Hydraulic fracturing and permeability change in granite under true triaxial stress condition at 400℃ or higher

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Abstract

Supercritical geothermal reservoir is located deeper than conventional reservoir. Supercritical geothermal reservoir has more energy than conventional reservoir because supercritical water is high enthalpy. However, mechanical property of rocks constituting the supercritical reservoir is ductile, and has few fractures. In order to realize supercritical geothermal power generation, it is necessary to artificially create fractures, and hydraulic fracturing is promising.

In this study, investigate permeability change in granite due to hydraulic fracturing. Hydraulic fracturing experiments were conducted at 400℃ and 450℃ by injecting water into cubic granite specimens having a borehole under true triaxial stress condition (40, 15, 5MPa). P-wave velocity was measured in 3 directions, up and down, front and back, left and right, before and after hydraulic fracturing. After hydraulic fracturing experiment, a water permeability tests were conducted at room temperature and atmospheric pressure. Permeability was inspected by using the numerical simulation. P-wave velocity decreased almost same rate in all 3 directions between before and after hydraulic fracturing. There were shorter fractures over the entire body of specimen. During a water permeability tests, water exuded from entire surface of specimen. According to the numerical simulation, permeability was enhanced to 1×10^{-15} m^2 after hydraulic fracturing. If hydraulic fracturing is conducted in crust, permeability may be more enhanced than this study.