

# Reactive Chemical Transport Simulation to Study Geothermal Production with Mineral Recovery and Silica Scaling

Xu, T.<sup>1</sup>, Pruess, K.<sup>1</sup>, Pham, M.<sup>2</sup>, Klein, C.W.<sup>2</sup>, and Sanyal, S.K.<sup>2</sup>

<sup>1</sup> Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720

<sup>1</sup> GeothermEx, Inc., 5221 Central Avenue, Suite 201, Richmond, CA 94804-5829 USA

## **Keywords:**

*Geothermal production, mineral recovery, reactive chemical transport, numerical modeling, silica scaling*

## **ABSTRACT**

There are vast reserves of dissolved minerals in the hyper-saline brines of geothermal fields in the Imperial Valley of California. Recovery of zinc from geothermal brines is being practiced in this area, and recovery of silica, manganese, silver, lead and lithium has been or is being considered. Therefore, the ability to model mineral recovery is very significant in terms of economic development and resource utilization. The reactive geochemical transport simulator TOUGHREACT has been used to model rock-fluid interactions during production from and injection into a hypersaline brine geothermal system. The modeling uses published water chemistry data from Imperial Valley and simplified flow system intended to capture realistic features of the hydrothermal system. A number of simulations were performed using different production/injection rate, pH values and silica concentrations of the injection waters. Results indicate that evolution of temperature and zinc concentration depends on production and injection rate. A lower rate results in a lower temperature drop and higher zinc concentration. A low injection pH significantly enhances the dissolution of sphalerite in the reservoir rock, increasing aqueous zinc concentration. A higher injection silica concentration leads to silica precipitation, but decreases the reservoir porosity only slightly even after 20 years. The purpose of this "numerical experiment" is to gain useful insight into the process mechanisms and conditions and parameters controlling zinc recovery and silica scaling in the reservoir. This example also demonstrates that TOUGHREACT can be a useful tool for simulating these kinds of problems.

[For a copy of this paper please e-mail us at mw@geothermex.com](mailto:mw@geothermex.com)