Title:	Speciation of Nitrogen-Bearing Species Using Negative and Positive Secondary Ion Spectra with Nano Secondary Ion Mass Spectrometry
Authors:	Sinha, B. (/jspui/browse?type=author&value=Sinha%2C+B.)
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Abstract:	In this study, we demonstrate that Nano Secondary Ion Mass Spectrometry (NanoSIMS) can be used to differentiate different nitrogen-containing species commonly observed in atmospheric aerosol particles with micrometer or submicrometer spatial resolution, on the basis of the relative intensity of secondary ion signals, both in negative and positive secondary ion mode, without the need to chemically or physically separate the samples. Compounds tested include nitrate, nitrite, ammonium salts, urea, amino acids, sugars, organic acids, amides, triazine, imidazole, protein, and biological tissue. We show that NO2– secondary ions are unique to the decomposition of nitrate and nitrite salts, whereas NH4+ secondary ions are unique to samples containing ammonium ions, with low signal intensities observed from amino groups but none from biological tissue. CN– signals are obtained from all nitrogen-bearing compounds, but relative signal intensities are the highest for organic nitrogen-containing compounds. We demonstrate that quantitative determination of the elemental fractions of carbon, oxygen, and nitrate in nanometer-sized aerosol samples using normalized secondary ion intensities is possible. We further demonstrate that stable isotope ratios measured on in-house standards of unknown isotopic composition using the 12C15N–/12C14N– ratio (all nitrogen-containing species), the 15N16O2–/14N16O2– ratio (nitrate and nitrite species), and the 15NH4+/14NH4+ ratio (ammonium salts, amino acids, and urea) are stable and sufficiently precise for nitrogen isotope analysis.
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