Viscosity, Interfacial Tension, Density, and Refractive Index of Ionic Liquids [EMIM][$Meso_3$], [EMIM][$Meohpo_2$], [EMIM][$Ocso_4$], and [BBIM][Ntf_2] in Dependence on Temperature at Atmospheric Pressure

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This work represents a continuation of former investigations, where viscosity, interfacial tension, density, and refractive index of ionic liquids (ILs) [EMIM][$EtSO_4$] (1-ethyl-3-methyl-imidazolium ethylsulfate), [EMIM][NTf_2] (1-ethyl-3-methyl-imidazolium bis(tri-fluoromethylsulfonyl)imide), [EMIM][$N(CN)_2$] (1-ethyl-3-methyl-imidazolium dicyanamide), and [OMA][NTf_2] (trioctylmethylammonium bis(trifluoromethylsulfonyl)imide) were studied. Here, the ILs [EMIM][$MeSO_3$] (1-ethyl-3-methyl-imidazolium methanesulfonate), [EMIM][$MeOHPO_2$] (1-ethyl-3-methyl-imidazolium methylphosphonate), [EMIM][$OcSO_4$] (1-ethyl-3-methyl-imidazolium octylsulfate), and [BBIM][NTf_2] (1-butyl-3-butyl-imidazolium bis(trifluoromethylsulfonyl)imide) were investigated again both by conventional techniques and by surface light scattering (SLS). An Abbe refractometer was used for the measurement of the refractive index in the range of (283.15 to 313.15) K with an expanded uncertainty (k = 2) of about 0.0005. The density was measured between (273.15 and 313.15) K with a vibrating tube densimeter and an expanded uncertainty (k = 2) of about 0.02%. The interfacial tension was obtained from the pendant drop technique at a temperature of 293.15 K with an expanded uncertainty (k = 2) of 1%. Based on this datum and the temperature dependence of density, the interfacial tension for all relevant temperatures was estimated via an appropriate prediction model. For the ILs studied within this work, at a first order approximation, the quantity directly accessible by SLS was the ratio of dynamic viscosity to surface tension. Combining the results from SLS with values for density and interfacial tension from conventional methods, the dynamic viscosity could be obtained from (273.15 to 333.15) K with an estimated expanded uncertainty (k = 2) of less than 3%. Besides a comparison with literature, the major aim of this work was to point out the influence of variations of the anion on thermophysical properties of $[EMIM]^+$ based ILs. In addition, the effect of different cations was studied in ILs with the $[NTf_2]^-$ anion. ILs with equal cations and similar anions can still exhibit different properties, which is interpreted with relevant molecular interactions.