A TEM, C-XANES AND NANOSIMS INVESTIGATION OF A FRAGMENT FROM THE STARDUST TRACK ADA.

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Introduction: We investigated the presence and nature of carbon in fragment #2 from track # 26, called Ada. This is a Wild2 particle of~12 μm in size. Like other fragments in this tack, it is composed of multiple nodules of fayalite each surrounded by rims of crystalline SiO_2 (tridymite). The particle was embedded in acrylic and microtomed and sections were subsiquently washed with sub-boiling chloroform vapor to dissolve the acrylic, as described in [1]. The sections were first analyzed by TEM to locate and characterize carbonaceous materials. The sections were then analyzed by X-ray Absorption Near Edge Structure Spectroscopy (XANES) to investigate the bonding state of the carbon. Other sections were analyzed with a NanoSIMS 50L for their C, N, O and H isotopic compositions.

Results: High resolution imaging and Electron Energy Loss Spectroscopy (EELS) measurements revealed the presence of amorphous carbon in 3 small (<100 nm) regions. In the same area, C, N and O-XANES measurements revealed the presence of a carbonaceous phase that contains N and O. The O in this phase occurs as a carbonyl (C=O) chemical bond, suggestive of an organic compound. NanoSIMS isotopic images show that the C-rich spot observed with EELS and XANES is ^{15}N-enriched (δ^{15}N=550±70‰, 1σ) and D-enriched (δD = 610 ±254 ‰, 1σ), proving that this organic material is indigenous to Wild2 and not contamination. The δ^{13}C of this material is within the range of meteoritic organic matter (-4±19 ‰). The O isotopes, which show homogeneous distributions (fayalite: δ^{17}O=3.1±13.9; δ^{18}O=-3.1±6.7 and crystalline SiO_2: δ^{17}O=9.0±12.1; δ^{18}O= -10.4±5.6), were also normal.

Discussion: Ada is a Stardust (SD) particle that has carbon concentrated in nanophases <200 nm in size which are found at the periphery of the particle. ^{15}N-enrichments of these C-rich regions are comparable to values found in other SD particles [2], IDPs [3,4] and carbonaceous chondrites [5,6]. The carbon is in an organic phase that also contains O. Carbon appears to be less abundant than in IDPs. However, given Ada's mineralogy (similar to OC-type chondrules [7]), composed of fayalite and tridymite, carbonaceous phases are unexpected. Perhaps the C was originally part of a fine-grained matrix that decomposed during impact into the aerogel and the remnants of it are the C-rich nanophases that we found at the edge of the particle.

References: [1] Matrajt, G. and Brownlee, D. 2006 *Meteoritics & Planetary Science* 41:1715-1720. [2] Matrajt, G. et al 2007 submitted to *Meteoritics & Planetary Science.* [3] Floss, C. et al. 2004. *Science* 303: 1355-1357. [4] Aleon, J. et al 2003. *Geochim. Cosmochim. Acta* . 67: 3773-3783. [5] Nakamura-Messenger, K. et al 2006. *Science* 314: 1439-1442. [6] Busemann H. et al 2006. **Science** 312: 727-730. [7] Wasson, J. and Krot, A. 1994 Earth Planetary Science Letters 122: 403-416.