COMPOSITE MATERIALS ENABLED FOR CO2 SEPARATIONS BY IONIC LIQUIDS

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Ionic liquids (ILs) are solvents that are made of salts with negligible vapor pressures and high CO2 solubilities. ILs can be tailored for CO2 capture and separation processes requiring specific capacity and selectivity owing to their immense structural design space. In this study, we demonstrate the utility of ILs in different structural supports as CO2 absorbers for packed-bed and membrane type separations. Specifically, we synthesized CO2-reactive ILs that are capable of achieving significant CO2 uptake at low partial pressures of CO2 and we formulate IL-IL mixtures where the CO2 capacity, uptake rate and diffusivity can be modulated. Furthermore, we have encapsulated these ILs via Pickering emulsions where the resulting capsule has a shell made of graphene oxide and polyurea, and an IL core. These IL capsules show enhanced mass transfer kinetics compared to bulk IL due to the increased gas-liquid surface area by encapsulation. This strategy can be adapted for gas scrubbing technologies requiring on-board capture such as automobiles, spacecrafts and submarines. Alternatively, we have fabricated polymer-IL composites as membranes via solution casting in order to adapt ILs for continuous gas separations suitable for post-process gas mixtures such as flue gas from coal-fired power plants.