Accelerator mass spectrometry measurement of the reaction ^{92}Zr(n,γ)^{93}Zr at stellar energies

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Zirconium isotopes are predominantly produced by the slow neutron capture process (*s*-process). Maxwellian averaged cross sections (MACS) for neutron capture in the keV region are one of the key parameters to model this astrophysical process. They are particularly interesting in the mass region between 90-100 amu, as this is the matching area between the main and the weak component of the *s*-process, taking part in two different stellar environments. However, significant uncertainties in the experimental data and deviations between theoretical predictions and experimental data for several neutron capture reactions in this mass region remain.

A combination of activation technique and accelerator mass spectrometry (AMS) was used to determine the MACS of the reaction ^{92}Zr(n,γ)^{93}Zr. This method provides a different approach compared to previous time-of-flight (TOF) measurements and hence addresses different systematic uncertainties. Zirconium oxide pellets enriched in ^{92}Zr were irradiated with a quasi-Maxwellian neutron spectrum of 30 keV at the Liquid Lithium Target beamline of the Soreq Applied Research Accelerator Facility. AMS measurements of the reaction product ^{93}Zr were performed at the Heavy Ion Accelerator Facility (HIAF) of the Australian National University in Canberra. The main challenge in AMS of ^{93}Zr is the interference from the stable isobar ^{93}Nb. The high particle energies available at HIAF are ideal to tackle this challenge. Recently we have developed the technique to measure ^{93}Zr with the required sensitivity and efficiency for such studies. Here we will present preliminary AMS results for the ^{92}Zr(n,γ)^{93}Zr capture cross section, which were found to be in fair agreement with the latest TOF measurement by Tagliente et al [1].

References

[1] G. Tagliente *et al.* (The n-TOF collaboration), Phys. Rev. C **81**(2010)055801.