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

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According to recent research, the brittle-ductile transition (BDT) does not reduce permeability drastically. The result implies that supercritical geothermal resource can be formed in continental crust that consists of granitic rocks mainly. However, it is unknown that the reservoirs in ductile crust have sustainable and sufficient permeability or not. Therefore, effectiveness of hydraulic fracturing in granitic rocks under ductile condition must be understood to maintain or enhance permeability artificially. Hydraulic fracturing experiment was done in granite from subcritical/brittle to supercritical/ductile condition. The experiment demonstrated that hydraulic fracturing with supercritical water can form productive geothermal reservoirs. The permeability of fractured granite under supercritical/ductile condition reach 10^{-15} order. However, it was difficult to consider that the result can apply to true triaxial stress condition. Therefore, we developed new experimental system for hydraulic fracturing under true triaxial stress condition at high temperature. The experimental system was able to real-time monitor specimen deformation , permeability enhancement and P-wave velocity during fracturing to insight into crack propagation. In result, we found possibility that intermediate principle stress affect breakdown pressure and barrel shape deformation occurs on specimens after fracturing. We also considered that temperature and stress state could affect speed of crack propagation. But crack distribution can be isotropic finally. We discussed stress state when breakdown occurred with $\lambda-\sigma$ failure mode diagram, and we considered that rocks breakdown under hybrid extensional-shear failure condition.