Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Permeability reduction of self-affine fractures explained by means of the critical barrier concept LAURENT TALON, HAROLD AURADOU, lab. FAST, CNRS, ALEX HANSEN, Norwegian University of Science and Technology —
In many low permeability geological formations, flow occurs primarily through fracture networks. There is therfore a need for reliable modeling of the hydromechanical behavior of fracture. We consider here fracture with self-affine correlation. Most of the models fails to predict the effective permeability of such fracture as soon as some contact area are present. We introduce a model based on the generalization of the concept of the bottle neck which allows the prediction of the permeability of self-affine rough channels (one-dimensional fracture) and two-dimensional fractures over the entire range of possible apertures. In one-dimensional rough fracture, when the two wall are brought to contact, the permeability is increasingly controlled by the region of minimum aperture. This is the bottle neck concept. In two-dimensionnal fracture, the position of the minimum aperture is not so crucial since the flow can easily by-pass regions of low permeability. To generalize this concept, we introduce the most restrictive barrier path defined as being the barrier that has the smallest average permeability. Using numerical simulation, we identify three permeability scaling regime that will be explained by the introduction of other critical barrier ordered by its criticality.

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Date submitted: 11 Aug 2011 Electronic form version 1.4