# Supporting Information

# Physicochemical and Tribophysical Properties of Trioctylalkylammonium-bis(salicylato)borate (N888n-BScB) Ionic Liquids: Effect of Alkyl Chain Length

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**$^{1}$H and $^{13}$C NMR Characterization of Ionic Liquids**

***Trioctylhexylammonium bis(salicylato)borate (N8886-BScB)***: $^{1}$H NMR (ppm): 0.84-0.93 (t, 12H, $N(CH_2)_7C\underline{H}_3$, $N(CH_2)_5C\underline{H}_3$), 1.25-1.36 (m, 36H, $N(CH_2)_2(C\underline{H}_2)_5$, $N(CH_2)_2(C\underline{H}_2)_3$), 1.62-1.78 (m, 8H, $NCH_2C\underline{H}_2$), 2.82-2.85 (t, 8H, $NC\underline{H}_2$), 6.86-6.90 (m, 4H, $C_6\underline{H}_4$), 7.39-7.40 (m, 2H, $C_6\underline{H}_4$), 7.87-7.89 (dd, 2H, $C_6\underline{H}_4$). $^{13}$C NMR (ppm): 14.01, 14.13, 22.55, 22.61, 23.96, 25.64, 26.17, 26.92, 28.52, 28.99, 29.12, 31.42, 31.62, 31.70, 52.63, 112.61, 114.76, 117.60, 118.91, 119.21, 129.70, 130.67, 132.52, 135.59, 166.52, 170.27, 174.81.

***Tetraoctylammonium bis(salicylato)borate (N8888-BScB)*:** $^{1}$H NMR (ppm): 0.86-0.90 (t, 12H, $N(CH_2)_7C\underline{H}_3$), 1.20-1.26 (m, 40H, $N(CH_2)_2(C\underline{H}_2)_5$), 1.76-1.79 (m, 8H, $NCH_2C\underline{H}_2$), 2.87-2.90 (t, 8H, $NC\underline{H}_2$), 6.86-6.90 (m, 4H, $C_6\underline{H}_4$), 7.39-7.40 (m, 2H, $C_6\underline{H}_4$), 7.86-7.88 (dd, 2H, $C_6\underline{H}_4$). $^{13}$C NMR (ppm): 14.10, 21.87, 22.62, 23.82, 25.98, 26.20, 26.74, 28.56, 29.08, 29.19, 29.31, 29.53, 31.65, 31.71, 31.90, 32.68, 52.84, 58.72, 112.58, 114.95, 117.45, 118.51, 119.16, 129.74, 129.90, 135.05, 135.60, 159.52, 161.64, 166.25, 170.27.

***Trioctyldecylammonium bis(salicylato)borate (N88810-BScB)*:** $^{1}$H NMR (ppm): 0.82-0.91 (t, 12H, $N(CH_2)_7C\underline{H}_3$, $N(CH_2)_9C\underline{H}_3$), 1.21-1.43 (m, 44H, $N(CH_2)_2(C\underline{H}_2)_5$, $N(CH_2)_2(C\underline{H}_2)_7$), 1.76-1.79 (m, 8H, $NCH_2C\underline{H}_2$), 2.85-2.88 (t, 8H, $NC\underline{H}_2$), 6.75-6.95 (m, 4H, $C_6\underline{H}_4$), 7.40-7.43 (m, 2H, $C_6\underline{H}_4$), 7.86-7.90 (dd, 2H, $C_6\underline{H}_4$). $^{13}$C NMR (ppm): 14.10, 22.63, 22.70, 26.90, 27.08, 28.92, 29.15, 29.22, 29.32, 29.50, 31.74, 31.90, 32.67, 45.20, 52.69, 53.49, 114.64, 116.33, 117.50, 117.62, 118.67, 119.25, 19.69, 130.65, 132.55, 135.26, 159.55, 161.64, 161.76, 166.70, 174.87.

