HELIUM AND NEON IN STARDUST AEROGEL SAMPLES FROM CELL 2044 ADJACENT TO TRACK 41

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Introduction: We have measured the concentrations and isotopic compositions of He and Ne by stepwise pyrolysis in >20 Stardust cell 2044 aerogel samples adjacent to track 41 and without visible particle fragments. Analyses were previously done on five 200μm thick blank aerogel "wafer" samples from this cell [1], four with area of ~15-20mm^2 and one ~41mm^2. Three of these samples released sufficient He and Ne for multiple stepwise heating analyses, with integrated isotopic compositions of $^3He/^4He = (3.4–3.7) \times 10^{-4}$, $^{20}Ne/^{22}Ne = 10.6–13.2$ and $^{21}Ne/^{22}Ne = 0.021–0.034$. A fourth sample ("X") released extremely high abundances of He and Ne between 800 and 900°C, accompanied by large amounts of water and hydrocarbons. A mass spectrometer memory effect only allowed limits to be placed on the measured isotopic compositions of "X"; nonetheless, these limits, $^3He/^4He < 2.27 \times 10^{-4}$ and $^{20}Ne/^{22}Ne > 18.0$, were intriguing in light of elevated $^{20}Ne/^{22}Ne$ ratios also observed in IDPs that may have originated in comets 26P/Grigg-Skjellerup and 55P/Tempel-Tuttle [2], prompting this study of more "blank" aerogel samples from cell 2044 between track 41 and the location of sample "X".

Samples: Samples were prepared from a 1.5mm-thick slice of aerogel cut parallel to track 41 and ~2mm away from it. The slice was divided into 54 ~(1.5mm)^3 samples. Samples were wrapped in Pt foil at UC Berkeley, ready for attachment to electrical leads in the UM multiple sample furnace. Blank Pt foil packets were also loaded for blank procedure background analyses. System bakeout took place at ~150°C for 3 days after sample loading, and all sample and blank foils were heated and analyzed by the same procedures, similar to those described in [3]. Two heating steps (<200°C) were first done to remove any surface sited contamination. Except in one case where significant He was evolved at <200°C, the He and Ne released in these steps was equal to that measured in both cold procedural and hot blank foil runs. Seven sequential pyrolysis steps were then carried out (maximum T ~1400°C), with the total gas released then analyzed for He and Ne gas concentrations and compositions.

Results: About half of the samples had ^4He and ^{20}Ne above blank levels, although not necessarily in the same samples. Average $^3He/^4He$ in all samples releasing gas with detectable ^3He at T >200°C was $4.9 \pm 0.4 \times 10^{-4}$, close to solar. Due to low gas abundances, most Ne isotopic ratios had large uncertainties. Averages of $^{20}Ne/^{22}Ne$ and $^{21}Ne/^{22}Ne$ over the sample suite are approximately compatible with air ratios. In only 5 cases were both ^4He and ^{20}Ne detectable in the same sample, and the range of $^4He/^{20}Ne$ was relatively narrow, 2.3–5.6.

Conclusions: Overall the data suggest the presence of a small but real solar-like He component erratically distributed through the samples, together with traces of air Ne contamination. Average measured amounts of ^4He and ^{20}Ne in this survey are respectively factors of ~1400 and ~300 below those found in sample "X". This survey of aerogel taken from the neighborhood of track 41 and "X" is continuing. To date no abundance or isotopic signals remotely similar to sample "X" have been observed.

References: [1] Palma R. et al. (2009) *Met. Planet. Sci.* 44, A164. [2] Palma R. et al. (2005) *Met. Planet. Sci.* 40, A120. [3] Marty B. et al. (2008) *Science* 319, 75-78.