GeoTHERM
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Tiefe Geothermie

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Ortenauhalle Congress 1
Deep geothermal energy

An Optimized HT-Stable Novel Drilling Fluid for Geothermal Wells

Eine optimierte HT-stabile neuartige Bohrflüssigkeit für geothermische Bohrungen

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Geothermal energy presents a perfect source of energy at minimal CO_2 emission, however a main disadvantage is high upfront investment cost for drilling the well.

In a project funded by the German Ministry of Economics and Climate Protection (BMWK) we recently developed a novel high temperature stable water-based drilling fluid with exceptional carrying and borehole cleaning properties, thus allowing a significantly improved rate of penetration, with substantially reduced drilling cost. The fluid is based on novel technology which involves chemical modification of a silicate precursor into colloidal SiO_2 particles which present the active ingredient of the fluid. This drilling mud is temperature stable up to at least 180 °C static aging and exhibits an exceptionally high Yield Point and low Plastic Viscosity for easy pumping and effective solids control. Common fluid loss additives and shale inhibitors can be used to tune the fluid to specific geological formations. Return permeability tests on cores from Soultz (FR) have proven that common acids effectively remove this fluid from the pores of the reservoir and allow high back-flow. Explicit technical details on the properties of this fluid will be included in the presentation.

In June 2024, this novel fluid system was used on two near-surface geothermal wells in Mainz, Germany. For this purpose, 5 m³ of fluid were prepared and used successfully. The novel mud system showed excellent carrying capacity (see photo) and hole cleaning while drilling through different formations (swellable and brittle shale, limestone) without any problem.

For this field test, the fluid was classified in WGK1 from the environmental authorities. Laboratory tests revealed that this mud could be valorized as mixing water in well cementing or as activator in slag cements, thus avoiding high disposal cost and contributing to a circular economy. An economical analysis revealed that this mud reduces material cost by ~25 % versus a bentonite fluid and saves substantial cost on drilling time and disposal.

The two field tests confirmed the attractive benefits of this novel inorganic drilling fluid system.

As a next step, application on a deep geothermal well at depths from 500 – 2500 m is planned.