

Insights into the effect of CO₂ absorption on the ionic mobility of ionic liquids

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Abstract

© 2016 the Owner Societies. We investigate a comparative effect of CO₂ absorption on the ionic mobility of two choline based ionic liquids comprising two different anions such as threonine and imidazole. The synthesized ionic liquids were characterized using ¹H and ¹³C NMR and other spectroscopic techniques. By keeping a common cation and changing the anion from threonine to imidazole both the viscosity and density reduced drastically. We found that [N1,1,6,2OH][Imi] exhibits the highest CO₂ capture capacity at 20 °C of 5.27 mol of CO₂ per kg of ionic liquid (1.27 mol of CO₂ per mol of ionic liquid, 23.26 wt% of CO₂) whereas [N1,1,6,2OH][Threo] exhibits 3.6 mol of CO₂ per kg of ionic liquid (1.05 mol of CO₂ per mol of ionic liquid, 15.87 wt% of CO₂). The activation energy for diffusion is calculated using the Vogel-Fulcher-Tamman (VFT) equation in the form of diffusivity. It was found that the activation energy for the diffusion of [N1,1,6,2OH][Threo] is ~10 times higher than that of [N1,1,6,2OH][Imi]. ¹H diffusion NMR data revealed that the diffusivity of [N1,1,6,2OH][Imi] is increased after CO₂ absorption whereas a decrease in diffusivity was observed in the case of [N1,1,6,2OH][Threo]. This anomalous behavior of [N1,1,6,2OH][Imi] was further explained by using DFT calculations.

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