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Characterisation of multiphase flow in heterogeneous rocks

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Most porous materials in nature and even from man-made are spatially heterogeneous from nanometer(molecular) scale to kilometre (field) scale. How to accurately characterise the effect of mineralogical and topological heterogeneity on hydrodynamic properties is extensively investigated, but still an open scientific question, particularly at decimeter (core) scale. Evidence from field-scale simulation and on-site observation suggest that the multi-scale mineralogical and topological heterogeneity are dominating features for accurate estimation of fluids' migration, such as during CO2 sequestration. The establishment of local equilibrium over core scales, due to capillary pressure, has a significant impact on fluid mobilisation in heterogeneous rocks. However, how to characterise the core scale heterogeneity in a complex rock (e.g., carbonate) is still not well addressed. Therefore, we sought to develop a robust algorithm to characterise the dependence of two-phase flow on the spatial distribution of topological and hydrodynamic properties using both CT-based imaging technology and the continuum-scale simulation approach. We subjected core-scale characterisation for two sandstones and three carbonate rocks, to compute the heterogeneous distributions of porosity, capillary pressure, as well as absolute permeability. Here, we concluded that the proposed algorithm is able to effectively and reasonably construct the 3D core-scale model using limited experimental information.

Participation

In-Person

References

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