

NEA/NSC ACTIVITIES ON NUCLEAR TRANSMUTATION

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Abstract

The Nuclear Science Committee (NSC) was set up at the end of 1991, to replace the former three science committees; the committee on reactor physics, the nuclear data committee and the Data Bank Committee. While continuing many projects started under the former committees, the NSC has started new activities according to new needs. Among them, the NSC has taken on different activities related to the transmutation of actinides under collaborations with NDC and the RWMC. Various concepts on transmutations are proposed, but at present one whose feasibility has yet to be demonstrated. In this context, the NSC decided, as a first step of approach to this area, to form a task force reviewing the physics aspects of various proposals on transmutation concepts. The task force requested about 30 specialists working for transmutation to inform the physics aspects on their concepts. Based on the comparison of the results of the calculation of transmutation rate of each concept, there seems to be significant discrepancies between those concepts. As the next step, a benchmark analysis is proposed for a set of common systems of calculation in order to understand and to assess their physics concepts.

1. Background of NSC activities

The NSC was set up at the end of 1991. It replaced the former three science committees. They are, the committee on reactor physics, the nuclear data committee, and the data bank committee.

The NSC was asked to take a very wide view in its choice of topics to study. The activities of former three committees had boundaries of physics and nuclear data. But the NSC was asked especially to identify major scientific issues in areas outside such traditional boundaries. At the same time, it was particularly emphasized to establish good working relations with other NEA committees, such as the NDC, the RWMC, the CSNI etc.

From the above mentioned point of view, one of the essential roles of the NSC is to correspond systematically and comprehensively to various needs of scientific information identified by other committees. Therefore, the international information exchange meeting, like this, will give very good chance for the NSC to identify the scientific issues at present and in future.

2. A first step of approach and related activities

While continuing many projects started under the former committees, the NSC has started new activities according to new needs. Among them, the NSC has taken on different activities related to the nuclear transmutation under collaborations with the NDC and the RWMC. The nuclear transmutation is in itself an interesting concept, and will form an essential component of the NSC's activity. Various concepts on transmutations are proposed, but at present any one feasibility has not been demonstrated. A very large number of studies still need to be carried out.

Observing the historical background of the NSC, the achievements of the former three committees, and the international position of the NSC, effective use of the following two scientific tools is most substantial for activities of the NSC. The one is the creation of data bases, and the other is the organization of inter laboratory comparison exercises in member countries. The role of the Data Bank is essential in this type of activities. The creation of nuclear data base on nuclear transmutation is one of the most important activities of the NSC at present and in future as well.

As for the transmutation concepts using fission reactors, most of nuclear data could be obtained from the data base which have been created in the history of reactor development. The other typical concepts of transmutation are based on accelerator driven processes. Many new nuclear data are requested for better evaluation of accelerator driven concepts. The typical examples of them are the nuclear data of high energy proton above several hundred MeV and those of intermediate energy neutrons above several MeV. The NSC has been intensively promoting the creation of nuclear data base for these new requirements.

As a preliminary step of inter laboratories exercises on transmutation concepts, the NSC decided to form a task force reviewing the physics aspects of various proposals on transmutation concepts. The task force requested 30 specialists working for transmutation studies to inform their physics aspects. An overview of the information has been compiled as NEA/NSC/DOC (94)11 by the task Force.

Based on the comparison of the results of the calculation of transmutation rate of each concept, there seem to exist significant discrepancies between the concepts.

As for reactor based systems, for example, there is a significant difference of Cm-244 burnup characteristics among fast reactor based systems. The reason of difference has not been identified.

As for accelerator based systems, only one calculated results has been reported on mass balance of minor actinides between the beginning of equilibrium cycle and the end of it. This might be partly due to calculational difficulties of taking account of neutrons having higher energy more than 20 MeV. Therefore, it is suggested that a next step of study is necessary.

3. A proposal of next step

As an example of the next step, a benchmark analysis is proposed by using a common set of system specifications and nuclear data. The results of benchmark will be substantially helpful to understand and to assess the performances of the system, more precisely. In addition to that, the task force members have suggested that the following issues should be studied in terms of transmutation concept, they are

- radiotoxicity after transmutation,
- safety features of transmutation systems, and
- nuclear data of transuranium nuclides.

In order to challenge these issues, the NSC needs further and stronger cooperation with other NEA committees. This meeting will give a lot of stimulations to activities of the NSC.