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Contribution ID: **631**

Type: **Oral Presentation**

Investigation of species transport in fractured media using 3D printed micromodels

Monday, 31 May 2021 11:40 (15 minutes)

Carbonate rocks are multiscale systems where features in the order of few microns such as pores and throats interact with features on the order of a few millimetres, such as fractures and vugs. Fractures allow fluids to move at an extremely high speed through the reservoir and possibly leak out, which would undermine engineering efforts. We must thus be able to predict these fluid movements to ensure storage permanence of injected fluids. Recent advances in three-dimensional (3D) printing allows for cheap and fast manufacturing of complex porosity models, allowing investigation of specific flow processes in repeatable manner and enabling sensitivity analysis for small geometry alterations. These 3-D models can be printed with multiscale porosity structures that include large features such as fractures with smaller pores. Flow and transport in these multiscale structure can be modelled using high resolution pore-scale simulations, but these simulations are restricted to small domain (<10003 voxels). Darcy scale models with discrete fracture network can be applied, but they lack the exact representation of the fracture geometry. The Darcy-Brinkman-Stokes (DBS) equation gives a seamless transition between the Stokes and Darcy scales allowing us to solve the Navier stokes equation for the large features and Darcy's equation for the small features. Although the use of the DBS equation for calculation of flow field and permeability has been widely applied, the validity of the transport equation remains to be investigated. Here we present an experimental investigation of species transport during single phase flow in custom 3D printed multiscale micromodels with fractured geometries. Different scenarios are examined where the connectivity of the fractures as well as the fracture shapes and apertures vary and their impact during single phase flow in the matrix is presented. The experimental results are then compared to high-resolution pore scale modelling simulations, 2D depth averaged simulations, and 2D multiscale simulations. The results of this work can be used to benchmark multiscale-simulations solving the single-phase Darcy-Brinkman-Stokes equation.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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Student Poster Award

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Session Classification: MS11

Track Classification: (MS11) Microfluidics in porous systems