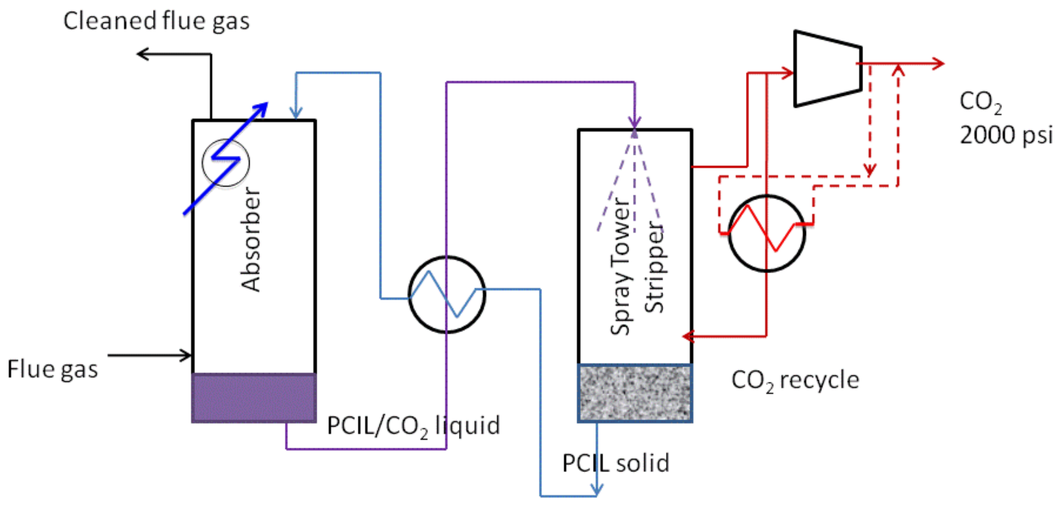
0208-1667

CO_2 Capture with Ionic Liquids Involving Phase Change

Joan F. Brennecke. Edward J. Maginn, Mark J. McCready, Patrick Murphy and William F. Schneider, University of Notre Dame
George Keller, MATRIC

Technology Summary

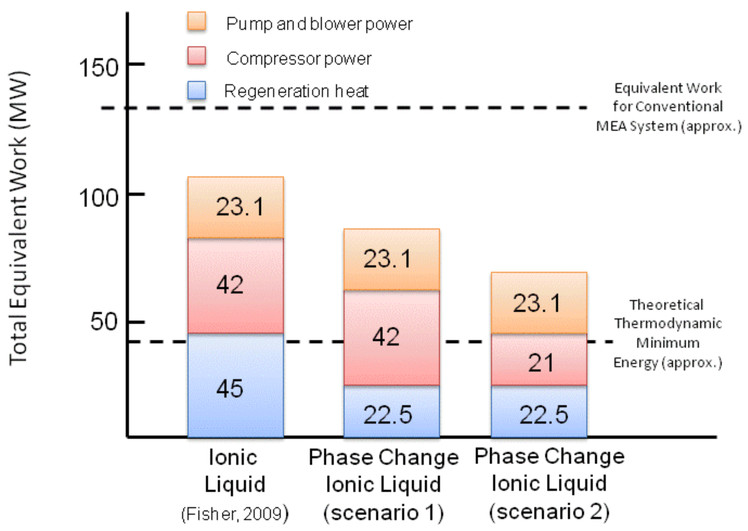
A new concept for CO_2 capture that uses *phase change ionic liquids (PCILs)* offers the potential to significantly reduce parasitic energy losses incurred from capturing CO_2 from flue gas. PCILs are solid ionic materials that have high CO_2 uptake (one mole of CO_2 for every mole of salt at post-combustion flue gas conditions) and form a liquid when they react with CO_2. This allows for a novel process that uses the heat of fusion to provide part of the heat needed to release CO_2 from the absorbent, reducing the total energy required.
This project will (1) develop and characterize PCILs; (2) evaluate energy savings in a new CO_2 capture process; and (3) demonstrate the technology at laboratory scale.



Goal: develop ionic salts that undergo a phase change (from solid to liquid) when they react with CO_2; taking advantage of the enthalpy change when PCILs react with CO_2 to enable capture of 90% of the CO_2 from post-combustion flue gas with less than a 35% increase in the cost of electricity.

