A Light Noble Gas Inventory of Stardust Cell C2044

R. L. Palma1,2, R. O. Pepin2, A. Westphal3, D. Schlutter2 and Z. Gainsforth3

1Minnesota State University, Mankato, USA. 2University of Minnesota, Minneapolis, USA. 3University of California, Berkeley, USA.

Introduction

We have completed an extensive survey of the concentrations and isotopic compositions of helium and neon in the following samples from Stardust cell C2044:

- aerogel with embedded particle fragments from the Track 41 wafer (C2044,86)
- aerogel without particle fragments from a "blank" wafer adjacent to Track 41
- wafer samples, a survey of 70 smaller aerogel blocks without observable particle fragments was a reiteration from aerogel around Track 41. Earlier progress reports have been made on this project [7, 8].

Results from aerogel blocks

70 Samples, 3 Basic Categories:

- 9 samples had blank gas levels
- 14 samples had traces of He and/or Ne
- 7 samples had sufficient He and/or Ne to determine isotopic compositions

Of the 7 samples with sufficient gas concentration for accurate isotopic determination of He and/or Ne (see Table above), one (C2044,73) has the elevated 4He/3He and low 4He/21Ne ratios characteristic of Sample "X" and potential presolar grains from neon novae [6]. Another of the 7 samples, C2044,46, released the highest abundance of Ne, while He was consistent with the blank value. The resulting lower bound of 0.015 for He/Ne is similar to the highest values for this ratio observed in IDPs [7]. An elevated 4He/3He ratio of 1.12 x 10² was also measured by Füri and Marty [2] in another blank aerogel block (C2044,25) with single step laser desorption. Most samples with sufficient helium for He/Ne ratio determination has values similar to the modern solar wind, within the uncertainty of the measurements.

Conclusions

Light noble gases appear to be distributed erratically in a "halo" surrounding Track 41 in cell C2044.

The wide array of helium and neon isotopic compositions and their release from aerogel relatively far from the Track 41 center line (up to ~6 mm) and the surface of cell C2044 (up to ~3 mm) poses significant difficulty to understanding the origin of these gases, especially if they are related to the original Track 41 impactor. Even if some mechanism can be invoked to provide the transfer of unobserved fragments from the Track 41 impactor to the aerogel samples analyzed, the ultimate origin of gases with such wide compositional differences within a single impactor suggests a complicated parent particle indeed.

References