Vapor Pressure for 1-Alkyl-3-Methylimidazolium Bis(Trifluoromethanesulfonyl)Imides

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Ionic liquids (ILs) possess very low vapor pressures in the range of their thermal stability often considered as non-measurable. This makes additional problems in investigation of vaporization process of these compounds. 1-Alkyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imides [$C_n$mim][NTf_2] are promising ILs due to their high thermal and chemical stability. It was found that in a scanning calorimeter under Ar pressure of 6 kPa these compounds did not decompose until 570 K. In this work we report the results of determination of vapor pressures for [C_2mim][NTf_2], [C_4mim][NTf_2], [C_6mim][NTf_2], [C_8mim][NTf_2] by the integral effusion Knudsen method. For purification samples of the studied compounds were exposed to vacuum at temperatures < 420 K until constant mass-loss rate had been reached. To prevent decomposition of the samples color and smell of residue in the container and of the condensate on a cold finger were controlled. IR spectroscopy confirmed that no decomposition occurred during vaporization. The vapor pressures were measured in the temperature interval (440 to 500) K. The vapor phase was considered to consist of ionic pairs. The enthalpies of vaporization for the studied ILs were determined from the slope of lnP vs 1/T lines to be 118.8 +/– 1.3 kJ/mol at 463 K for [C_2mim][NTf_2]; 118.3 +/– 1.7 kJ/mol (478 K) for [C_4mim][NTf_2]; 123.4 +/– 0.8 kJ/mol (462 K) for [C_6mim][NTf_2]; 134.5 +/– 0.5 kJ/mol (467 K) for [C_8mim][NTf_2]. The normal boiling temperatures of ILs were estimated by extrapolation of the results of vapor pressure determination to be 907 K for [C_2mim][NTf_2], 933 K for [C_4mim][NTf_2], 885 K for [C_6mim][NTf_2], 848 K for [C_8mim][NTf_2]. The obtained results were used to justify the correlation procedure for the estimation of the enthalpy of vaporization of ILs.

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