



SMART CEMENT. SAFER WORLD.



SENSYTEC

2010 DeepWater Horizon

- \$40 Billion in Damages
- 11 workers killed
- 19,000 jobs lost
- Poor Cementing job was one of the major factors leading to the blowout



The problem in Well Cementing today

- Quality of cementing job is validated with cement bond logging / ultrasound imaging (**50-80k/day onshore, offshore 3-5x**)
- Cement bond logs takes 1-2 days of rig to perform test (**200-300k/day onshore, offshore 3-5x**)
- Currently there is **no information** on the condition of cement after completion – investigations and potential remedial cementing job starts when production decreases
- Inability to monitor cement conditions post-drilling affects design choices for wellbores and sidetracks

Operators experience delays in these processes due to inherent issues with the conventional cement bond logs

This costs them about **\$250-300k per day onshore wells, (Offshore 3-5x)!**

Opportunity

- Knowledge on cement integrity during the construction phase validates the quality of cementing job
- **100% replacement of Cement bond logs during the wellbore completion – especially in multistage completions**
- Enable faster well completions and less rig time cost. **Reduction by 2 days of rig time**
- Get real-time strength and quality prediction for initial placement and throughout the lifetime.
- Knowledge on the future availability of cement condition information enhances drilling design with optimized drilling paths, lower costs.



