

Nonisothermal Richards flow in porous media with cross diffusion

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The existence of large-data weak solutions to a nonisothermal immiscible compressible two-phase unsaturated flow model in porous media is proved. The model is thermodynamically consistent and includes temperature gradients and cross-diffusion effects. So-called variational entropy solutions, which involve the integrated total energy balance, are considered in order to overcome the lack of integrability of some terms in the total energy flux. A priori estimates are derived from the entropy balance and the total energy balance. A sequence of approximated solutions is built via a time semi-discretization and several regularizations. The compactness of the sequence of approximated solutions is achieved by using the Div-Curl lemma.