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Measurements and model calculations of activation reaction rate for (n,p) reaction on 54Fe isotope

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In China Fusion Engineering Testing Reactor (CFETR) research, the blanket neutronics experiment is essential in validating the neutronics codes and tools used in blanket. The neutron activation method, supported by neutron transport calculations, is particularly useful in the estimation of the neutron intensity in the blanket, which based on the estimation of the activation reaction rate.
Due to Fe is a significant component of the structural material of blanket, including Water Cooled Ceramic Blanket(WCCB), the accuracy of the reaction rate of 54Fe(n,p)54Mn was investigated. We conducted activation experiment of Fe in the 252Cf neutron field. The neutron source intensity of 252Cf is 3*108n/s. After irradiated for 5 days, the activated Fe foil was measured by a high resolution gamma-ray spectrometer with a high-purity Germanium (HPGe) detector. The neutron flux calculations were carried out using Monte Carlo transport code and FENDL 3.0 Files. The neutron group cross section was calculated by NJOY .
The half-life of the product 54Mn, 312.3d, is much longer than 56Mn, so it should be taken into consideration in the radiation shielding calculation of the WCCB. The relative error between the calculated and experimental value is 9.72%. The main sources of the error are coming from the neutron source intensity, the calculation of HPGe efficiency, gamma full energy peak counts and etc.

Eligible for student paper award?

Yes

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