	<b>IL-B2001</b> High Temperature Cooling Liquid Product No. C000000022 <b>Technical Data Sheet</b>	Date	Jan. 21 <sup>th</sup> 2016
		Revision	7.2
		Release	RKa
		Page	1 von 3

## Identity:

- 1-Ethyl-3-methylimidazolium tetrafluoroborate stabilized (stabilized EMIM-BF<sub>4</sub>)
- REACH Registration number: 01-2120086816-43-0000
- CAS-Number: 143314-16-3
- Empirical Formula (Hill Notation): C<sub>6</sub>H<sub>11</sub>BF<sub>4</sub>N<sub>2</sub>

## Specifications:

- Assay Dialkylimidazolium<sup>+</sup> (HPLC)<sup>1</sup> ≥ 93%w
- Assay BF<sub>4</sub><sup>-</sup> (titration) ≥ 93%w
- Stabilizer (HPLC) 4.5 – 5.5%w
- Fluoride (ion chromatography) ≤ 1.5%w
- H<sub>2</sub>O (Karl Fischer titration) ≤ 1%w
- pH(50)<sup>2</sup> = 5.5 – 8.0
- Refractive index = 1.4100 – 1.4250
- Weight loss at 200°C (TGA, 24h, Ar) ≤ 7%w
- Aspect according to Ph.Eur.5.0: Clear to faintly turbid, viscous liquid
- Color according to Ph.Eur.5.0: Light yellow to brown

## Thermal properties:

- Operating temperature 50°C to 200°C
- Thermal stability in a closed system with nitrogen: 200°C for at least 2 years, 250°C for up to 3 hours.
- Flash point: No flash point according to EU-Method A.9
- Melting point: 15°C to -60°C<sup>3</sup>
- Boiling point: No boiling according to OECD 103 and EU method A.2
- Enthalpy of thermal decomposition: +689.2 J/g (endothermal) with T<sub>Onset</sub> = 418°C (TGA-DSC, 2K/min, Ar)
- Specific heat capacity: 1.325 J·g<sup>-1</sup>K<sup>-1</sup> (20°C), 1.367 J·g<sup>-1</sup>K<sup>-1</sup> (40°C), 1.418 J·g<sup>-1</sup>K<sup>-1</sup> (60°C), 1.457 J·g<sup>-1</sup>K<sup>-1</sup> (80°C), 1.500 J·g<sup>-1</sup>K<sup>-1</sup> (100°C), 1.541 J·g<sup>-1</sup>K<sup>-1</sup> (120°C), 1.583 J·g<sup>-1</sup>K<sup>-1</sup> (140°C), 1.633 J·g<sup>-1</sup>K<sup>-1</sup> (160°C), 1.687 J·g<sup>-1</sup>K<sup>-1</sup> (180°C), 1.698 J·g<sup>-1</sup>K<sup>-1</sup> (200°C).

<sup>1</sup> Sum 1,3-Dimethylimidazolium, 1-Ethyl-3-methylimidazolium, 1,3-Diethylimidazolium

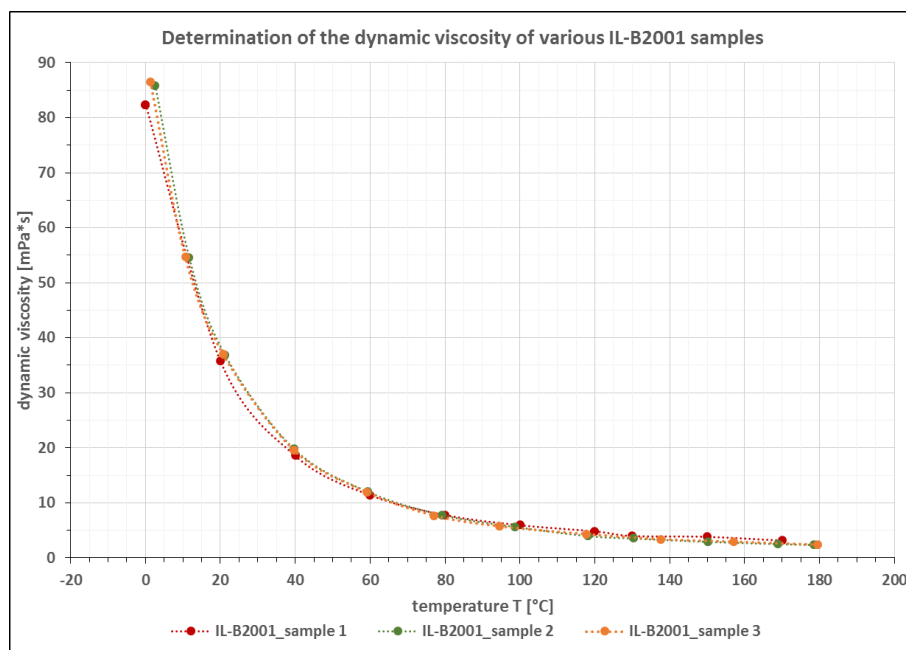
<sup>2</sup> pH of a freshly prepared 50%w aqueous solution at 20°C

<sup>3</sup> IL-B2001 may form glassy or crystalline solids depending on cooling kinetics and other parameters, resulting in different melting points on heating up. Typically, the melting point is below 0°C.


