Effect of rock anisotropy on hydrofracturing crack formation under supercritical geothermal environment

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Abstract

This thesis presents an analysis to study the effect of rock anisotropy in Ohshima (fine) granite as rock sample, on fracture formation using a newly developed hydraulic fracturing technique, Molten Plastic (PEEK) Tri-axial Cell System, which enables hydrofracturing test to be conducted under extreme geothermal environment, where the surrounding temperature is above 343℃ and surrounding pressure is above 22MPa. This geothermal environment also called as supercritical geothermal environment as water under these conditions will be supercritical.

This study should support the recent new concept of Engineered/Enhanced Geothermal Systems (EGS) in term of producing more energy by creating fractures by hydrofracturing within ductile deformation zone deep under Earth's surface. Results from this research, did clearly show that rock anisotropy effect the pattern of fracture formation in rocks and water pressure required to break apart rocks for enhancing rock permeability are confirmed, by flooding water pressure parallelly to the rock strongest anisotropic direction, resulting less pressure needed to break the rock upon hydrofracturing, but more fractures can be created if water is flooded through less anisotropic direction.

In conclusion, this study has demonstrated that rock anisotropy could directly affects the overall geothermal energy production's efficiency.