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# IRON AND NICKEL ISOTOPIC COMPOSITIONS OF SILICON CARBIDE Z GRAINS.

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**Introduction:** Most presolar SiC grains (~93%) have Si isotopic ratios that fall along the so-called mainstream correlation line of 1.37 on a Si three isotope plot [1]. Z grains, which constitute only ~1% of the total presolar SiC population, plot on the $^{30}Si$-rich side of this line and typically have negative $\delta^{29}Si/^{28}Si$ values, suggesting that they originated in asymptotic giant branch stars of approximately one-third solar metallicity [2]. This makes them valuable probes of Galactic Chemical Evolution. Recent measurements of Fe and Ni in SiC X grains, which are thought to originate in supernovae, showed significant isotopic anomalies in both elements [3]. One Z grain was also measured. It had a large enrichment in $^{54}Fe$, unlike most of the X grains, as well as an excess in $^{62}Ni$. Here we report Fe and Ni isotopic measurements on 26 Z grains from the Indarch meteorite.

**Experimental:** SiC grains from the IH6 fraction (0.25 – 0.65 µm diameter) of the Indarch (EH4) enstatite chondrite were analyzed in the Washington University NanoSIMS. The $^{12,13}C$ and $^{28,29,30}Si$ isotopes were measured with the automated technique developed by [4]. Z grains were identified based on their Si isotopic compositions and criteria similar to those used in previous studies [1, 5]; the IH6 separate was chosen for its comparatively high percentage of Z grains (~8% of the presolar SiC grains) [1]. Following identification of Z grains, SEM images were taken with the Auger Nanoprobe to select good (well-isolated on the mount) candidate grains for additional NanoSIMS measurements. The $^{54,56,57}Fe$, $^{58,60,61,62}Ni$, $^{59}Co$, and $^{52}Cr$ (in order to make corrections for $^{54}Cr$ interferences) isotopes of the Z grains were subsequently measured in the NanoSIMS with a combination of magnetic peak-jumping and multidetection.

**Results:** Due to small grain size and low Fe-Ni elemental concentrations of the grains, the errors are large for individual isotopic ratios; however, roughly half of the grains are anomalous by more than 2σ in at least one isotopic ratio and several are anomalous in multiple ratios. Most of the anomalous grains contain Ni isotopic excesses or deficits relative to $^{58}Ni$, but this could be a statistical effect, as the grains are Ni-rich and thus the errors for the Ni ratios are smaller than those for the Fe ratios. At least one grain (e5-1-7-5) contains an obvious Fe-Ni subgrain, with both the Fe and the Ni signals varying together. Within errors, the isotopic composition of the subgrain appears to be similar to that of the rest of the grain. The X grains studied by [3] contained primarily Fe-rich subgrains, with little accompanying Ni, and, in some cases, the Fe anomalies were carried by the subgrains. No Fe-Ni subgrains have been previously reported in Z grains. Grain e5-1-7-5 is enriched in both $^{54}Fe$ and $^{57}Fe$ relative to $^{56}Fe$ by several hundred permil. The $^{54}Fe$ excesses in this grain, as well as in several other Z grains, are particularly difficult to explain, as low-metallicity stars are expected to have $^{54}Fe$ deficits rather than excesses [3].

**References:** [1] Zinner E. et al. 2007. *GCA* 71:4786-4813. [2] Hoppe P. et al. 1997. *ApJ* 487:L101-L104. [3] Marhas K.K. et al. 2008. *ApJ* 689:622-645. [4] Gyngard F. et al. 2009. Abstract #1386. 40th LPSC. [5] Nittler L.R. and Alexander C.M.O.D. 2003. *GCA* 67:4961-4980.