MASS-FRACTIONATION INDUCED BY THE GENESIS SOLAR WIND CONCENTRATOR: ANALYSIS OF NEON ISOTOPES BY UV LASER ABLATION.

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The solar wind (SW) concentrator, a key instrument onboard the Genesis Mission, was designed to provide larger fluences of implanted SW for precise isotope analyses of oxygen and nitrogen [1]. SW ions in the mass range 4 - 28 amu were accelerated and focussed onto a "concentrator target" by an electrostatic mirror. This concentration process caused some instrumental mass fractionation of the implanted SW ions as function of the radial position on the target. Correction of this fractionation will be based on a combination of the measured radial fractionation of Ne isotopes with results of simulations of the implantation process using the actual performance of the concentrator and the SW conditions during exposure. Here we present He and Ne abundance and Ne isotopic composition data along one arm of the gold cross that framed the 4 concentrator sub-targets.

He and Ne were released from pits ~120 m in diameter by UV laser ablation using a 248 nm Eximer laser [2]. In the first 34 analyses He and Ne were analysed together at constant analytical conditions. In a second set of 16 analyses, He and Ne were separated to protect the mass spectrometer from solar ^{3}He. In total, 12 positions along the arm (30 mm long) were analysed, each with 1 to 6 single analyses. He and Ne abundances increase from the edge (at 30 mm) towards the centre of the concentrator cross, He from 5.3E+15 ions/cm^2 (at 20.5 mm) to 1.8E+16 ions/cm^2 (at 2.9 mm) and Ne from 3.5E+12 ions/cm^2 (at 29.4 mm) to 3.4E+13 ions/cm^2 (at 1 mm). Thus, the concentration factor increases by about a factor of 10, similar to expected values from post-flight models for oxygen. Applying a simplified backscatter correction measured and expected Ne abundances agree within 20%. The measured Ne isotopes show a large mass fractionation as function of the target radius. The ^{22}Ne values (relative to SW ^{20}Ne/^{22}Ne of 13.75, [3]) range from –19‰ (at 26 mm) to +40‰ (at 2.9 mm), reflecting a preferential implantation of the heavier isotopes towards the centre of the concentrator target. Precision of the ^{20}Ne/^{22}Ne ratios, expressed as error of the mean, is on average 4‰ (2) for the analyses in which He and Ne were not separated. More work is needed to reduce the considerably larger scatter observed so far in the analyses where He and Ne were separated. The obtained Ne isotope fractionation curve resembles, in shape and extent of fractionation, the post-flight modelled ^{18}O curve. The two curves are offset by about 10‰. This is probably to be explained by the missing backscatter correction for the measured Ne isotopes. At the conference we will compare measured Ne data with simulated results of Ne implantation at SW conditions prevalent during Genesis collection period.

References: [1] Wiens R. C. et al. (2003) Space Sci. Rev. 105, 601-625. [2] Heber V. S. et al. (2006) 37th LPSC abstract, CD #2175. [3] Grimberg A. et al. (2006) 37th LPSC abstract, CD #1782.