Progress in the determination of ^{10}Be using Accelerator Mass Spectrometry in the CENTA laboratory

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^{10}Be is a long-lived radioactive cosmogenic isotope of beryllium (half-life 1.387 Ma), produced by high-energy cosmic rays in the Earth's environment, dominantly in the atmosphere. It serves as an important tracer, frequently used for dating in geosciences and has many applications in Earth and environmental sciences. Due to its long half-life and beta decay mode, accelerator mass spectrometry is dominantly used for the ultratrace concentration determination of ^{10}Be in natural samples.

The CENTA laboratory, founded in 2013, was equipped with a 3 MV Pelletron accelerator. Our initial attempts at measuring ^{10}Be in 2015 (Ješkovský et al., 2015) were limited by insufficient background suppression in the high-energy part of the beamline. In 2023, a major upgrade of the beam line was implemented, allowing better suppression of interfering ions; however, for suppression of ^{10}B, the main isobar for ^{10}Be, additional methods need to be implemented.

For the full suppression of ^{10}B, an absorption technique in front of the gas ionisation detector was used, while a stack of silicon nitride foils with a defined areal density was used as an absorber. This technique was tested by using a 2^+ charge state, for higher transmission and a gas ionisation chamber supplied by NEC. Standard reference materials with an isotopic ratio of ^{10}Be/^{9}Be ranging from 2.502×10^{-11} to 1.01×10^{-13}, obtained from University of California (Nishiizumi, 2022), were used for the determination of linearity in this range. When the production of BeH molecules was suppressed by increasing the pressure of the stripper gas in the accelerator, a background level of about 10^{-14} was achieved.

References

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