DGMK/ÖGEW-Frühjahrstagung, Fachbereich Aufsuchung und Gewinnung
Celle, 5./6. April 2017

Extended Horizontal Jet Drilling for EGS applications in Petrothermal Environments

S. Hahn*, M. Duda*, V. Wittig*, R. Bracke*, F. Stoeckhert**
*International Geothermal Centre Bochum, **Ruhr Universität Bochum

Abstract

High pressure water jet drilling technologies are widely used in the drilling industry. Especially in geothermal and hard rock applications, horizontal (radial) jet drilling is, however, confronted with several limitations like lateral length, hole size and steerability. In order to serve as a serious alternative to conventional stimulation techniques, these high pressure jetting techniques are experimentally investigated to gain fundamental knowledge about the fluid-structure interaction, to enhance the rock failing process and to identify the governing drilling parameters.

The experimental program is divided into three levels. In a first step jetting experiments are performed under free surface conditions while logging fluid pressures, flow speeds and extracted rock volume. All process parameters are quantified with a self-developed jet-ability index and compared to the rock properties (density, porosity, permeability, etc.). In a second step experiments will be performed under pressure-controlled conditions. A test bench is currently under construction offering the possibility to assign an in-situ stress field to the specimen while penetrating the rock sample with a high pressure water jet or a radial jet drilling device. The experimental results from levels 1 and 2 allow to identify the governing rock failure mechanisms and to correlate them with physical rock properties and limited reservoir conditions.

Results of the initial tests show a clear relation between achievable penetration depth and the interaction of jetting, rock parameters and an individual threshold of the nozzle outlet velocity that can be noticed in order to successfully penetrate different formation types.

At level 3 jetting experiments will be performed at simulated reservoir conditions corresponding to 5.000 m depth (e.g. up to 1.250 bar and 180°C) on large samples with a diameter of 25 cm and a length of up to 3 m using GZB´s in-situ borehole and geofluid simulator 'iBOGS'. Experiments will be documented by active and passive ultrasound measurements and high speed imaging.