ORGANIC CHARACTERISTICS OF D-RICH AND D-POOR CLUSTER IDPs. L. P. Keller[1], S. Messenger[2], G. J. Flynn[3], S. Wirick[4] and C. Jacobsen[4], [1]Code SR, NASA/JSC, Houston, TX 77058, [2]Physics Dept., Washington Univ., St. Louis, MO 63130, [3]Dept. Physics, SUNY, Plattsburgh, NY 12901, [4]Dept. Physics, SUNY, Stony Brook, NY 11794.

Introduction: A consistent picture is emerging from our coordinated ion microprobe and transmission electron microscope (TEM) analyses of deuterium- (D) and ^{15}N-rich interplanetary dust particles (IDPs) [1]. These isotopic anomalies are believed to represent partially preserved presolar molecular cloud materials [2]. The TEM evidence shows that the D-rich areas identified in the ion microprobe are correlated with the carbonaceous materials seen in microtome thin sections. Based on the spectroscopic evidence to date from Fourier-transform infrared (FTIR) and X-ray absorption near edge structure (XANES) analyses, the D-rich carrier phase is spatially associated with the aliphatic and aromatic hydrocarbons in these particles [1]. We have made preliminary spectroscopic analyses of fragments from cluster IDPs whose D/H ratios span the entire range observed among primitive solar system materials, and use these data to further constrain the nature of the carbonaceous material that is associated with high D/H ratios and ^{15}N enrichments.

Samples: We studied 3 particles: 1) L2005, #4, a fragment from a cluster IDP ("Dragonfly") with a measured δD of 25,000-50,000 ‰ and a $\delta^{15}N$ of 340 ‰, 2) L2009D11 (a fragment from cluster particle "Taz" [2]) that showed a δD of +5600-11,000 ‰ and 3) L2005*A3, a D-poor fragment from "Dragonfly" with a δD of –417 ‰ and a $\delta^{15}N$ of +396 ‰ . TEM data indicate that L2005*A3 has undergone moderate heating during atmospheric entry.

Methods: We used XANES and FTIR instruments at synchrotron beamlines X1A and U10B, respectively at Brookhaven National Lab to further characterize these particles. We have obtained FTIR spectra from L2009D11 and L2005*A3 and XANES spectra at the carbon k-edge for L2005, #4 and L2009D11. XANES measurements on L2005*A3 are in progress.

Results and Discussion: The FTIR spectra from the D-rich and D-poor fragments both show a Si-O absorption feature at ~10 μm and features which correspond to the CH_2 and CH_3 stretching vibrations in aliphatic hydrocarbons that occur at ~3.4 μm. The intensity ratio of the aliphatic feature relative to the silicate feature ($I_{3.4\,\mu m}/I_{10\,\mu m}$) in the D-poor fragment (L2005*A3) is ~1/5 the ratio observed in the D-rich fragment L2009D11. C-XANES spectra for L2005#4 and L2009D11 show three major absorptions similar to those observed in previous analyses of C-rich material in IDPs [3]. The spectra show distinct features which correspond to carbon in ring structures (aromatics) and to C=O functional groups.

The enormous variation in D/H observed in different fragments of these IDPs demonstrates that the organic matter is composed of at least two isotopically distinct components. In this initial dataset, aliphatic hydrocarbons are observed in far greater abundance in the D-rich particles than the D-poor fragment. It is possible that the variation in D/H observed within these IDPs reflects the partial loss of a volatile, very D-rich phase during atmospheric entry heating. The preservation of ^{15}N enrichments in heated particles suggests aromatic hydrocarbons as a carrier for this anomaly, consistent with earlier observations of N-rich PAHs in some IDPs [4].

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