Programmable Sealant-Loaded Mesoporous Nanoparticles For Gas/Liquid Leakage Mitigation

DE-FE0026511

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DE-FOA0001240
Aug 17, 2016

Outline

- Benefits to the Program
- Project Overview
- Technical Status
- Synergy Opportunities
- Accomplishment and Summary

Benefits to the Program

1) Our technology benefits the CCS program objective[1]:

✓ Works with a variety of CCS storage site material (concrete/cement, rock, metal).

✓ Fills nearly any size fluid escape channel (>50 nm).

✓ Easily integrates into existing remediation procedures.

2) Our technology benefits one of CCS program's main goals[2]:

✓ Programmable for specific conditions (high acidity, etc.).

✓ Designed to seal all types of fluid escape channels for over 99% gas/liquid barrier efficiency.

3) ↑ Durability/Stability = ↓ Cost = $$ Savings

4) Expediting CCS program = Faster reduction in environmental CO_2 = Reduction in Global Warming

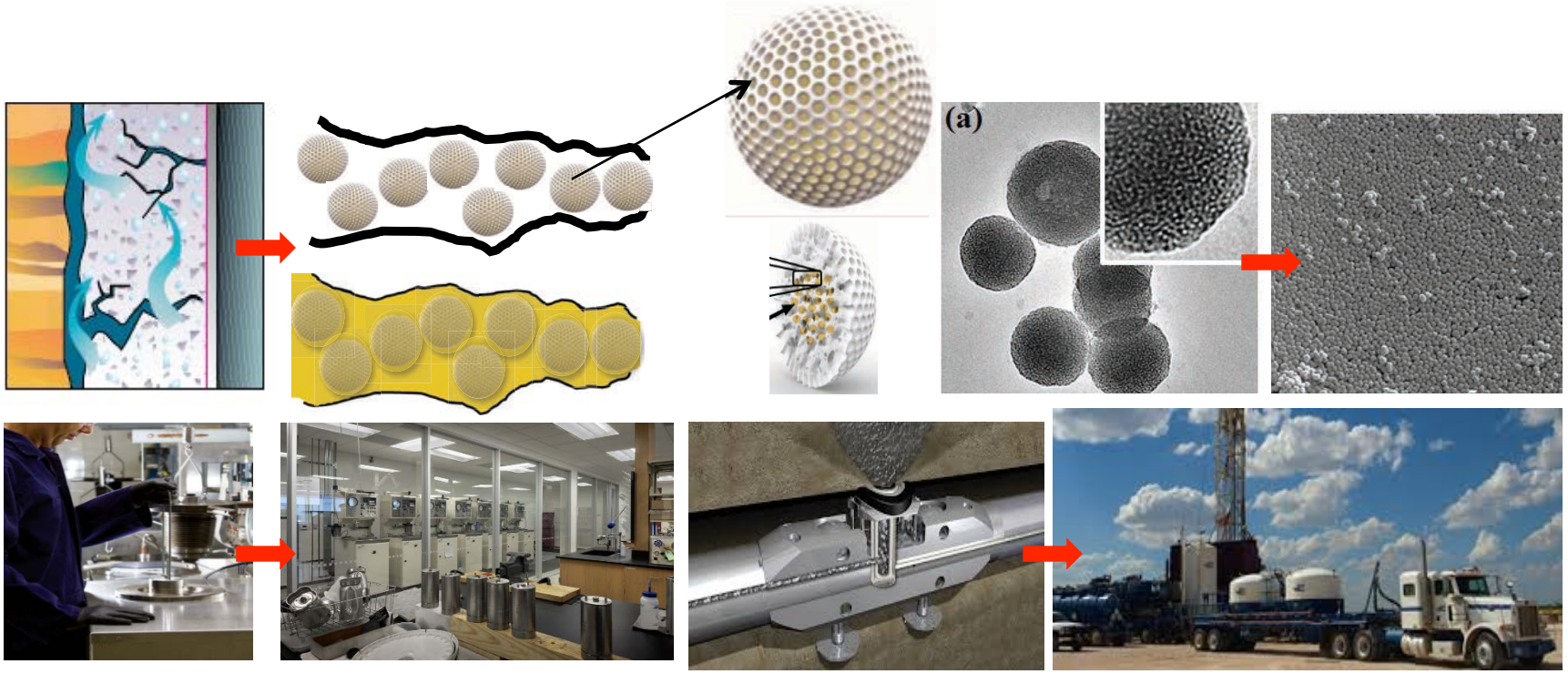
5) Multifunctional technology = Wide applicability = Extension to other industrial sectors (oil, construction, etc.)

