PERFORMANCE COMPARISON OF METHODS FOR THE DETECTION OF ^{10}Be AT THE HELSINKI AMS FACILITY

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Accelerator mass spectrometry (AMS) is used for the measurement of ultra-low isotope ratios, emphasizing long half-life radionuclides, applications reducing the carbon footprint, and raising the socio-economic impact of sustainable development. ^{10}Be with a half-life of 1.4~Ma is a naturally occurring radionuclide of cosmogenic origin with a wide range of applications, among others, in geological and environmental sciences supporting research and climate monitoring. AMS can separate interfering isobars, and measurement of ^{10}Be/^{9}Be ratios at the level 10^{-16} or below is also possible [1]. At the University of Helsinki, we have a 5 MV tandem accelerator that is routinely used for ^{14}C dating. In an ongoing project, we are developing the capability of our tandem accelerator to measure ^{10}Be. In this work, different detection systems, which can separate atomic and molecular isobars, are studied. These detection systems were tested during the first measurements using neutron activated BeO samples.

We investigated the response of two detector systems, namely, a Si detector and a gas ionisation detector with and without absorbers for the B and Be ions. We have carried out simulations of the effect of absorbers using SRIM. In the experimental setup, passive and active absorbers were placed in front of the detector in a vacuum chamber. As a passive absorber, we used Havar foils with a thickness range of 2 – 10 μm, and as an active absorber isobutane gas was used. The SRIM output was convoluted with the measured detector response. In this way, we were able to simulate the actual response of the detector system with absorbers. By a combination of experimental and simulated results, we were able to find out which detector type, together with what thickness of the absorber, would be ideal.

Through our previous work [2], we have determined the charge state to have the highest yield of Be through our tandem accelerator. By selecting the +2 charge state and a terminal voltage above 4MV, we obtain the best transmission of ^{10}Be through our system, dependent on the molecular background. Thus, in order to measure ^{10}Be, a proper detection system is required. The competing B-Be isobars were measured showing good energy separation. Isotopic ratios of ^{10}Be/^{9}Be were measured and compared to standards. To conclude, we make performance comparisons of the Si detector and a gas ionisation detector with and without passive absorbers in the context of ^{10}Be AMS. These results will be useful to the AMS community and can be used as a guidepost for ^{10}Be AMS. We report on first ^{10}Be AMS measurements from standards and activated BeO.

REFERENCES

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