# Concepts for Rock Specific Hydraulic Fracturing and Matrix Acidizing to Enhance a Geothermal System

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The concepts and results of stimulation treatments in the geothermal research well GtGrSk4/05 at Groß Schönebeck, Germany are presented. The reservoir is located at a 4100-4300 m depth within the Lower Permian of the NE German Basin. The stimulation treatments included multiple hydraulic stimulations and an acid treatment. In order to initiate a crossflow from the sandstone layer, the hydraulic stimulations were performed in different depth sections. In low permeability volcanic rocks, a cyclic hydraulic fracturing treatment was performed over 6 days in conjunction with adding quartz in low concentrations to maintain a sustainable fracture performance. Flow rates of up to 150 l/s were realized, and a total of 13170 $m^3$ of water was injected. A hydraulic connection to the sandstone layer was successfully created in this way. However, monitoring of the water level in the offsetting well EGrSk3/90, which is 475 m apart at the final depth, showed a very rapid water level increase due to the stimulation treatment. This can be explained by a connected fault zone within the volcanic rocks. Two gel-proppant treatments were performed in the slightly higher permeability sandstones to obtain long-term access to the reservoir rocks. A total of 100 tons of high strength proppants were injected with 500 $m^3$ of cross-linked gel. The subsequent production test in conjunction with flowmeter logging showed an improvement of productivity by a factor of more than 4. Due to assumed residual drilling mud (constituents: calcite, dolomite, aragonite) in the near wellbore vicinity, an acid stimulation was performed using a coil tubing unit. The following nitrogen lift test demonstrated another increase of productivity by 30 – 50%.