

EMSL Research and Capability Development Proposals

Development of Novel Approaches for Analysis of Secondary Organic Aerosols Using High Resolution Mass Spectrometry

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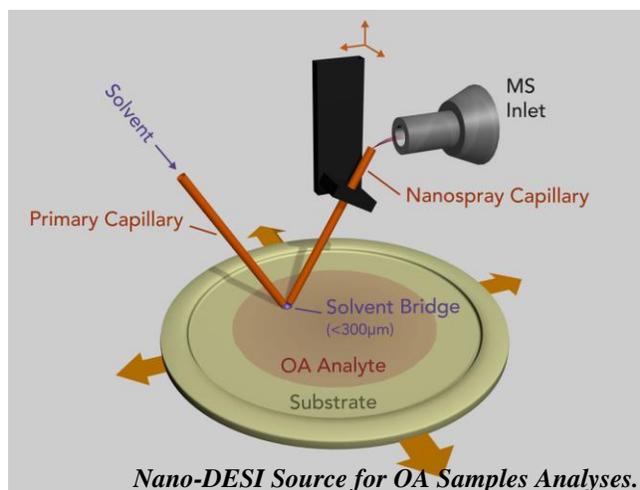
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The objective of this ongoing research project is development of new analytical approaches for obtaining molecular-level understanding of the chemical composition of organic aerosols (OA) and their reaction chemistry pertaining to atmospheric environment. State-of-the-art high-resolution mass spectrometry is being applied using novel atmospheric pressure surface ionization techniques that enable characterization of OA samples collected on substrates under ambient conditions.

Emission of anthropogenic aerosols into the atmosphere is one of the major environmental issues related to energy use. Aerosols pose a substantial health risk, reduce regional and local air quality and have a significant impact on the Earth's climate. Organic aerosols are an area of major uncertainty. The production and use of energy results in soot and primary organic aerosol (POA) emissions, as well as generation of secondary organic aerosol (SOA) formed via subsequent reactions of volatile organic

compounds (VOC) emitted into the atmosphere. To address environmental issues related to the safe production and use of energy, it is necessary to improve substantially the understanding of the origin, fate, chemical and physical properties of OA. Despite its acknowledged importance, the database relating chemical composition and physical properties of OA, its mechanisms of formation and atmospheric oxidation (aging) remain poorly understood.

The application of a novel nanospray Desorption Electrospray Ionization (nano-DESI) method developed as part of this project and other atmospheric ionization methods allows examination of aerosol chemistry without many of the artifacts inherent to other ionization methods.



Products and Output

New Capability for EMSL Users

Atmospheric ionization capabilities developed as part of this EMSL Research and Capability Development project are now available for EMSL users.

Publications

Laskin J., A. Laskin, P.J. Roach, G.W. Slysz, G.A. Anderson, S.A. Nizkorodov, D.L. Bones, and L.Q. Nguyen. 2010. "High-Resolution Desorption Electrospray Ionization Mass Spectrometry for Chemical Characterization of Organic Aerosols." *Analytical Chemistry* 82(5):2048–2058. DOI: 10.1021/ac902801f.

Roach P.J., J. Laskin, and A. Laskin. 2010. "Nanospray Desorption Electrospray Ionization: an ambient method for liquid-extraction surface sampling in mass spectrometry." *Analyst* 135(9):2233-2236. DOI: 10.1039/c0an00312c.

Patent Application

Roach P.J., J. Laskin, and A. Laskin. "Focused analyte spray emission system, apparatus, and process for mass spectrometric analysis." U.S. Patent Application No. 12/722,257.

Presentations

Roach P.J., J. Laskin, and A. Laskin. 2010. "Nanospray Desorption Electrospray Ionization Mass Spectrometry." *The 58th ASMS Conference on Mass Spectrometry and Allied Topics*. Salt Lake City, Utah, May 23-27, 2010.

Laskin J., A. Laskin, P.J. Roach, G.W. Slysz, G.A. Anderson, S.A. Nizkorodov, D.L. Bones, and L.Q. Nguyen. 2010. "High Resolution DESI-MS study of organic aerosol aging." *AirUCI Workshop*. Laguna Beach, California, January 21-22, 2010.

Laskin A., J. Laskin, J. Smith, A. Bateman, and S.A. Nizkorodov. 2009. "Molecular Characterization of Organic Aerosols Using High-Resolution Mass Spectrometry." *The 18th International Mass Spectrometry Conference*. Bremen, Germany, August 30-Sept. 4, 2009.

Highlight

<http://www.pnl.gov/science/highlights/highlight.asp?id=751>