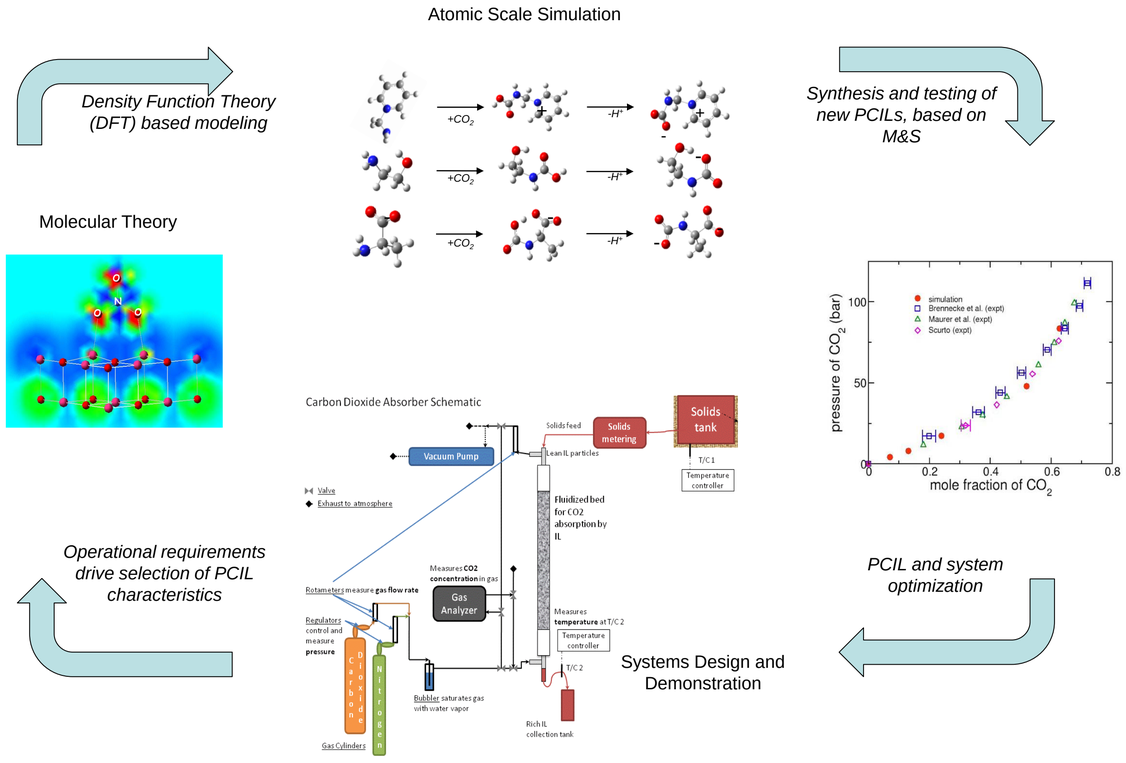
Discovery - solid ionic materials that:
- have high CO_2 uptake (close to one mole of CO_2 per mole of salt at post-combustion flue gas conditions) and
- form a liquid when they react with CO_2

Invention – use the heat of fusion (generated as the salt solidifies upon release of CO_2) as part the heat needed to release the CO_2 from the absorbent in the solvent regeneration step



In a 500 MW (471 MW de-rated) coal plant:
- Aqueous amine scrubbing incurs parasitic energy losses of 28% (132 MW).
- Current ionic liquids could reduce this to 23% (110 MW)
- **Proposed PCIL process could reduce energy losses to 14% (66 MW)**

Approach

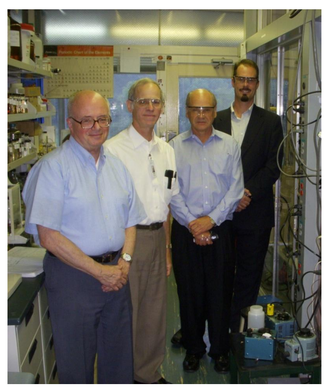


	Key Milestones & Deliverables
Year 1	•Characterization of first set of PCILs (TRL 3) •Identification of key process variables
Year 2	•Detailed process model based on theoretical and experimental results •Go/NoGo based on predicted parasitic energy
Year 3	•TRL 4 demo of PCIL based CO_2 capture process

Progress to Date

- Synthesized five Gen1 PCILs
- Measured CO_2 uptake of two Gen1 PCILs and began measurements of other compounds
- Developed forcefields for Gen1 PCILs and initiated molecular simulations
- Initiated measurements of heats of reaction and construction of packed bed absorption column
- Initiated process modeling

University of Notre Dame Team



MATRIC Team