UH UNIVERSITY OF HOUSTON
Cullen College of Engineering

IN PARTNERSHIP WITH



McKinsey&Company



KONGSBERG

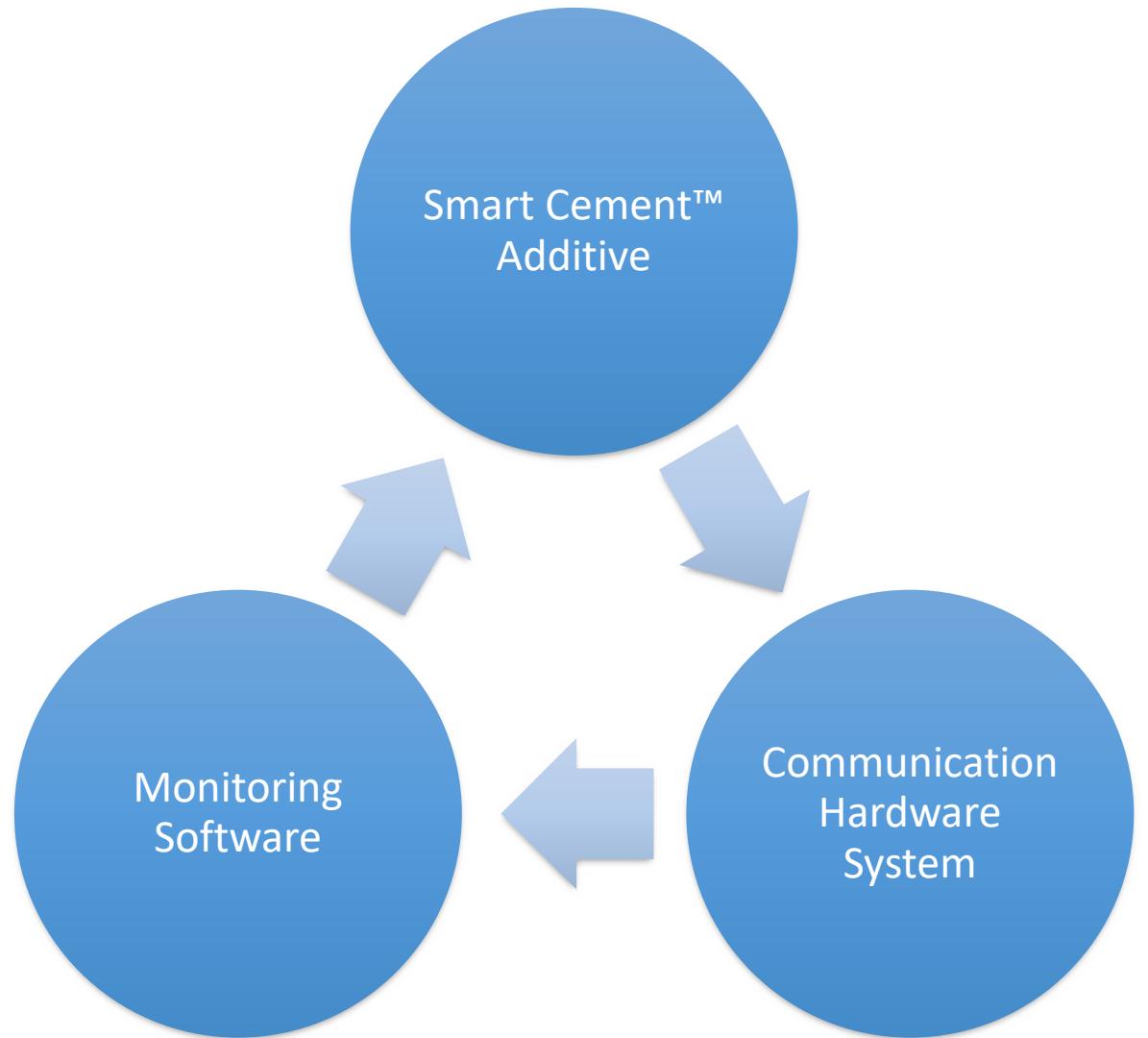


Department of Energy

- \$2.5 Million Grant

