EMSL

Instrument Series: **Spectroscopy and Diffraction**

# High Spatial Resolution Secondary Ion Mass Spectrometry (NanoSIMS)

EMSL's novel, new-generation ion microprobe extends high spatial resolution secondary ion mass spectrometry (NanoSIMS) analysis to extremely small areas (down to 50 nm) and volumes while maintaining high sensitivity (e.g., ppm in element imaging) at high mass resolution. NanoSIMS can measure up to seven ions in parallel, offering perfect isotopic ratio results from the same small volume for perfect image superimposition. NanoSIMS can be used for enhanced imaging of cellular structures; simultaneous imaging of elements/isotopes on minerals and soft surfaces at the nanoscale; and imaging elements and isotopes of aerosols, nanoparticles, and organic and inorganic surfaces.

## *Research Applications*

**Environmental Microbiology** – tracing compounds that affect pollutant cleanup or generate biofuels by imaging relevant elements and their isotopic ratios in microorganisms (e.g., microbial colonies)

**Cell Biology** – affording sensitive, intracellular isotopic measurements of individual cells and imaging to <50 nm resolution

**Atmospheric** – imaging and compositional analysis of aerosol particles with high spatial resolution

**Materials Sciences** – providing high sensitivity and high lateral resolution for trace-element imaging and quantification

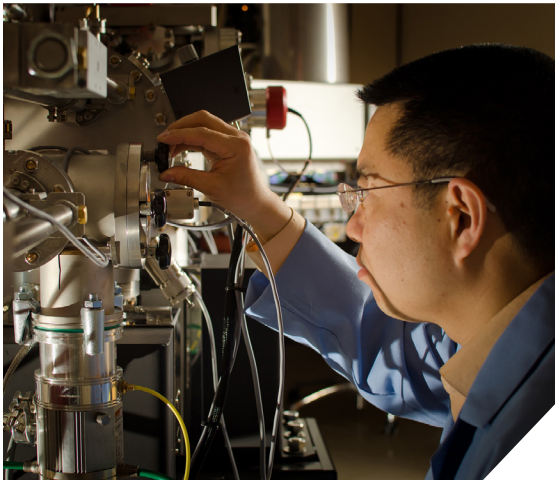
**Geology** – providing accurate isotopic ratio measurements to determine mineral sources and aging

**Mineral Aqueous Interactions** – evaluating the interactions between mineral surfaces and microbes, as well as other biogeochemical reactions, via compositional analysis.

## Quick Specs

- Simultaneous detection of up to seven masses plus secondary electron image
- Mass range: Max/Min = 22
- Switchable Faraday cup and electron multiplier detectors
- Charge neutralization by electron beam (for insulating samples)
- High-resolution imaging: <50 nm $Cs^+$ source; <200 nm $O^-$ source
- Beam current: $Cs^+$ source: >2 pA using 100-nm beam; $O^-$ source: >2 pA using 400-nm beam
- High mass resolution with high transmission: >55% transmission at M/ΔM of 6000; >20% transmission at M/ΔM of 9000
- Sub per mille isotopic ratio sensitivity:
  - Electron Multiplier: $^{29}Si/^{28}Si$ and $^{30}Si/^{28}Si$: Standard Deviation <0.15%
  - Faraday Cup: $^{29}Si/^{28}Si$ and $^{30}Si/^{28}Si$: Standard Deviation <0.06%
  - Faraday Cup: $^{18}O/^{16}O$: Standard Deviation <0.12%
  - Manufacturer: CAMECA

## EMSL's NanoSIMS Offers:



**Availability** – EMSL is the first user facility in the world to offer a NanoSIMS capability for global research.

**Very high spatial resolution** – NanoSIMS can image all elements (except noble gases), as well as their isotopic ratios at the nanoscale (down to 50 nm).

**Excellent detection limits** – Parts-per-million (ppm)-level detection is regularly available for most elements.

**Diverse impact** – NanoSIMS supports studies in atmospheric science, biology, geochemistry, materials science, and nanoparticulate research.

To learn more about NanoSIMS and how it is being applied to EMSL users' research, see: http://goo.gl/csa7C.

EMSL, a national scientific user facility, provides free instrument access for open-source research. Learn how to become a user and about upcoming proposal calls at www.emsl.pnl.gov/access/calls/.

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