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Stepped-up development of AMS for the detection of ^{60}Fe with the HI-13 tandem accelerator

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The Moon provides a unique environment for investigations of nearby astrophysical events such as supernovae. Lunar samples retain valuable information provided by these nearby astrophysical events, via detectable long-lived ”fingerprint” radionuclides such as ⁶⁰Fe.

In this work, we stepped up the development of an accelerator mass spectrometry (AMS) method for detecting ⁶⁰Fe using the HI-13 tandem accelerator at the China Institute of Atomic Energy. Since interferences could not be sufficiently removed with the existing magnetic systems of the tandem accelerator and the following Q3D magnetic spectrograph, a Wien filter with a maximum voltage of plusmn;60nbsp;kV and a maximum magnetic field of 0.3nbsp;T was installed after the accelerator magnetic systems to lower the detection background for the low abundance nuclide ⁶⁰Fe. A 1nbsp;micro;m thick Si₃N₄ foil was installed in front of the Q3D as an energy degrader. For particle detection, a multi-anode gas ionization chamber was mounted at the center of the focal plane of the spectrograph. Finally, an ⁶⁰Fe sample with an abundance of 1.125 times; 10⁻¹⁰ was used to test the new AMS system. The results indicate that ⁶⁰Fe was clearly distinguished from the isobar ⁶⁰Ni. The sensitivity was evaluated to be better than 4.3 times; 10⁻¹⁴ based on the 5.8 hours blank sample measurements, and the sensitivity could in principle be expected to be about 2.5 times; 10⁻¹⁵ when the data are accumulated for 100 hours which is feasible for future lunar sample measurements because the main contaminants were sufficiently separated.

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