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Nuclear Data Needs in China

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1. Evaluated completed neutron reaction data file

a) Actinide: ^{233,234,235,236,238}U, ^{237,238,239}Np, ^{237,239,240,241,242}Pu, ^{241,242,242m,243}Am, ^{242,243,244,245,246,247,248,250}Cm, ^{249,250}Bk, ^{249,250,251,252}Cf.

b) Structure material: ^{23}Na, ^{27}Al, ^{28,29,30}Si, ^{0,40}Ca, ^{50,51,52,53,54}Cr, ^{46,47,48,49,50}Ti, ^{54,55,56,57,58}Fe, ^{59,60}Co, ^{63,64,65}Cu, ^{90,91,92,93,94,95,96}Zr, ^{93,94,95,96}Nb, ^{204,206,207,208}Pb, ^{0,180,181,182,183,184,185,186}W

c) Fission product: ^{154,155,156,157}Gd, ^{101,102,104,106}Ru, ^{103}Rh, ^{121,123}Sb, ^{133,134,135}Cs, ^{142,143,144,147}Nd, ^{148,149,150,151,152}Sm, ^{151,153}Eu

d) Light nuclides：n, ^{1,2,3}H, ^{6,7}Li, ^{9}Be, ^{0,12}C, ^{14,15}N, ^{16,17}O, ^{19}F

- neutron energy up to 30MeV, File MF 1-6,12-15,31-40

e) Photon reaction data: isotopes of Be, Fe, Cu, Zr, W, Pb, Bi and Th, U, Pu

2. Activation cross sections:

To meet the needs for burn-up analysis & calculation, decay heat calculation:
key reactions: (n,γ) and(n,2n) for ^{147,148}Nd, ^{147,148,148m} Pm, ^{147,148,149,150,151,152}Sm, ^{142,143,150}Nd, ^{152}Eu, ^{141}Pr, ^{124,125}Sn, ^{124,125}Sb, ^{104,105,106}Ru, ^{133,134}Cs;

3. Fission yields：

Independent and cumulative fission yields of n+^{235,238}U，^{239}Pu, the yields of the products with masses of 125, 106, 134, 142, 144, 148,149,151, 154, are applied to the reactor research such as for the fuel consumption benchmark verification and , fundamental scientific research, such as elements evolution in nuclear astrophysics.

The prompt fission spectrum is applied in the reaction design, for calculation of the neutron transport.

4. Decay data:

The decay data for ^{105,106}Ru, ^{124,125}Sb, ^{125}Sn, ^{134}Cs, ^{141}Ce, ^{142,144}Pr, ^{144,147,149,151}Nd, ^{147,148,148m,149,151}Pm, ^{151,153}Sm, ^{152,154}Eu,will be evaluated.

5. GIF reactor and fusion:

The GIF reactors, such as, Sodium-cooled Fast Reactor(SFR), Thorium Molten Salt Reactor(TMSR), Very High Temperature Reactor (VHTR) are being studied and some demonstration and experimental facilities of them under construction, and the research about fusion energy (ITER international collaboration) are performing in China. The requirements of nuclear data have been proposed as following:

For the TMSR project research purpose:

1) Photonuclear data: ^{6,7}Li, ^{9}Be, ^{12}C, ^{19}F.
2) Fission product yields: ^{231,232,233}Pa, ^{242}Am .
3) Decay data: ^{7}Be, ^{107}Pd, ^{153}Gd, ^{208}Tl, $^{225.226.227}$Ac, ^{232,233,234,235}U, ^{230,231,232,233,234,234m}Pa, ^{227,228,229,230,231,232,234}Th, etc.
4）Activation cross section: ^{155,157}Gd(n,γ), ^{155,157}Gd(n,2n), ^{232}Th(n,γ), ^{232}Th(n,2n), ^{233}Pa(n,γ), etc.

