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Objectives of the EXFOR compilation Workshop

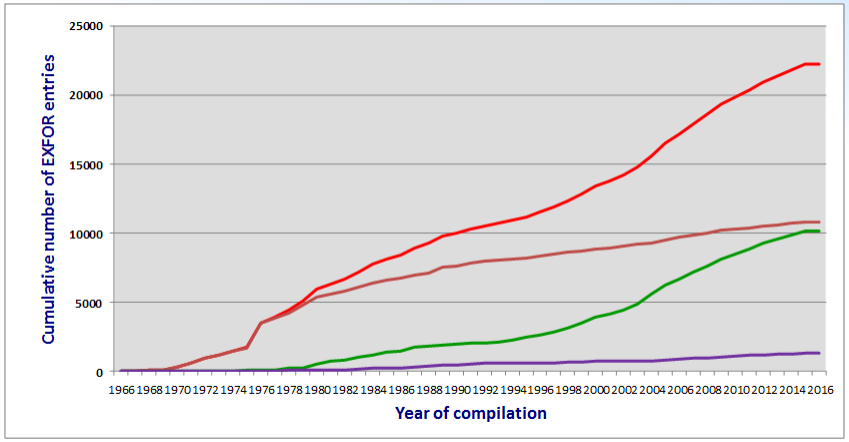
V. Semkova

International Atomic Energy Agency, Nuclear Data Section, Vienna, Austria

Outline

- EXFOR database: current scope and status
- Topics on the Workshop
- Expected outcomes

EXFOR database: scope of compilation



total

neutrons
charged particles

photons

Incident energy range
up to 1 GeV

Quantities:

Cross sections CS (51%); Partial differential with respect to angle DAP (19.4%); Differential data with respect to angle DA (19.3%); Resonance parameters RP (8.89); Partial cross section data CSP (8.53%); Polarisation data POL (5.15%); Fission product yields FY (5.03%); Differential data with respect to angle and energy DAE (4.78%); Fission neutron quantities MDQ (2.27%); Gamma spectra SP (2.14); Resonance integrals RI (2.08); Differential data with respect to energy DE (1.74%); Thick target yields TT (1.65%) etc.

Currently there are no major amendments in the EXFOR scope and the format.
Our efforts are focused on improving of the completeness and the quality.
Revisiting compilation of particular types of data.

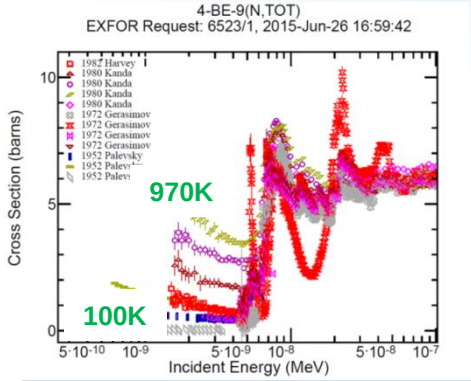
CM “Compilation of thermal neutron scattering data in EXFOR”

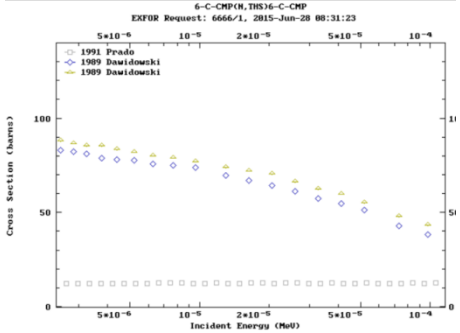
- Quantities considered in TSH measurement and evaluations
  - Measured data $S_{i,j}(Q)$, $\rho(\omega)$, T_D, a_i
  - Derived scattering function S(Q,ω)
  - $d^2\sigma/dE'd\Omega$, $d\sigma/d\theta$, σ_t, Neutron diffusion parameters
  - *S(α,β)*

What should be compiled in EXFOR?

- Quantities considered in EXFOR

,AMP	L	(Scattering amplitude)
BA,AMP	L	(Bound-atom scattering amplitude)
BA/COH,AMP	L	(Bound-atom coherent scattering amplitude)
BA/PAR,AMP	L	(Partial bound-atom scattering amplitude)
COH,AMP	L	(Coherent scattering amplitude
COH/IM,AMP	L	(Coherent scattering amplitude (imaginary part
FA,AMP	L	(Free-atom scattering amplitude)
INC,AMP	B	(Incoherent scattering amplitude)
POT,RAD	L	(Potential scattering radius)





Density of C2-Cl4 : 1.6256 g/cm3
Thickness of C2-Cl4: 0.7051 cm

Density of C-Cl4: 1.5977 g/cm3
Thickness of C-Cl4: 0.7036 cm

Polymeric (C-F2)n. Density = 2.12 g/cm3.
Thickness: 2.498 cm

Do we need to revise the existing compilation rules?

