NEW, hydrophobic solvent CASSH-1 shows potential for extending equipment lifetime for pre-combustion carbon capture processes.

NETL FILES PATENT FOR HYDROPHOBIC CARBON CAPTURE SOLVENT THAT REDUCES CORROSION OF STEEL TO LOWEST REPORTED LEVELS

Extending the lifetime of process equipment can decrease capital expenses.

- Pre-combustion carbon capture processes rely on solvents that can capture carbon dioxide (CO₂) at high capacity and selectivity over hydrogen in the presence of water.
- Solvents with hydrophilic properties tend to corrode both stainless and carbon steel, which are common equipment materials for absorbers.
- Rapid corrosion can result in equipment replacement and higher operating costs, driving the need to develop high-performance, non-corrosive solvents for carbon capture, including CASSH-1.

HIGH POTENTIAL FOR IMPLEMENTATION OF SOLVENT WITH NEAR-ZERO STEEL CORROSION

This novel solvent can benefit capture processes even when used with cheaper carbon steel.

The hydrophobic CASSH-1 solvent demonstrates superior performance, with uptake capacities comparable to hydrophilic Selexol™ and similar selectivities for CO₂.

These results show a promising technology ideal for long-lasting compatibility with absorber equipment.

- Computational simulations (with OLI Studio Software) for predicting corrosion rate and water and CO₂ uptake were used to downselect promising candidates.
- Testing of solvent capture properties showed that CASSH-1 outperforms commercially available solvents in terms of corrosion rates, vapor pressure, and absorption kinetics.
- Simulations were validated by corrosion testing of the hydrophobic solvent, which caused no measurable corrosion with either carbon or stainless steel.

PARTNERS

OLI systems, inc.

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NETL-DEVELOPED SOLVENT SHOWS UNPRECEDENTED CORROSION RESISTANCE

CASSH-1 shows notable capture performance.

- Steel Surface After Exposure to Non-Corrosive Cassh-1 Solvent

RIGOROUS EXPERIMENTAL TESTING OF CORROSION RATES

Cross-section of steels, solvents, and operating conditions investigated:

- NETL/RIC research facilities are used to synthesize and test hydrophobic solvents in specialized Parr reactors.
- Corrosion rates of both carbon and stainless steel exposed to eight different solvents and aqueous solutions were measured under a range of temperatures, pressures, and gas compositions.
- The amount of corrosion is determined by measuring both the formation of nodules on the steel surface and the concentration of free metal ions released into the solvent.
- Long-term experimental testing, spanning one-to-four weeks, gives results that more accurately represent the projected performance of the solvents.

Parr Reactors (Top) are Used to House Steel Samples in Solvents for a Period of Time (A Low Corrosion Rate Results in a Clear Solvent [Bottom Left], While a High Corrosion Rate Imparts a Yellow Hue to the Solvent [Bottom Right])

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DEMONSTRATE AND DEPLOY POINT-SOURCE CARBON CAPTURE

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