

**Nuclear Data Center (NDC) of
Korea Atomic Energy Research Institute (KAERI)**

Progress Report to the
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Young-Ouk LEE (yolee@kaeri.re.kr)

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

1. General

Nuclear Data Center (NDC, former Nuclear Data Evaluation Lab.) of Korea Atomic Energy Research Institute (KAERI) has a director, 10 permanent staffs (2 in evaluation, 1 in measurement, 2 in atomic and molecular data, 2 in processing and validation, 3 in applications), one PhD student and one secretary. KAERI/NDC recently expanded its scope of work into the atomic and molecular data where two permanent staffs are involved. Mission of KAERI/NDC is disseminating outcomes of international network as well as promoting domestic nuclear data activities and related applications.

1.1 Nuclear Data Needs

Nuclear data needs are mainly from following major national nuclear R&D programs:

- **Advanced Reactor Development** (mainly Liquid Metal Fast Reactor) requires quantification of cross section uncertainties in their reactor designs.
- **Advanced Fuel Cycle** needs up-to-date neutron cross sections of MA and fission products
- **Korean TBM project** in ITER requires reliable neutron data of important materials for its neutronics analysis.
- **Accelerator projects** requires high energy neutron and charged particle nuclear data relevant to the radiological safety and beam application of the accelerators
- Usual activities for **the nuclear power plant operation, medical isotope production and the radioisotope applications**, are requesting up-to-date nuclear data

1.2 International Collaboration

To fulfill the above mentioned nuclear data needs in Korea, KAERI/NDC is performing nuclear data compilation/evaluation, processing and validation in close collaboration with the international nuclear data network, namely:

- Compilation of nuclear data into EXFOR under the guidance of IAEA/NDS
- Fusion Evaluated Nuclear Data Library CRP of IAEA
- Joining the formal JEFF and participating in WPEC subgroup of NEA
- Evaluation of nuclear data for Np-237, Pu-240, Cm isotopes with ORNL
- ENDF improvement (Zr isotopes and KERCEN) with BNL

2. EXFOR compilation

- The EXFOR compilation activity of KAERI/NDC is ongoing since 2009 under the guidance of IAEA/NDS.
- As of 2012, KAERI/NDC has produced 25 entries, consisting of experimental data for neutron total cross section, isomeric-yield ratio induced by bremsstrahlung, photo-fission yields, and the production cross section by proton induced reactions.

Table 1. Compilation statistics of KAERI/NDC

#	TRANS	ENTRY	SUBJECT	STATUS
1	D068	D0569	Charged Particle	EXFOR (2009)
2	D069	D0570	Charged Particle	EXFOR (2009)
3	3136	31666	Neutron	EXFOR (2009)
4	3136	31668	Neutron	EXFOR (2009)
5	3139	31675	Neutron	EXFOR (2009)
6	3144	31679	Neutron	EXFOR (2009)
7	G023	G0015	Gamma	EXFOR (2010)
8	G020	G0016	Gamma	EXFOR (2010)
9	G023	G0017	Gamma	EXFOR (2010)
10	G020	G0018	Gamma	EXFOR (2010)
11	G023	G0019	Gamma	EXFOR (2010)
12	G023	G0020	Gamma	EXFOR (2010)
13	3145	31688	Neutron	EXFOR (2010)
14	3145	31689	Neutron	EXFOR (2010)
15	G021	G3101	Gamma	EXFOR (2010)
16	3146	30826	Neutron	EXFOR (2010)

17	D074	D7001	Charged Particle	EXFOR (2010)
18	3152	30827	Neutron	EXFOR (2011)
19	G022	G3102	Gamma	EXFOR (2011)
20	G022	G3103	Gamma	EXFOR (2011)
21	G022	G3104	Gamma	EXFOR (2011)
22	D078	D7002	Charged Particle	EXFOR (2011)
23	G023	G3105	Gamma	EXFOR (2011)
24	D079	D7003	Charged Particle	EXFOR (2011)
25	D081	D7004	Charged Particle	EXFOR (2012)
26		G3106	Gamma	PRELIM (2012)
27		G3107	Gamma	PRELIM (2012)

3. Facilities

For measurement of nuclear reaction data, KAERI/NDC 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)

3.1 Pohang Neutron Facility of PAL (M.W.Lee, mwlee@knu.ac.kr)

- Measurement of total cross sections based on the TOF method using 50-70 MeV, 30-70 mA, 10-15 Hz beam
- Measurement of nuclear reaction using Bremsstrahlung gamma-ray
- Measurement of thermal neutron capture cross section and resonance integral
- Development of the BGO detector and the measuring software

Specifications:

Electron beam energy = 40 ~ 80 MeV

Repetition rate = 10~15 Hz

Pulse width = 1~2 μ s

Peak beam current = 30~60 mA

TOF flight length =12 m

Target + water moderator to produce neutron pulse

Ta plates + cooling system

Detector: scintillator + PM tube, 12 BGO detectors

BC702 [6Li-ZnS(Ag)] Thickness 1.6cm, diameter 12.5cm

Sample changer consisting of remotely controlled 4 sample holders

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

- Measurements of cross sections with neutron energies from 0.7 to 1.2 MeV for Ta, Co, Bi, Y, Nb, O, Si, Fe, Cu, Ti, Au
- Improving the beam bunching system

Specifications:

Based on Van der Graff with bunching and pulsing, Time pick up detecting system

Monoenergetic pulsed neutron beam energy = 500 keV ~ 6.5 MeV

Repetition rate = 4 MHz

Pulse width = 1~2 ns

$^7\text{Li}(p,n)$, $^3\text{H}(p,n)$ and $\text{D}(d,n)$ reaction, with $10^6\sim 10^8$ neutrons/sec and FWHM < 6%

Detector: two cylindrical plastic detectors (3" x 1 cm)

TOF flight length = 4.18 m

3.3 MC-50 of KIRAMS (G.N.Kim, gnkim@knu.ac.kr)

- Measurement of proton-induced reaction cross-sections for $^{\text{nat}}\text{Sn}(p,x)$, $^{\text{nat}}\text{Zr}(p,x)$, $^{\text{nat}}\text{Ti}(p,x)$, $^{\text{nat}}\text{Pd}(p,x)$, $^{\text{nat}}\text{Ni}(p,x)$, $^{\text{nat}}\text{Al}(p,x)$, $^{\text{nat}}\text{Y}(p,x)$ reactions with 40 MeV proton irradiation

Specifications:

Azimuthally-Varying Field-Type MC-50 cyclotron

Proton beam energy: ~45 MeV

Beam current: < ~100 nA

Used for neutron therapy with $\text{Be}(p,n)$ reaction and radioisotope production