

1. MATXS-J50

MATXS-J50 is a set of MATXS format multigroup libraries for multigroup transport calculations such as DOORS produced from JENDL-5 neutron, thermal scattering law (TSL) and photo-atomic sublibraries. It has two group structures; one is neutron 200 group and gamma 42 group, and the other is neutron 48 group and gamma 20 group.

2. Directory structure of MATXS-J50

The directory structure of MATXS-J50 is as follows:

MATXS-J50

- | - README_en.pdf : this file
- | - J5TSL-MATXS.xlsx : Description of TSL MATXS files
- | - j50.200.42.n250 : MATXS files of neutron 200 group and gamma 48 group at 250 K from JENDL-5
- | - j50.200.42.n300 : MATXS files of neutron 200 group and gamma 48 group at 300 K from JENDL-5
- | - j50.200.42.n600 : MATXS files of neutron 200 group and gamma 48 group at 600 K from JENDL-5
- | - j50.200.42.n900 : MATXS files of neutron 200 group and gamma 48 group at 900 K from JENDL-5
- | - j50.200.42.n1200 : MATXS files of neutron 200 group and gamma 48 group at 1200 K from JENDL-5
- | - j50.200.42.n1800 : MATXS files of neutron 200 group and gamma 48 group at 1800 K from JENDL-5
- | - j50.tsl.200.42 : MATXS files of neutron 200 group and gamma 48 group with TSL from JENDL-5 (all temperatures in TSL are included. No SiO₂ because Si and O are mixed.)
- | - j50.48.20.n250 : MATXS files of neutron 48 group and gamma 20 group at 250 K from JENDL-5
- | - j50.48.20.n300 : MATXS files of neutron 48 group and gamma 20 group at 300 K from JENDL-5
- | - j50.48.20.n600 : MATXS files of neutron 48 group and gamma 20 group at 600 K from JENDL-5
- | - j50.48.20.n900 : MATXS files of neutron 48 group and gamma 20 group at 900 K from JENDL-5
- | - j50.48.20.n1200 : MATXS files of neutron 48 group and gamma 20 group at 1200 K from JENDL-5
- | - j50.48.20.n1800 : MATXS files of neutron 48 group and gamma 20 group at 1800 K from JENDL-5

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- j50.tsl.48.20 : MATXS files of neutron 48 group and gamma 20 group with TSL from JENDL-5 (all temperatures in TSL are included. No SiO₂ because Si and O are mixed.)

3. How to produce MATXS-J50

The specification of MATXS-J50 is as follows.

- Group structure : neutron 200 group + gamma 48 group, neutron 48 group + gamma 20 group
- Weighting function : VITAMIN-E (neutron) , 1/E spectrum (gamma)
- Legendre expansion order : P₆
- Background cross section : 10¹⁰, 10⁴, 10³, 300, 100, 30, 10, 1, 0.1, 10⁻⁵
- Temperature : 250, 300, 600, 900, 1200, 1800 K except for TSL. All temperatures in TSL for TSL.
- Maximum energy for thermal neutrons : 10 eV
- KERMA factor : calculated with the kinematics method (same as ACR-J50)

The production method of MATXS-J50 is as follows.

- A) Neutron ACE files (temperature : 250, 300, 600, 900, 1200, 1800 K) are produced from JENDL-5 neutron sublibrary with FRENDY(20241030) modified as shown in Appendix 1 and NJOY2016.65 modified for JENDL-5 (see https://rpg.jaea.go.jp/download/ace_lib/acej50/20221205/NJOY2016.65.modification.r2.pdf). The input files for this process are as follows (Fe56 at 300 K).

First FRENDY input

```
reconr
  20 22
'pendf tape for jendl-5  n_026-Fe-056 '/'
  2631 3 0 /
.001 /
'n_026-Fe-056 from jendl-5/'
'processed with the frendy nuclear data processing system'/
'see original jendl-5 tape for details of evaluation'/
0/
broadr
  20 22 23
  2631 1 0 0 0/
.001 /
300 /
```

0/
stop

Next NJOY input

moder
20 -21
moder
23 -25
heatr
-21 -25 -26 0 /
2631 5 0 0 0 2 0 1 /
302 318 402 443 444 /
moder
-26 24
stop

Next FRENDY input

gaspr
20 24 28
acer
20 28 0 29 30
1 1 1 .20/
'n_026-Fe-056 jendl-5 frendy njoy 2025.5'/
2631 300 /
1 1 /
/
stop

- B) GENDF files are produced from the ACE files with FRENDY(20241030). The input file for this process is as follows (Fe56 at 300 K).