*This funding was only for technology R&D,
not business development*

Smart Cement™ Technology





Pressure



Temperature



Contamination



Corrosion

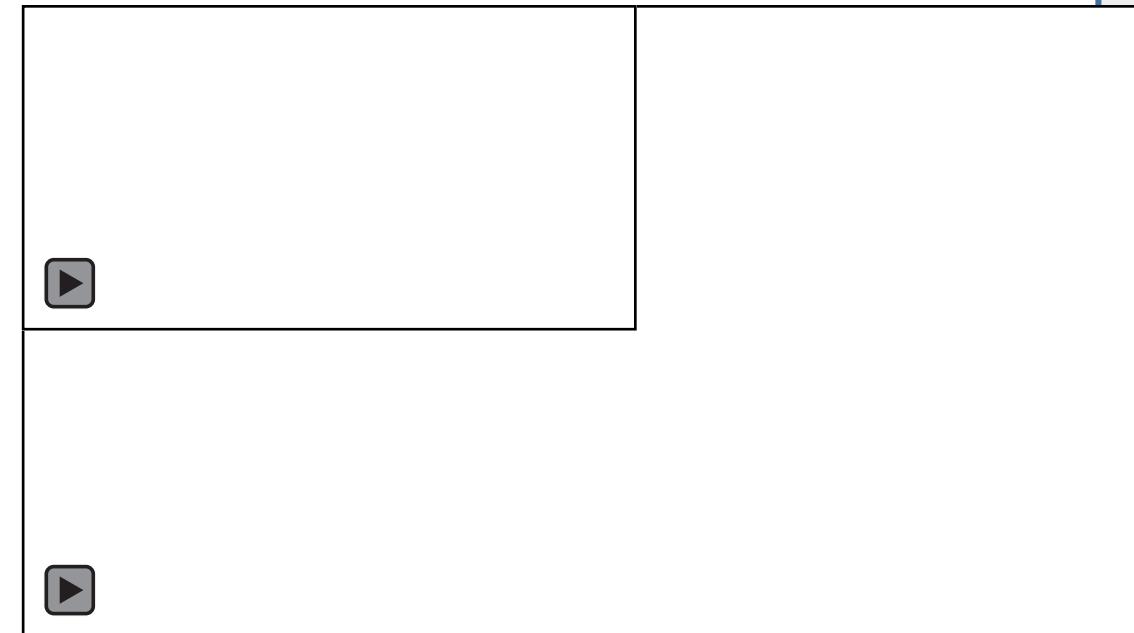
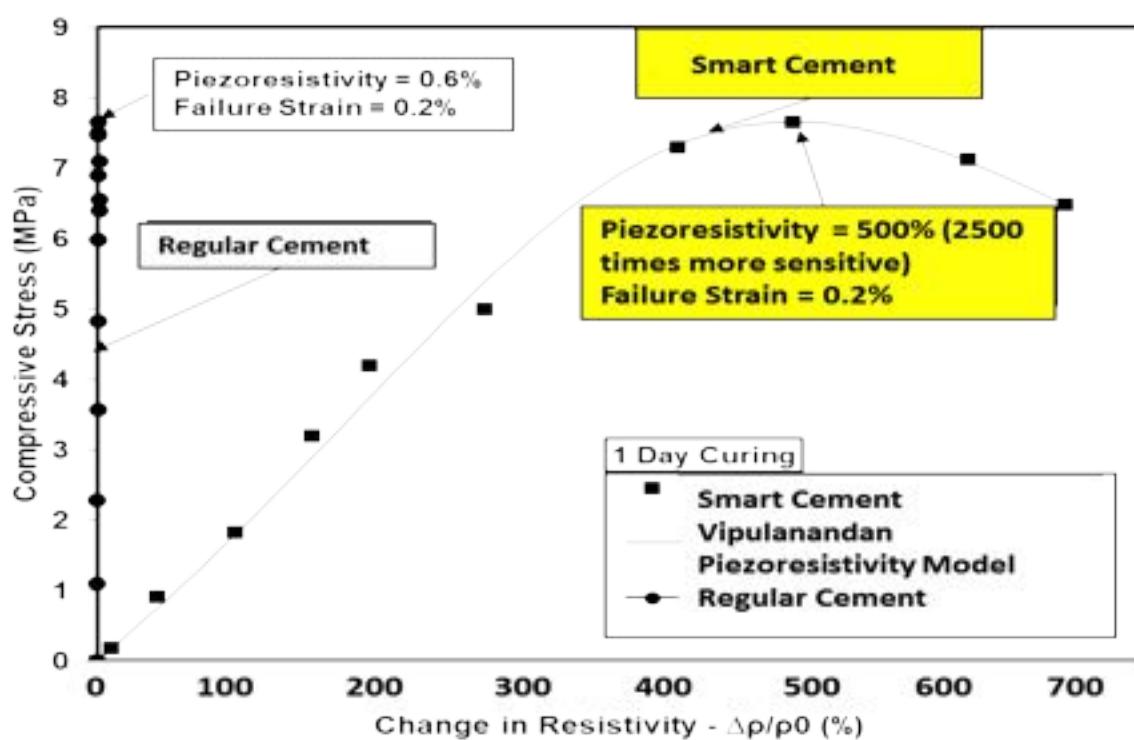


