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NUMERICAL MODELING OF REACTIVE INFILTRATION INSTABILITIES

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Abstract. We present a numerical model for reactive transport in porous media with porosity changing due to the reaction. The mathematical model is a nonlinear system of coupled flow, transport, and reaction equations. The nonlinear effects produced by the porosity changes may lead to fingering instabilities. The numerical model uses a mixed finite element method for flow and a Godunov-mixed method for transport. A time-splitting and operator-splitting approach decouples the system and requires the solution of only linear equations.

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Optimal order a priori error estimates for the discretization of the coupled nonlinear system and the operator-splitting error are derived. Numerical studies on the effect of the Peclet number and the dispersion on the stability of the front are presented. Our results confirm earlier analytical results. We also present some numerical studies on layered and heterogeneous porous medium.

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