FRENDY inoput

mg_neutron_mode //Process mode
ace_file_name (n_026-Fe-056.ace)
mg_edit_option (GENDF)
mg_file_name n_026-Fe-056

mg_structure (ign102) //VITAMIN-B6 200
mg_structure_gam (igg10) //VITAMIN-J 42

```

mg_weighting_spectrum ( iwt11 ) //VITAMIN-E weight function (ORNL-
5505)
legendre_order          6

mg_mat_no ( 2631 )

```

- C) Gamma GENDF files are produced from JENDL-5 photo-atomic sublibrary with NJOY2016.65 GAMINR module. The input file for this process is as follows (Fe56 at 300 K).

NJOY input

```

reconr
30 31
'pendf tape from jendl-5'/
2600 1 0 /
.001 0. 7 /
'n_026-Fe-056 from jendl-5'/
0/
gaminr
30 31 0 32
2600 10 3 6 0
'42-group photon interaction library'/
-1 0 /
0/
stop

```

- D) The neutron GENDF file produced in B) and the gamma GENDF file produced in A) are merged to a MATXS file with NJOY2016.65 MATXS module. The input file for this process is as follows (Fe56 at 300 K).

NJOY input

```

moder
27 -28
matxsr
-28 32 33/
15 'jendl-5 frendy'/
2 4 1 1/
'jendl-5 n_026-Fe-056 300K frendy'/
'n'

```

```

'g'/
200 42/
'nscat' 'ng' 'gscat' 'ntherm' /
    1    1    2    1 /
    1    2    2    1 /
'fe056' 2631 2600/
stop

```

4. Notes on TSL files in MATXS-J50

- TSL MATXS files has no KERMA and damage energy production cross section data.
- TSL SiO₂ MATXS file was not produced because TSL SiO₂ is a mixed file of Si and O.
- Names of TSL MATXS files were set to mt249 and mt250 except for thermal data specified in MATXS_R (see Table 1). See J5TSL-MATXS.xlsx in detail.
- Graphite in TSL is only C12 and N in UN is only N14.

Table 1 Thermal Material Names

Name	MT	Description	Name	MT	Description
free	221	free-gas scattering	zrzrh	235	Zr in ZrH incoherent
hh2o	222	H in H ₂ O	zrzrh\$	236	Zr in ZrH coherent
poly	223	H in polyethylene (CH ₂) incoherent	obeo	237	O in BeO incoherent
poly\$	224	H in polyethylene (CH ₂) coherent	obeo\$	238	O in BeO coherent
hzrh	225	H in ZrH incoherent	ouo2	239	O in UO ₂ incoherent
hzrh\$	226	H in ZrH coherent	ouo2\$	240	O in UO ₂ coherent
benz	227	Benzene incoherent	uuo2	241	U in UO ₂ incoherent
dd2o	228	D in D ₂ O	uuo2\$	242	U in UO ₂ coherent
graph	229	C in graphite incoherent	al	243	Al metal incoherent
graph\$	230	C in graphite coherent	al	244	Al metal coherent
be	231	Be metal incoherent	fe	245	Fe metal incoherent
be\$	232	Be metal coherent	fe	246	Fe metal coherent
bebeo	233	Be in BeO incoherent			

5. Remarks in using MATXS-J50

- A multigroup library for a calculation model should be produced from MATXS-J50 with the TRANSX code, which can be obtained from RSICC or NEA/Databank, to use MATXS-J50 in Sn codes such as DOORS.
- MATXS-J50 is text format, but TRANSX can process not a text format MATXS file but a binary format MATXS file. Thus MATXS-J50 must be converted to binary format with the BBC code in the TRANSX code package before TRANSX processing. A simple shell script @bcd2bin for the convert is as follows.

```

#!/bin/csh
ln -s $1.m text
$HOME/transx/bbc < $HOME/transx/bcd2bin >! $1.out
mv matxs $1
rm text

```

The content of \$HOME/transx/bcd2bin is as follows.

```
-1 1 0 1 1
```

```
1 1 1 1 1 1 1 1 1 1
```

If you execute “@bcd2bin fe056”, you get a binary MATXS file “fe056”.

