New Burnup Calculation System for Fusion-Fission Hybrid System (P3-J-288)

Isao Murata, Shoichi Shido, Masayuki Matsunaka, Keitaro Kondo, Hiroyuki Miyamaru

Osaka University Yamada-oka 2-1 565-0871 Suita Japan, Osaka

Investigation of nuclear waste incineration has positively been carried out worldwide from the standpoint of environmental issues. Some candidates such as ADS, FBR are under discussion for possible incineration technology. Fusion reactor is one of such technologies, because it supplies a neutron-rich and volumetric irradiation field, and in addition the energy is higher than nuclear reactor. However, it is still hard to realize fusion reactor right now, as well known. An idea of combination of fusion and fission concepts, so-called fusion-fission hybrid system, was thus proposed for the nuclear waste incineration. Even for a relatively lower plasma condition, neutrons can be well multiplied by fission in the nuclear fuel, tritium is thus bred so as to attain its self-sufficiency, enough energy multiplication is then expected and moreover nuclear waste incineration is possible.

 In the present study, to realize it as soon as possible with the presently proven technology, i.e., using ITER model with the achieved plasma condition of JT60 in JAEA, Japan, a new calculation system for fusion-fission hybrid reactor including transport by MCNP and burnup by ORIGEN has been developed for the precise prediction of the neutronics performance. The author's group already has such a calculation system developed by them. But it had a problem that the cross section libraries in ORIGEN did not have a cross section library, which is suitable specifically for fusion-fission hybrid reactors. So far, those for FBR were approximately used instead in the analysis. In the present study, exact derivation of the collapsed cross section for ORIGEN has been investigated, which means it is directly evaluated from calculated track length by MCNP and point-wise nuclear data in the evaluated nuclear data file like JENDL-3.3. The system realizes several-cycle calculation one time, each of which consists of MCNP criticality calculation, MCNP fixed source calculation with a 3-dimensional precise model and burnup calculation by ORIGEN2. The series calculation can be easily executed in one batch processing by a simple script command.

 The details of the calculation system for analysis of fusion-fission hybrid reactor especially concentrating on making of collapsed cross section for ORIGEN is to be presented in the conference together with some burnup calculation results of Japanese possible fusion fission hybrid reactor.