Mesoscale Priority Research Direction

Functional Materials in Extreme Subsurface Conditions

Opportunity

Smart integrated materials with triggerable composite functionalities can eliminate CO_2 and methane leakage through tight fractures in the subsurface environment, or enable efficient and environmentally favorable exploitation of subsurface natural resources.

The science and technology enabling economical materials that can reliably function in extreme chemical and physical conditions typical to the subsurface environment and the emergent mesoscale colloidal and interfacial phenomena associated with their synthesis, delivery, and functionality in these environments.

Meso Challenge

Inadequate theories and characterization techniques for understanding colloidal and interfacial mesoscale phenomena in extreme chemical and physical conditions.

Predicting the performance of candidate materials and the triggers of their functionalities in subsurface mesoscale physical spaces under extreme conditions.

Approach

Test and modify current colloid stability and interfacial dynamics theories and characterization (direct and indirect) technique for application in extreme chemical and physical conditions.

Colloid self- and directed-assembly to produce integrated materials with triggerable composite functionalities that are stable in extreme subsurface conditions.

Functionality triggers compatible with natural environmental conditions (temperature, pressure drop, pH, salinity) and common field applications (dynamic stress, electromagnetic, electroacoustic).

Put more effort towards integrating existing materials than inventing new ones, and focus on characterizing performance (will they remain stable? Will they do what we want them to do?) under the extreme conditions.

Impact

Solve major subsurface energy harvesting and environmental problems. Significant enhancement of subsurface harvesting and transformation of current technologies.

U.S. DEPARTMENT OF ENERGY | Office of Science

Contact: Amr Abdel-Fattah
Los Alamos National Laboratory, P.O. Box 1663, MS: J966, Los Alamos, NM 87545
Ph.: (505) 665-2339; Fax: (505) 606-2258; E-Mail: amr2450@lanl.gov