Hydraulic fracturing of high-temperature ductile rock under load / displacement control and its crack characteristics and permeability

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Geothermal power generation in a supercritical geothermal environment requires three elements: heat as energy, fluid as a medium for carrying thermal energy, and cracks as a path for fluid. From this, it is necessary to know in advance how cracks are formed by hydraulic fracturing in a supercritical geothermal environment and what kind of crack morphology it will take. In hydraulic fracturing experiments in a supercritical geothermal environment using load control so far, there is a possibility that the specimen is crushed after crushing with water. In this study, we compared the experimental results of load control and displacement control. In addition, hydraulic fracturing experiments were conducted in a supercritical geothermal environment using displacement control for the purpose of clarifying the characteristics of hydraulic fracturing with displacement control, the crack growth process, and the effect on permeability. As a result, in the experiment by displacement control, the axial displacement was reduced to less than one twentieth of that of load control, and it was found that the specimen was crushed after crushing by water in load control. It was also found that the crushing cracks progressed in stages rather than suddenly, and that the mechanical anisotropy and mineral grain size of granite affect the growth process and permeability. Since the crushed cracks could not be visually recognized in this study, it is necessary to visualize and observe the cracks. It is also necessary to perform a quantitative analysis with an increased number of experiments and a visual analysis of the crack growth process.