

Water-gas flow with mass exchange. Mathematical models and upscaling

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We consider the mathematical modeling of the two-phase, two-component flow of water and gas through porous medium, described in Couplex-Gaz Test Case 1 (<http://www.andra.fr/couplex-gaz>). The gas (hydrogen) is generated by the corrosion of nuclear waste containers and the two fluid components, water and hydrogen, can exchange phases through mechanisms of dissolution and evaporation. The waste repository itself is highly heterogeneous porous medium with contrasting lithological properties.

We discuss the mathematical modeling of this highly complex physical situation and consider possible simplifications of the model, with the aim to describe accurately the transport of the gas. Further on, we consider the upscaling of absolute and relative permeabilities and capillary pressures in the part of the porous domain comprising the waste repository in order to simplify numerical simulation of the transport problem.