

Symposium on Nuclear Data 2020

Ag102 12.9 m	Ag103 65.7 m	Ag104 69.2m	Ag105 41.29 d	S ymposium on	Ag107 51.839 %	Ag108 2.37 m	Ag109 48.161 %	Ag110 24.6 s	Ag111 7.45 d	Ag112 2.130 s
Pd101 8.47 h	Pd102 1.02 %	Pd103 16.991 d	Pd104 11.14 %	Pd105 22.33 %	N uclear	Pd107 4.36 s	Pd108 26.46 %	Pd109 11.700 s	Pd110 11.72 %	Pd111 20.1 m
Rh100 20.8 h	Rh101 3.3 y	Rh102 1.75 y	Rh103 100 %	Rh104 42.3 s	Rh105 35.95 h	D ata	2020 Nov.	Rh108 5.1 m	Rh109 89 s	Rh110 3.3 s

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Optimization of Activation Detector for Benchmark Experiment of Large-angle Elastic Scattering Reaction Cross Section by 14MeV Neutrons / 14MeV 中性子による大角度弾性散乱反応断面積ベンチマーク実験のための放射化検出器の最適化

Thursday, 26 November 2020 17:05 (1h 45m)

 The elastic scattering reaction cross section data commonly show smaller in backward angles compared to those of forward angles when the energy of the incident neutron is high. However, in high neutron flux field, such as fusion reactor, the back-scattering reaction cross section is becoming not negligible on the calculation result. Until now, there were differences reported between experimental and calculated values of neutron benchmark experiments using a DT neutron source, which focused on back-scattering phenomena like a gap streaming experiment. For this problem, the author's group developed a benchmark method for large-angle scattering cross sections and has carried out experiments with an iron sample for the last few years. The benchmark method was successfully established based on the activation of Nb foil having a large activation cross section at around 14 MeV.

 We are now planning to carry out benchmark experiments for other fusion structural materials such as tungsten, lead, F82H and so on. And in the next step, we aim to consider benchmark experiments for lighter materials like Li, Be, B, C, N and O. In this case, the energy of neutrons generated by backscattering is low. Especially for Li, being one of the most important materials in fusion reactor, back-scattering neutrons cannot be captured by Nb foil due to the high threshold energy of $^{93}\text{Nb}(n,2n)$ reaction.

 In this study, to solve this problem, we examined possible nuclides having a low activation reaction threshold energy, so that it can react with low energy neutrons generated by the backscattering of Li, and simultaneously having not too low threshold energy, so that the influence of room-return neutrons can be eliminated properly. The optimization was achieved by calculating and comparing the number of counts for all the possible reactions of all the existing stable nuclides considering appropriate irradiation and measuring times. The activation reaction cross section data were taken from JENDL/AD-2017.

 As a result, we have found that $^{181}\text{Ta}(n,2n)$ was the most suitable reaction giving us the largest number of counts in an acceptable short experimental time. Then experiments were carried out to confirm whether $^{181}\text{Ta}(n,2n)$ cross section was consistent with the nuclear data.

Primary author: RYOHEI 峻平, Takehara/竹原 (Graduate school of Engineering, Osaka University/大阪大学工学研究科)

Co-authors: Mr FUKUI/福井, Kazuki/和輝 (Graduate school of Engineering, Osaka University/大阪大学工学研究科); Mr ARAKI/荒木, Sota/颯太 (Graduate school of Engineering, Osaka University/大阪大学工学研究科); Dr TAMAKI / 玉置, Shingo / 真悟 (Osaka University/大阪大学); Ms KUSAKA / 日下, Sachie / 祐江 (Osaka University/大阪大学); Prof. MURATA / 村田, Isao / 勲 (Osaka University/大阪大学)

Presenter: RYOHEI 峻平, Takehara/竹原 (Graduate school of Engineering, Osaka University/大阪大学工学研究科)

