**Speciation of nitrogen bearing species using negative and positive secondary ion spectra with Nano Secondary Ion Mass Spectrometry**

Kexue Li1, Baerbel Sinha2, Peter Hoppe3, Stephan Borrmann4

1 Particle Chemistry Department, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128 Mainz, Germany, [kexue.li@mpic.de](mailto:kexue.li@mpic.de)

2 Department of Earth Sciences, IISER Mohali, Sector 81 SAS Nagar, 140306 Manauli P.O., India, [baerbel.sinha@mpic.de](mailto:baerbel.sinha@mpic.de)

3 Particle Chemistry Department, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128 Mainz, Germany, peter.hoppe@mpic.de

4 Particle Chemistry Department, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128 Mainz, Germany, stephan.borrmann@mpic.de

The atmospheric cycling of reactive nitrogen is a focus of both scientific and policy concern, because of its importance in controlling the tropospheric ozone formation and the formation of particulate matter. Its long range transport modifies the global carbon cycle by providing nitrogen fertilization to remote ecosystem. Measurements of stable nitrogen isotope ratios (15N / 14N) offer a means of discriminating sources of nitrogen, and reactions involved in reactive nitrogen cycling via their specific isotopic signatures. 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, 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 inorganic: ammonium sulfate, sodium nitrate and sodium nitrite; organic: urea, cysteine and benzylimidazole. The results show that 14N16Ox-=1,2 and 3 secondary ions are unique to the decomposition of nitrate and nitrite. 14NHx+=1-4 secondary ions were unique to samples containing ammonium ions or amino groups, but were not observed in biological tissue. CN- signals are obtained from all nitrogen bearing compounds but relative signal intensities are highest for organic nitrogen containing compounds. For coarse aerosols (diameter > 1 µm), organic and inorganic materials in this study can be separated by measuring four secondary ions: 16O-, 12C14N-, 14N16O2- and 14NH4+ on the same area sequentially. For fine aerosols (diameter < 1 µm), four secondary ions: 12C-, 16O-, 12C14N- and 14N16O2- in negative secondary ion mode or 14NH+, 14NH3+ and 14NH4+ in positive secondary ion mode also can be used to separate different species. Nitrogen isotope ratio measurements can successfully performed using 12C15N- / 12C14N- - ratio on all samples. The 15N16O2- / 14N16O2- - ratio can potentially be used to measure species specific nitrogen isotope ratios in Nitrate/Nitrite samples and the 15NH4- / 14NH4- - ratio can potentially be used to meas-ure species specific nitrogen isotope ratios in ammonium salts, urea and pure amino acids.