Evaluate Thermal Spray Coatings as a Pressure Seal

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Specialized Materials and Fluids and Power Plants

Overview

- Project Overview
  - Timeline
    - Project start date April 2010
    - Project end date April 2012
  - Budget
    - Non ARRA project; funded by DOE geothermal
    - Total budget $350k – FY10 $100k, FY11 $250k
  - Barriers
    - Funding needed for completion
    - Possible funding delays
  - Partners
    - Pacific Process Systems (PPS)

Relevance/Impact of Research

- Pressure seals are required for all downhole tools
  - Elastomer type seals are commonly used where well temperatures are under 200° C
- Sealing issues can lead to catastrophic failure costing thousands of dollars
  - Higher temperatures with high pressures can lead to catastrophic failures
  - Failed internal components include: electronics, sensors and Dewars
- Specialized HT tools often have limited availability and can not be easily replaced
  - Resulting delays can severely impact programs

Relevance/Impact of Research

Objective

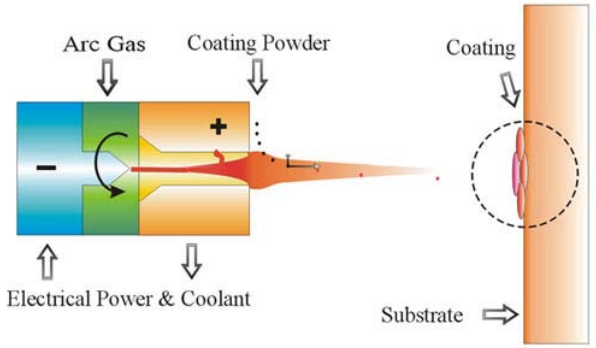
- Develop a pressure seal alternative to conventional elastomer and metal C-rings
  - Thermal spray coating may alleviate sealing issues where metal-to-metal seals can not be utilized
  - Coating can also serve as a redundant seal; ideal for long-term monitoring tools
  - Coating can easily be removed for servicing tool and reapplied

Scientific/Technical Approach

- Major milestones:
  - Determine spray process and coating to be applied onto mock tools – February 2011
  - Year one report – March 2011
  - Field mock tools – April 2011
  - Year two report – April 2012

Scientific/Technical Approach

- Sandia has extensive experience in applying thermal spray coatings for a wide variety of applications
  - Based on experience, select thermal spray processes
    - Twin wire arc
    - Atmospheric plasma spray
    - Cold spray
    - Vacuum plasma spray
    - Flame spray



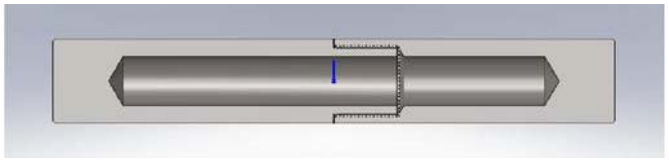
  - Select coatings best suited for application
    - Nickel
    - Zinc
  - Identify test matrix

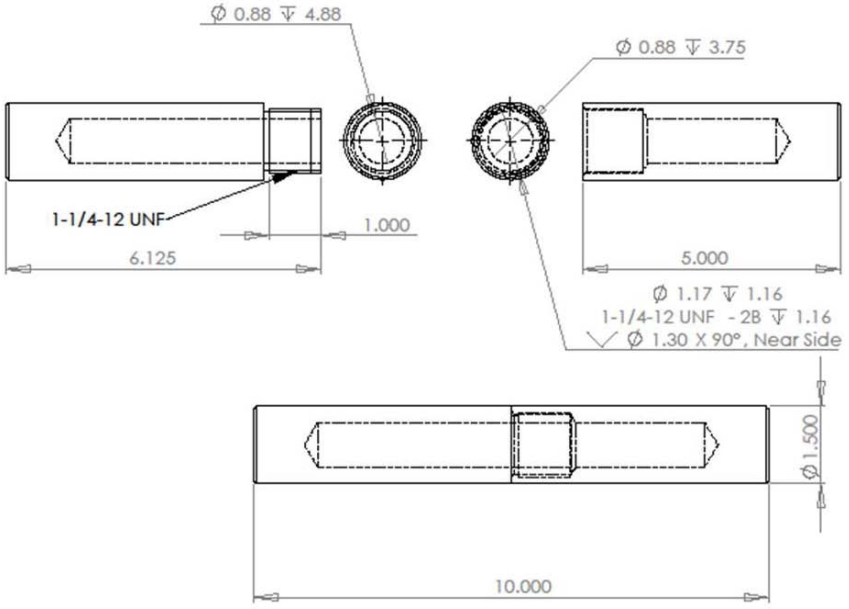
Scientific/Technical Approach

- Evaluate performance (lab tests)
- Determine if additional thermal spray processes and/or coatings should be included
- From testing, determine best thermal spray process and top three coatings
- Evaluate performance (lab tests)
- From results, determine coating to be sprayed onto mock tools for field deployment
- Field twelve mock tools; every quarter, remove three tools for analysis

Accomplishments, Expected Outcomes and Progress

- Project in early stages
  - Basic mock tool designed
    - First seven tools fabricated
  - Initial coatings selected
    - Nickel coating
    - Zinc coating





Project Management/Coordination

- Schedule
  - Early stages
  - First major milestone due in 10 months
- Application of resources
  - Sandia geothermal department – hardware design
  - Sandia thermal spray department – coating selection and application of coating
  - Sandia rock mechanic department – initial lab testing of coatings
- Project integrated
  - If developed coating can be utilized as a pressure seal, future tools may utilize process for redundant and primary seal applications
- Coordination with industry
  - Working with Pacific Process Systems (PPS) for deploying tools

Future Directions

- Scope of work will be divided into two phases:
  - Phase I
    - Select thermal spray process and coating
      - Identify potential coating material
      - Coat mock tools
      - Evaluate
      - Identify best three coating materials
      - Evaluate
      - Write report
  - Phase II
    - Deploy mock tools in a geothermal well
      - Coat mock tools
      - Evaluate performance every quarter
      - Write final report

Summary

- Project in early stages
  - Basic mock tool designed
    - First seven fabricated
  - Initial coatings are selected
    - Nickel coating
    - Zinc coating
- Work plan presented (overview)
- Project potentially advances HT pressure sealing systems
  - Alternative to conventional elastomer and metal-to-metal seals
  - Redundant pressure seal for long-term monitoring tools

Publications and Presentations

Early stages of project. As such, no publications so far.

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