SULFUR ISOTOPIC MEASUREMENTS OF PRESOLAR SIC AGB GRAINS FROM THE INDARCH METEORITE

F. Gyngard[1], F.-R. Orthous-Daunay[1], E. Zinner[1], and F. Moynier[2]. [1]Laboratory for Space Sciences and Physics Department, Washington University, St. Louis, MO, 63130 USA. Email: fgyngard@physics.wustl.edu. [2]Department of Earth and Planetary Sciences and McDonnell Center for Space Sciences, Washington University.

Introduction: Presolar SiC grains have been identified in primitive meteorites and classified into various types based on their C, N, and Si isotopic compositions [e.g., 1]. Here we report on S isotopic measurements of SiC grains of asymptotic giant branch (AGB) star origin chemically isolated from a separate of Indarch (EH4) not treated with H_2SO_4 in order to avoid S contamination.

Experimental: Automated NanoSIMS measurements of the C and Si isotopic compositions were performed on a recent separate from Indarch [2]. After subsequent identification into various grain types, ion images of $^{12}C^{14}N^-$, $^{12}C^{15}N^-$, $^{32}S^-$, $^{33}S^-$, and $^{34}S^-$ were taken in muticollection of selected grains from all types to determine their N and S isotopic compositions. Imaging mode allowed us to assess possible contamination from nearby grains.

Results: Fourteen mainstream grains were analyzed for S isotopes and seven have depletions in ^{34}S greater than two sigma, with one grain also having a two sigma depletion in ^{33}S. Most grains show depletions in ^{34}S and have average values of $\delta^{33}S/^{32}S$ = -26‰ and $\delta^{34}S/^{32}S$ = -29‰. In addition, two out of five Y grains and one out of three Z grains analyzed also show depletions in ^{34}S at the two sigma level.

Discussion: Sulfur isotopic anomalies have been observed previously in supernova (SN) grains, both X and C [3, 4], and AB grains [5]. The S isotopic compositions of these SN grains, especially the C grains, are significantly enriched in ^{32}S, down to values of $\delta^{33}S/^{32}S$ and $\delta^{34}S/^{32}S$ of ~ -900 ‰ in one case. SiC X grains show less extreme enrichments in ^{32}S on average, which is puzzling as these grains contain large ^{28}Si excesses characteristic of the Si/S zone in SNe where ^{32}S is predominant [6]. The only experimentally known mineralogical carrier of S isotopic anomalies is oldhamite in an AB grain, but it showed evidence for heavy S [5], contrary to the present results. For mainstream grains, depletions in ^{34}S are not expected as they come from stars of solar metallicity ($Z_\odot$) and low mass (1-3 $M_\odot$). Theoretical models for these stars predict enrichments in both ^{33}S and ^{34}S [7]. Possible explanations are: matrix effects from lack of appropriate standards, the QSA effect [8], mass-dependent fractionation (the data does not seem to support this), or true nucleosynthetic anomalous S inherited from their parent stars. For Y and Z grains, which come from $< Z_\odot$ stars, moderate depletions in ^{33}S and ^{34}S are more plausible. Sulfur measurements of more of these grains and gas mass-spectrometer measurements of our standard (FeS) are planned to investigate whether these S anomalies are intrinsic or instrumental artifacts.

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