***Trioctyldodecylammonium bis(salicylato)borate (N88812-BScB)*:** $^{1}$H NMR (ppm): 0.85-0.89 (t, 12H, $N(CH_2)_7C\underline{H}_3$, $N(CH_2)_{11}C\underline{H}_3$), 1.20-1.45 (m, 48H, $N(CH_2)_2(C\underline{H}_2)_5$, $N(CH_2)_2(C\underline{H}_2)_9$), 1.64-1.86 (m, 8H, $NCH_2C\underline{H}_2$), 2.82-2.85 (t, 8H, $NC\underline{H}_2$), 6.86-6.96 (m, 4H, $C_6\underline{H}_4$), 7.34-7.44 (m, 2H, $C_6\underline{H}_4$), 7.83-7.88 (dd, 2H, $C_6\underline{H}_4$). $^{13}$C NMR (ppm): 14.09, 14.14, 21.88, 22.62, 22.72, 24.00, 25.99, 26.21, 26.88, 28.21, 28.58, 29.02, 29.26, 29.38, 29.48,

29.53, 29.58, 31.65, 31.72, 32.88, 34.02, 52.53, 58.77, 112.61, 114.88, 117.48, 118.57, 119.12, 129.74, 129.90, 135.10, 135.58, 159.56, 161.68, 166.40, 170.27.

