Impact of Nuclear Data on Design Work for High Temperature Gas-cooled Reactors

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Concerning to nuclear design for the high temperature gas-cooled reactors (HTGRs), the calculation method has been improved with experimental data of the research reactors, such as the HTTR in Japan and the HTR-10 in China. One of the HTGRs type with very high temperature, called VHTR, has been proposed in the Generation IV International Forum.

In nuclear design of HTGRs, several cross sections were interested to characterize the criticality and burn-up situations.

- U-235, Pu-241: (n,f) and (n,g) reactions
- U-239, Pu-239, Pu-240 : (n,g) reaction
- C : elastic and (n,g) reactions
- MAs and LLFPs: generation and transformation

From the recent studies, it is indicated that JENDL-3.3 gives the k_{eff} agreement with the experiments within 1.5%Δk, JENDL-3.2 gives within 1.7%Δk, and ENDF/B-IV.8 and JEFF-3.0 give within 1.8%Δk for the some HTTR core conditions. The k_{eff} discrepancy between JENDL-3.3 and JENDL-3.2 is caused by difference of U-235 fission data and its ratio of (n,f)/(n,g) reaction in neutron energy range of 0.1-1.0eV. There is no discrepancy of k_{eff} value between ENDF/B- IV.8 and JEFF-3.0.

In thermal energy range, the capture cross section of carbon in the nuclear library JENDL is about 4% larger than those of ENDF/B and JEF. From the calculation results of the HTR-10 and HTTR, it was found that the reactivity discrepancy by the carbon capture data is about 0.6%$\Delta k/k$ for criticality analysis, although the section is very small as about 3mb at 2200m/s.

The influence of cross sections of carbon and impact for design work of HTGRs will be cleared by the neutronics calculation using the Monte Carlo code MVP and the diffusion code system SRAC.