For the SFR project research purpose:

1) Covariances for material in common use
2) KERMA, DPA
3) Lumped fission product of ^{232}Th, ^{233,235,238}U, ^{237}Np, ^{238,239,241,242}Pu, ^{241}Am, ^{244}Cm
4) Delayed gamma multiplicity and spectrum for gamma heat deposition calculation for ^{238}U、^{241}Pu
5) Photonuclear data: ^{9}Be, ^{12}C
6) Decay data: ^{22,24}Na, ^{26}Al, ^{103,106}Ru, ^{106}Rh, ^{103}Pd, ^{108m,110m}Ag, ^{109,113m}Cd, ^{111,113m}In, ^{113}Sn, ^{123,124,125,129,131}I, ^{123m}Te, ^{124,125}Sb, ^{127,131m,133}Xe, ^{131,134,137}Cs, ^{133,140}Ba, ^{139,141,144}Ce, ^{140}La, ^{144}Pr, ^{147}Pm, ^{148,153}Gd, ^{152,154,155}Eu, ^{153}Sm, ^{233,234,235,236,238}U, ^{237}Np, ^{238,239,240,241,242}Pu, ^{241,243}Am, ^{242,243,244}Cm etc.
7) Activation cross section: ^{24}Na(n,2n), ^{155,157}Gd(n,2n), ^{182,183,184,186}W(n,2n), ^{206,207,208}Pb(n,2n), ^{235,238}U(n,f), ^{239}Pu(n,f), ^{241}Am(n,γ),(n,2n),etc.

For the fusion study purpose:

The nuclear data for light nuclei, structure material are also need for the fusion study. Although these data have been included in the FENDL and other evaluated data files, but the more accuracy and reliability are required, especially for deuterium and tritium et al.

6. For the isotope production/ medicine and other fields

For the nuclear medicine and isotope production et al. the more accurate information of nuclei, such as: the half live, decay data, Q value, level scheme et al. are also needed to update. These information are also very useful for the popular education, fundamental research, and nuclear technology application.

For the isotope production purpose:

Isotopes production by accelerator: production of the ^{11}C, ^{13}N et al. more than 30 isotopes, which need the excitation function, production yields etc of the charged particle(p，d，t, etc) induced reactions for the ^{14}N, ^{16}O, ^{24}Mg, ^{30}Si, ^{40}Ar, ^{50,52}Cr, ^{55}Mn, ^{57}Fe, ^{60}Ni, ^{63}Cu,^{209}Bi(p,n),(p,2n) and up to ^{203}Tl.

Isotopes production by reactor: production of the ^{3}H, ^{14}C, ^{24}N et al. more than 150 isotopes, and the targets contain ^{6}Li, ^{14}N, ^{24}Na and the more than 150 reactions yields of the (n,γ), (n,p), (n,α) are need which including the cross sections, decay data, half time etc.

For the medical isotopes purpose:

The current widely used isotopes: ^{32}P,^{89}Sr, ^{90}Y, ^{103}Pd, ^{125,131}I, ^{137}Cs, ^{153}Sm, ^{186}Re,^{188}Re, ^{192}Ir. The new medical isotopes: ^{47}Sc, ^{67}Cu, ^{91}Y, ^{103}Pd, ^{117m}Sn, ^{166}Ho, ^{186}Re, ^{195m}Pt, ^{213}Bi,^{225}Ac. The future will be used isotopes: ^{64}Cu,^{67}Ga,^{68}Ga,^{89}Sr,^{86}Y,^{105}Rh,^{111}In,^{114m}In, ^{124}I,^{149}Pm, ^{169}Yb,^{177}Lu,^{211}At,^{225}Ac,^{209}Po,etc.

For the improvement in analysis neutrino spectra:

The decay data especially the β^- spectra for ^{95}Sr, ^{90}Rb,^{92}Rb, ^{93}Rb,^{94}Rb, ^{100}Nb, ^{96}Y, ^{97}Y, ^{98}Y, ^{99}Y,^{138}I, ^{140}Cs, ^{142}Cs should be revised.

For the needs of activation cross section for SAND-II Lib:

^{63}Cu, ^{115}In, ^{175,177}Lu, ^{197}Au(n,γ); ^{235}U,^{237}Np(n,f); ^{115}In(n,n')^{115m}In; ^{24}Mg, ^{31}P, ^{32}S, ^{27}Al, ^{47,48,nat}Ti, ^{54,56}Fe, ^{59}Co,^{92}Mo, ^{58}Ni,^{64}Zn(n,p); ^{27}Al,^{59}Co,^{63}Cu(n,a); ^{55}Mn,^{58}Ni,^{89}Y,^{90}Zr,^{127}I(n,2n).