ACFER 094 PRESOLAR SILICATES CHARACTERIZED USING NANOSIMS AND AUGER NANOPROBE.

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Introduction: The discovery of presolar silicates in meteorites was initially achieved by NanoSIMS raster ion imaging of size-separated grains from the primitive meteorite Acfer 094 [e.g. 1]. Here we report further searches for presolar silicate and oxide grains in Acfer 094 using the NanoSIMS; we also report elemental compositions acquired with the Auger Nanoprobe [e.g., 2] in order to better understand grain formation in stellar environments.

Experimental: Presolar grains are identified by NanoSIMS C and O isotopic imaging of grain size separates. They are subsequently characterized in the Auger Nanoprobe by elemental mapping and spot measurements in order to determine their elemental compositions. We are currently developing analytical routines and calibrating powdered standards (e.g., olivine and pyroxene), which will allow us to quantitatively determine the compositions of these presolar grains.

Results and Discussion: Our current round of NanoSIMS analyses led to the identification of 14 presolar silicate/oxide grains. Ten grains have enrichments in ^{17}O and are normal in their $^{18}O/^{16}O$ indicating an origin from a low-mass red giant or asymptotic giant branch star [3]. The other 4 grains show enrichments in ^{18}O and are consistent with a Group 4 classification. Elemental characterization shows that 8 grains are silicate grains, 3 are Al-rich oxide grains and 1 is an exceptionally Fe-rich oxide grain [4]. Based on preliminary calibrations of the standards, 2 silicate grains have pyroxene-like compositions (e.g. Mg+Fe+Ca/Si ratios close to 1) with one of these containing a small amount of Ca. The other silicates appear to have non-stoichiometric compositions. Two silicate grains are Mg-rich, 4 are Fe-rich and 2 have similar Fe and Mg contents. Condensation under non-equilibrium conditions produces substantially higher Fe contents in silicate grains than equilibrium condensation [5]. Thus, the high abundance of Fe in many of our grains suggests that they may have formed under non-equilibrium conditions [e.g., 6], although we cannot rule out parent body alteration.

We also identified 4 grains with carbon anomalies; $^{12}C/^{13}C$ ratios range from 18 to 48, similar to the compositions of mainstream SiC grains [7]. Although accurate abundances are difficult to determine on grain size separates, a relative comparison of the abundances of silicates/oxides with those determined by [1] suggests an abundance of presolar carbonaceous phases of ~85 ppm. This is significantly higher than the estimated abundances of SiC and graphite in primitive meteorites and, if corroborated, may require substantial revision of presolar grain abundance estimates.

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References: [1] Nguyen A. N. et al. 2007. *Astrophys. J.* 656: 1223-1240. [2] Stadermann F. J. et al. 2006. Abstr. #1663. *37th Lunar & Planet. Sci.* [3] Nittler L. et al. 1997. *Astrophys. J.* 483: 475-495. [4] Stadermann F. J. et al. 2007. This volume. [5] Ferrarotti A. S. & Gail H. –P. 2001. *Astron. Astrophys*. 371: 133-151. [6] Floss C. et al. 2005. *Meteorit. Planet. Sci.* 40: A49. [7] Zinner E. 2004. In *Treatise on Geochemistry* Vol. 1 (ed. A. M. Davis) pp. 17-39.