Fe ISOTOPIC COMPOSITION OF SUPERNOVA GRAINS.

K. K. Marhas, S. Amari, F. Gyngard and E. Zinner. Laboratory for Space Sciences, Physics Department, Washington University, St. Louis, MO 63130. E-mail: kkmarhas@yahoo.com.

Presolar SiC grains from supernovae (type X) have excesses in ^{57}Fe on the order of ~1000 ‰ [1]. Two interesting points to be noted along with these excesses are: (a) ^{56}Fe/^{54}Fe ratios are normal (within 3σ) for all 36 SiC X grains analyzed and (b) 19 grains with excesses in ^{57}Fe contain Fe-Ni rich subgrains. Out of these 19 grains, 10 were also measured for ^{59}Co. During analysis, ^{59}Co counts from the grains were correlated with the Fe and Ni counts indicating that the subgrains are indeed Fe-Ni-Co subgrains.

The ^{57}Fe enrichment in the SN grains can be explained in four different ways. (a) **Inner SN zone contributions** (Ni zone): The presence of ^{44}Ti and ^{49}V in some supernova grains is explained by contributions from the innermost SN zone [2,3]. This inner zone is dominated by ^{54}Fe [4]; hence, any contribution from this zone to the formation of SiC should result in very high excesses in ^{54}Fe and huge variations in ^{57}Fe, which is not observed. A mixing calculation from the other zones covers the solar value but is unable to explain the observed high ^{57}Fe anomalies as well as close-to-normal ^{56}Fe/^{54}Fe. (b) A **neutron-burst model** was invoked to explain the Mo and Zr isotopic patterns in X grains [5]. Mixing a very small percentage of n-burst material with solar material might be able to explain the ^{57}Fe enrichments. A way to confirm the contribution from the n-burst region is to obtain evidence for the presence of the radionuclide ^{60}Fe expected to be produced in the n-burst. Unfortunately, due to high Ni/Fe ratios, no ^{60}Ni excess was found within errors. (c) The **weak s-process** is thought to occur in massive stars during core He and/or shell C burning. Calculations [6] indicate excesses in both ^{57}Fe and ^{56}Fe relative to ^{54}Fe. Mixing this material with solar material can explain the anomalies obtained by [1]. (d) **Presence of the radionuclide ^{57}Co:** Another possibility to explain ^{57}Fe excesses is incorporation of radioactive ^{57}Co into SiC and in-situ decay. ^{57}Co has a half-life of 272 days, which is very similar to that of ^{49}V, and evidence for it has been detected in X grains [3]. If this explanation is true, the initial ^{57}Co/^{59}Co value inferred from 10 X grains range from 0.01 to 0.75, in agreement with theoretical SN models.

References: [1] Marhas K. K. et al. 2007. Abstract # 2124. 38th Lunar & Planetary Science Conference. [2] Nittler L. R. et al. 1996, Astrophysical Journal Letters 462: L31-L34. [3] Hoppe P. et al. 2002 Astrophysical Journal 576:L61-L72. [4] Rauscher T. et al. 2002. Astrophysical Journal 576: 323- 348. [5] Meyer B. S. 2000. Astrophysical Journal 540: L49- L52 [6] The L.-S. et al. 2007. Astrophysical Journal 655: 1058-1078.