**Control of the spatial and temporal distributions of mineral precipitates by the nature of reactant mixing in porous media**

George Redden1, Don Fox1, Luanjing Guo1, Tsigabu Gebrehiwet2, James Henriksen1, Hai Huang1, Yoshiko Fujita1, Chi Zhang1

*1Idaho National Laboratory, Idaho Falls, Idaho, USA*

*2University of Idaho-Idaho Falls, Idaho Falls, Idaho, USA*

**ABSTRACT:** Formation of mineral precipitates in the subsurface can be used to control contaminant mobility, fluid flow and geotechnical conditions. The general principles of the relevant chemical and biochemical processes are relatively well understood. Reactions in porous media, however, are influenced by transport and mixing, and can be far from equilibrium. This is especially true for engineered conditions. In porous media, regions where reactants mix can be spatially complex and characterized by transient chemical gradients. Local thermodynamic conditions within the gradients determine reaction rates and products.

When mineral precipitates are among the reaction products, the transport properties of the media will also be affected. Thus reactant transport, mixing and reaction are tightly coupled. In our laboratory we are investigating several reactant mixing geometries that represent plausible engineered or natural scenarios for forming mineral precipitates in porous media. These include diffusion-controlled mixing, parallel flow of reactant solutions, and *in situ* formation of reactants at solid-solution interfaces. The intention is to experimentally test how the formation of mineral precipitates influences the local and volume averaged progress of precipitation reactions, and to support development of approaches to represent pore-scale events in continuum-scale simulations of complex system behavior through the derivation of accurate constitutive relationships from pore-scale simulations.