Chemical Stimulation of Engineered Geothermal Systems

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Project Summary

Objectives Summary: The objective of this project is to demonstrate chemical stimulation as an alternative to hydraulic stimulation for enhancing permeability in Engineered Geothermal Systems. Currently, the only viable approach to the development of permeability within EGS reservoirs is to induce shear failure in critically stressed reservoirs by reducing effective normal stresses through increases in pore pressure. If chemical dissolution agents are injected in marginally conductive fractures, however, minerals dissolve and fracture apertures increase. This 'soft' stimulation approach may prove to be both more effective and more economical than the more conventional hydraulic stimulation approach.

Approach Summary: Upon identifying a set of mineral dissolution agents, a series of tests with then be performed on each candidate in order to screen it for thermal stability and reactivity towards the target minerals under conditions that simulate a hydrothermal environment. Likewise, screening tests will be conducted to determine the reactivity of each compound towards the steel alloys used in wellbore casings, in order to identify the need for corrosion inhibitors.

A detailed analysis will be then performed on each compound that emerges from the screening tests in order to characterize its decay kinetics and reaction kinetics as functions of temperature and chemical composition. From among the compounds emerging from the laboratory studies, one or more compounds will be chosen for field studies in order to verify the laboratory predictions. The thermal decay and dissolution reaction kinetics will be input into the reactive transport code TOUGHREACT and 1-D models will be constructed to model the performance of the chemical stimulants under hydrothermal conditions. A field study will then be conducted to test the effectiveness of the chemical dissolution agents on the near wellbore region of a tight injection well at the Coso geothermal field. Finally, a 3-D TOUGHREACT reservoir model will be constructed in order to simulate chemical stimulation within the Coso/EGS reservoir. It will then be used to determine the effectiveness and economics of the use of chemical dissolution agents for the soft stimulation of an EGS. Coso Operating Company is a participant in this project and will provide support in the form of cost share and field experimental data. Derek Elsworth of Pennsylvania State University will collaborate on experimental design.