Compilation guidelines for specific measurement techniques

Template for Submission of Time-of-Flight Spectra

A. EXPERIMENT DESCRIPTION

1. Main Reference		[1]
2. Facility	n_TOF	[2]
3. Neutron production		[2]
Neutron production beam	Proton beam from CERN Proton Synchrotron.	
Nominal average beam energy	20 GeV (per proton)	
Nominal average peak current	7×10^{12} protons per pulse	
Repetition rate (pulses per second)	Maximal: 0.8 Hz. Average: 0.4 Hz.	
Pulse width	7 ns	
Primary neutron production target	Cylindrical Pb spallation target (1.3 t in mass, 40 cm in length, 60 cm in diameter).	
Target nominal neutron production intensity	2×10^{15} neutrons per pulse	
4. Moderator		[2]
Moderator material	Pb target itself, 1 cm layer of demineralized water, 4 cm layer of borated water (H_2O + 1.28% H_3BO_3; mass fraction)	
Moderator dimensions (internal) (thickness, height×width×depth,…)	Pb target: 11.5 t/m^3. Water: 1 t/m^3.	
Density (moderator material)	20°C	
Temperature (K)		
5. Other experimental details		[1]
Measurement type	Neutron capture measurement.	
Method (total energy, total absorption, …)	Time-of-flight technique; detection of at most one γ-ray from γ-cascades by low-efficiency detectors.	
Flight path length (m) (moderator –detector)	184 m	
Neutron beam dimensions at sample position (mm × mm, diameter in mm, …)	~3.5 cm diameter	
Neutron beam profile	Gaussian; σ = 0.7 cm	
6. Detector		[1,3]
Type	Two C_6D_6 liquid scintillators.	
Material	C_6D_6	
Surface Dimensions	10.2 cm diameter (Bicron detector); 12.73 cm	

IAEA International Atomic Energy Agency

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INDC International Nuclear Data Committee

Summary Report of the Consultants' Meeting on

EXFOR Data in Resonance Region and Spectrometer Response Function

IAEA Headquarters, Vienna, Austria

8 – 10 October 2013

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…
SAMPLE      Cylindrical (19.91 mm diameter, 0.72 mm thick)
             metallic sample (2.069 g, 6.9E-3 at/b) enriched to
             58Ni (99.5%) at 20 deg with 1.5 um thick Mylar
             backing.
            (28-NI-58,ENR=0.995)
            (28-NI-60,ENR=0.0048)
            (28-NI-61,ENR=0.0001)
DETECTOR    (SCIN) Two C6D6 liquid scintillators;
              - Bicron detector (10.2 cm diameter, 7.6 cm length,
                4.3% of 4pi)
              - FZK detector (12.73 cm diameter, 7.8 cm length,
                6.8% of 4pi)
             placed at ~10 cm from sample and 125 deg with respect
             to neutron beam direction.
            Pulse Height Weighting Technique was applied (i.e.,
             making the gamma-ray detection efficiency
             proportional to the gamma-ray energy).
…
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Compilation of thermal neutron cross sections and resonance integrals

NRDC 2013 meeting

A35 Otsuka

Formulate completeness checking against the citation lists in S. Mughabghab's "Atlas of Neutron Resonances", and assign responsibility of the checking to four neutron centres.

N.Otsuka extracted all articles (excluding theses and private communications) related to experimental cross sections or resonance integrals (**3144** articles) from the citation lists of "Atlas of Neutron Resonances" (2006)

Characterization of the experimental conditions and particularly the spectral distribution of the neutron beam is important and should be properly compiled.

Thermal Neutron Constants (TNC)

N.Otsuka presented on ND2016 conference

- Cross sections, Westcott g-factor, total fission neutron multiplicities of ^{233,235}U and ^{239,241}Pu for thermal neutrons

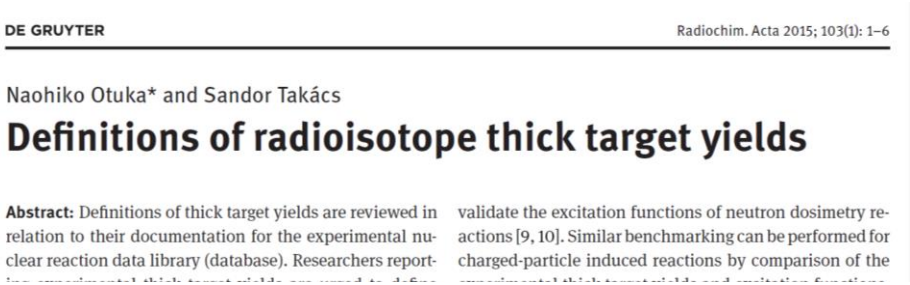
- Pioneering evaluation at the IAEA by Westcott (1965), Hanna (1969) and Lemmel (1975), which took over by Axton (1984-1986)

- Typical evaluation within the IAEA Neutron Standards is based on Axton's database containing 167 experimental values.

- Many of them are not confirmed in EXFOR.

Other topics

- Compilation activities carried out at some NRDC centres
- Nuclear fusion reaction measurements at LUNA for nuclear astrophysics
- Calculation of catalytic nuclear reactions induced by reactor neutrons and its applications
- Definitions of radioisotope thick target yields



DE GRUYTER Radiochim. Acta 2015; 103(1): 1–6

Naohiko Otuka* and Sandor Takács

Definitions of radioisotope thick target yields

Abstract: Definitions of thick target yields are reviewed in relation to their documentation for the experimental nuclear reaction data library (database). Researchers report- validate the excitation functions of neutron dosimetry reactions [9, 10]. Similar benchmarking can be performed for charged-particle induced reactions by comparison of the

MOST DOWNLOADED ARTICLES

1. Production and properties of transuranium elements by Nagame, Y. and Hirata, M.
2. Definitions of radioisotope thick target yields by Otuka, Naohiko and Takács, Sandor

- Software developments at NDS
- Software developments at CNPD

Outcomes

- Present and discuss EXFOR database reviews on specific topics in response to request from Consultants' Meetings, Coordinated Research Projects and NRDC Meetings recommendations.
- Discuss compilation activities carried out at the some NRDC centres
- Discuss research activities in various fields of nuclear science and applications
- Present software developments
- Compilation exercises and compilation tools training

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Thank you!