

Nuclear Data Evaluation Lab. (NDEL) of Korea Atomic Energy Research Institute (KAERI)

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Young-Ouk LEE (yolee@kaeri.re.kr)

Web: <http://www.atom.kaeri.re.kr>

0. General

Nuclear Data Evaluation Laboratory (NDEL) of Korea Atomic Energy Research Institute (KAERI/ NDEL) has 7 Staffs and 1 Secretary (Evaluation 3, Processing and Benchmark 4). KAERI/NDEL is funded by government as a long term nuclear energy development program. The nuclear data needs from the program are as follows;

- Advanced Reactor Development (Liquid Metal Fast Reactor and High Temperature Gas Cooled reactor) requires quantification of cross section uncertainties in their reactor designs.
- Advanced Fuel Cycle needs up-to-date neutron cross sections of fission products.
- Proton Accelerator Development requires high energy neutron and proton nuclear data relevant to the radiological safety and beam application of the accelerator
- Beside the R&D program, usual activities for the nuclear power plant operation, medical isotope production and the radioisotope applications, are requesting up-to-date nuclear data.

KAERI/NDEL is performing nuclear data evaluation, multi-group library processing, and validation which are required by the above mentioned R&D program in Korea. For measurement of nuclear reaction data, KAERI/NDEL is coordinating measurements of Pohang Neutron Facility (PNF) of Pohang Accelerator Laboratory (PAL), Van de Graff laboratory of Korea Institute of Geosciences and Mineral Resources (KIGAM), and MC-50 Cyclotron at Korea Institute of Radiological and Medical Sciences (KIRAMS)

1. Facilities and Measurements

1.1. Pohang Neutron Facility of PAL (Y.D. Oh, ydoh@postech.ac.kr)

Specifications:

- electron energy = 65 MeV
- repetition rate = 10 ~ 15Hz
- pulse width = 1 ~ 2 μ s
- peak beam current = 30 ~ 50 mA
- TOF flight length = 12m
- Target + water moderator to produce neutron pulse
- Ta plates + cooling system
- Detector : scintillator + PM tube
- BC702 [6Li-ZnS(Ag)] Thickness 1.6cm , diameter 12.5cm
- Sample changer consisting of remotely controlled 4 sample holders

Measurements:

- The total cross sections of natural Pd, Nb, Mo were measured using TOF method.
- The resonance parameters of Pd, Nb, Mo were determined using SAMMY code
- Nuclear spectroscopic data and photo-neutron ($(\gamma,3n)$) cross-sections in ^{209}Bi with 65 MeV bremsstrahlung were measured at first time

1.2 Van der Graaf of KIGAM (G.D. Kim, gdkim@kigam.re.kr)

Specifications:

- 1 MeV ~ 2 MeV monoenergetic pulsed beam with TOF system
- based on Van der Graaf with bunching and pulsing
- $^3\text{H}(p,n)$ reaction with $10^7 \sim 10^8$ neutrons/sec and FWHM < 15 %
- Pulsed beam with period 125 ns, width 1-2ns, Time Pick up detecting system
- Prompt gamma-ray with anti-Compton system and two parameter (E,T) data taking system
- BC-501 monitor detector (2"x2", 3"x 1 cm)

Measurements:

- Neutron captured gamma spectrum on ^{197}Au is measured and being analyzed for

neutron energies 1 ~ 2 MeV

1.3 MC-50 of KIRAMS (GN Kim, gnkim@knu.ac.kr)

Specifications:

- Azimuthally-Varying Field-Type MC-50 cyclotron
- Proton Beam Energy : ~ 45 MeV
- Beam current : < ~ 50 nA

Measurements of proton induced reaction cross-sections on ^{nat}Mo , ^{nat}Zn , and ^{nat}W :

- $^{nat}\text{Mo}(p,xn)^{99m,96m,g,95m,g}\text{Tc}$
- $^{nat}\text{Zn}(p,xn)^{66}\text{Ga}$, $^{nat}\text{Zn}(p,xn)^{67}\text{Ga}$, $^{nat}\text{Zn}(p,pxn)^{62}\text{Zn}$, $^{nat}\text{Zn}(p,axn)^{61}\text{Cu}$, $^{nat}\text{Zn}(p,axn)^{65}\text{Zn}$,
 $\text{Zn}(p,axn)^{69m}\text{Zn}$
- $^{nat}\text{Mo}(p,xn)^{99m,96m,g,95m,g}\text{Tc}$

2. Evaluation and Benchmark (Y.-O. Lee, yolee@kaeri.re.kr)

- A number of different emission channel production cross sections induced by charged particles such as reactions such as $^{nat}\text{Cu}(\alpha,x)^{66,67}\text{Ga}$, ^{65}Zn , $^{nat}\text{Fe}(d,X)^{56}\text{Co}$ are being evaluated using the statistical model code TALYS, which allow us to solve the discrepancies existing among the literature data.
- For design of an accelerator-based facility, proton induced nuclear data was evaluated for Al-27 in the energy region up to 100 MeV using nuclear reaction model code TALYS and validated with experimental data available. Our evaluation includes the production cross sections and double-differential cross sections for all residual nuclides as well as light particles such as neutron, proton, and alpha.
- In response to discrepancies between calculations and measurements of several fusion shielding benchmarks, neutron cross sections for $^{182,183,184,186}\text{W}$ were evaluated in the neutron-incident energy range from 0.1 MeV to 20 MeV using the nuclear reaction model code EMPIRE-2.19 with a consistent set of input parameters for all tungsten isotopes.

- A new module has been developed for the evaluation of cross sections in the resolved and unresolved resonance regions. It automates most of the evaluation procedures and can be executed within EMPIRE or as a stand-alone program. When it is used as connected to the EMPIRE code, the single ENDF-6 formatted file can be obtained in the full energy region. -
- As a first step for the fusion neutronics shielding benchmarks, the ENDF/B-VII beta 1, JEFF-3.1, and JENDL-3.3 have been tested for 5 pulsed sphere experiments performed at the OKTAVIAN, FNS/JAEA, and FNG/ENEA facilities. The leakage neutron and/or gamma spectra calculated by the MCNPX code have been compared with the measurements.