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Abstract

Experimental results on tracer transport in a porous column consisting of two adjacent segments of different (fine and coarse) glass bead packs having the same porosity value, have shown that the breakthrough curve behavior depends of the transport direction (Berkowitz, B., Cortis, A., Dror, I., & Scher, H. (2009). Water Resources Research, 45(2)). It was found that tracers migrating in the fine-to-coarse (FC) direction arrive significantly faster than in the coarse-to-fine (CF) direction. In this work, we simulate Brownian tracers moving in a 2D random porous medium in a configuration similar to that of the referred experimental set-up. By considering only diffusive effects, the results confirmed the transport asymmetry across the heterogeneous interface. Arguments based on effective medium equations for the porous medium transport indicate that the asymmetry can be explained by subtle differences of effective diffusivity between the coarse and fine porous medium. In turn, such diffusivity differences are induced by differences in the tortuosity and porosity in the vicinity of the porous media boundary.

Keywords: Heterogeneous porous media; Diffusion; Transport asymmetry; Effective medium equations.

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