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Thermophysical Properties of Novel Ethyl-2-alkylpyridinium based Ionic Liquids

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Abstract

Densities and viscosities and their dependence on temperature were measured for the 1-ethyl-2-alkylpyridinium bis(trifluoromethanesulfonyl)imide, [$^{2}C_{N-2}{}^{1}C_{2}Py$][NTf_2] (N=4, 5, 6, 7, 8, 9, 10) ionic liquid series. Molar volume, thermal expansion coefficients, VTF parameters, as well as, the energy barrier related to the fluid shear stress at T = 298.15 K, were derived. High precision heat capacities, at T = 298.15 K, were measured using a heat capacity drop calorimeter.

The effect and trend of the thermophysical properties along the alkyl chain length in the position 2 of the core 1-ethylpyridinium cation, are used to explore the nanostructuration effect of ILs. A trend shift on the thermophysical properties at the [$^{2}C_{5}{}^{1}C_{2}Py$][NTf_2] was found, which presents an indication and support for the initiation of the nanostructuration in the pyridinium based ionic liquids. The results and insights are in agreement with the previously studied alkylimidazolium ionic liquids series.[1-6] The observed trend shift in the viscosity and in the heat capacities of the pyridinium ionic liquids is more pronounced in the pyridinium than in the imidazolium ionic liquids series. This work confirms and is an additional support, for the molecular understanding of the trend shift observed in the thermophysical properties of ionic liquids, as well as, a contribution for the understanding of the relation between the structural organization of the ionic liquids, their physico-chemical properties, tuning and design.

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