Study of $^{236}U/^{238}U$ ratio at CIRCE using a 16-strip silicon detector with a TOF system

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Accelerator Mass Spectrometry (AMS) is presently the most sensitive technique for the measurement of long-lived actinides, e.g. ^{236}U and ^{239}Pu. A new actinide line [1,2,3,4], based on a 3-MV AMS pelletron tandem system, is operated at the Center for Isotopic Research on Cultural and Environmental heritage (CIRCE) [5] in Caserta, Italy.
In order to validate the energy and position determinations of the ^{236}U ions, the energy calibration of the 16 strip silicon detector was verified by comparing the pulse height defect with the literature values.

Results on $^{236}U/^{238}U$ isotopic ratio show that the background level of about 3×10^{-11} ($5x10^{-12}$ was obtained just with the central strip) can be reached using a Time of Flight-Energy (TOF-E) system in conjunction with the 16-strip silicon detector with a flight path of 1.5 m. This value is just slightly better than the upper limit of 6×10^{-11} estimated from the yield distribution vs strip number measured without the TOF-E system [2]. We interpret this result as a consequence of the angular straggling due to the thickness of the carbon foil, which deteriorates the spatial separation of the interfering ions with respect to ^{236}U.

In this picture to identify more precisely the background contributions and their spatial distributions an upgrade of the CIRCE actinides detector system is planned for the future using a TOF-E system, with a longer flight path, a thinner carbon foil and a 16 strip silicon detector.

[1] M. De Cesare et al., Nucl. Inst. and Meth. in Ph. Res. B, 268 (2010) 779
[2] M. De Cesare et al., Radiocarbon 52 Nr 2-3 (2010) 286
[3] M. De Cesare, Nuclear Power - Control: Reliability and Human Factors, ISBN 978-953-307-599-0, 2011
[4] M. De Cesare et al., Nucl. Inst. and Meth. in Ph. Res. B, 294 (2013) 152
[5] F. Terrasi. et al., Nucl. Inst. and Meth. in Ph. Res. B, 259 (2007) 14
[6] L. K. Fifield et al., Nucl. Inst. and Meth. in Ph. Res. B, 117 (1996) 295