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EMSL In Brief
Environmental Molecular Sciences Laboratory

Powerful New NMR Furthers Study of Strontium

EMSL's new ultra-high-field 900-MHz nuclear magnetic resonance (NMR) spectrometer—one of very few worldwide— was recently used by a Penn State University research team to study soil and environmental systems at the Hanford Site in Richland, Washington, and to investigate these systems' interactions with leaking tank waste.

Geoffrey Bowers, a graduate student under Penn State professor Karl Mueller, spent his two-week visit developing NMR methods for his studies of environmental phases that sequester strontium—^{90}Sr is the second most abundant radioisotope found in tank waste—and how strontium is bound in these phases. According to Bowers, good models that simulate radionuclide transport when tank waste comes in contact with the environment require much more information—and strontium's role has historically been difficult to study using lower-field solid-state NMR.

"To my knowledge, only three publications in all of the literature contain a solid-state spectrum of strontium—that is, ^{87}Sr," says Bowers.

Other analytical techniques can be used to develop a molecular-level understanding of strontium, such as extended x-ray absorption fine structure analysis—but have difficulty distinguishing between multiple cation environments. However, "solid-state NMR with ultra-high-field capabilities—such as those of the 900-MHz NMR spectrometer—is useful for the effective study of multi-phase samples simultaneously and should allow us to distinguish among phases," says Bowers.

Bowers will return to EMSL to again use the 900-MHz NMR spectrometer for his research, which is funded by the U.S. Department of Energy's Office of Environmental Management. In addition to an "absolutely fantastic" staff and clean, easy-to-use equipment and facilities, he has high praise for the cutting-edge instrument.

"EMSL's 900-MHz NMR spectrometer is an excellent instrument for solving problems involving low gyromagnetic ratio, low-frequency nuclei—such as strontium," says Bowers. "It is equipped with some of the most modern sensitivity-enhancing pulse sequences and also offers many additional benefits that improve the sensitivity of insensitive quadrupoles."

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