

NITROGEN-MAPPING AND NITROGEN-XANES SPECTROSCOPY OF INTERPLANETARY DUST PARTICLES.

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Introduction: We employ two Scanning Transmission X-Ray Microscopes (STXMs) on Beamline X1A of the National Synchrotron Light Source at Brookhaven National Laboratory to characterize the biologically important elements C, N, and O in interplanetary dust particles (IDPs). We map spatial distributions, at an ~50 nm scale, by comparing absorption maps taken above and below the element's K-edge, and we determine the functional groups by X-ray Absorption Near-Edge Structure (XANES) spectroscopy. The XANES results on 11 IDPs were reported by Flynn et al. [1]

Samples: Our first combined C, N, and O-XANES analyses, of two IDPs, one anhydrous and the other hydrated, and Murchison acid residue were described by Feser et al. [2]. We have now obtained N-, C-, and O-XANES spectra on ultramicrotome sections, each ~80 nm thick, of four IDPs, L2005*A3, L2006 #14 (a fragment from cluster 10), L2008U13, L2011R11, and we have obtained N- and C-XANES spectra on a fifth IDP, L2008H9.

Results: Three of the IDPs -- L2005*A3, L2011R11, and L2008U13 -- show similar N-XANES spectra, with broad pre-edge absorptions at ~400, ~402, and ~407 eV, indicating that the dominant N-carrier is the same in all three of these IDPs. In most cases the absorption at the N-edge is detectable but weak, indicating a relatively low N-concentration (near our detection limit of ~1% [2]). L2006 #14 has a strong absorption at the N-edge, but relatively weak pre-edge absorptions. In addition, the C-rich IDP, L2008H9, exhibits a strong N-edge absorption, and three strong pre-edge absorptions at ~400.9, 403.6, and ~406.7 eV (see Figure 1).

The images of L2008H9 taken above and below the N-edge were of sufficient quality to allow us to produce a N-map of this IDP. Surprisingly, the areas of high N-concentration do not correlate with the areas of highest C-concentration, suggesting that the organic carbon that we have detected in all IDPs examined to date [1] is not the dominant carrier of N, at least in L2008H9.

References: [1] Flynn, G. J. et al. 2003, *Geochim. Cosmochim. Acta*, **67**, 4791-4806. [2] Feser, M. et al. 2003, *34th Annual Lunar and Planetary Science Conference*, Abstract #1875.

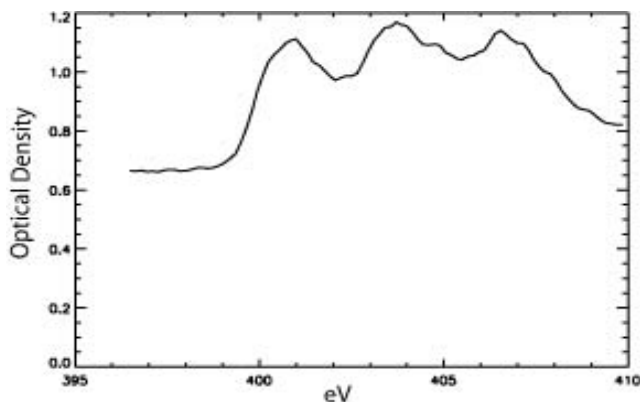


Figure 1: N-XANES spectrum of L2008H9, showing pre-edge absorption features.