Upscaling of Transport Parameters in Reacting Porous Media; Pore-Scale Modelling

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Pore scale modelling provides a tool for upscaling of flow and transport parameters in porous media. We use PoreFlow, a pore-network modelling tool capable of simulating fluid flow and multi-component reactive and adsorptive transport under saturated and variably saturated conditions. Simulations include: pore network generator, drainage simulator, calculation of pressure and velocity distributions, and modelling of reactive solute transport accounting for advection and diffusion. The pore space is represented using a multi-directional pore-network capable of capturing the random structure of a given porous media with user-defined directional connectivities for anisotropic pore structures.

The chemical reactions can occur within the liquid phase, as well as between the liquid and solid phases which may result in an evolution of porosity and permeability. Potential applications are geological sequestration of CO_2, affecting the reservoir rock transport properties as well as influencing the wellbore integrity, and acid-gas injection during enhanced oil recovery. Other examples will be provided, showing use of pore-scale information to determine macro-scale properties such as permeability-porosity changes, solute dispersivity, adsorption reaction coefficients, effective diffusion and tortuosity. Such information can be used as constitutive relations within continuum scale governing equations to model physical and chemical processes more accurately at the larger scales.