# Geochemical Compositional Simulations of $CO_2$ Sequestration in Fractured Sandstone Formation

LUANJING GUO[1], MILIND DEO[2,*]

1luanjing.guo@gmail.com, Salt Lake City, UT, USA
2milind.deo@utah.edu, Salt Lake City, UT, USA

Deep saline aquifers are the most vastly available storage for anthropogenic carbon dioxide in terms of storage capacity. Although regulation requires no pressure-induced fracturing could take place, one of the two major types of sedimentary host rocks, sandstone formations, is generally associated with naturally existing fractures due to deformation or physical diagenesis. We have developed a compositional geochemical simulator, named Advanced Reactive Transport simulator (ARTs), based on control volume finite element discretization method and provides capabilities of simulating multiphase flow, transport and reactions in fractured medium in a fully coupled manner. Fractures add more complexity to all nonlinearly coupled processes. Control volume finite element method combines the physical intuition of control volume methods with the geometric flexibility of finite element methods. Discrete fracture network (DFN) modeling is implemented to explicitly describe the fracture locations and properties. Aqueous equilibrium reactions and kinetic mineral dissolution/precipitation reactions can be included. The global nonlinear equations are solved using Newton-Raphson method. The simulator is verified against analytical solution (flow in fractured medium without reactions) and widely used reactive transport simulator TOUGHREACT. Iron output from dissolution of iron-bearing minerals in sandstone formations has important implications on carbonate mineral formation downstream of injection well. The simulator is then applied to a synthetic case where supercritical $CO_2$ is injected into a sandstone formation with an artificial fracture network. Mineralogy of iron-bearing Berea™ sandstone is applied. Fracture effect on $CO_2$ migration and the fate of iron is investigated in this study.