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INNOVATIVE LOW WEIGHT CEMENT SYSTEMS – CHALLENGING APPLICATIONS IN GEOTHERMAL PROJECTS

In oil well cementing, the incompatibility of drilling mud and low-weight cement slurries is a well-known problem. The use of spacer systems to separate these two fluids and to remove residual mud filter cake from the borehole is a common method. Here, spacer efficiency is essential for the subsequent cement job and – even more important – for the integrity of the well. In its first part, this paper introduces a new abrasive spacer, its development and first field application in a geothermal project.

To quantify the mud removal capacity of different spacer systems, we developed a specially customized lab instrument. The corresponding procedure included build up and removal of mud filter cake under dynamic conditions. Employing modified cement crushing tests, the evaluation of the spacer efficiency was determined. Under these lab conditions, we tested the new spacer, compared it with a standard barite-based system, and optimized its composition.

The quality of the cement job and hence the mud removal capacity of the abrasive spacer was quantified through wireline logging. Laboratory and field results impressively proved the enhanced efficiency of this innovative product.

In its second part, this paper presents a customized low-weight cement system specially adapted to cement glass-reinforced epoxy (GRE) casing and presents field trials in a geothermal project. Corrosion resistance, even under harsh borehole conditions, reduced thermal conductivity, and extremely smooth inner-pipe surfaces are this materials main advantage when compared to steel. However, reduced collapse resistance demands specially customized cement slurries. To ensure zonal isolation and hence well integrity, appropriate adhesion of hardening cement onto the outer-surface of GRE casings is essential.

For the first field trial, the customer planned to cement 7” GRE tubulars in old corroded 9 ¼” carbon steel casings. Through extensive laboratory research, we formulated an optimized slurry containing blast furnace slag cement and lightweight additives. For lab testing, we employed two new laboratory methods to evaluate the adhesion behavior of hardening cement systems on GRE casings.

The excellent quality of the first application and hence the supreme adhesion efficiency of the new cement system onto GRE surfaces was verified through wireline logging. Lab and field results impressively manifest this blast furnace slag cement-based system as an alternative to commonly used API Class G-based slurries. For premium results in geothermal projects, we at Fangmann Energy Services recommend a combination of both innovative products.