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PRELIMINARY STUDIES OF Xe AND Kr FROM THE GENESIS POLISHED ALUMINUM COLLECTOR

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Introduction: Low solar wind (SW) abundances of Xe and Kr require a large collector area to provide measurable quantities of these rare gases. Originally we planned to use large areas of Al on Sapphire (AloS) collectors, but the hard landing of Genesis fractured these collectors, changing our initial plans. The only large, relatively intact, surface exposed to SW was the kidney-shaped polished aluminum T6-6061 alloy (AlK) designed to serve as a thermal shield rather than a SW collector. Here we describe what has been done and the problems remaining to be solved for optimized Xe and Kr abundances and isotopic compositions from the AlK.

Experimental: A laser extraction technique was developed for the AlK with controlled depth resolution using 7 ns-pulsed (30Hz) UV laser (266 nm). Longer focal length (100 mm) optics and a deeper cell were needed for acceptable laser extraction from the distorted surface of the post-impact AlK collector. A large area (~10 cm^2) is needed to recover enough Kr and Xe for reasonably precise measurement. A sliding shutter with a narrow slit was installed in the cell to protect the sapphire viewport from deposition of some of the Al sputtered during raster of these large areas. Noblesse, our new 8-multiplier mass spectrometer, was designed for Kr and Xe measurements and, prior to this, it has only been exposed to atmospheric noble gases.

Results: Diffusion losses from the aluminum alloy heat shield are much greater than from the AloS collectors. AlK has apparently lost ~35% of SW-He and ~15% of SW-Ne [1], but this trend suggests that the AlK retained most of its Kr and Xe. Blanks for Kr and Xe remain a problem due to the complex design including a linear-motion feedthrough for the shutter and the long raster times required for the areas extracted. Electropolishing of all internal surfaces, two-week bake (with AlK samples included) at 215 °C, and extensive exercising of moveable parts to reduce gas release in flexing have allowed us to reduce Xe blanks to about 1×10^{-15} c^3 $STP^{132}Xe$, equivalent to that contained in ~2 cm^2 of this collector. However, the first attempt to study the AlK revealed a new problem—an unknown contaminant released from AlK that was not completely removed by gettering. Nevertheless, both the observed $^{84}Kr/^{132}Xe$ ratio of ~16 and the lighter than atmospheric Xe composition suggest a mixture of ~1 part SW-Xe and ~3 parts atmospheric Xe, about 3 times more than expected from blanks. Work is underway to discover the contaminant and develop a more efficient cleaning protocol for heavy noble gases released from AlK Genesis collector. We will report data from areas large enough for reasonably precise Kr and Xe once proper gettering is established.

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LIBNUCNET: A TOOL FOR UNDERSTANDING NUCLEOSYNTHESIS

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Introduction: With recent advances, the sciences of nucleosynthesis and meteoritics have become increasingly intertwined (e.g., [1]). This is true in particular for the study of presolar grains (e.g., [2]) and the study of extinct radioactivities in primitive meteorites (e.g., [3]). Such intergrowth of the two sciences is calling for increased sophistication on the part of practitioners in either field regarding the details of the other.

Libnucnet: In order to help facilitate an understanding of nucleosynthesis by the broadest possible community, we are releasing libnucnet, our code module for computing yields from nuclear reaction networks. Libnucnet is free software written in the C programming language. It is available at http://www.webnucleo.org/home/modules/libnucnet.

Libnucnet is built on top of other freely available and well-tested code modules-libgdome and gsl (the GNU Scientific Library). We provide tutorials and over twenty code examples that demonstrate how to download, install, and use libnucnet.

The API: While one goal of our release of libnucnet is to allow students and professionals to gain a better appreciation of nucleosynthesis theory by running their own calculations, another is to provide a useful module for modelers to incorporate into their own codes. The libnucnet application programming interface (API) is straightforward to use and is documented online at the webnucleo.org web site. Libnucnet's flexibility and capacity to handle multiple excited states within a single nuclear species and multiple physical zones in an astrophysical model should make it an excellent choice for many applications.

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