***Supplementary Material***

**Viscosities and Densities of Phosphonium-Based Ionic Liquids Mixed with Dodecane**

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Table S1: Viscosities *η* and densities *ρ* for binary mixtures of dodecane with [TMPP-PA].

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| wt. %  dodecane |  | 0 | |  | 10 | |  | 20 | |  | 30 | |
| *T* (oC) |  | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) |
| 20 |  | - | - |  | - | 0.8986 |  | - | 0.8804 |  | - | 0.8627 |  |
| 25 |  | - | - |  | 318 | 0.8954 |  | 88.6 | 0.8770 |  | 39.4 | 0.8593 |  |
| 30 |  | - | - |  | 214 | 0.8921 |  | 67.8 | 0.8737 |  | 31.0 | 0.8559 |  |
| 35 |  | - | - |  | 159 | 0.8889 |  | 53.6 | 0.8704 |  | 25.4 | 0.8525 |  |
| 40 |  | - | - |  | 112 | 0.8856 |  | 41.9 | 0.8671 |  | 21.7 | 0.8492 |  |
| 45 |  | - | - |  | 81.6 | 0.8824 |  | 34.4 | 0.8638 |  | 18.3 | 0.8458 |  |
| 50 |  | 283 | 0.8956 |  | 60.6 | 0.8792 |  | 27.1 | 0.8605 |  | 16.1 | 0.8424 |  |
| 55 |  | 210 | 0.8925 |  | 40.7 | 0.8760 |  | 22.4 | 0.8572 |  | 14.3 | 0.8390 |  |
| 60 |  | 162 | 0.8894 |  | 32.9 | 0.8728 |  | 19.2 | 0.8539 |  | 13.1 | 0.8356 |  |
| 65 |  | 124 | 0.8863 |  | 27.3 | 0.8696 |  | 16.5 | 0.8506 |  | - | 0.8323 |  |
| 70 |  | 96.0 | 0.8833 |  | 22.9 | 0.8664 |  | 14.6 | 0.8473 |  | - | 0.8289 |  |
| 75 |  | 78.0 | 0.8803 |  | 19.4 | 0.8632 |  | 13.0 | 0.8440 |  | - | 0.8255 |  |
| 80 |  | 63.0 | 0.8772 |  | - | 0.8600 |  | - | 0.8407 |  | - | 0.8222 |  |
| 85 |  | - | - |  | - | 0.8568 |  | - | 0.8375 |  | - | 0.8188 |  |
| 90 |  | - | - |  | - | 0.8537 |  | - | 0.8342 |  | - | 0.8155 |  |

Table S2: Viscosities *η* and densities *ρ* for binary mixtures of dodecane with [TMPP-TP].

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| wt. %  dodecane |  | 0 | |  | 10 | |  | 20 | |  | 30 | |
| *T* (oC) |  | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *η* 103 (Pa∙s) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) |
| 20 |  | - | 0.8938 |  | - | 0.8770 |  | - | 0.8611 |  | - | 0.8454 |  |
| 25 |  | 804 | 0.8906 |  | 172 | 0.8738 |  | 58.2 | 0.8578 |  | 23.8 | 0.8421 |  |
| 30 |  | 560 | 0.8874 |  | 129 | 0.8706 |  | 46.0 | 0.8545 |  | 20.1 | 0.8387 |  |
| 35 |  | 408 | 0.8843 |  | 99.8 | 0.8675 |  | 36.5 | 0.8512 |  | 17.1 | 0.8354 |  |
| 40 |  | 306 | 0.8811 |  | 79.4 | 0.8643 |  | 30.0 | 0.8479 |  | 14.9 | 0.8320 |  |
| 45 |  | 227 | 0.8780 |  | 63.3 | 0.8611 |  | 25.0 | 0.8447 |  | 12.9 | 0.8287 |  |
| 50 |  | 177 | 0.8749 |  | 51.3 | 0.8579 |  | 21.3 | 0.8414 |  | - | 0.8254 |  |
| 55 |  | 149 | 0.8719 |  | 42.1 | 0.8548 |  | 18.2 | 0.8382 |  | - | 0.8220 |  |
| 60 |  | 110 | 0.8688 |  | 34.7 | 0.8516 |  | 15.7 | 0.8349 |  | - | 0.8187 |  |
| 65 |  | 91.2 | 0.8657 |  | 29.2 | 0.8484 |  | 13.9 | 0.8316 |  | - | 0.8154 |  |
| 70 |  | 70.6 | 0.8627 |  | 24.9 | 0.8453 |  | 12.5 | 0.8284 |  | - | 0.8120 |  |
| 75 |  | - | 0.8594 |  | 21.5 | 0.8421 |  | - | 0.8251 |  | - | 0.8087 |  |
| 80 |  | - | 0.8563 |  | 19.2 | 0.8390 |  | - | 0.8219 |  | - | 0.8054 |  |
| 85 |  | - | - |  | - | 0.8359 |  | - | 0.8187 |  | - | 0.8021 |  |
| 90 |  | - | - |  | - | 0.8328 |  | - | 0.8154 |  | - | 0.7987 |  |