Technical Terms

- Resistivity – Measure of resistance to the flow of electric current
- Water/cement ratio - The amount of water in the slurry to weight of cement.
- Downhole communication – The way we transmit/communicate the data from the oil well.
- Strain – The change in length of specimen to its original length
- Piezoresistivity – The change in resistivity with the application of load. (Sensitivity to stress)

Smart Cement™ Vs Conventional Cement

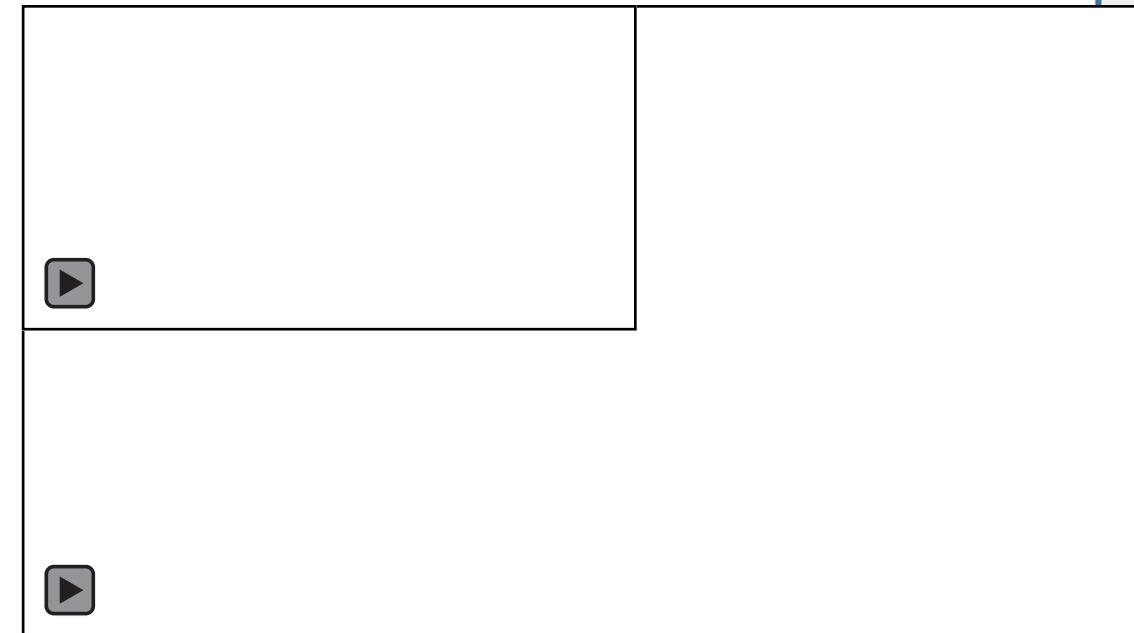
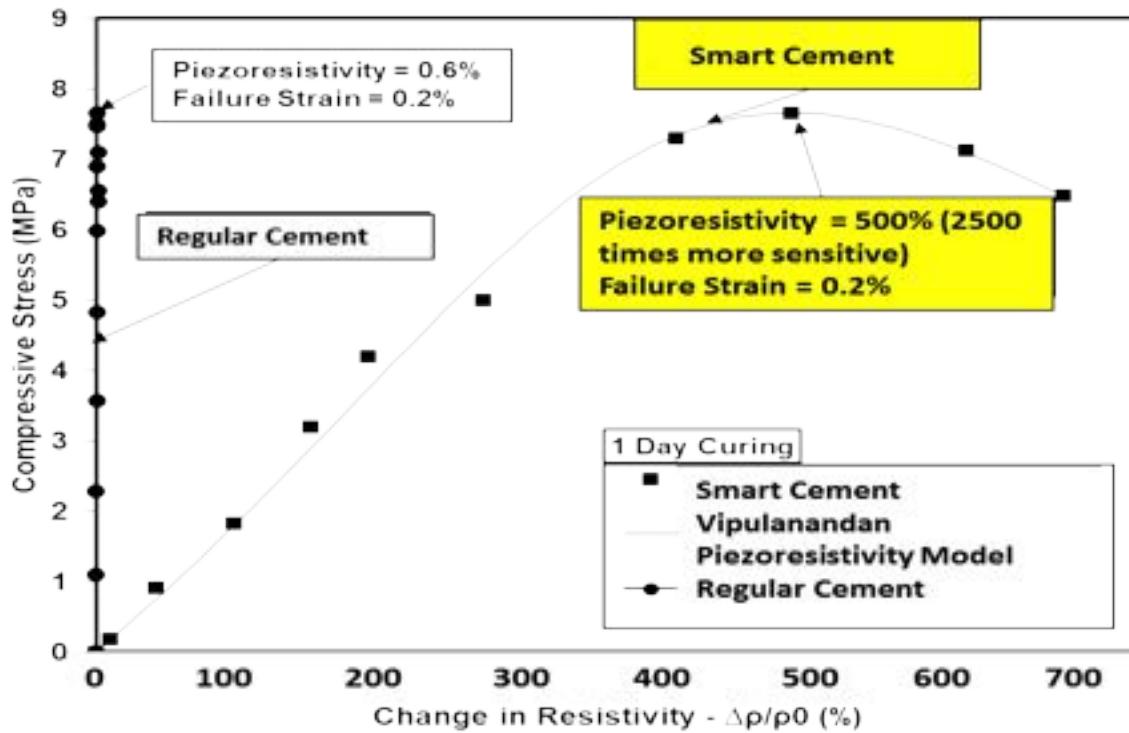
- Add less than .1% (by weight of cement) of our proprietary additive.
- Difficult to monitor strain.
- Sensing parameter “Electrical resistivity”.
- Magnifies changes by “2500x”.



