



Geochemistry

Sandia National Laboratories/Carlsbad

Description

Sandia National Laboratories is the scientific advisor for the Waste Isolation Pilot Plant (WIPP), the nation's first repository for the permanent disposal of radioactive wastes. Sandia's continuing role in this position is to provide scientific and technical guidance for recertification and continued safe operation of the WIPP. In 2000, the Department of Energy (DOE) funded a new, state-of-the-art geochemistry laboratory in Carlsbad to support ongoing investigations into issues relevant to hazardous and nuclear waste disposal and environmental remediation.

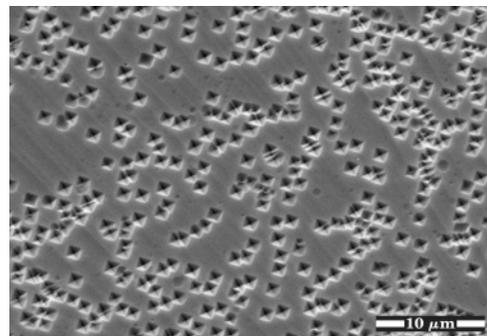
Staff Capabilities

The geochemistry staff has experience in the following areas: metal or radionuclide speciation-solubility in high-ionic strength environments, repository and backfill chemistry, reactive transport experiments and modeling, waste-water interactions, and environmental application of nanostructured materials.

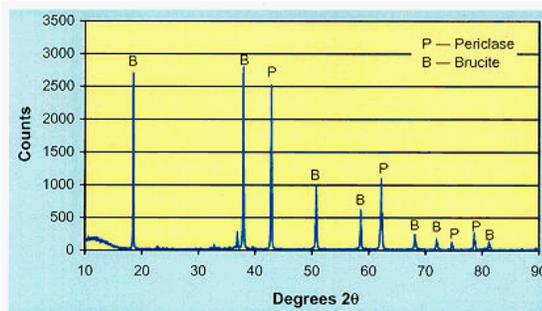
Current Projects

Current projects include:

- Investigation of backfill properties. Currently, MgO is used as a reactive backfill to control the chemical conditions in the repository. The rates and reaction products of MgO hydration/carbonation are being determined experimentally.



SEM Photo of Etch Pits Marking Atomic Dislocations on a Salt Cleavage Surface

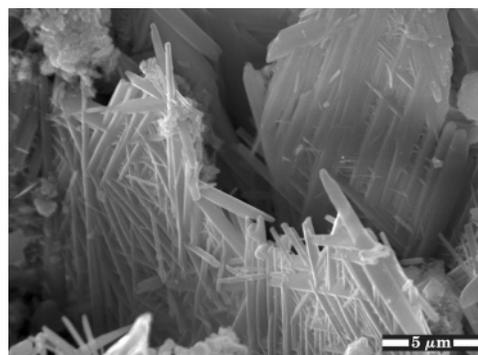


XRD Pattern of Partially Hydrated MgO

- Investigation of the mechanical and hydrologic properties of disturbed rock zones (DRZ) extending from repository excavations into the surrounding formation. Drill cores from the DRZ are being analyzed mineralogically and chemically, and fracture and dislocation densities are being determined. The objective of this activity is to characterize features of the DRZ for validation of a geomechanical model, which predicts DRZ development and evolution in bedded salts.



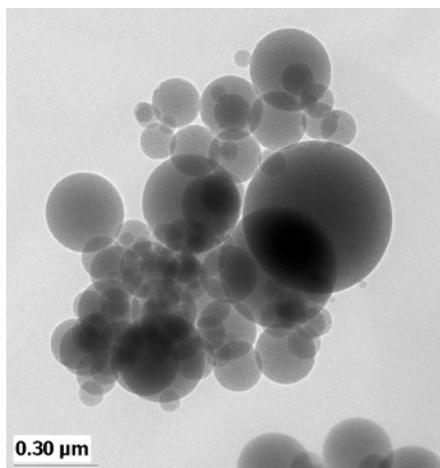
- Upgrading geochemical modeling capabilities to integrate WIPP-related chemical data, including the actinide source term, redox conditions, MgO backfill reactions, actinide/ligand interactions, organic ligand generation, waste degradation pathways, and sorption/coprecipitation of actinides with MgO backfill.
- Development of a thermodynamic model for cement/brine interactions and to evaluate the effect of cement waste forms on repository chemistry.



SEM Photo of Goethite Crystals in Borehole Casing Scale

- Environmental applications of nanostructured materials. Such materials, by virtue of their high surface area and/or small size, commonly exhibit chemical characteristics that could vary significantly from their coarse-grained equivalents, such as enhanced reactivity or Waste Isolation Pilot Plant catalytic properties.

Facilities



TEM Image of Mesoporous Silica

The Sandia/Carlsbad Laboratory Facility is well-equipped for materials characterization and chemical analysis. Equipment present in the facility include:

- **Scanning electron microscope** with element analysis/mapping capabilities
- **X-ray diffractometer** with a heating/environmental stage.
- **ICP-OES** for simultaneous analysis of up to 70 elements in aqueous samples
- **Petrographic microscope** with capabilities for reflected/transmitted/Nomarski/fluorescence viewing
- **Carbon analyzer**
- **UV-Visible spectrophotometer**
- **Sample preparation equipment**, including rock saws and diamond coring bits, a ball mill, a vacuum impregnation unit, grinding and polishing equipment, a high-speed centrifuge, and a freeze-dry system.

Contacts

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