Thermal Mechanical Analysis of the Drift Scale Test Via Distinct Element Modeling.

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We have performed a thermal mechanical analysis of the Drift Scale Test (DST) currently underway at Yucca Mountain. The Yucca Mountain Site Characterization Project is investigating Yucca Mountain, Nevada, as a potential repository for high-level nuclear waste. The purpose of the DST is to acquire a more in-depth understanding of coupled Thermal-Mechanical-Hydrological-Chemical (TMHC) processes likely to exist in the rock mass surrounding a potential geologic repository at Yucca Mountain. Moreover, the DST is located in a highly fractured and densely welded ash-flow tuff, and movement of fluids in this rock is thought to occur primarily through the fractures. Our work is concerned with describing fracture deformation due to thermal mechanical effects, as normal and shear deformation of fractures can substantially change the fracture permeability, and affect the coupled TMHC behavior.

We modeled the DST by defining a rectangular rock mass 50mx50mx100m in size. The rock mass was formed by an assemblage of discrete, elastic blocks. Excavations within the DST were closely simulated, and discrete fractures mapped from video logs of several boreholes in the DST test block were incorporated. Stress boundary conditions were used on the top and sides of the rock mass, while the bottom was considered a roller boundary. Thermal inputs were based on the test design specifications.

Results of the simulations show good agreement with deformations measured in the DST using multiple-point borehole extensometers. Our analysis also indicates that the most fracture deformation occurs above the drift, and co-located with micro seismic activity and acoustic emissions observed during the DST.

Results to be presented include predicted temperature and stress fields, fracture displacements, and comparison between observed and predicted displacements at specific locations in the test. Maps of fractures in the DST test block will also be presented.

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