**Multiphase Flow in Fractured Porous Media**

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**ABSTRACT:** Whenthe permeability of open, or partially open, fractures in porous media is orders of magnitude greater than the matrix permeability, the bulk flow properties of a fractured porous medium will be dictated by the localized flow within fractures. This is true in a multitude of geologic flow situations, including prediction of contaminant transport in the subsurface, shale-gas production from fractured sites, and the potential motion of geologically sequestered CO2 through caprocks and wells from storage reservoirs. In this review several experimental and computational studies of flow in fractured geologic media are presented.

The natural complexity of a fracture in Berea sandstone was captured with a computed tomography (CT) scanner. This digital version of the fracture was used to fabricate an experimental flow cell, high resolution pore-throat flow models, and finite-volume CFD models. Multiphase flows through the flow cell and the different simulations were performed and the results are compared. Each method enabled different aspects of multiphase flow through a single fracture to be examined in detail. Relative permeability curves and insight into the effect of geometric constrictions were obtained.

When the geometry of a fracture changes due to chemical effects or mechanical forces, the resultant flow through the fracture changes. Here some experimental results of changes to a fracture aperture due to CO2 saturated brine motion through a fractured limestone and the CFD models results that evaluate the change in fracture transmissivity with changes in the geometric fracture are presented.

Finally, efforts to scale up the behavior observed at the core scale to the reservoir scale with the discrete fracture reservoir simulator NFFLOW are presented and discussed. A case study that describes fluid motion through a fractured caprock will be presented, as well as a description of how the core scale phenomena can be incorporated into this reservoir model.