If you convert all text MATXS files in a directory to binary MATXS files, you can use the following shell script @bcd2bin.all.

```
#!/bin/csh
foreach file (*.m)
    if (-e text) then
        rm text
    endif
    echo $file
    set NUC = `echo $file | sed -e s@"%.m"@@g`
    echo $NUC
    ln -s $NUC.m text
    $HOME/transx/bbc < $HOME/transx/bcd2bin >! $NUC.out
    mv matxs $NUC
    mv index $NUC.index
    rm $NUC.out
    rm $NUC.index
    rm text
end
```

- Bugs of TRANSX were reported[#]. The below patches are necessary for MATXS-J50.

```
*d up14.4
```

```
maxds=5+12*(nl+1)
```

```
*d transx.1364
```

```
if (nwds+nk.ge.maxw) go to 230
```

```
*d transx.2298
```

```
if (nwds+nk.ge.maxw) go to 215
```

: C. Konno, et al., EFFECT OF IAEA PATCH FOR TRANSX2.15, ANS RPSD 2018 - 20th Topical Meeting of the Radiation Protection & Shielding Division of ANS, Santa Fe, NM, August 26 – 31, 2018, on CD-ROM, American Nuclear Society, LaGrange Park, IL (2018).-->If you cannot obtain this paper, please send an e-mail to konno.chikara@jaea.go.jp.

6. Download site of MATXS-J50

<https://rpg.jaea.go.jp/main/en/MATXS-J50/>

7. References of MATXS-J50

Chikara Konno, “Production of JENDL-5 MATXS Library”, JAEA-Data/Code 2025-016 (in Japanese) (<https://jopss.jaea.go.jp/pdfdata/JAEA-Data-Code-2025-016.pdf>)

The reference of JENDL-5 is

O. Iwamoto, et al., “Japanese Evaluated Nuclear Data Library version 5: JENDL-5,” J. Nucl. Sci. and Technol., 60 pp.1-60 (2022).

8. Contact

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9. Appendix 1

FRENDY(20241030) was modified as follows for MATXS-J50.

Line 12 in frendy/UnresoUtils/ProbabilityTableCalculator.cpp

```
const Real8 ProbabilityTableCalculator::min_xs_coef      = 1.0E-2;  
→  
const Real8 ProbabilityTableCalculator::min_xs_coef      = 1.0E-1;
```

Line 2369 in frendy/UnresoUtils/ProbabilityTableCalculator.cpp

```
xs_val[j][k] = min_sig_val;  
→ xs_val[j][k] = min_sig_val;  
if( k == fission_xs && fis_flg == 0 )  
{  
    xs_val[j][k] = 0.0;  
}  
}  
}
```

```
//Modify small cross section data to appropriately calculate P1 bondarenko cross section  
//When the back ground cross section and sampled total cross section are so small,  
//this small total cross section affects p1 total Bondarenko self-shilding cross section.  
//To avoid such problem, small cross section is modified.
```

```
if( xs_val[j][total_xs] < xs_data_back[total_xs] * min_xs_coef )  
{
```

```

for(int k=0; k<xs_type_no; k++)
{
    xs_val[j][k] = xs_data_back[k] * min_xs_coef;
}

```

10. Appendix 2

New NJOY2016.65 bugs (multiple temperature bug and fission spectrum bug) were specified and corrected as follows, though they were not necessary for MATXS-J50.

Line 15 in matxsr.f90

```

integer::mult=2          ! used for counting 8-byte entries
→ integer::mult=2        ! used for counting 8-byte entries
real(kr)::a0(200000)

```

Line 445 in matxsr.f90

```

character(16)::word
→ character(16)::word
integer::i

```

Line 463 in matxsr.f90

```

ngen8=0
→ ngen8=0
do i=1,200000
a0(i)=0.0
enddo

```

Line 2217 in matxsr.f90

```

a(icdat-1+jg2)=b(irinp+lz+ik-1)
→ a(icdat-1+noutg+jg1)=b(irinp+lz+1)-a0(icdat-1+noutg+jg1)
if (iref.eq.0) a0(icdat-1+noutg+jg1)=b(irinp+lz+1)

```

Line 2222 in matxsr.f90

```

a(icdat-1+noutg+jg1)=b(irinp+lz+1)
→ a a(icdat-1+noutg+jg1)=b(irinp+lz+1)-a0(icdat-1+noutg+jg1)
if (iref.eq.0) a0(icdat-1+noutg+jg1)=b(irinp+lz+1)

```

Line 5718 in groupr.f90

```

if (mfd.eq.6.and.mtd.eq.18) nz=nsigz
→ delete

```