

Fission Energy Release in ENDF/B-VII β 3

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Presented at the Annual CSEWG Meeting
Brookhaven National Laboratory

November, 2006

Fission Energy Release

- MF1, MT458 – Components of Fission Energy Release
 - 18 element “LIST” array: Nine values, including total energy, fission product energy, prompt and delayed photon energy, prompt and delayed neutron energy, beta decay energy, neutrino energy, (total – neutrino) energy plus nine uncertainties.
 - D. G. Madland, “Total prompt energy release in the neutron-induced fission of ^{235}U , ^{238}U and ^{239}Pu ,” Nuclear Physics A772, 113(2006).
 - Provides new results for fission product energy, prompt neutron and prompt photon energy for the major actinides.
 - Recommended linear or quadratic energy dependence does not conform to existing ENDF formats.

Fission Energy Release

- Fission Product Energy Release
 - Madland's recommended energy dependencies for ^{235}U , ^{238}U and ^{239}Pu are (in MeV):
 - $(169.13 \pm 0.07) - (0.2660 \pm 0.02) * E_n$
 - $(169.8 \pm 0.05) - (0.3230 \pm 0.01) * E_n + (0.004206 \pm 0.0004) * E_n^2$
 - $(175.55 \pm 0.03) - (0.4566 \pm 0.02) * E_n$
 - These intercept values are accepted for the fission product energy release term in MF1, MT458.
 - ENDF/B-VI.8 values are 169.12, 169.57 and 175.78 MeV.

Fission Energy Release

- Prompt Neutron Energy Release
 - Madland's recommended energy dependencies for ^{235}U , ^{238}U and ^{239}Pu are (in MeV):
 - $4.838 + 0.3004 * E_n$
 - $4.558 + 0.3070 * E_n$
 - $6.128 + 0.3428 * E_n$
 - The intercept term does not equal the product of prompt thermal nu-bar times the average prompt neutron energy (from the prompt neutron spectrum in MF5, MT18).
 - Existing ENDF/B-VI.8 data are also inconsistent.
 - Use prompt thermal nu-bar times average prompt energy.
 - ^{235}U , ^{238}U and ^{239}Pu values are 4.916 MeV, 4.719 MeV and 6.070 MeV.
 - Close to Madland recommendation.

Fission Energy Release

- Prompt Photon Energy Release
 - Madland's recommended energy dependencies for ^{235}U , ^{238}U and ^{239}Pu are (in MeV):
 - $(6.600 \pm 0.03) + (0.0777 \pm 0.004) * E_n$
 - $6.6800 + 0.1239 * E_n$
 - $(6.741 \pm 0.02) + (0.1165 \pm 0.004) * E_n - (0.0017 \pm 0.0002) * E_n^2$
 - Accept Madland's intercept terms in MF1, MT458.
 - Retain existing spectrum data in MF15, MT18.
 - Adjust yield data in MF12, MT18.
 - Product of yield (MF12, MT18) times average prompt photon energy (from MF15, MT18 spectrum) equals recommended prompt photon energy (at thermal energy).

Fission Energy Release

- For the major actinides (^{235}U , ^{238}U & ^{239}Pu):
 - No changes to delayed neutron, photon, beta and neutrino energy release terms.
 - MF1, MT458 Total and (Total – Neutrino) energy release terms adjusted to reflect the new prompt data.

- No changes in fission energy release data for other actinides.