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On an evolving non-isothermal reactive upscaled model in a porous medium

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For a non-isothermal reactive flow process, effective properties such as permeability and heat conductivity change as the underlying pore structure evolves. We investigate changes of the effective properties for a two-dimensional periodic porous medium as the grain geometry changes. We consider specific grain shapes and study the evolution by solving the cell problems numerically for an upscaled model derived in Bringedal et al.[2]. In particular, we focus on the limit behavior near clogging. The effective heat conductivities are compared to common porosity-weighted volume averaging approximations. The resulting macroscale equations are tested on a case where the geochemical reactions cause pore clogging and a corresponding change in the flow and transport behaviour at Darcy scale. As pores clog the flow paths shift away, while heat conduction increases in regions with lower porosity.

References

1. C. Bringedal, K. Kumar, Effective behavior near clogging in upscaled equations for non-isothermal reactive porous media
flow, Transport in Porous Media, 120(3), 2017, 553–577.
2. C Bringedal, I Berre, I S Pop, F A Radu, Upscaling of non-isothermal reactive porous media flow with changing porosity, Transport in Porous Media, 114 (2), 371–393, 2016.

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