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Noble gases of solar wind origin in Surveyor 3 material

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The Apollo 12 astronauts salvaged an unpainted Al-tube from the Surveyor 3 spacecraft. He and Ne were measured in a small ring cut from this tube. The lower side of the tube is contaminated by lunar dust, which cannot be completely removed by ultrasonic cleaning. The upper half is essentially dust free and contains trapped solar wind He and Ne with $\text{He}_4/\text{Ne}^{20} = 295$ in the trapped gas. The $\text{He}_4$ distribution around the Al-tube is in agreement with the theoretically expected distribution and corresponds to an average solar wind $\text{He}_4$ flux of $7 \times 10^6$ cm$^{-2}$ sec$^{-1}$. The value lies within the range of $\text{He}_4$ fluxes observed by other experiments. However, we cannot exclude diffusion loss and the true average flux may be higher. The observed $\text{He}_4/\text{Ne}^{20}$ ratio of 295 corresponds, after correction for differences in trapping efficiencies between $\text{He}_4$ and $\text{Ne}^{20}$, to a solar wind $\text{He}_4/\text{Ne}^{20}$ ratio of 335. This value is lower than the ratios measured by the Apollo 11 and 12 SWC experiments (430 and 620 respectively). The low $\text{He}_4/\text{Ne}^{20}$ ratio obtained from the Surveyor 3 material could be due to $\text{He}_4$ diffusion losses or a
residual small contamination with lunar dust. Neglecting the possible
small influence of these two effects we obtain the following average
isotopic compositions for the solar wind during the exposure of the
Surveyor 3 material: $\text{He}^4/\text{He}^3 = 2700 \pm 100$; $\text{Ne}^{20}/\text{Ne}^{22} = 13.3 \pm 0.4$;
and $\text{Ne}^{22}/\text{Ne}^{21} = 31 \pm 5$. Compared with the Apollo 11 and 12 SWC results
the $\text{He}^4/\text{He}^3$ ratio is unexpectedly high. Possible mechanisms which may
have changed this ratio will be discussed.