Capturing of CO_2 from flue gasses using ionic liquids

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Flue gasses contain large amounts of CO_2, which are each day emitted to the atmosphere. Separating and capturing the CO_2 from especially power plant flue gases, originating from burning of fossil fuels, is a challenge the World must overcome in near future. Today's known CO_2 absorbents use chemical absorption for separating and capturing the CO_2. This sorption has some down sides e.g. it binds firmly the CO_2, causing a lot of energy to be used for the reversible release of the absorbed CO_2, corresponding to around 30-40 % of the total energy production of the power plant. Furthermore the absorbents have high volatility, which means that some part will be emitted to the flue gas, causing loss of materials and waste of energy for the evaporation of water and absorbent. These problems can be solved using Ionic Liquids for CO_2 absorption.

Ionic liquids are molten salts that are liquid below 100 C and often around room temperature. Some of these fluids show high absorption capacity of CO_2 compared to other small gasses. They absorb CO_2 by physical absorption mechanisms. By this technique the CO_2 is held in the liquid by molecular CO_2, where the absorption depends on factors as solubility and vapour pressure of CO_2 in the flue gas. This method demands much less energy to reversibly release the CO_2 or evaporate the sorbent, since Ionic Liquids have a negligible vapour pressure and therefore neither evaporate or get lost during the absorption/desorption process.
Furthermore they may be designed to absorb very little of the water present in the flue gas, and thus eliminate the problem of energy waste for useless evaporation of water during the industrial process, as experienced for the actual applied technology..

Today's challenge is the design of Ionic Liquids with high enough CO_2 absorption ability for commercial use. This project concerns model calculations on selected ionic liquids currently being synthesized in an ongoing research project at DTU Chemistry, and inspires to design the best Ionic Liquids suitable for CO_2 capturing. DTU is on the international forefront regarding these issues, and the present project and the research effort behind will further add to keep this position.