

PROJECT FACT SHEET

Gas Retention and Release Experiments with Low Yield Stress Fluids

FIU's Applied Research Center is assisting the Department of Energy's Waste Treatment and Immobilization Plant (WTP) by investigating the gas retention and release properties of selected non-Newtonian fluids in the gelled state relevant to waste streams of the WTP at Hanford.

The current flow sheet of the WTP includes the use of pulse jet mixers (PJM) throughout the plant to provide adequate mixing of the process fluids. During normal operation, the mixing systems in the WTP vessels must achieve safe, controllable release of flammable gases including hydrogen. During design basis events (DBE), the PJM may be operated intermittently on backup power for extended periods, which may result in gelling of the slurry and accumulation of hydrogen or other flammable gas in the gelled slurry. Upon restart of the PJM, the mass of released hydrogen gas and rate of release must not create flammable conditions in the vessel headspace. FIU has conducted in-situ gas retention and release tests to investigate the gas retention and release properties of selected low yield stress non-Newtonian fluids (<10 Pa) in the gelled state relevant to waste streams of the WTP at Hanford.

Project Objectives

- Provide a relative comparison of the simulants' gas retention and release characteristics.
- Determine the rate of release of gas entrapped from gelled simulants with yield stress range of 0-10 Pa.

Project Benefits

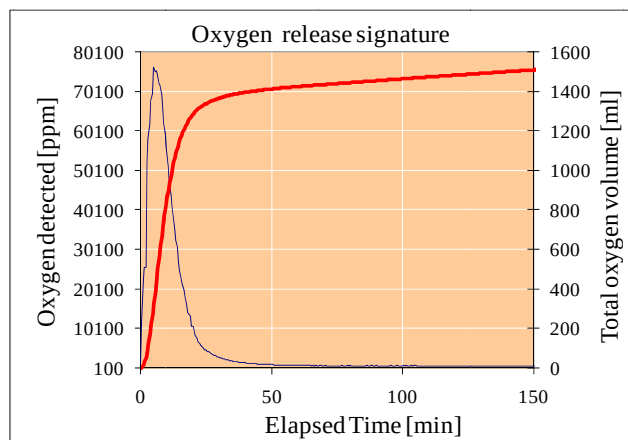
- Provide timely insight for the pilot tests at Battelle.
- Better understanding of the principal properties of the solid phase that alter the gas retention and release behavior.

Project Accomplishments

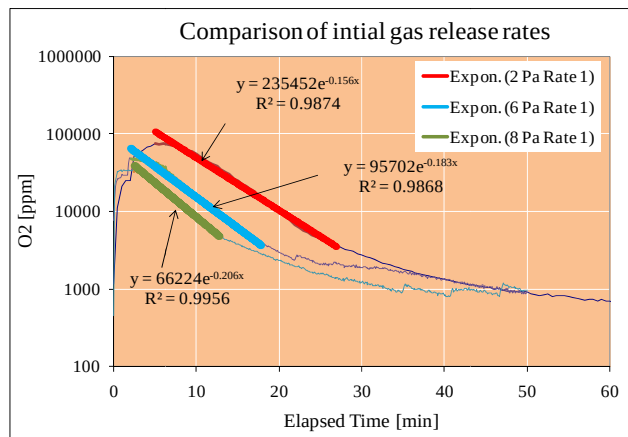
- Release rate appears to be associated with 2 time constants: The shorter time constant (5 – 15 min) may be related to the release of larger bubbles. The longer time constant (50 – 150 min) may be related to release of smaller bubbles and incomplete mobilization of slurry.
- About 60-80 % of gas is released within the first 15 minutes and about 98% within 150 minutes.

Future Work

- Bench scale tests will be carried out in FY11 to evaluate the gas retention and release characteristics of low yield stress waste simulants with an anti-foam agent..
- A correlation will be developed linking critical waste properties to the simulant tests.



Oxygen release signature in the effluent stream



Release curve for 2, 6 and 8 Pa clay simulant