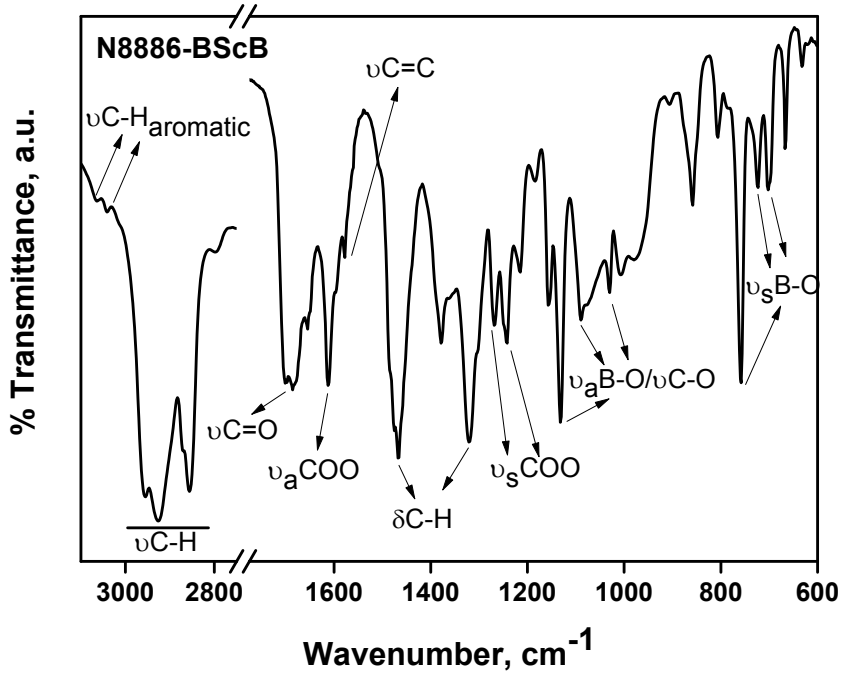


**Figure S1:** FTIR spectrum of N8886-BScB as a representative ionic liquid.

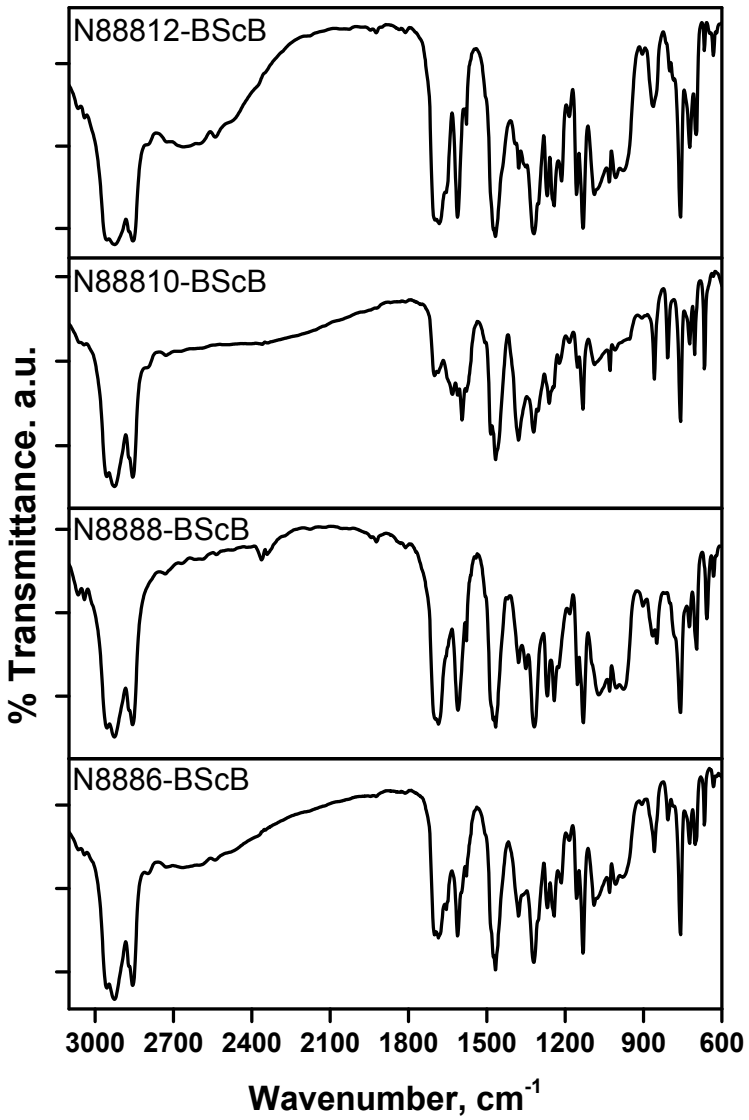


**Figure S2**. FTIR spectra of N8886-BScB, N8888-BScB, N88810-BScB and N88812-BScB ionic liquids

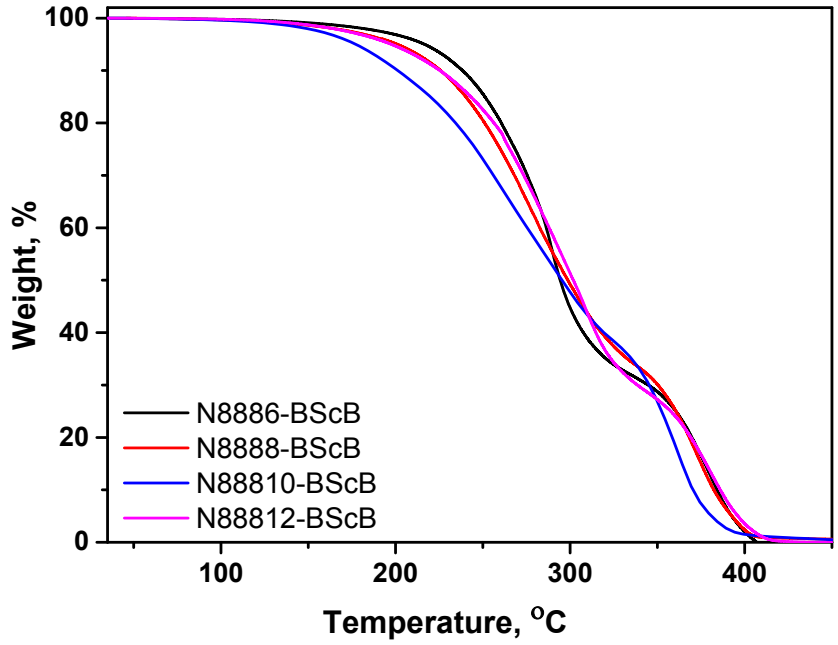


**Figure S3:** Thermal decomposition patterns of N8886-BScB, N8888-BScB, N88810-BScB and N88812-BScB ionic liquids at thermal rate of 10 °C.min$^{-1}$ under the nitrogen flow.

