Geophysical Research Abstracts
Vol. 19, EGU2017-610-1, 2017
EGU General Assembly 2017


# Numerical simulation based on core analysis of a single fracture in an Enhanced Geothermal System

Miad Jarrahi (1) and Hartmut Holländer (2)

(1) Department of Civil Engineering, University of Manitoba, Winnipeg, Canada (jarrahim@myumanitoba.ca), (2) Department of Civil Engineering, University of Manitoba, Winnipeg, Canada (hartmut.hollaender@umanitoba.ca)

The permeability of reservoirs is widely affected by the presence of fractures dispersed within them, as they form superior paths for fluid flow. Core analysis studies the fractures characteristics and explains the fluid-rock interactions to provide the information of permeability and saturation of a hydraulic fracturing reservoir or an enhanced geothermal system (EGS). This study conducted numerical simulations of a single fracture in a Granite core obtained from a depth of 1890 m in borehole EPS1 from Soultz-sous-Forêts, France. Blaisonneau et al. (2016) designed the apparatus to investigate the complex physical phenomena on this cylindrical sample. The method of the tests was to percolate a fluid through a natural fracture contained in a rock sample, under controlled thermo-hydro-mechanical conditions. A divergent radial flow within the fracture occurred due to the injection of fluid into the center of the fracture. The tests were performed within a containment cell with a normal stress of 2.6, 4.9, 7.2 and 9.4 MPa loading on the sample perpendicular to the fracture plane. This experiment was numerically performed to provide an efficient numerical method by modeling single phase flow in between the fracture walls. Detailed morphological features of the fracture such as tortuosity and roughness, were obtained by image processing. The results included injection pressure plots with respect to injection flow rate. Consequently, by utilizing Hagen-Poiseuille's cubic law, the equivalent hydraulic aperture size, of the fracture was derived. Then, as the sample is cylindrical, to modify the Hagen-Poiseuille's cubic law for circular parallel plates, the geometric relation was applied to obtain modified hydraulic aperture size. Finally, intrinsic permeability of the fracture under each mechanical normal stress was evaluated based on modified hydraulic aperture size. The results were presented in two different scenarios, before and after reactive percolation test, to demonstrate the effect of chemical reactive flow. The fracture after percolation test showed larger equivalent aperture size and higher permeability. Additionally, the higher the normal stress, the lower permeability was investigated. This confirmed the permeability evolution due to chemical percolation and mechanical loading. All results showed good agreements with corresponding experimental results provided by Blaisonneau et al. (2016).

**Keyword:** Core analysis, Hydraulic fracturing, Enhanced geothermal system, Permeability, Fluid-rock interactions.