Effect of grain size and flow rate on hydrofracturing crack formation Under supercritical geothermal environment

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Abstract

In recent years, researches about producing supercritical geothermal reservoir are being conducted because it is thought that has high productivity and sustainability. In supercritical condition, granite is ductile, and ductile granite has few fractures. Therefore, formation of fracture network that can be a reservoir is required for extraction of supercritical geothermal energy, and hydrofracturing is promising for this realization. In this study, how grain size of granite and flow rate of injecting water give the effect on hydrofracturing crack under supercritical geothermal environment.

Hydraulic fracturing experiments were conducted at temperature of 450℃ and initial confining pressure of 40MPa by injecting water into cylindrical granite specimens containing a borehole .The kinds of granite used to evaluate the effect of the grain size are Oshima granite (Grain size=1.5~2.0mm) and Aji granite (Grain size=0.5). Flow rate was 3.0mL/min. Created fracture pattern varied with grain size. In Oshima granite, there were a lot of small fractures near the borehole and a circular crack around their small fractures. However in Aji granite, there was linear fracture. The factor of the difference is perhaps the ratio of particle size and borehole diameter. To investigate the effect of flow rate, the hydraulic fracturing experiment was conducted using Aji granite under condition of flow rate of 0.3mL/min. Fracture pattern did not vary so much compared to the result of 3.0mL/min, but the number of fractures increased a little and some fractures were bent. It was thought that this deference occurred by infiltration of water.

As a result, it was cleared that particle size of granite gives the effect on fracture pattern, and flow rate gives the effect on the number of fractures.