Damage Simulation of Fracture Asperity in Geothermal Systems

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Abstract

Mechanical simulation at one pair of asperity contact has been conducted by COMSOL mechanical module to study the sliding friction of rock fractures surface as real fracture surface contact slides driven by pressure solution. The evolving fluid-saturated two-dimensional contact region results from the elastic contact between opposing fracture rough surfaces in response to the effective confining pressure. A transfer layer surrounding one grain boundary is taken into account in this model to allow for attachment of debris from sliding. This decreases contact area of two asperities and hence minimizes the sliding rate of two boundaries. Therefore, the specific sliding rate of two surfaces is time-dependent and non-linearly varied. Diffusion process for some portions of debris is also considered by finite difference method in MATLAB. Results show that topology of grain contact surfaces changed as time advances. A sinusoidal perturbation takes places at upper grain surface, whereas a trough develops at lower grain surface, but much smaller than the magnitude of sliding for upper grain. In addition, contact pressure distribution along contact line also has perturbation at 'hill' down the peak. Diffusion process slightly smooths contact surface.