Pressure Test

Smart Cement™ vs Conventional Cement

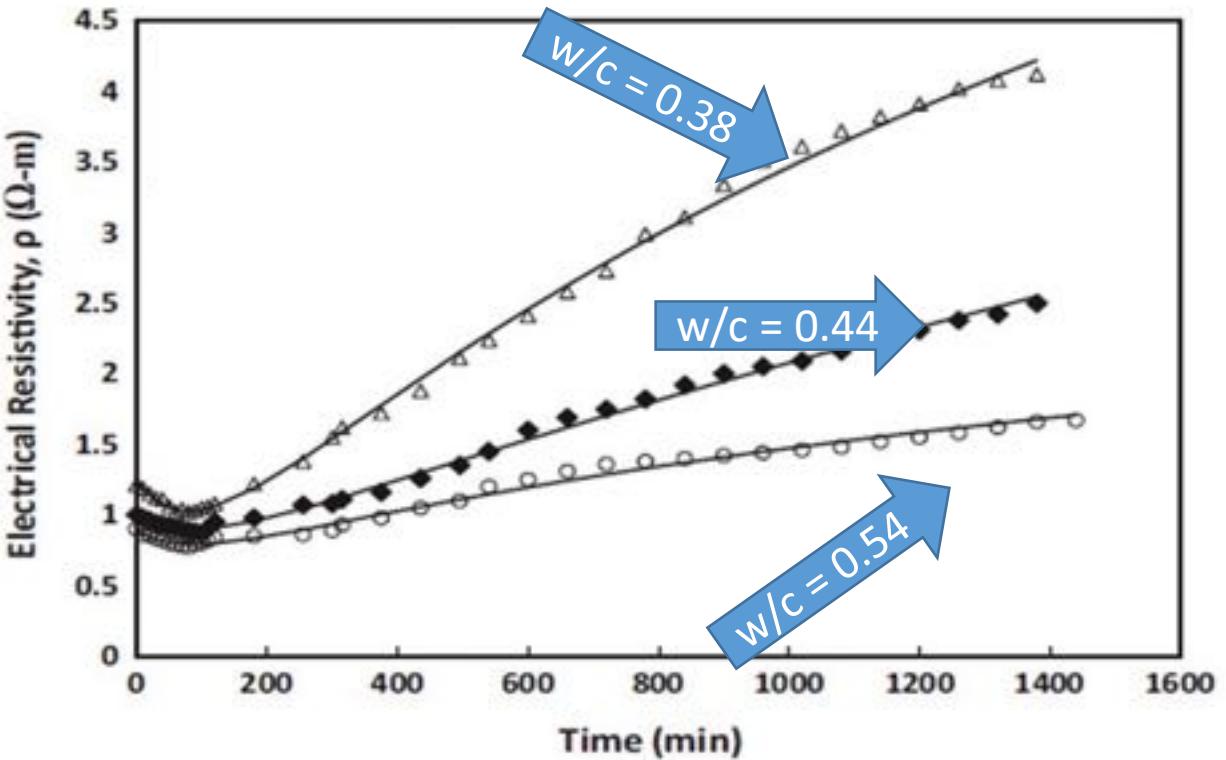
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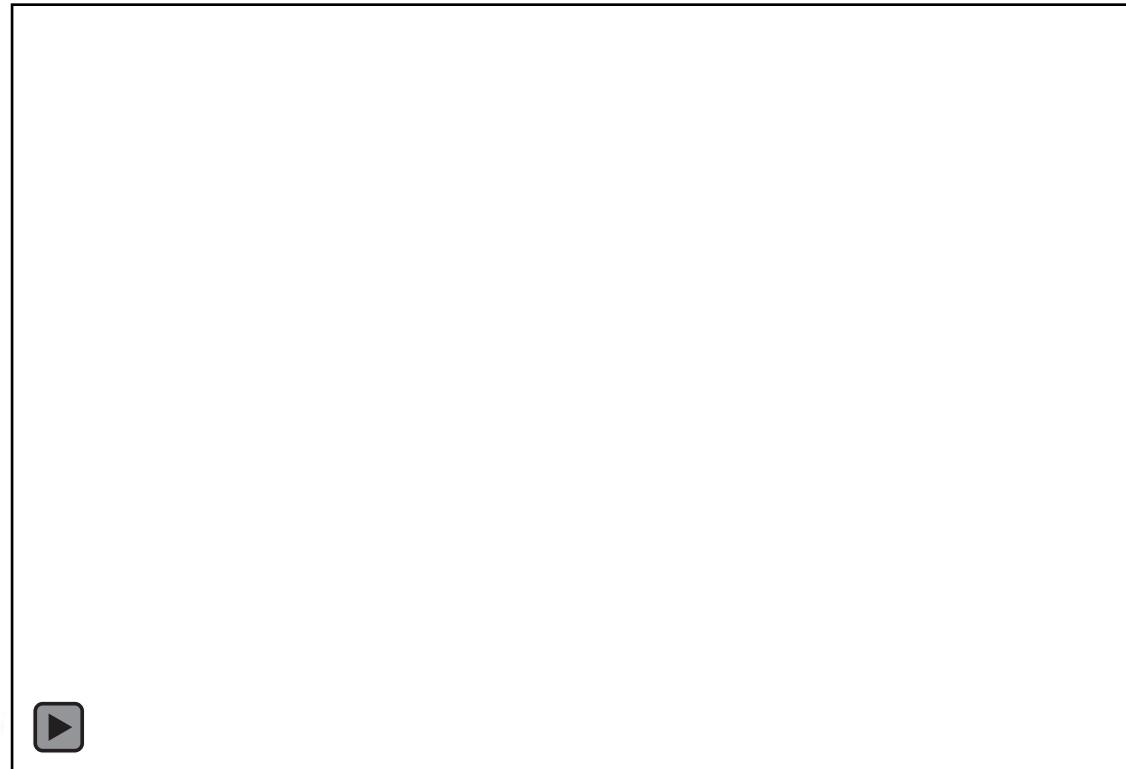
Pressure Test

