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A two-scale phase-field model for reactive transport in porous media with evolving pore-scale geometry

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We consider a two-scale model for reactive transport in a porous medium. At the pore scale, a micro-structural evolution can be encountered due to processes like precipitation and dissolution, which can impact the fluid flow. One encounters free boundaries separating the space available for flow from the solid, impermeable part in the medium. To avoid difficulties related to the micro-scale free boundaries, we consider a phase-field pore-scale model [2]. Employing formal homogenization, a two-scale phase-field model is derived, in which the pore-scale and the Darcy-scale model components are coupled through the cell problems providing the effective parameters. For the resulting model, we discuss an adaptive two-scale scheme [1]. It involves iterations between the two scales, linear iterations for solving the nonlinear cell problems, an adaptive selection of the elements wherein the effective parameters are computed, and adaptive mesh refinement.

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