

## GROUPS

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SIMTECHE CO<sub>2</sub> Capture Process Wins R&D 100 Award

Introducti

Each year, R&D Magazine picks the 100 most significant technological advances in research and industry and honors them with awards that The Chicago Tribune has called, "The Oscars or Invention." A 2009 entry led by Chemistry Division staff member Robert Currier and collaborator Dwain F. Spencer (SIMTECHE) has won an R&D 100 Award for an innovative method of capturing CO<sub>2</sub>.

The SIMTECHE CO<sub>2</sub> Capture Process captures and compresses the greenhouse gas carbon dioxide (CO<sub>2</sub>) emitted by advanced fossil fuel power plants and other industrial operations. Based on the reversible reaction of CO<sub>2</sub> and cold water, our process pulls CO<sub>2</sub> out of flowing mixtures of gases and traps individual CO<sub>2</sub> molecules within tiny molecular cages made of water. Once separated from the gas stream, the CO<sub>2</sub> hydrate can be decomposed to regenerate CO<sub>2</sub> gas at elevated pressures for sequestration or sale on the emerging CO<sub>2</sub> market. Informed control of thermodynamic conditions throughout the process and efficient reactor design reduce parasitic power losses and minimize incremental costs.

## Applications

- CO<sub>2</sub> capture in integrated gasifier combined-cycle (IGCC) power plants burning coal, petroleum coke, natural gas, or biomass
- CO<sub>2</sub> capture in coal-fired power plants using high-purity oxygen for combustion
- Compressed CO<sub>2</sub> for use in enhanced oil recovery or sequestration in underground geological formations
- Purification of high-pressure hydrogen for use in hydrotreating, petrochemical synthesis, and refinery operations

## Benefits

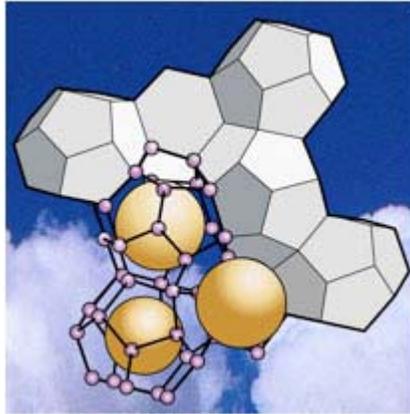
- Addresses climate-change concerns by providing large-scale, low cost CO<sub>2</sub> capture and compression
- Provides flexible CO<sub>2</sub> capture levels of 65%–90% or more to be set by the customer in response to markets and government mandates
- Energy efficient to reduce the costs of capturing and compressing CO<sub>2</sub>
- Clean—uses no noxious chemicals and produces no hazardous byproducts
- Can simultaneously capture and compress H<sub>2</sub>S and other sulfur compounds

The SIMTECHE CO<sub>2</sub> Capture Process is proven and now poised to reduce CO<sub>2</sub> emissions at industrial scales. Efforts to find a commercialization partner are underway. The technology was developed as a joint Los Alamos/SIMTECHE effort with engineering support from Bechtel National and Nexant, Inc. The team completing the project included Robert Currier (C-PCS), Dali Yang (MST-7), Ron Martinez (C-PCS), Loan Le (C-PCS), and Steve Obrey (C-IIAC). Additional staff at Los Alamos who participated in the development of this technology include ex-employee Michael Sedillo (C-PCS), Graydon Anderson (C-PCS), Jennifer Young (X-2), Bob Barbero (PMT-2), and Gary Baca (C-PCS).

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*The SIMTECHE CO<sub>2</sub> Capture Process uses a new low-temperature approach to controlling CO<sub>2</sub> emissions from fossil-fuel power plants and other sources. It pulls CO<sub>2</sub> out of flowing mixtures of gases and traps individual CO<sub>2</sub> molecules within tiny molecular cages made of water. The molecular structure above illustrates the resulting ice-like compound, a crystalline solid called CO<sub>2</sub> hydrate.*

*Information released under  
LA-UR-09-01829*



*The engineering test-scale flow equipment has been fully tested and is ready for scale-up to industrial uses.*

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