Cement Quality Control

Cement Slurry Stage



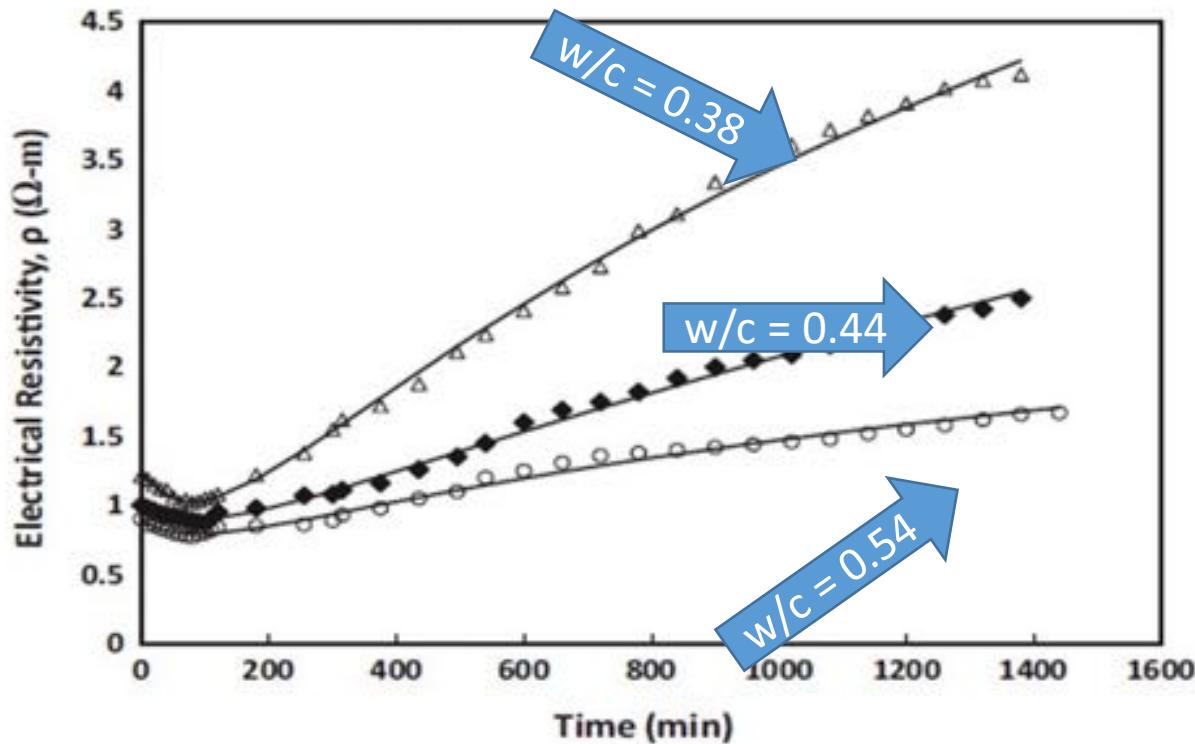
Hardened Cement



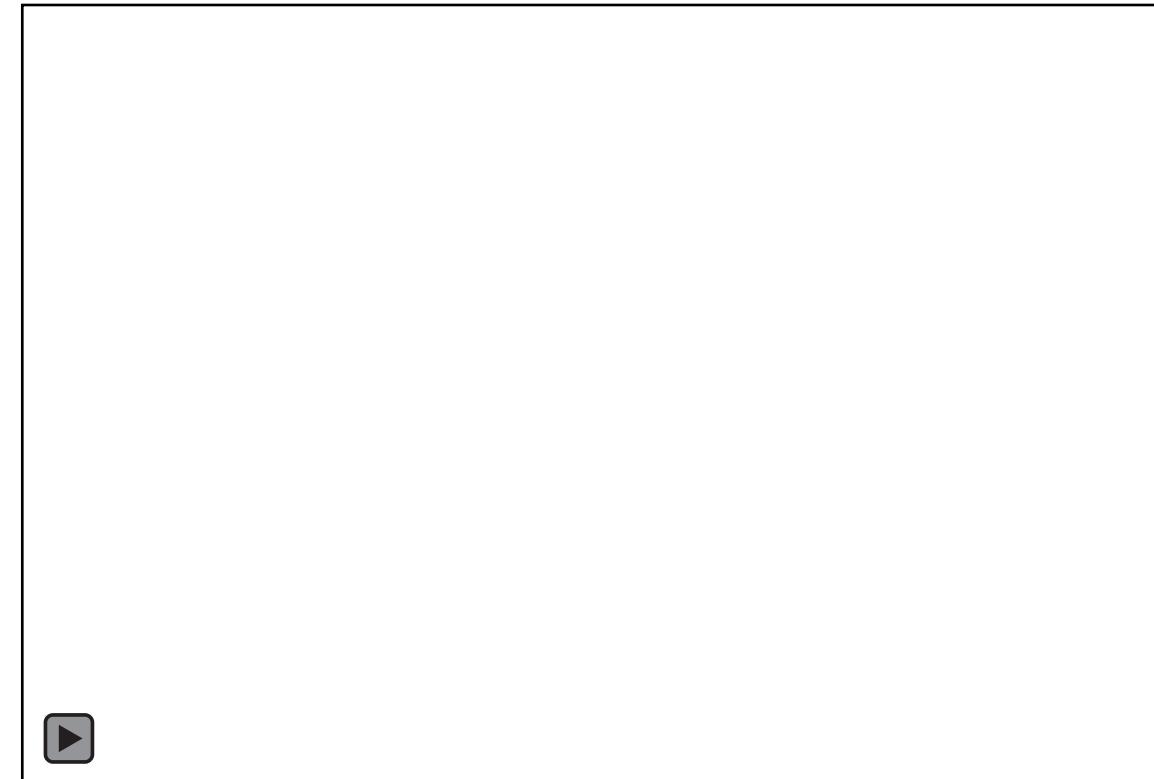
- Smart Cement sensitive to contamination in both the slurry and hardened state.

