Geophysical Research Abstracts,
Vol. 11, EGU2009-8393, 2009
EGU General Assembly 2009

Experiments on front roughness and averaged saturation for immiscible displacement in heterogeneous porous media

V. Heiss (2), I. Neuweiler (1), and A. Faerber (2)

(1) Leibniz Universität Hannover, Department of Civil Engineering / Inst. of Fluid Mechanics, Hannover, Germany (neuweiler@hydromech.uni-hannover.de), (2) Universität Stuttgart, Institute of Hydraulic Engineering , Stuttgart, Germany (heiss@iws.uni-stuttgart.de)

For mass transfer during two-phase two-component flow processes in heterogeneous porous media, the fluid-fluid interface of the two-phases have a strong influence. To predict mass transfer it is therefore important to determine the interface properties.
An important characterization criterion for displacement of one fluid by another, immiscible one in porous media, is the morphology of the fluid-fluid interface.

The interface morphology is investigated intensely since a long time. It is determined by the interplay between capillary, gravity and viscous forces and by the structure of the pore space. The interface morphology influences the modeling of a displacement process on the Darcy scale, where the pore scale is no longer resolved. However, the interface criteria on the pore scale cannot necessarily be transferred to the larger scale. This is in particular true in heterogeneous media, where the structure of material interfaces on the large scale may determine the flow process. Immiscible displacement fronts on a Darcy scale are often sharp and may show instabilities on the larger scale. Pore scale instabilities, on the other hand, may appear as stabilized on the large scale due to large scale structures.

We will present observations of displacement fronts in Darcy scale heterogeneous media, where fluid content was measured using optical methods. The front properties were analyzed for different flow regimes and structures. The growth rate of the front roughness shows a different behavior than the spatially averaged fluid content. While the front is in most cases stable after some time, the width of the distribution of the averaged fluid content continues to grow due to pore-scale and macroscopic trapping events.