Performance and pressure drop of CO2 absorption into task-specific and halide-free ionic liquids in a microchannel

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Abstract

The gas-liquid two-phase flow pattern, absorption rate and pressure drop of CO2 absorbed into the aqueous solution of the task-specific ionic liquid (1-aminopropyl-3-methylimidazole tetrafluoroborate [Apmim][BF4] and 1- hydroxyethyl-3-methylimidazole tetrafluoroborate [OHemim][BF4]) and halide-free ionic liquid 1- butyl -3-methylimidazolium methylsulfate [Bmim][CH3SO4] were investigated in a microreactor. The absorption mechanism of the three ionic liquids was analyzed employing the 13C NMR spectroscopy. The [Apmim][BF4] was found to have the best ability of CO2 capture compared to the other two ionic liquids, as chemical absorption occurred between [Apmim][BF4] and CO2, while only physical absorption took place between [OHemim][BF4] / [Bmim][CH3SO4] and CO2. The sequence of CO2 absorption rate in three ionic liquid aqueous solutions is: [Apmim][BF4] > [Bmim][CH3SO4] >[OHemim][BF4]. Furthermore, the effects of gas-liquid flow rate and ionic liquids concentration on CO2 absorption rate and pressure drop were studied, the pressure drop models based on various flow patterns were proposed.

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