William R. Wiley EMSL
Environmental Molecular Sciences Laboratory

The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) is a U.S. Department of Energy (DOE) national scientific user facility. EMSL is the centerpiece of DOE's commitment to provide world-class research capabilities for enabling fundamental research on the physical, chemical, and biological processes that underpin critical scientific issues.

EMSL capabilities are used to address the fundamental science that will be the basis for finding solutions to national environmental issues such as cleaning up contaminated areas at DOE sites across the country and developing "green" technologies to reduce or eliminate future pollution production. The capabilities also are used to further our understanding of global climate change, environmental issues relevant to energy production and use, and health effects resulting from exposure to contaminated environments.

If you are interested in collaborating with our scientists or using the facility's resources, more information and specific procedures for becoming an EMSL user can be found at http://www.emsl.pnl.gov.

www.EMSL.PNL.GOV

The W.R. Wiley Environmental Molecular Sciences Laboratory (EMSL) is a U.S. Department of Energy (DOE) national scientific user facility located at Pacific Northwest National Laboratory (PNNL) in Richland, Washington. EMSL is operated by PNNL for the DOE Office of Biological and Environmental Research.

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Office of Science
U.S. DEPARTMENT OF ENERGY

Contacts

Access to this facility is granted based on a peer-review proposal system. Scientists are welcome to submit proposals of research using an online form at http://www.emsl.pnl.gov.

For details about the resources in the EMSL Environmental Spectroscopy & Biogeochemistry Facility, collaborative opportunities, or information on how to become a user, please contact:

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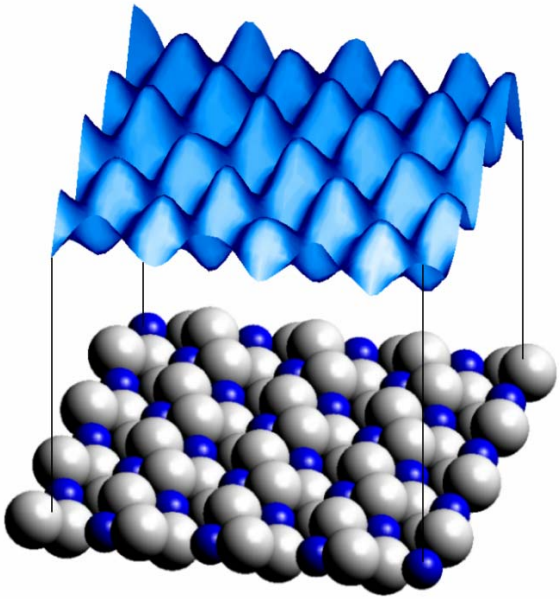
Environmental Spectroscopy & Biogeochemistry Facility



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Environmental Spectroscopy & Biogeochemistry

ES&B Facility scientists focus on environmental molecular science and the application of fundamental physical chemistry concepts to the study of chemical reactions in heterogeneous natural material, with an emphasis on soil and subsurface systems.

Capabilities are available for materials characterization, aqueous-phase and solid-phase speciation and reaction/kinetic measurements, analytical environmental chemistry, modeling of molecular and thermodynamic geochemical processes, and large-scale reactive-transport studies.

The ES&B Facility consists of the seven laboratories described below. The labs are co-located in close proximity to facilitate multi-technique studies. Environmental chambers are available with spectroscopic access where the atmosphere may be controlled. These labs are located near other instrumentation integral to environmental molecular science, including high-resolution scanning and transmission electron microscopes and a variety of ultra-high vacuum microprobe techniques for surface analyses.

Optical Spectroscopy. Laser-based fluorescence, photothermal beam deflection, and photoacoustic spectroscopies are available for investigations of aqueous and interfacial reactions. Kinetic studies ranging from stopped-flow to ultrafast optical pump-probe methods, as well as cryogenic capabilities for enhanced spectroscopic studies, are also available.

Infrared (IR) Spectroscopy. Fourier transform (FT) spectrometers enable the study of various mineral-chemistry topics as well as sorbate binding mechanisms at mineral, biotic, and organic interfaces. A variety of cells are available for gas, liquid, solid, and slurry samples across the visible to the near-, mid-, or far-IR regions. Raman vibrational analyses can be obtained using the FT-Raman module and Raman microscope. A vacuum bench equipped with a helium-cooled bolometer and step-scanning capabilities is optimized for far-IR measurements down to 10 cm^{-1} as well as time-resolved spectroscopy at 10-ns resolution. A nitrogen-purged system equipped with a microscope and temperature-controlled mapping stage allows spatially resolved measurements.

Imaging Microscopy. Optical and scanning-probe microscopes are available for particle imaging from the millimeter to the nanometer scales. A laser confocal microscope that allows imaging is linked to optical spectroscopy systems. A scanning probe microscopy facility has been developed for imaging water-wet samples and microbe-water and mineral-microbe interfaces, and for characterizing a wide variety of environmental materials. Expertise is also available in the characterization of processes of microbial reduction and biogenic minerals formation by high-resolution TEM involving lattice imaging, SA diffraction, and EDS analysis.

Environmental Analytical Chemistry. A wide variety of instrumentation, including gas and liquid chromatographs with mass spectrometry (MS), capillary electrophoresis, carbon analysis, and inductively coupled-MS, are available to support user projects for quantification of inorganic and organic contaminants and their reaction, transformation, or degradation products.

Mössbauer and EPR Spectroscopy. Mössbauer spectrometers with cryogenic capabilities and a 10^{-12}-Tesla superconducting magnet allow studies of iron structure and redox chemistry in oxides, clays, and biogeochemical systems. Software incorporating Voigt-line fitting and quadrupole-splitting distributions enable spectral deconvolution and fitting. A continuous-wave multifrequency (S, X, and Q bands) electron paramagnetic resonance spectrometer equipped with a helium-cooled cryostat and a stop-flow-freeze quench system allows studies of free-radical reactions and electronic environments of paramagnetic species in solids, suspensions, and at surfaces.

Subsurface Flow and Experimental Transport. This lab is equipped for meter-scale experiments in single- and multifluid (air/water, air/nonaqueous phase liquid/water, and nonaqueous phase/liquid-water) porous media systems. These unique experimental systems allow testing of basic theories of flow and transport; studies of coupled processes involved with microbial, reactive chemical, or colloid transport; or experimental simulation of subsurface remediation scenarios. Close linkages exist between this lab and modelers to aid in experimental design and interpretation.

Computational Geochemistry. Using a graphics, simulation, and modeling laboratory with multiple workstations linked to the EMSL computational infrastructure, modelers can perform molecular dynamics and electronic structure calculations as either a stand-alone activity or in support of experimental or spectroscopic measurements. Thermodynamic and kinetic geochemical codes are available as well as multidimensional geochemical reaction/transport codes for numerical experiments or simulation of the intermediate-scale flow and transport experiments.