SILICON AND TITANIUM ISOTOPIC ANALYSIS OF SILICON CARBIDE GRAINS OF TYPE X AND Z. S. Amari[1], E. Zinner[1], R. Gallino[2], and C. S. Lewis[3], [1]Laboratory for Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, USA (sa@wuphys.wustl.edu), [2]Dipartimento di Fisica Generale dell'Universita' di Torino, 10125 Torino, Italy, [3]Enrico Fermi Institute, University of Chicago, Chicago, IL 60637, USA.

We measured Ti isotopic ratios of four X and two Z grains from the Murchison KJG SiC separate (average size: 3μm) [1]. These are the first Ti isotopic analyses of Z grains and are of particular interest. Z grains are believed to have formed in low-mass low-metallicity asymptotic giant branch (AGB) stars [2]. Measurements of Si and Ti isotopic ratios of Z grains provide us with the opportunity to examine both the Galactic chemical evolution of these elements and neutron-capture processes in the He-shell of AGB stars because both effects are of comparable magnitude.

Candidates of X and Z grains were located by ion imaging with the CAMECA-3f. This was followed by C, Si and Ti isotopic ratio measurements with the NanoSIMS. All four X grains have excesses in ^{49}Ti and ^{50}Ti relative to ^{48}Ti (Fig. 1a). Grain KJGN2-345-1 shows unusual Si and Ti isotopic features. In contrast to most X grains, it has a larger ^{29}Si (δ^{29}Si/^{28}Si = –589±5‰) than ^{30}Si (δ^{30}Si/^{28}Si = –412±6‰) depletion (see also Lin et al. [3]) and almost equal excesses in ^{46}Ti and ^{47}Ti. The Ti isotopic patterns of the X grains are similar to those of previously analyzed SiC X [4-6] and low-density graphite grains [7]. Three grains show the initial presence of ^{44}Ti in the form of ^{44}Ca excesses with inferred ^{44}Ti/^{48}Ti ratios ranging from 5.2×10^{-4} to 6.7×10^{-2}.

The two Z grains have relatively high ^{12}C/^{13}C ratios (93.5±0.6 for KJGN2-249-1 and 81.1±0.5 for KJGN2-415-3) but exhibit the typical Si isotopic signature of Z grains with ^{29}Si depletions and ^{30}Si enhancements (δ^{29}Si/^{28}Si = –130±5‰ and –108±5%; δ^{30}Si/^{28}Si = 201±6‰ and 392±6‰ for 249-1 and 415-3, respectively) [2]. Their Ti isotopic patterns are striking (Fig. 1b). Titanium-46, ^{47}Ti and ^{49}Ti are depleted relative to ^{48}Ti to almost the same degree for the two grains, while their ^{50}Ti/^{48}Ti ratios are quite different. Grain KJGN2-415-3 has a ^{50}Ti excess (δ^{50}Ti/^{48}Ti = 276±26‰), while grain KJGN2-249-1 has a deficit (δ^{50}Ti/^{48}Ti = –66±25‰). These ^{50}Ti/^{48}Ti ratios are positively correlated with the ^{30}Si/^{28}Si ratios of these two grains. Apparently, all original Si and Ti isotopic ratios in the parent stars of the two Z grains were lower than solar, indicating stars of low metallicity. During the 3rd dredge-up, the ^{30}Si/^{28}Si and ^{50}Ti/^{48}Ti ratios in the envelope are expected to increase more than the other Si and Ti isotopic ratios, leading to relative ^{30}Si and ^{50}Ti excesses. The correlation thus reflects the result of nuclear processes in the He-shell.

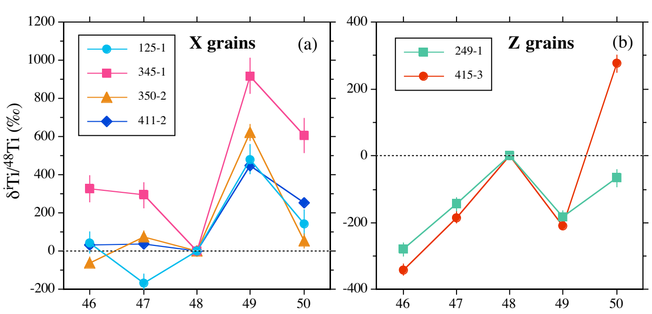

Figure 1

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