- Volumetric heat capacity: 1.666 J·cm<sup>-3</sup>K<sup>-1</sup> (20°C), 1.711 J·cm<sup>-3</sup>K<sup>-1</sup> (40°C), 1.814 J·cm<sup>-3</sup>K<sup>-1</sup> (100°C), 1.864 J·cm<sup>-3</sup>K<sup>-1</sup> (140°C), 1.928 J·cm<sup>-3</sup>K<sup>-1</sup> (200°C).
- Thermal conductivity: 0.157 W·m<sup>-1</sup>K<sup>-1</sup> (20°C), 0.162 W·m<sup>-1</sup>K<sup>-1</sup> (100°C)
- Thermal-expansion coefficient: 6.61·10<sup>-4</sup> K<sup>-1</sup>

### Other properties:

- Density: 1.2571 g·cm<sup>-3</sup> (20°C), 1.2520 g·cm<sup>-3</sup> (40°C), 1.2091 g·cm<sup>-3</sup> (100°C), 1.1778 g·cm<sup>-3</sup> (140°C), 1.1352 g·cm<sup>-3</sup> (200°C).
- Partitioning coefficient *n*-octanol / water (log POW) = -1.932 at 25°C
- Vapor pressure: 2.20·10<sup>-6</sup> Pa (20°C)<sup>4</sup>, 4.30·10<sup>-6</sup> Pa (25°C)<sup>4</sup>, 1.16·10<sup>-3</sup> Pa (75°C), 5.77·10<sup>-3</sup> Pa (90°C), 1.35·10<sup>-2</sup> Pa (105°C), 6.22·10<sup>-2</sup> Pa (120°C), 8.50·10<sup>0</sup> Pa (200°C)<sup>4</sup>
- Viscosity: 115 mPas (0°C), 18.9 mPas (40°C), 5.04 mPas (100°C)
- Surface tension: 50.7 mN·m<sup>-1</sup> at 20°C.
- Dynamic viscosity:



<sup>4</sup> Calculated from a linear fit  $y = -5075,7x + 11,657$  with  $y$  being  $\log P$  in [log Pa] and  $x$  being  $1/T$  in [1/K] derived from the four experimental values between  $T = 75^\circ\text{C}$  and  $120^\circ\text{C}$ , with a coefficient of correlation  $r^2 = 0.9872$ .

	<b>IL-B2001</b> High Temperature Cooling Liquid Product No. C000000022 <b>Technical Data Sheet</b>	Date	Jan. 21 <sup>th</sup> 2016
		Revision	7.2
		Release	RKa
		Page	3 von 3

temperature T [°C]	viscosity [mPa*s]	temperature T [°C]	viscosity [mPa*s]	temperature T [°C]	viscosity [mPa*s]
IL-B2001_sample 1	IL-B2001_sample 1	IL-B2001_sample 2	IL-B2001_sample 2	IL-B2001_sample 3	IL-B2001_sample 3
0	82,41	2,5	85,88	1,4	86,55
0	82,41	11,6	54,55	10,7	54,65
20	35,75	21,2	36,83	20,8	36,98
40	18,57	39,6	19,81	39,7	19,54
60	11,43	59,4	12,02	59,1	11,93
80	7,82	79,1	7,81	77,0	7,67
100	5,99	98,7	5,66	94,5	5,70
120	4,87	118,2	3,99	117,8	4,28
130	4,03	130,3	3,55	137,7	3,35
150	3,87	150,1	2,95	157,1	2,89
170	3,19	168,9	2,54	179,5	2,35
		178,50	2,37		

- Corrosion test at 200°C for 1 month in a closed system with nitrogen:

Material	St52	X6	A101	A965	Cu	Monel 400
Corrosion Δd/t [mm/year]	< 0.08	< 0.01	< 0.01	< 0.03	<0.02	<0.02

>0,1mm not recommended, ≤0,1mm acceptable, ≤0,05mm good, ≤ 0,02mm excellent

## Comment:

Values presented are results of careful measurements on representative batches of IL-B2001<sup>5</sup>. New batches, in full compliance with the specifications, may result in slightly divergent values and may change over time during operation. However, this will not affect their full operability and is a result of normal batch-to-batch variations and aging processes.

<sup>5</sup> Lot.17PI118\_6, 17PI120\_1, 17PI131, 17PI131\_5, 17PI158\_3, 25PI049\_2 and 25PI049\_3