



Contribution ID: 226 Contribution code: PSA-39

Type: Poster

Pushing the limits of ^{26}Al at MILEA

Monday, 21 October 2024 17:15 (20 minutes)

Competitive AMS measurements of ^{26}Al are possible at low ion energies. Selecting Al^- as a negative ion for the tandem accelerator has the benefit of the complete suppression of the interfering isobar ^{26}Mg . However, because of the notoriously low yield of Al^- from a Cs sputter ion source, we have to pull out all the stops to improve the overall efficiency, in particular the ionization yield at the ion source, the transmission through the accelerator and the detection efficiency. Here we describe the performance of Al^- measurements on the 300 kV MILEA multi-isotope AMS system and discuss the critical components and their optimization.

Mixing the Al_2O_3 sample material with a carefully selected metal powder in an optimal mixing ratio can result in a high practical overall. We investigated several commonly used metal powders in different mixing ratios and found that, for our ion source, the optimal mixing ratio is 1:1 Al_2O_3 with Cu (by weight). With this mixing ratio, an ionization yield of 0.08% was achieved after 4 h of sputtering.

At low energies and by using He stripping the highest transmission can be achieved by selecting the 2+ charge state (Al^{2+}) on the HE side. We investigated the transmission and deduced stripping yields for Al over the energy range accessible at MILEA (~100-330 keV). Highest transmission close to 60% was found at around 250 keV for the 2+ charge state. However, even at much lower energies of 140 keV transmission values for 2+ charge state of ~50% are found, indicating that ^{26}Al measurements are possible at very low energies with only slightly reduced yield.

Selecting the 2+ charge state for ^{26}Al , however, has the drawback that the mass/charge ambiguity of $^{13}\text{C}^+$ has to be suppressed. At low ion energies this can be solved using a passive absorber cell in front of the gas ionization detector, because at energies below ~500 keV/u the range of ^{13}C is significantly shorter than ^{26}Al , partly increased by anomalies in the stopping cross section. By optimizing the absorber geometry we can detect most of the ^{26}Al despite the low residual ion energy and measure the nominal ratio to ~88%.

In practice, most geological samples are not limited by the amount of sample material, but by low $^{26}\text{Al}/^{27}\text{Al}$ ratios. With long measurement times we can still achieve high overall efficiencies of a few 0.01% resulting in statistical errors comparable to ^{10}Be . Currently, however, cross-talk at the ion source seems to be the ultimate limit for the background and a careful assessment of this contribution is needed to fully exploit the high efficiency measurements at the low concentration limit.

Student Submission

No

Primary authors: VOCKENHUBER, Christof (ETH Zurich, Laboratory of Ion Beam Physics); GAUTSCHI, Philip (ETH Zurich, Laboratory of Ion Beam Physics); Mr STREBEL, Silas (ETH Zurich, Laboratory of Ion Beam Physics); CHRISTL, Marcus (ETH Zurich, Laboratory of Ion Beam Physics)

Presenter: VOCKENHUBER, Christof (ETH Zurich, Laboratory of Ion Beam Physics)

Session Classification: Poster Session A

Track Classification: New and Advanced AMS Techniques