[1]DOE's CCS program objective = "To develop and advance technologies that will significantly improve the effectiveness and reduce the cost of implementing carbon storage, both onshore and offshore, and be ready for widespread commercial deployment in the 2025–2035 timeframe"

[2] A DOE's CCS goal = "Develop and validate technologies to ensure 99 percent storage permanence."

Overall Project Goal

To obtain and validate a programmable nanocomposite technology that significantly mitigates gas/liquid leakage in wellbores

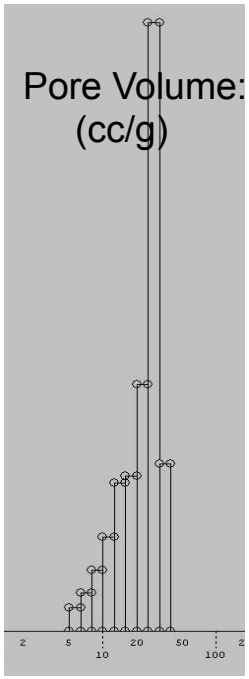


Specific Objectives

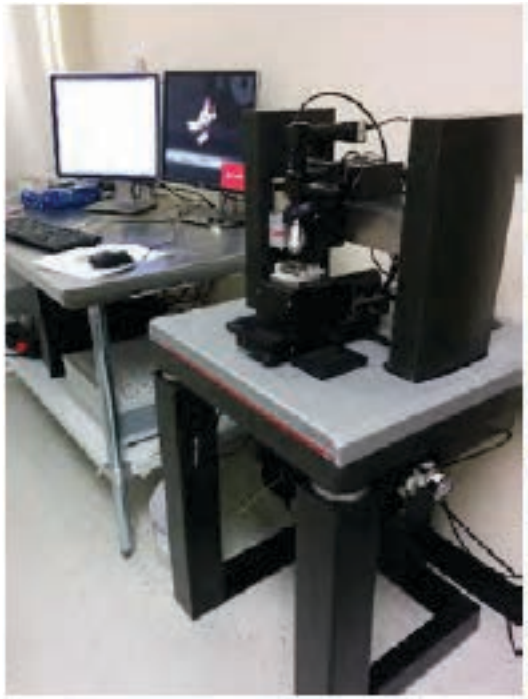
Objective 1: Development and fine-tuning our current prototypal Cement-based Porous Nanoparticles (CPNPs) to offer the best solution to gas/liquid leakage in environments with a variety of extreme conditions including high temperature, high pressure, and high acidity.

