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A Comparative Study on Supercritical C02 and Water as Working Fluids in a Heterogeneous Geothermal Reservoir

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Abstract : The incapability of supercritical C02 to transport and dissolve mineral species from the geothermal reservoir to the fracture apertures and other important parameters in heat mining makes it an attractive substance for Heat extraction from hot dry rock. In other words, the thermodynamic efficiency of hot dry rock (HDR) reservoirs also increases if supercritical C02 is circulated at excess temperatures of 3740C without the drawbacks connected with silica dissolution. Studies have shown that circulation of supercritical C02 in homogenous geothermal reservoirs is quite encouraging; in comparison to that of the water. This paper aims at investigating the aforementioned processes in the case of the heterogeneous geothermal reservoir located at the Soultz site (France). The MultiPhysics finite element package COMSOL with an interface of coupling different processes encountered in the geothermal reservoir stimulation is used. A fully coupled numerical model is developed to study the thermal and hydraulic processes in order to predict the long-term operation of the basic reservoir parameters that give optimum energy production. The results reveal that the temperature of the SCC02 at the production outlet is higher than that of water in long-term stimulation; as the temperature is an essential ingredient in rating the energy production. It is also observed that the mass flow rate of the SCC02 is far more favourable compared to that of water.

Keywords : FEM, HDR, heterogeneous reservoir, stimulation, supercritical C02
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