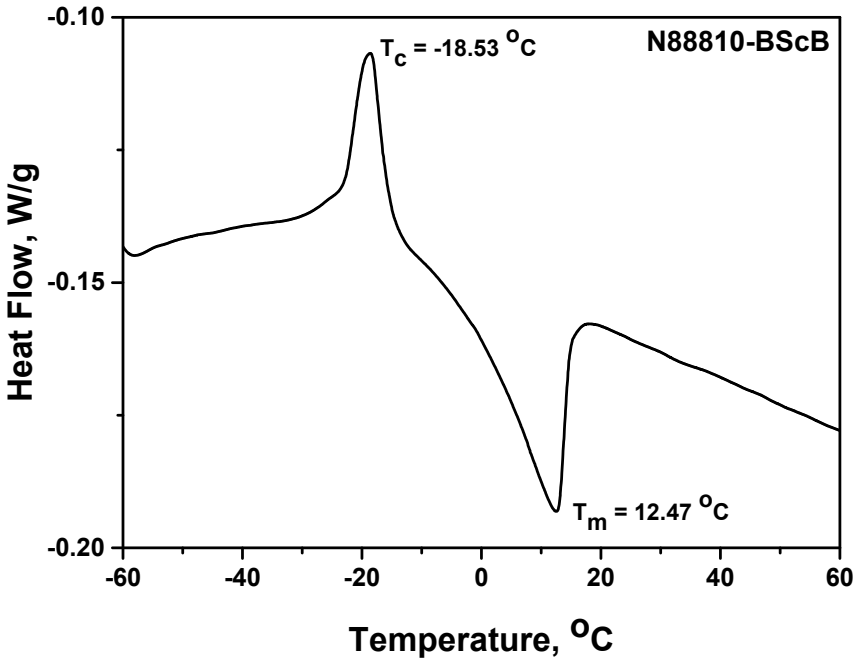


**Figure S4:** Differential scamming calorimetric pattern of N88810-BScB ionic liquids as a representative ionic liquid.

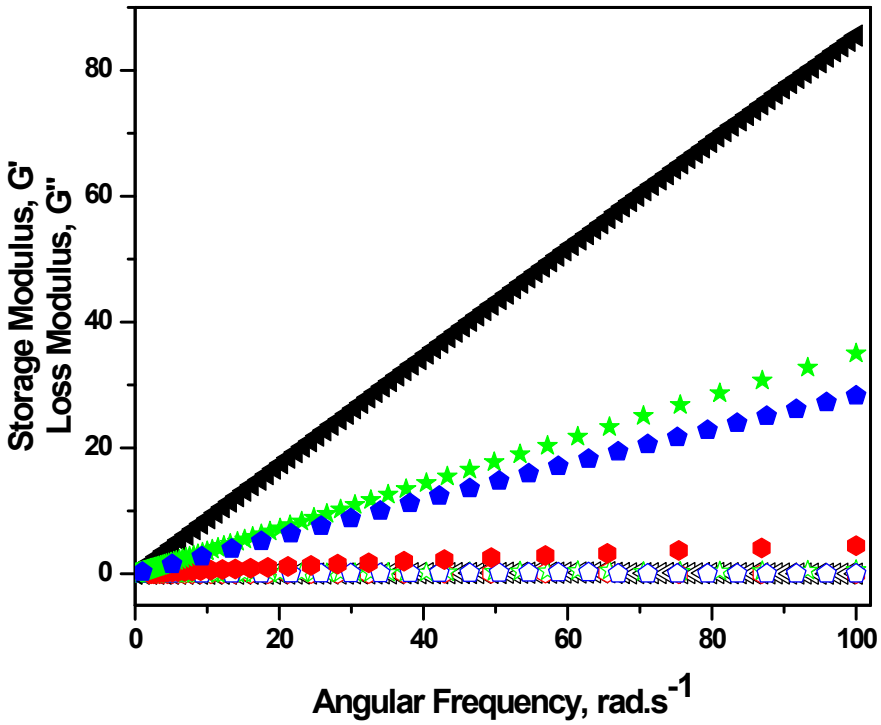


**Figure S5:** Storage modulus (G′, hollow symbols) and loss modulus (G″, filled symbols) as a function of angular frequency for N888n-BScB ionic liquids. Black, red, green and blue color symbols represent N8886-BScB, N8888-BScB, N88810-BScB and N88812-BScB, respectively.

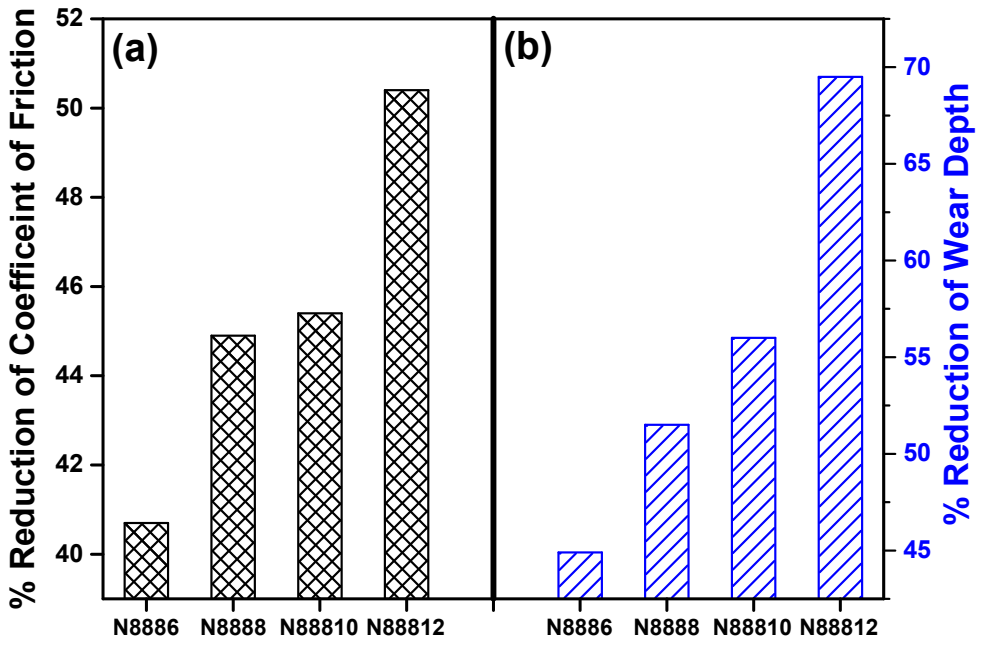


**Figure S6**: % Reduction of (a) coefficient of friction and (b) wear depth of N888n-BScB (n = 6, 8, 10 and 12) ionic liquids-lubricated aluminium disc compared to PEG 300 lube oil.after 5000 cyclic laps. Lubrication characteristics of PEG 300 lube base oil are plotted for a comparison. A steel ball ($\phi$ = 2 mm) was used as counter sliding body. Load: 100 mN, cyclic speed: 50 rpm.

