Amine-Functionalized Amino Acid-based Ionic Liquids as Efficient and High-Capacity Absorbents for CO2 - DTU Orbit (28/01/2019)

Amine-Functionalized Amino Acid-based Ionic Liquids as Efficient and High-Capacity Absorbents for CO2

Ionic liquids (ILs) comprised of ammonium cations and anions of naturally occurring amino acids containing an additional amine group (e.g., lysine, histidine, asparagine, and glutamine) were examined as high-capacity absorbents for CO2. An absorption capacity of 2.1 mol CO2 per mol of IL (3.5 mol CO2 per kg IL, 13.1 wt% CO2) was measured for [N66614][Lys] at ambient temperature and about 1 mol CO2 per mol of IL at 80°C (under 1 bar of CO2). This demonstrated that desorption is possible under CO2-rich conditions by temperature-swing absorption; three consecutive sorption cycles were performed with the IL. The mechanistic and kinetic study of the absorption process was further substantiated by NMR spectroscopy and in situ attenuated total reflectance FTIR for [N66614][Lys] and the homologous phosphonium-based IL [P66614][Lys]. This study revealed that carbamic acid was formed with CO2 in both ILs by chemisorption; however, the amino acid–carboxyl groups on the anion played an important—but different—catalytic role for the sorption kinetics in the two ILs. The origin of the cationic effect is speculated to be correlated with the strength of the ion interactions in the two ILs.

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