Biofilm-Mediated Mineral Precipitation Technology – From the Microscale to the Field-Scale

ROBIN GERLACH[1,2], A.J. PHILLIPS[1,2], A.B. CUNNINGHAM[1,2], L. SPANGLER[2]

[1] Center for Biofilm Engineering, Montana State University, Bozeman Montana, USA; Contact e-mail: robin_g@biofilm.montana.edu

2 Energy Research Insitute, Montana State University, Bozeman Montana, USA

We recently completed a field-scale demonstration of the biomineralization sealing technology validating that microbially-induced calcium carbonate precipitation can be used to seal fractures in sandstone surrounding wells.

This presentation will focus on the successful field demonstration completed in a well at the Gorgas Powerplant in Alabama (USA) but will also provide an overview of the experimental and modeling efforts completed prior to the demonstration.

The field demonstration consisted of the creation of perforations and fractures around the well at around 1116 ft below ground surface. Subsequently, a bailer delivery system was used to deliver the biomineralization sealing agents through 2 7/8" well tubing and fluids were injected using a pulsed injection strategy over 4 days. On day 5, no significant amount of fluid could be injected anymore below the original fracturing pressure. Finally the formation was re-fractured at a higher pressure than during the initial fracturing event.

Overall, the results indicated that the biofilm-induced mineralization technology, reduced injectivity, increased the re-fracturing pressure and reduced the ability to inject fluids after re-fracturing. The rationale and success of the laboratory and modeling work leading up to the field demonstration will be summarized in the context of the field demonstration. This work consisted of micro- to meso-scale reactors, packed sand columns and core samples of up to 70 cm diameter operated at ambient and elevated pressures (>75 bar). Darcy, pore network, and pore-scale reactive transport models were developed and guided the experimental and field-demonstration efforts.

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2015-05559s.R1. Accepted. February 24, 2016