Table S3: Viscosities *η* and densities *ρ* for binary mixtures of dodecane with [TTDP-DB].

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| wt. %  dodecane |  | 0 | |  | 10 | |  | 20 | |  | 23 | |  | 30 | |
| *T* (oC) |  | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) |
| 20 |  | - | - |  | - | 0.9319 |  | - | 0.9074 |  | - | - |  | - | 0.8845 |  |
| 25 |  | - | 0.9556 |  | 2930 | 0.9286 |  | 594 | 0.9042 |  | 456 | - |  | 312 | 0.8812 |  |
| 30 |  | - | 0.9525 |  | 1580 | 0.9252 |  | 441 | 0.9009 |  | 325 | - |  | 225 | 0.8779 |  |
| 35 |  | - | - |  | 1130 | 0.9220 |  | 319 | 0.8977 |  | 239 | - |  | 167 | 0.8746 |  |
| 40 |  | 1480 | 0.9428 |  | 812 | 0.9188 |  | 236 | 0.8944 |  | 180 | - |  | 127 | 0.8713 |  |
| 45 |  | - | - |  | 596 | 0.9157 |  | 176 | 0.8912 |  | 135 | - |  | 95.0 | 0.8680 |  |
| 50 |  | 750 | 0.9366 |  | 431 | 0.9125 |  | 135 | 0.8880 |  | 105 | - |  | 74.3 | 0.8648 |  |
| 55 |  | - | - |  | 316 | 0.9094 |  | 101 | 0.8848 |  | 81.7 | - |  | 59.1 | 0.8615 |  |
| 60 |  | 409 | 0.9304 |  | 228 | 0.9063 |  | 81.6 | 0.8816 |  | 65.7 | - |  | 47.7 | 0.8582 |  |
| 65 |  | - | - |  | 169 | 0.9032 |  | 65.1 | 0.8784 |  | 53.6 | - |  | 39.1 | 0.8549 |  |
| 70 |  | 238 | 0.9243 |  | 133 | 0.9001 |  | 54.4 | 0.8752 |  | 44.3 | - |  | 31.5 | 0.8516 |  |
| 75 |  | - | - |  | 108 | 0.8970 |  | 43.3 | 0.8720 |  | 36.8 | - |  | 26.5 | 0.8483 |  |
| 80 |  | 148 | 0.9183 |  | 86.1 | 0.8939 |  | 37.1 | 0.8688 |  | 31.1 | - |  | 22.6 | 0.8450 |  |
| 85 |  | - | - |  | - | - |  | - | 0.8656 |  | - | - |  | - | 0.8417 |  |
| 90 |  | - | - |  | - | - |  | - | 0.8624 |  | - | - |  | - | 0.8384 |  |

Table S4: Viscosities *η* and densities *ρ* for binary mixtures of dodecane with [TTDP-DC].

