Reverse-Circulation Cementing and High Performance Geothermal Cements

Presenter: Rafael Hernández
Overview

- Reverse Circulation Cementing
  - Advantages of Reverse Circulation Cementing
  - Challenges of Reverse Circulation Cementing
- Geothermal Cements
  - Foamed Cement
    - Properties
  - Latex Cement
  - CaP Cement
- Summary
Reverse Circulation Cementing

- In conventional cementing, the spacers and cement are pumped down the casing or tubing and the drilling fluid is returned through the annulus.

- In reverse cementing, the spacers and cement are pumped down the annulus directly and the drilling fluid is returned through the casing or tubing.
Reverse Circulation Advantages

- Reduced ECD
- Reduced job pump time
- Shorter slurry thickening times
- Improved early compressive-strength development
- Improved environmental management
- Easier cement-slurry selection and design
Reverse Circulation Advantages
Conventional vs. Reverse ECDs

Fracture pressure/ECD at 3,680 ft TVD

Reservoir pressure/ECD at 3,680 ft TVD

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Reverse Circulation Challenges

- Determining cement location
- Rig up
- Job design and execution
- Float equipment
- Experience
Geothermal Cements

Foamed Cement
Geothermal Cements

Foamed Cement Properties

- Light weight
- Energized
- Improved displacement
- Ductily
- Low fluid loss
- No free water
- Variable density
- Gas migration control
Foamed Cement Properties

![Graph showing the relationship between cement density and Young's modulus](image)

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Foamed Cement Properties
Geothermal Cements

Latex Cement

- Improved acid resistance
- Fluid-loss control
- Excellent wetting properties
- Improved bonding
- Increased resiliency
- Slows CO2 attack
CaP Cement (Calcium Aluminate Phosphate cement)

- CO$_2$ resistant
- Not subject to corrosion
- Not subject to strength retrogression
- Does not shrink
- Good bonding properties
- Tested @ 700 F
Geothermal Cements
## Geothermal Cements

After 3 months CO$_2$ exposure @ 200F and 2000psi

<table>
<thead>
<tr>
<th>Neat Class G cement</th>
<th>Latex cement</th>
<th>CaP cement</th>
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Benefits of CaP Cement

Thermo-Gravimetric Spectra

- Latex Cement
- Neat G
- CaP Cement

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Summary

- RCC is a viable option available to the geothermal industry
- RCC is becoming a common and acceptable cementing technique
- RCC can be the best method used to cement a well
- RCC can increase the chances of achieving good zonal isolation
- Mechanical properties of foamed cement may enhance the life of the well
- Geothermal cements may reduce CO2 attack effects