Potential of AMS for quantifying long-lived reaction products

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Accelerator mass spectrometry (AMS) represents a powerful technique for the detection of long-lived radionuclides through ultra-low isotope ratio measurements. In many cases, counting atoms rather than measuring decay products yields much higher sensitivities. The potential of AMS will be demonstrated on typical radionuclides of interest with half-lives between some tens of years up to hundred million years.

A variety of nuclides are produced both in nature (e.g. cosmogenic) as well as in man-made fission and fusion devices. Particularly long-lived radionuclides may lead to significant long-term waste disposals. In addition, long-lived radionuclides can also serve as diagnostic tools for different applications. For such nuclides, production cross-sections as well as total induced activities are key parameters. Therefore, well-established data on their production rates are highly desired.

The Vienna Environmental Research Accelerator (VERA) represents a state-of-the-art AMS facility which provides the ability for quantifying nuclides over the whole mass range. Some of the routinely measured radioisotopes are e.g. ^{10}Be, ^{14}C, ^{26}Al, ^{129}I, ^{182}Hf, ^{236}U and ^{244}Pu . Another example, complementing the VERA lab, are AMS facilities which provide high particle energies. For example, the AMS setup at the Accelerator laboratory in Munich, which comprises a 14-MV tandem accelerator in combination with a gas-filled-magnet system. This combination offers the best suppression of isobaric background, in particular in the medium mass range: Isotopes like ^{63}Ni, ^{53}Mn, ^{59}Ni, ^{41}Ca, ^{60}Fe are routinley measured in a wide range of applications.

Lack of information exists for a list of nuclides as pointed out by nuclear data requests. The potential of AMS will be demonstrated by means of some prime examples: E.g. the precise measurement of the ^{27}Al(n,2n)^{26}Al excitation function. In addition, a brief overview on detection limits and applications for a variety of long-lived radionuclides will be presented.

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