

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

Award Number: DE-FE0026511

Project Summary:

C-Crete Technologies developed a new sealant product and technology that significantly mitigates carbon dioxide (CO₂) leakage and increases reservoir storage efficiency for various wellbore conditions and chemical environments. The core synthesis strategy is a bottom-up approach to further develop the knowledge base related to nanoparticles and nanocomposites and apply it to a new cement-based porous nanoparticles (CPNP)-sealant product (Figure 1). The technical results were coupled to a cost-benefit/socioeconomic analysis that incorporated materials/method cost structures and risk and environmental priorities to quantitatively evaluate the impact and benefits of the new product and technology.

Prime Performer:

C-Crete Technologies, LLC

Key Performers:

*Baker Hughes Oilfield Operations, LLC
Rice University*

Principal Investigator:

Dr. Rouzbeh Shahsavari

Project Duration:

10/1/2015 – 9/30/2020

Performer Location:

Houston, Texas

Program:

Carbon Transport & Storage

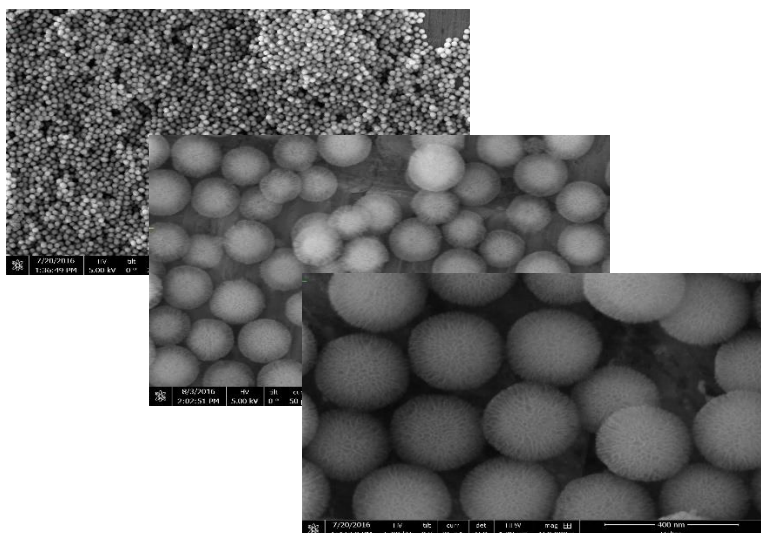


Figure 1: Full control over particle composition, morphology, and size.

Project Outcomes:

The project developed a novel programmable material that can be used to seal cracks in the wellbore casing, the surrounding cement sheath, or the surrounding rock formation. The product consists of a CPNP-sealant material that can be pre-programmed with a range of ingredients that best fit various complicated well/reservoir environments under a variety of temperatures, pressures and chemical conditions. The final CPNP-sealant (matrix) product is easily integrated with existing remedial technologies to efficiently mitigate CO₂ leakage toward the goal of maximal storage permanence. This project not only mitigates wellbore leaks but provides a new toolbox of multifunctional materials and composites for numerous analogous applications, including application to various gases and liquids and as a carrier for nanomaterials.

Presentations, Papers, and Publications

Final Report: [Programmable Sealant-Loaded Mesoporous Nanoparticles for Gas/Liquid Leakage Mitigation](#) (December 2020) – Rouzbeh Shahsavari