MG ISOTOPE COMPOSITIONS OF TWO SILICATE STARDUST GRAINS IN THE ACFER 094 CHONDRITE

J. Kodolányi and P. Hoppe, Max Planck Institute for Chemistry, 27 Joh.-Joachim-Becher-Weg, 55128 Mainz, Germany; E-mail: j.kodolanyi@mpic.de.

Introduction: The chemical and isotope composition of silicate material produced in stellar outflows and found in primitive meteorites tells about nucleosynthesis in parent stars and the Galactic chemical evolution of the stardust grains' constituent elements [1-3]. The Mg isotope composition of presolar silicate stardust is of particular interest because, combined with O isotope compositions, it can provide information central to understanding the Galactic isotope evolution of Mg and the production of ^{26}Al during the TP-AGB phase of stars with low to intermediate mass [2, 3]. However, Mg isotope analysis of such silicate grains is challenging because of the small size of these grains (d mostly < 300 nm) and their chemical similarity to the host meteorite matrix, potentially compromising in situ measurements and hindering chemical separation for ex situ analysis. Even the highest resolution in situ analysis technique (NanoSIMS) is unable to produce Mg isotope data on the 300 nm scale without being influenced by the isotope signal of the grains' surroundings. For this reason, Mg isotope data on presolar silicates are rare [4,5]. We applied the sample preparation procedure of [4], developed for dense grain separates, to 200-400 nm-sized in-situ stardust in the Acfer 094 primitive carbonaceous chondrite. Here we present the Mg isotope compositions of two silicate stardust grains and compare our results with previous measurements on oxide and silicate stardust.

Sample preparation and analytical methods: Presolar silicate stardust grains were identified in a petrographic thin section by their O isotope compositions using NanoSIMS (ca. 100 nm spatial resolution). After relocating the grains using secondary electron images, a focussed Ga ion beam was used to remove material around the grains in a 2.5-3 µm diameter circle to a depth of 1.5-2.5 µm. With the material around the grains removed, dilution effects for the lower spatial resolution (ca. 200-300 nm) Mg isotope analyses were minimized.

Results: Our first measurements indicate that the applied in situ sample preparation and analytical procedure yields sufficiently accurate Mg isotope compositional data for 200-400 nm silicate stardust. Two group 1 grains have been analyzed so far. They are characterized by solar ^{25}Mg/^{24}Mg (δ^{25}Mg = -9 ± 17 ‰ and 11 ± 17 ‰ relative to the meteorite matrix which is assumed to have solar isotope ratios). The ^{26}Mg/^{24}Mg of one grain was solar as well (δ^{26}Mg = -13 ± 16 ‰), whereas the other grain's ^{26}Mg/^{24}Mg differs by more than 2σ from solar with δ^{26}Mg = 35 ± 16 ‰. Assuming solar ^{26}Mg/^{24}Mg at the time of star formation and negligible effect of n-capture on the abundance of the heavy Mg isotopes during stellar evolution, an initial ^{26}Al/^{27}Al ratio of 0.016 ± 0.006 is calculated for the ^{26}Mg-enriched grain. This ^{26}Al/^{27}Al is at the upper end of compositions found in group 1 oxide grains [2, 3] but lower than the value (0.12) inferred for a group 2 silicate grain [5] and in many group 2 oxide grains [2, 3].

References: [1] Vollmer C. et al. 2008. *The Astrophysical Journal* 684:611–617. [2] Zinner E. et al. 2005. *Geochimica et Cosmochimica Acta* 69:4149-4165. [3] Nittler L. R. et al. 2008. *The Astrophysical Journal* 682:1450-1478. [4] Nguyen A. N. et al. 2010. Abstract #2413. 41st Lunar & Planetary Science Conf. [5] Nguyen A. N. and Zinner E. 2004. *Nature* 303:1496-1499.