

PARTITIONING AND TRANSMUTATION

Summary :The nuclear waste management requires new capabilities in the Partitioning and Transmutation of these nuclear wastes and involves the study and the development of innovative concepts of nuclear reactors able to burn Minor Actinides in good safety conditions. The following actions are considered and will be developed during the FP6 through a large Integrated Project:

- Nuclear data program: New data on nuclear reactions covering the whole energy range of interest for ADS and transmutation will be measured, evaluated and entered in Nuclear Data basis. Sensitivity studies will be carried out to evaluate the needs and the reliability.
- The XADS demonstrator project has to be strongly carried on : Experimental qualification of full-scale components of the accelerator with respect to reliability and maintainability, study and design of the spallation target, preparation of the irradiation capabilities of the XADS , material behaviour under irradiation studies.

The electricity production of nuclear origin participates to the improvement of the energetic independance of the E.U. countries and to the reduction of the greenhouse gases. But this production with the up to now water-moderated reactors generates also a lot of long life nuclear wastes which have to be properly managed. Two ways are under study and still require a lot of research: the deep geological disposal and the partitioning and transmutation. In that way, whatever the choice made to use the Pu largely produced in the present reactors, the Pu burning leads at the end to the production of a noticeable amount minor actinides (Am and Cu). Due to their poor properties in term of safety, it is difficult to manage their burning in large industrial critical reactors. So the Accelerator Driven Systems, where the criticality is obtained by neutron produced by an accelerator, offers larger and safer possibilities to burn the minor actinides in dedicated plants.They would allow to close the Pu cycle whatever the chosen ways.

So the main goal and the main activity for the FP6 in the priority thematic of the management of nuclear wastes(part dedicated to partitioning and transmutation) is to increase the knowledge required to build and run an ADS and mainly to prepare the XADS european demonstrator project. This project ought to be the main priority of this program and according to the recomandations of the ETWG would be largely pushed forward. Two actions have to be conducted: the increase in quantity and quality of the nuclear data required by the running of an ADS and the preparation, study and design of the XADS project

Nuclear data program dedicated to ADS and long life nuclear waste transmutation

The studies will cover the whole energy range between the thermal neutron energy and the high energy proton sent in the spallation target. The efforts have to be made not only to produce new high quality data but also to accelerate the evaluation of this huge quantity of new data and at the end to make sensitivity tests to identify the key points which may need more efforts.

Cross-section measurements

Large efforts have been made during the FP5 for the high and medium energy allowing interesting improvements in the codes describing the particle and residue production. Nevertheless some new coincidence measurements in the spallation process and some (n,xn) measurements are foreseen to improve the reliability of the codes and the physical

knowledge. In the low energy region a lot of new measurements are needed and are under preparation in various places. There are projects to measure the Minor actinides cross section directly or by the way of transfert reactions. The main problem would probably be the availability of the targets. Another project will give better normalisation of the neutron-induced fission in the 0.5-3 MeV energy range.

Data evaluation

To be used in the simulation codes (stochastic or deterministic) the data must be organized in data basis. A lot of data are being prepared for physical publication but an effort has also to be made to put the data (raw experimental data or calculated data given by a code) in a form where they are quickly and easily usable.

Sensitivity tests

The data are known with an uncertainty which may have more or less influence on the operation of the system. In some cases, it may be important to check the influence of selected parameters before to require a valuable level of uncertainty or some new difficult measurements. These tests give the opportunity to establish interactions between the communities .

XADS demonstrator project

It is the major part of the FP6 partitioning and transmutation thematic. Every part of the project has to be put forward and the aim is to be as near as possible of a detailed design at the end of the FP6..

Accelerator

The major choices for the essential components are being made now. So the major issue is to make an experimental qualification of the full-scale components with respect to the reliability and the maintainability. The global design will be prepared in interaction with the reactor choices and various scenarios concerning the beam tuning and sharing.

Spallation target

The spallation target will take benefit from the studies made for the MEGAPIE project. The experimental results obtained will be used to make comparisons with the spallation codes and will be used also to prepare the design and the building of a 5 MW target. The works on the corrosion and on the window will continue from the point of view of the materials.

Subcritical reactor

If we assume that that the choice of the coolant has been made during the FP5, a serie of precise simulations will be made to prepare the design of the core and to the ways to characterize the coupling between the target and the core. They will take into account the possibility to use the reactor for fast neutron irradiation device.