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| wt. %  dodecane |  | 0 | |  | 10 | |  | 20 | |  |
| *T* (oC) |  | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) |
| 20 |  | - | - |  | - | 0.8856 |  | - | 0.8688 |  |  |
| 25 |  | 440 | 0.8998 |  | 238 | 0.8826 |  | 160 | 0.8658 |  |  |
| 30 |  | 328 | 0.8969 |  | 181 | 0.8796 |  | 116 | 0.8628 |  |  |
| 35 |  | - | - |  | 141 | 0.8767 |  | 90.0 | 0.8597 |  |  |
| 40 |  | 196 | 0.8911 |  | 112 | 0.8738 |  | 71.6 | 0.8567 |  |  |
| 45 |  | - | - |  | 89.1 | 0.8709 |  | 57.8 | 0.8537 |  |  |
| 50 |  | 123 | 0.8862 |  | 72.7 | 0.8680 |  | 47.4 | 0.8507 |  |  |
| 55 |  | - | - |  | 60.0 | 0.8650 |  | 39.2 | 0.8477 |  |  |
| 60 |  | 82.0 | 0.8802 |  | 49.3 | 0.8621 |  | 32.8 | 0.8447 |  |  |
| 65 |  | - | - |  | 41.4 | 0.8592 |  | 28.0 | 0.8416 |  |  |
| 70 |  | 56.0 | 0.8743 |  | 35.5 | 0.8563 |  | 24.2 | 0.8386 |  |  |
| 75 |  | - | - |  | 30.3 | 0.8534 |  | 21.2 | 0.8356 |  |  |
| 80 |  | 41.0 | 0.8682 |  | 26.1 | 0.8505 |  | 19.0 | 0.8326 |  |  |
| 85 |  | - | - |  | - | 0.8475 |  | - | 0.8296 |  |  |
| 90 |  | - | - |  | - | 0.8446 |  | - | 0.8266 |  |  |

Table S5: Viscosities *η* and densities *ρ* for binary mixtures of dodecane with [TTDP-PA].

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| wt. %  dodecane |  | 0 | |  | 5 | |  | 10 | |  | 20 | |
| *T* (oC) |  | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) | *η* 103 (Pa∙s) | *ρ* (g∙cm-3) |
| 20 |  | - | - |  | - | - |  | - | 0.8732 |  | - | 0.8585 |
| 25 |  | 1000 | 0.8875 |  | 449 | - |  | 249 | 0.8702 |  | 82.0 | 0.8554 |
| 30 |  | 757 | 0.8844 |  | 344 | - |  | 195 | 0.8672 |  | 64.2 | 0.8523 |
| 35 |  | - | - |  | 291 | - |  | 156 | 0.8642 |  | 56.3 | 0.8491 |
| 40 |  | 439 | 0.8783 |  | 233 | - |  | 126 | 0.8611 |  | 48.0 | 0.8460 |
| 45 |  | - | - |  | 180 | - |  | 103 | 0.8584 |  | 40.9 | 0.8428 |
| 50 |  | 264 | 0.8723 |  | 144 | - |  | 85.0 | 0.8550 |  | 35.2 | 0.8397 |
| 55 |  | - | - |  | 118 | - |  | 69.9 | 0.8519 |  | 30.5 | 0.8366 |
| 60 |  | 170 | 0.8664 |  | 95.4 | - |  | 59.3 | 0.8489 |  | 27.1 | 0.8334 |
| 65 |  | - | - |  | 81.1 | - |  | 50.4 | 0.8458 |  | 24.2 | 0.8303 |
| 70 |  | 111 | 0.8604 |  | 65.0 | - |  | 43.4 | 0.8428 |  | 21.2 | 0.8271 |
| 75 |  | - | - |  | - | - |  | - | 0.8398 |  | - | - |
| 80 |  | 78.0 | 0.8545 |  | - | - |  | - | 0.8368 |  | - | - |
| 85 |  | - | - |  | - | - |  | - | - |  | - | - |
| 90 |  | - | - |  | - | - |  | - | - |  | - | - |