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Image-based modeling of flow and transport in porous media

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Flow and transport in porous media is encountered in many industrial and hydrogeological applications, such as hydrogen fuel cells, inkjet printing, hydrocarbon exploration, and subsurface remediation. The relevant study domain can cross multiple scales from a few nanometers to hundreds of kilometers. Therefore, in porous media research, the upscaling and multiscale techniques have been widely used to bridge the hierarchical scales. Recently, with the increase of powerful computational resources and the improvement of characterization methods of pore structures, image-based modeling is attracting much attention. It sheds light on fundaments of pore-scale flow dynamics, and assists in the upscaling of porous media models. In this work, we will discuss the current challenges of image-based modeling of single-phase reactive transport and two-phase flow in various porous materials (e.g., paper and shale). Then, we will present our PDMS-based micromodel benchmark experiments of two-phase flow in porous media. The obtained data will be used to calibrate and validate pore-scale models.

References

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