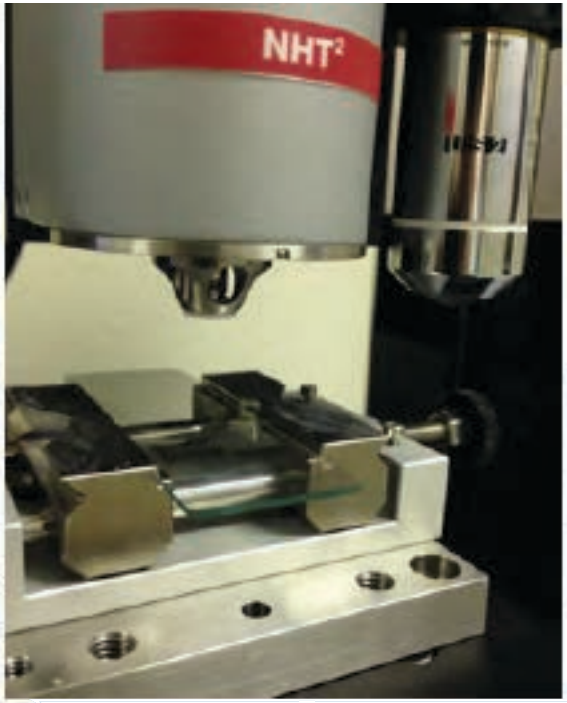
Objective 2: Testing of the actual barrier efficiency inside a simulated environment along with product validation and integration with current (or minimally modified) methods and equipment used for wellbore remediation (field tests).

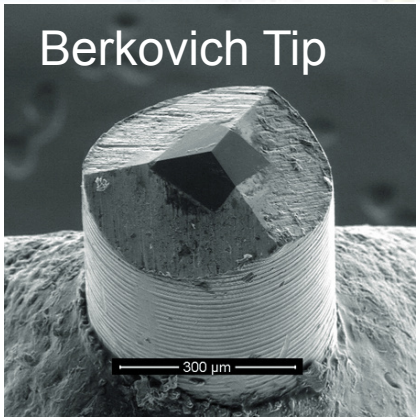
Full Control Over Particle Shapes and Porosity

