl)ethyl]1-methylimidazolium tetrafluoroborate (3c)
4-methoxybenzenesulfonyl chloride (6)
4-methoxybenzenesulfonamide (7)
Bis(4-methoxybenzene)sulfonimide (8)
1-Phenyl-(3-buten-1-yl)imidazolium bis(4-methoxybenzene)sulfonimide (9)
3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium bis(4-methoxybenzene)sulfonimide (10)
1-Phenyl-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-methoxybenzenesulfonyl)imide (12a)
1-Phenyl-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (12b)
1-Phenyl-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (12c)
3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-methoxybenzenesulfonyl)imide (13a)
3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (13b)
3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (13c)
1-[4-(3-Buten-1-yl)phenyl]-3-(3-buten-1-yl)imidazolium bromide (diIm-Br)
1-[4-(3-Buten-1-yl)phenyl]-3-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (14a)
1-[4-(3-Buten-1-yl)phenyl]-3-(3-buten-1-yl)imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (14b)
3-[(2-[(oxiran-2-yl)ethyl]-1-[(4-[(2-((oxiran-2-yl)ethyl)phenyl)imidazolium](trifluoromethylsulfonyl)(4-fluorobenzenesulfonyl)imide (15a)
3-[[2-(Oxiran-2-yl)ethyl]·1-{4-[[2-(oxiran-2-yl)ethyl]phenyl]imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (15b)
V. TGA and derivative curves of the epoxides

TGA of monoepoxide ionic liquids type "Cat-NTf₂":

![Imidazolium (1a)](image)

![Pyridinium](image)

![Pyrrolidinium](image)

TGA of monoepoxide imidazolium type "Im-NTf₂":

![Methyl (1a)](image)

![Phenyl](image)

![Benzyl](image)

TGA of monoepoxide imidazolium type "Im-X":

![BF₄](image)

![PF₆](image)
TGA of compound 10

![Graph showing TGA for compound 10 with chemical structure](image)

TGA of compound 13a

![Graph showing TGA for compound 13a with chemical structure](image)
TGA of monoepoxide fluorinated salts 13b and 13c

\[ \text{13b, } R = F \]
\[ \text{13c, } R = \text{CF}_3 \]

TGA of diepoxide fluorinated salts 15a and 15b

\[ \text{15a } R = F \]
\[ \text{15b } R = \text{CF}_3 \]
**Summary table:**

<table>
<thead>
<tr>
<th>Ionic liquid monomer</th>
<th>Structure / Appearance</th>
<th>Tonset weight loss (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-[2-(Oxiran-2-yl)ethyl]-pyridinium bis(trifluoromethanesulfonyl)imide</td>
<td><img src="image" alt="Structure" /></td>
<td>Colorless oil</td>
</tr>
<tr>
<td>1-[2-(Oxiran-2-yl)ethyl]-1-methylpyrrolidinium bis(trifluoromethanesulfonyl)imide</td>
<td><img src="image" alt="Structure" /></td>
<td>Brown oil</td>
</tr>
<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium bis(trifluoromethanesulfonyl)imide</td>
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<td>Brown oil</td>
</tr>
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<td>Brown oil</td>
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<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium bis(trifluoromethanesulfonyl)imide (3a)</td>
<td><img src="image" alt="Structure" /></td>
<td>Yellow oil</td>
</tr>
<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium hexafluorophosphate (3b)</td>
<td><img src="image" alt="Structure" /></td>
<td>Yellow oil</td>
</tr>
<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-methylimidazolium tetrafluoroborate (3c)</td>
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<td>Yellow oil</td>
</tr>
<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium bis(4-methoxybenzene)sulfonimide (10)</td>
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<td>Yellow oil</td>
</tr>
<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-phenylimidazolium (trifluoromethylsulfonyl)(4-methoxybenzene)sulfonimide (13a)</td>
<td><img src="image" alt="Structure" /></td>
<td>Yellow oil</td>
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<tr>
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<td><img src="image" alt="Structure" /></td>
<td>Colorless oil</td>
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<td>White solid</td>
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<td><img src="image" alt="Structure" /></td>
<td>Yellow oil</td>
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<tr>
<td>3-[2-(Oxiran-2-yl)ethyl]-1-{4-[2-(oxiran-2-yl)ethyl]phenyl}imidazolium (trifluoromethylsulfonyl)(4-trifluoromethylbenzenesulfonyl)imide (15b)</td>
<td><img src="image" alt="Structure" /></td>
<td>Colorless oil</td>
</tr>
</tbody>
</table>

Melting point/ Crystallization point (°C) : 79.8 °C
VI. References

