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Hydraulic attributes of heterogeneous pore spaces

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We design porous geometries with different grain organizations and embed these in novel microfluidics set-ups to directly assess hydraulic attributes of porous media as a function of the degree of structural complexity of the pore space. A variety of studies have documented the relationship between the overall flow and pressure drops for homogeneous permeable media. Otherwise, the fundamental nature of such a relationship within heterogeneous system characterized by a broad range and a complex arrangement of pore sizes is still not completely explored. Here, we couple microfluidics experiments and direct observation of (a) flow through the designed geometries while imposing a macroscopic pressure gradient as well as (b) flow patterns therein with detailed numerical simulation of flow. We the synthesize the results upon deriving an analytical formulation relating the overall intrinsic permeability and key features of the porous structure. While our formulation is grounded on the classical Kozeny-Carman relationship, it embeds the spatial variability of pore sizes, thus contributing to enhance our knowledge on the feedbacks between the microstructure of the pore space and the overall medium permeability.

Participation

In-Person

References

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Energy Transition Focused Abstracts

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