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Improvement of Cl-36 measurements at the Tsukuba 6 MV AMS facility

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Long-lived nuclides ^{10}Be, ^{14}C, ^{26}Al, ^{36}Cl, ^{41}Ca, ^{90}Sr, and ^{129}I have been successfully detected with the 6 MV accelerator mass spectrometer at the University of Tsukuba [1]. ^{36}Cl is one of the most difficult radionuclides to measure due to contamination with the interfering isobaric ^{36}S. Sulfur itself is easily present in the environment, making its removal difficult. In order to separate and discriminate ^{36}S, we have studied acceleration conditions, methods to reduce ^{36}S in the beam itself emitted from the Cs sputtering ion source, and to separate and identify the spectrum between ^{36}Cl and ^{36}S incident on the detector [2]. To reduce ^{36}S, we compared the material of the cathode in which the sample is loaded, a copper cathode filled with AgBr powder and a cathode with Ta metal attached. The sample cathode made of Cu, filled with AgBr, and with a 1 mm diameter hole had the lowest contamination of ^{36}S. When the sample volume is large, AgCl is placed on the entire surface. In addition, we attempted to suppress ^{36}S contamination by covering the surface of the wheel disk with a 0.5 mm Ta plate. As a result, the contribution of ^{36}S was reduced by a factor of 50. ^{36}Cl detection performances of Cl^{5+} (30.0 MeV), Cl^{7+} (48.0 MeV), and Cl^{8+} (54.0 MeV) were compared by acceleration at 6 MV. We also compared how the spectrum separation changes with the gas pressure in the gas ionization chamber. As a result, background values were ~3×10^{-15} for all charge numbers q=5+, 7+, and 8+. Cl^{7+} (48.0 MeV) is commonly used for ^{36}Cl AMS at the University of Tsukuba because the beam transmittance is as high as about 14% and the effect of interfering nuclides on the spectrum is small. In this presentation, we will report on progress in ^{36}Cl AMS detection techniques and applied researches with the 6 MV tandem accelerator.

References

[1] K. Sasa et al., Nucl. Instrum. Methods Phys. Res. B, 437 (2018) 98.

[2] S. Hosoya, K. Sasa et al., Nucl. Instrum. Methods Phys. Res. B, 438 (2018) 131.

Student Submission

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