EGW 2019

7th European Geothermal Workshop
Karlsruhe, 9-10 October 2019

Contribution ID: **109** Type: **Oral**

Modeling of High-Enthalpy Geothermal Projects in Fractured Reservoirs

Wednesday, October 9, 2019 4:45 PM (15 minutes)

In general, high-enthalpy geothermal systems are characterized by a presence of vapor or coexistence of vapor-liquid phases. There is a complex phase transition (condensation) process during its development with cold water re-injection. Also, high-enthalpy geothermal reservoirs either contain naturally developed fractures or need induced fractures for fluid to flow at economically relevant rates. Simulation of heat production in high-enthalpy geothermal fracture systems is associated with solving complex physical process in complicated fracture networks. Besides, the existence of fracture networks magnifies the uncertainty of reservoir properties due to its wide range of scales and complex geometry, which can increase reservoir heterogeneity to a large extent.

In this work, a discrete fracture-matrix (DFM) model is used to describe the geothermal reservoir with fractures. Fractures are explicitly characterized in the model with individual grid cells. The numerical scheme is implemented within the Delft Advanced Research Terra Simulator (DARTS), which can provide fast and accurate flow response of the geothermal field. This simulation framework uses the Operator-Based Linearization (OBL) technique. In DARTS, the molar formulation is selected with pressure and enthalpy as primary variables. Besides, a fully implicit two-point flux approximation on an unstructured grid is implemented to solve the mass and energy conservation equations.

We use a realistic fracture network in this study. To achieve both accuracy and computational performance, firstly a reasonable resolution of grid discretization is determined through the comparison of solutions and convergence analysis among different sets of grid discretization. With the optimal grid resolution, we investigate the influence of geo-static and thermal parameters on thermal breakthrough and heat production. We find that the thermal production and distribution are sensitive to fracture-matrix permeability ratio, rock heat conduction and heat capacity, which can provide insights for the development of high-enthalpy geothermal reservoirs with fractures.

Author: Mr WANG, Yang (TU Delft)

Co-authors: Prof. BRUHN, David (TU Delft); Dr VOSKOV, Denis (TU Delft)

Presenter: Mr WANG, Yang (TU Delft)

Session Classification: Session 4: Resource Development

Track Classification: Topic 4: Resource Development