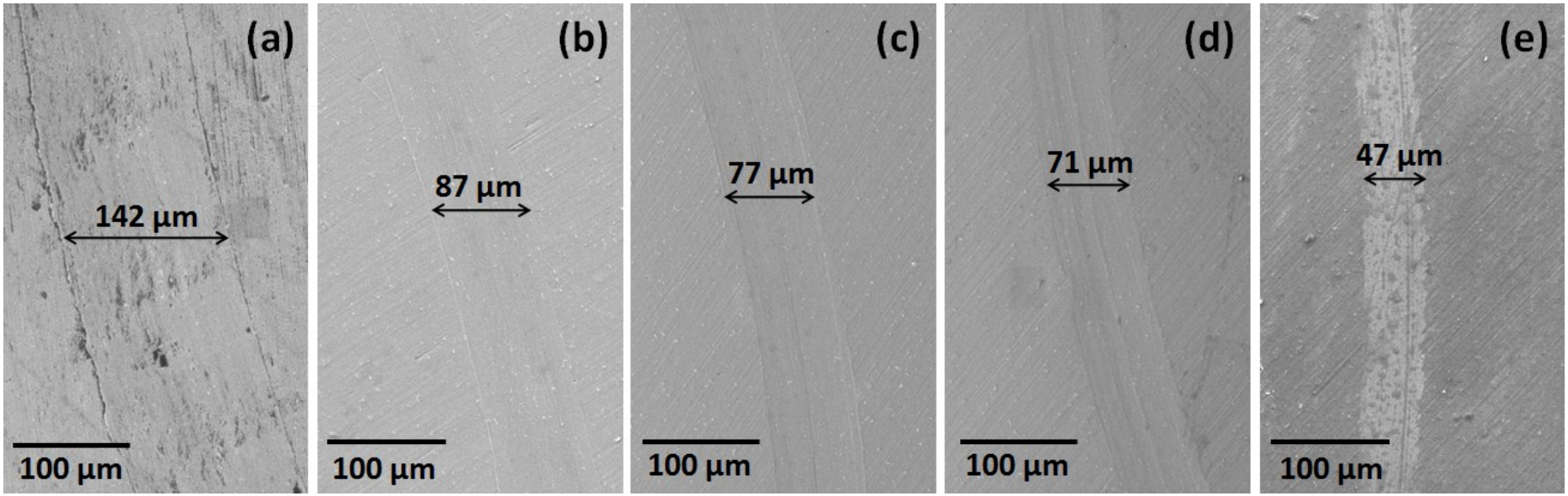


**Figure S7:** Changes in wear track width on the aluminium disc lubricated with (a) PEG 300 synthetic lube oil, (b) N8886-BScB, (c) N8888-BScB, (d) N88810-BScB and (e) N88812-BScB ionic liquids after 5000 cyclic laps. A steel ball ($\phi$ = 2 mm) was used as counter sliding body. Load: 100 mN, cyclic speed: 50 rpm.

**Table S1**: Infrared vibrational assignments of characteristics vibrational features of N888n-BScB ionic liquids

| N8886-BScB, $cm^{-1}$ | N8888-BScB, $cm^{-1}$ | N88810-BScB, $cm^{-1}$ | N88812-BScB, $cm^{-1}$ | Vibrational Assignment |
|---|---|---|---|---|
| 3071, 3042 | 3070, 3042 | 3063 | 3070, 3042 | υ(C–H), aromatic ring |
| 2957, 2921, 2857 | 2957, 2928, 2850 | 2957, 2928, 2850 | 2957, 2921, 2850 | υa/υs(C–H), $CH_2$/$CH_3$ groups |
| 1687 | 1680 | 1701 | 1701 | υ(C=O) |
| 1610 | 1609 | 1595 | 1616 | υa(COO) |
| 1573 | 1573 | 1574 | 1573 | υ(C=C), aromatic |
| 1467, 1375, 1319 | 1467, 1375, 1318 | 1467, 1382, 1318 | 1467, 1375, 1318 | δC–H, $CH_2$/$CH_3$ groups |
| 1270, 1240 | 1269, 1240 | 1261, 1240 | 1269, 1240 | υs(COO) |
| 1200-900 | 1200-900 | 1200-900 | 1200-900 | υa(B–O)/υ(C–O) |
| 758, 722, 701 | 758, 722, 695 | 758, 722, 701 | 758, 722, 701 | υs(B–O) |