Cement Quality Control

Cement Slurry

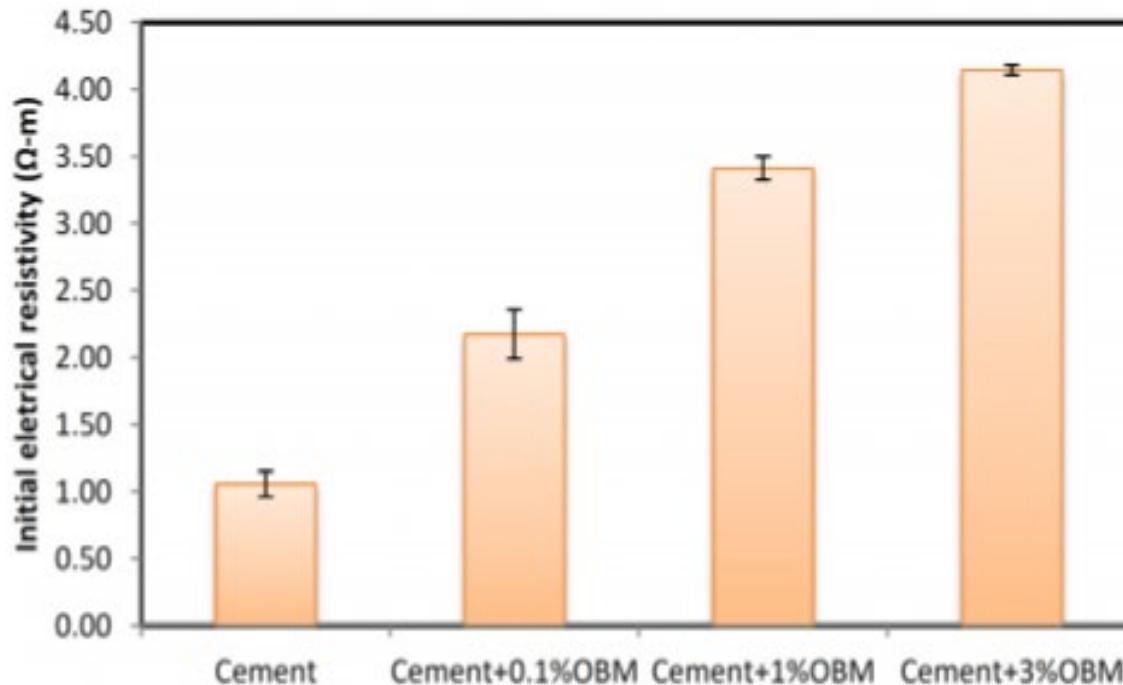


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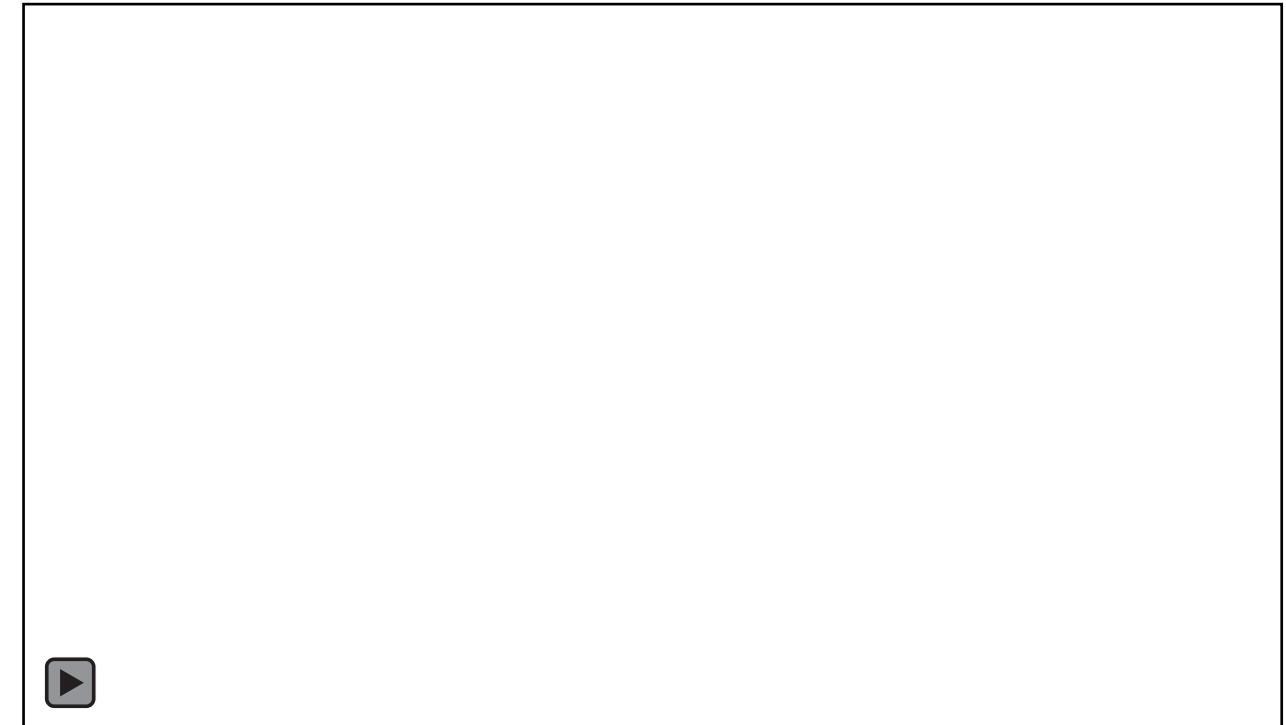
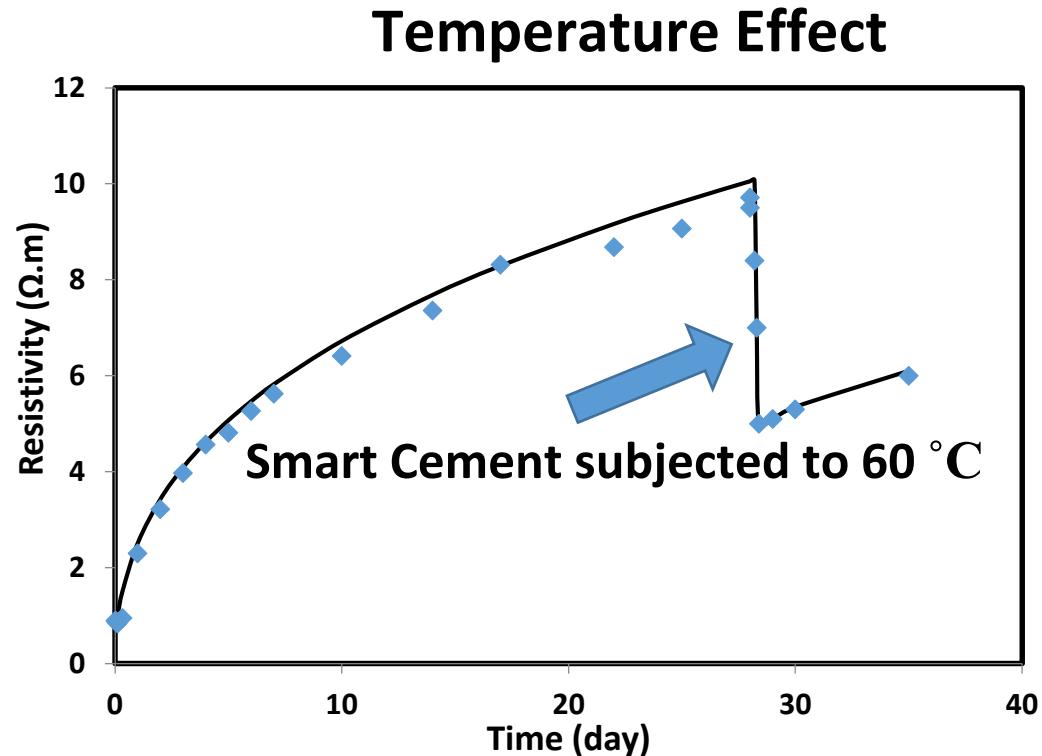
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Contamination



- We have tested smart cement with close to 100 additives such as Oil based Muds, Water based muds, different acids, surfactants, foams and so on.
- We have developed and tested analytical models for predicting the contaminations of different nature.

Temperature Sensing



- Smart cement was tested for temperatures close in range of -25 °C to 150 °C.