Self-Consuming Downhole Packer

Project Officer: Greg Stillman

Total Project Funding: $400,000

April xx, 2013

Principal Investigator (always include)

Mark Grubelich

Track Name

HT Tools

Relevance/Impact of Research

Objective:

- Adapt existing self-consuming epoxy system to function under geothermal environments:
  - 200 C, brine, stable for 24 – 48 hours
- Proof-of-concept through 3” x 3” tall cylinder demonstration under the above +/-conditions

Impact:

- “Mechanical” packer that can quickly (self-consumption) be removed from the borehole would facilitate multi-stimulation treatments for EGS wells and save considerable time ($$)

Geothermal Technologies Office 2013 Peer Review

Patent in Progress

Scientific/Technical Approach

Key challenges:

- Must avoid thermal run-away
- High temperature material properties (stable oxidizer)
- Water resistant /stable properties

Approach:

- A room temperature (125 C) self-consuming system has been successfully demonstrated at SNL – epoxy based fiber reinforced composites
- During this project, formulation were tested that survived to 315 C

Patent in Progress

Technical Approach continued

- For this project:
  - Understand the limitation in the existing approach as they pertain to high temperature and brine environments (Task 1)
  - Adapt existing formulation to enhance its performance under geothermal conditions (Task 2)
  - Fabricate and demonstrate performance of a scaled monolith (Task 3)
  - Triggering system (formulation dependent):
    - Thermal
    - Chemical

Patent in Progress

Accomplishments, Results and Progress

- General material formulations: inorganic oxidizer + metal powder + structural elements (epoxy) + curing agent + “energetic” plasticizer
- Thermal run away encountered in existing formulates; chemistries changed for high temperature curing and stability
- Two formulation successfully burned under water

Original Planned Milestone/ Technical Accomplishment	Actual Milestone/Technical Accomplishment	Date Completed
Evaluate current system, until failure/limitation	High temperature data unobtainable due to formulation exhibited thermal-runaway during cure; existing formulation of limited value	Jan 2013
Adapt materials to meet geothermal conditions	Chemistry changes to fuel/oxidizer	June 2013

Patent in Progress

Technical Approach continued

Technical Advances and patent submissions

TA SD-11845 (patent submission in progress) “Self Consuming Structural Materials and Composites” Thoma/Celina/Grubelich

TA SD-12098 (patent submission in progress) “Self Consuming Downhole Drilling Packer” Vaughn/Celina/Thoma/Grubelich/Knudsen

Patent in Progress

Future Directions

- Project completed after 3” by 3” monolith test
- However if successful would pursue measurement of mechanical properties (adhesive strength, etc.), long-term environmental testing, field deployment strategy development
- High temperature (200 C, high pressure) + aqueous environment test

Milestone or Go/No-Go	Status & Expected Completion Date
3” by 3” monolith experiment	Behind schedule, new completion date expected July 2013

Patent in Progress

Summary

- Develop and demonstrate a safe handling, environmentally friendly, cost effective epoxy based system that
  - Maintains structural properties at 150 °C in an aqueous environment;
  - Will self-consume on demand;
  - Can be used for packers, plugs and downhole tools

FY2012-13 Target/Milestone		
Qualitatively evaluate environmental and processing limitations of baseline formulation	In progress	June 2012
Refine baseline formulation to enhance environmental stability	In progress	Nov 2012
Refine above formulation from a room temperature cure to a high temperature cure to enable in-situ fabrication	Pending	June 2013
Fabricate test article (~ 3” diameter x 3” tall) for packer demonstration; self consumes in heated water	Pending	June 2013
Communicate results	Pending	June 2013

Patent in Progress

Project Management

Timeline:

Planned Start Date	Planned End Date	Actual Start Date	Actual /Est. End Date
2/1/2012	2/1/2013	2/1/2012	6/30/2013

Budget:

Federal Share	Cost Share	Planned Expenses to Date	Actual Expenses to Date	Value of Work Completed to Date	Funding needed to Complete Work
$400,000	$0	$320,000	$280,000	$302,500	$0

- Project leveraged heavily from existing self-consuming materials developed at Sandia National Laboratory
- Project is behind schedule, ~4 months