A Digression to Ionic Liquid Metastability – The case of [C_2mim][CH_3SO_3]

Daniel Lozano-Martín
Grupo de Termodinámica y Calibración (TERMOCAL), Research Institute on Bioeconomy, Escuela de Ingenierías Industriales, Universidad de Valladolid, Valladolid, Spain

Salomé Vieira, Xavier Paredes, Maria José Lourenço and Carlos Nieto de Castro [C, S]
Centro de Química Estrutural, Universidade de Lisboa, Faculdade de Ciências, Lisbon, Portugal
cacastro@ciencias.ulisboa.pt

Jan Sengers
Institute for Physical Science and Technology, University of Maryland, College Park, Massachusetts, U.S.A.

Klemens Massonne
RC/OI—M300, BASF SE, Ludwigshafen, Germany

Ionic liquids have been suggested as new engineering fluids, namely in the area of heat transfer, as alternatives to current biphenyl and diphenyl oxide, alkylated aromatics and dimethyl polysiloxane oils, which degrade above 200 °C and pose some environmental problems. Recently, we have proposed 1-ethyl-3-methylimidazolium methanesulfonate, [C_2mim][CH_3SO_3], as a new heat transfer fluid, because of its thermophysical and toxicological properties [1]. The behavior of the ionic liquid below the melting point (shown to be T_{melt} = 307.8 ± 1 K) [2] demonstrated the existence of metastability, a fact that can justify its use in several industrial applications, extending its temperature range to temperatures lower than the melting temperature. This phenomenon was demonstrated by performing accurate measurements of the thermal conductivity of the liquid and solid between 278 and 355 K with an estimated uncertainty of 2% at a 95% confidence level.

References

[1] - Bioucas, F.E.B.; Vieira, S.I.C.; Lourenço, M.J.V.; Santos, F.; Nieto de Castro, C.A.N.; Massonne, K.; Dos Santos, F.J.V. [C2mim][CH3SO3]—A Suitable New Heat Transfer Fluid? Part 1. Thermophysical and Toxicological Properties. Ind. Eng. Chem. Res. 2018, 57, 8541–8551, DOI: https://doi.org/10.1021/acs.iecr.8b00723

[2] - Lozano-Martín, D.; Vieira, S.I.C.; Paredes, X.; Lourenço, M.J.V.; Nieto de Castro, C.A.; Sengers, J.V.; Massonne, K. Thermal Conductivity of Metastable Ionic Liquid [C2mim][CH3SO3], Molecules, 2020, Volume 25(18), 4290. DOI: https://doi.org/10.3390/molecules25184290