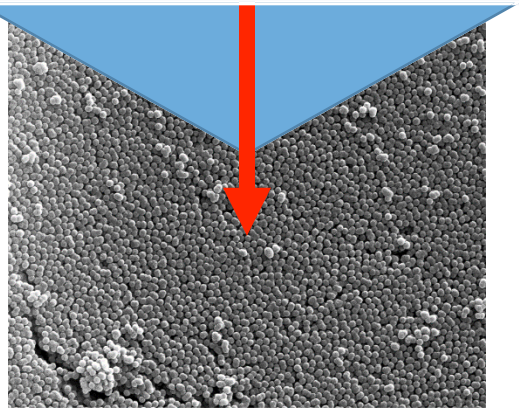


Angstrom

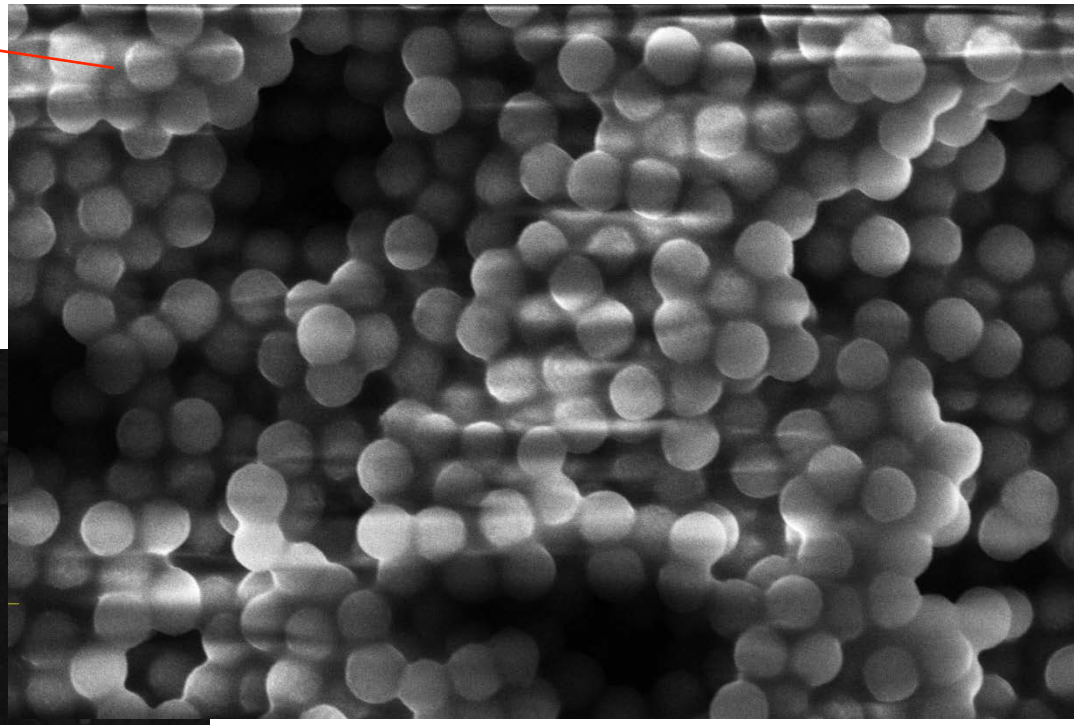


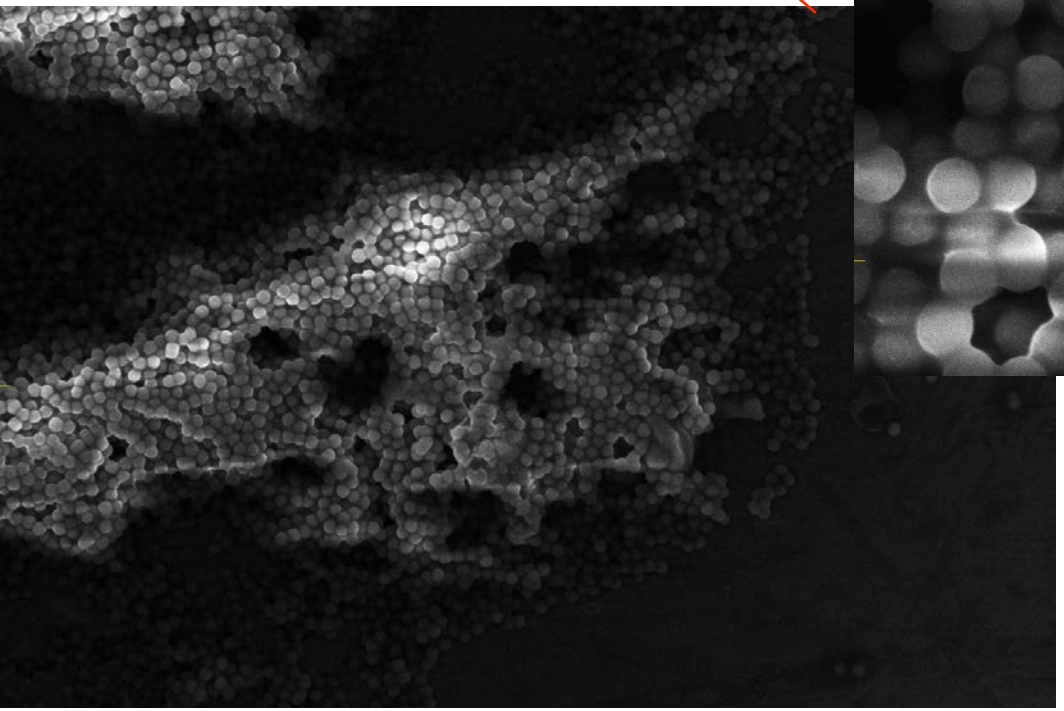




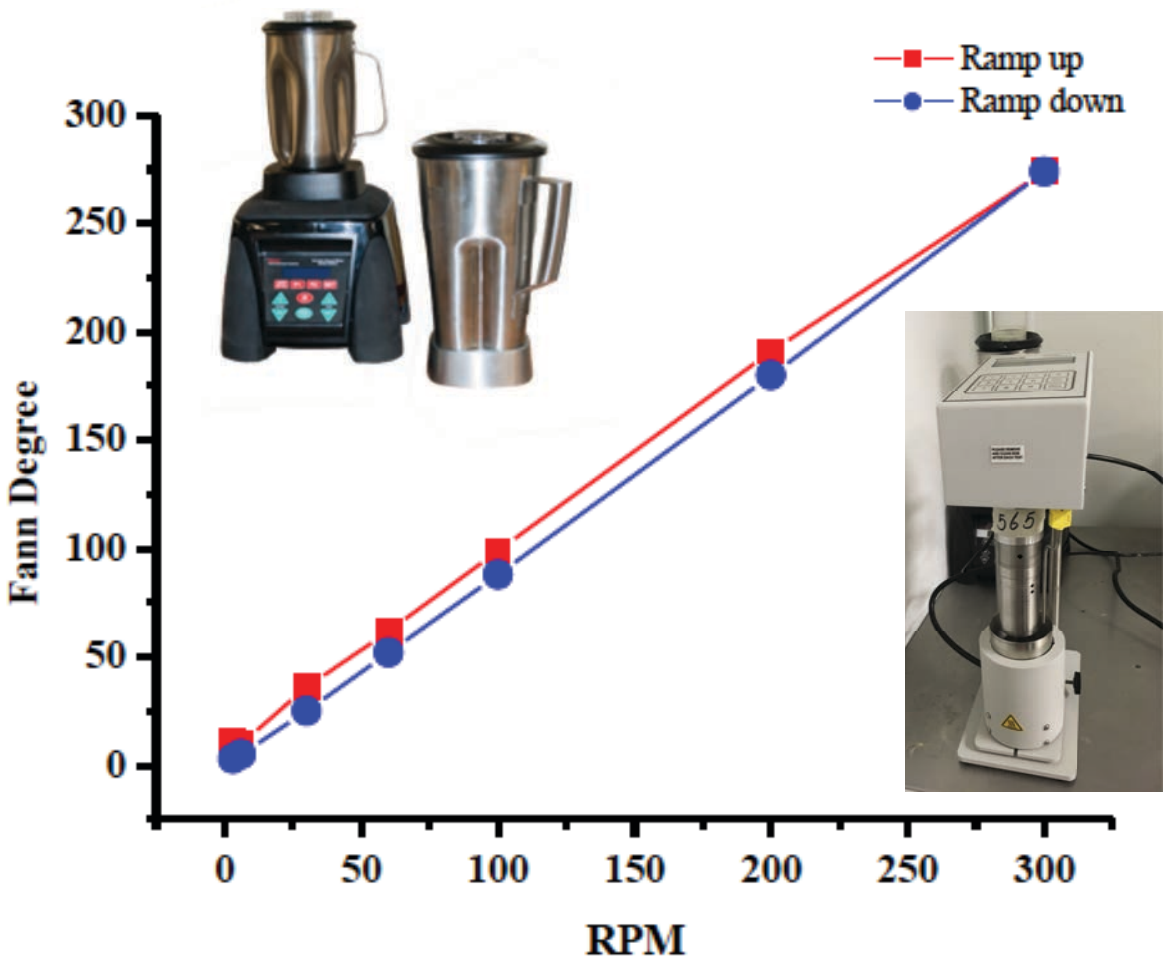


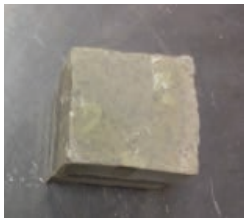
Structural and leakage Characterization





Strong and pumpable in the Field



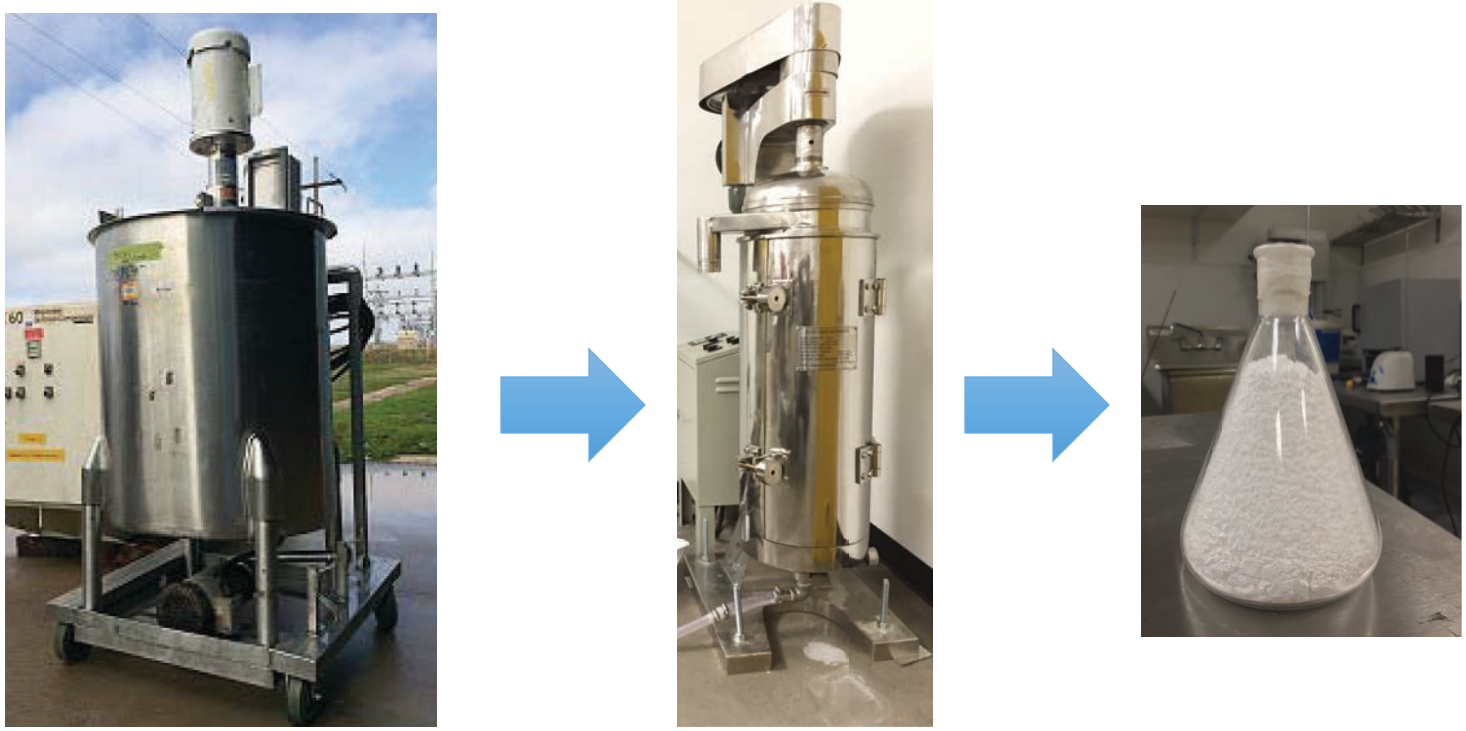


Permeation Testing

C-Crete TECHNOLOGIES

Promising CO_2 blockage

Scaled Up reactions



- Easily scalable via Industrial mixing vats
- No loss of consistency
- No loss of reproducibility

Mobile Unit and Field Test

C-Crete TECHNOLOGIES

Mobile Unit and Field Test

Synergy Opportunities

- Add other nanoparticles (e.g. microbes from Montana State Univ.) to the list of our sealants while providing feedback about the ability and effectiveness of those nanoparticles for sealing CO_2 under wellbore conditions

- Take the lessons from the nanoparticle injection technology of Univ. of Colorado to better strategize our injection protocol

Accomplishments and summary

C-Crete TECHNOLOGIES

Creating the *Minimum Viable Product* with

1. Full synthetic control over particle size, composition and morphology
2. Optimum ratios of sealants and its conjugates
3. High strength & low viscosity (pumpable in the field)
4. Scaled-up reactions without loosing consistency and reproducibility→ field test