

Do ether functionalized ionic liquids improve the CO₂ solubility?

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Do Ether Functionalized Ionic Liquids Improve the CO₂ Solubility?

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Abstract

CO₂ absorption using a solvent is accepted as the most compatible technology. In the recent years ionic liquids (ILs) have shown to be good candidates for CO₂ capture. They exhibit major advantages compared to amine-based systems. Their negligible vapor pressure, high thermal and chemical stability and tunability outweigh the disadvantages of lower absorptive capacity and kinetics.

In this work a comprehensive study of the ILs [C₂mim]-, [C₄mim]-, [C₆mim]-, [C₇mim]- and [C₈mim] tricyanomethanide (TCM) has been carried out. Furthermore, in order to evaluate the presence of ether groups in the alkyl chain of the imidazolium, this work includes 1-(2-methoxyethyl)-3-methylimidazolium- and 1[2-(2-methoxyethoxy)ethyl]-3-methylimidazolium tricyanomethanide. These non-fluorinated and low-viscous ILs are studied for the first time as a solvent for CO₂ capture. Two different methods (volumetric vs gravimetric) were applied to study the thermodynamics (i.e., absorptive capacity and Henry's law coefficient) and kinetics (i.e., diffusion coefficient) at several temperatures and pressures up to 150 bars. The experimentally determined phase behavior of the IL and CO₂ systems are correlated using the Peng-Robinson equation of state. Furthermore, the thermal operating window (e.g., glass transition and decomposition temperature) and physical properties (e.g., density, viscosity, conductivity and surface tension) were determined.

It will be shown at the conference that TCM-based ILs are promising sorbents for pre-combustion CO₂ capture due to their high (physical) absorptive capacity, their low regeneration energy consumption (low heat of absorption) and improved kinetics (due to their low viscosity) compared to the conventional ILs.

