

PANEL DISCUSSION

In the course of the panel session the following statements and proposals were made by the delegations of the various countries and organizations:

A. Unsolved Problems in ceramic dense fuels:

1. The delegates of France, Japan and India stressed the existence of many unsolved problems with regard to the reprocessing of carbide and nitride fuels. In particular were mentioned :
 - lack of experience in the dissolution of irradiated nitride fuel (France);
 - the role of ^{14}C in the reprocessing of nitride fuel and the release of ^{85}Kr and ^3H during the reprocessing of FBR fuels with high burnup (Japan);
 - the problems occurring at the direct dissolution of carbide fuel in nitric acid (India);
2. The lack of data on high burnup nitride in general. The poorly known chemistry of high burnup advanced fuels as well as the lack of a pin design for attaining high burnup, were mentioned by Japan, USSR and Switzerland.
3. There is a lack of reliable basic data on carbide and nitride properties, these data are required for fuel and pin modelling (Japan, CEC).
4. More specific unsolved problems for nitride fuels are:
 - insufficient precision in the available methods for nitrogen analyses in nitrides (France)
 - the presently available results by
chemical analysis
x-ray lattice parameters

ceramography
in nitride fuels are not coherent (CEC)

The panel emphasises that work should be done to solve the problems mentioned.

B. Future Developments

The priorities proposed by the various delegations reflect to a certain degree the state of development and the boundary conditions which exist in the different countries for the development of advanced LMFBR fuels:

1. The delegations from France, Switzerland and the USSR emphasise, it should be demonstrated that advanced fuels can reach a burn-up of 15 atom %. In addition an optimized design for fuel pins (pellets and sphere-pac fuels) attaining high burnup should be developed.
2. The Japanese delegation ranks the priorities in the following order:
 - The integrity of carbide and nitride fuel pins with linear ratings between 70 and 80 kW/m and a burnup of 15 atom a/o should be demonstrated in two steps:
 - a) in experimental fast reactors
 - b) in prototype fast reactors also on a statistical basis.
 - The feasibility of the reprocessing of advanced fuels must be shown.
 - The fuel fabrication technology should be studied on the industrial scale.
 - Japan has initiated the evaluations of metallic fuel. The feasibility of the use of metallic fuel will be studied.

3. The representative of India sees the following future developments:

- Efforts must be made to establish a fabrication procedure for nitride fuel with low oxygen and carbon impurities on a large scale.
- A metal fuel on the basis of a Th-U-Pu-Zr alloy will be developed.
- The following fuels are planned to be irradiated in the FBTR:
 $(U_8Pu_2)C$, $(U_8Pu_2)N$, $(U_3Pu_7)N$ and U-Pu-Zr.

4. The delegates of the CEC propose:

A comparative study of the neutron physics and optimized core designs for a carbide -, a nitride -, a metal and a heterogeneous oxide core should be conducted in the near future.

5. The delegation of the USSR considers that MOX fuel would be used in the near future for the FBR national programme. The main efforts would be directed to the increase of burnup values as well as to the development of oxide fuels to reach these burnups under the condition of a heterogeneous active core.

The second stage will consist of designing FBRs with the improved characteristics resulting from carbide and nitride fuels. The utilization of metallic fuels is considered as a following stage.

C. Recommendations to the Agency

1. Because of its potential interest the development of the nitride and carbide fuel cycles should be emphasized and supported by the Agency.
2. The Agency should aid in the exchange of standard materials between different laboratories for the purpose of oxygen determination in carbide and nitride fuels and for nitrogen measurements in nitrides.

3. All delegates recommend to the Agency to organize the next meeting of the Technical Committee on Advanced Fuels for Fast Breeder Reactors in 3 to 5 years including neutron physics, fabrication and properties before and under irradiation.

4.
 - a) The Agency should become more active in explaining the potential advantages of the fast breeder reactors to the public. The position of the fast breeder reactor within the world energy scenario and its key aspects should be made clear. The participants agreed that the IWGFBR could play an important role in this activity.

 - b) The Agency is asked to organize a conference in which the role of the FBR in the nuclear energy scenario of the 21st century should be worked out. At this occasion the future development of the FBR in all relevant aspects should be forecast: fuel development, advanced core design, safety aspects, reprocessing and waste management.

5. Strong interest was expressed by the panel that a meeting of the reprocessing of advanced FBR fuels should be organized by the Agency in the coming years.

6. The following recommendations should be discussed in the next meeting of the Advisory Group on Advanced Fuel Technology and Performance in 1989.
 - Organization of a programme on FBR advanced fuel performance.

 - