

Public Abstract

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Title: Functional Ionic Liquids and Deep Eutectic Solvents for Luminescence Sensing Applications and Carbon Capture

Ionic liquids (ILs) and deep eutectic solvents (DESS) have recently become a topic of great interest due to their unique properties and their variety of potential applications and enhancement of desired properties. One unique property is that they are stable up to high temperatures and sometimes considered to be environmentally friendly, benign solvents. Few applications that were explored included carbon dioxide (CO₂) capture, lanthanide recognition, and proton sensing. CO₂ capture is of interest due to its continued increase in emissions and its negative impact on the environment. Lanthanides in general are used for ion extraction, light-emitting devices, and optical fibers. Proton sensing is useful when pH sensitive materials are used.

Eight novel ILs based on four different β -diketonate anions were synthesized and characterized. These ILs shown the potential to be used for lanthanide recognition in which the ILs coordinated with Eu³⁺ resulting in an intensification of luminescence. These ILs also displayed a prominent color change as the acid concentration increased. However, experimental and computational studies revealed that these ILs were essentially incapable of binding CO₂.

A bio friendly DES mixture of choline chloride and glycerol along with a superbases was optimized and shown to efficiently capture CO₂. This reaction can be easily reversed upon heating under nitrogen to release the captured CO₂.

Overall, these newly introduced β -diketonate ILs and DES and superbases mixture were relatively green and showed interesting and useful physicochemical properties applicable to a number of applications.