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Neutron capture and total cross-section measurements on Mo isotopes at n_TOF and GELINA

The neutron-induced reaction cross-sections for molybdenum, particularly the capture cross-sections, are relevant across various scientific fields, from nuclear astrophysics to nuclear technologies. Molybdenum isotopes are present as fission products in conventional nuclear reactors and its use is under study for potential applications in next-generation fission and fusion reactors. Additionally, molybdenum isotopes are observed in pre-solar silicon carbide (SiC) grains, where precise neutron capture cross-sections are essential for constraining models of stellar nucleosynthesis, especially in Asymptotic Giant Branch (AGB) stars where the s-process is active. Discrepancies in model predictions of isotopic compositions in SiC grains have emerged when using Mo cross-section data from the two primary KADoNiS database versions. This shows the importance of an accurate knowledge of the total and capture cross-section for molybdenum isotopes.

However, available experimental data for neutron capture cross-sections of Mo isotopes exhibit substantial uncertainties. This is also reflected in the large uncertainties of the cross-sections recommended in the ENDF/B-VIII.0 library, where uncertainty levels can reach up to 40% for certain isotopes. The uncertainty on the data in the literature has an effect in the uncertainty of the MACS (Maxwellian Averaged Cross Section) found in the latest version of KADoNiS, which presents uncertainties on the level of 10% in the MACS at 30 keV for all the molybdenum isotopes. One of the reasons for these large uncertainties is related to the absence of transmission data for enriched samples.

For these reasons a series of neutron induced cross section measurements were performed on all the natural occurring isotopes of molybdenum. The measurements were performed in two different neutron time-of-flight facilities n_TOF (CERN, Switzerland) and GELINA (EC-JRC Geel, Belgium). This work presents preliminary results from transmission and radiative neutron capture measurements conducted at n_TOF and GELINA for the isotopes ^{94}Mo, ^{95}Mo, and ^{96}Mo. Moreover, the first results of the latest capture measurements performed at both experimental areas of n_TOF on ^{92}Mo,^{97}Mo,^{98}Mo, and ^{100}Mo will be presented.

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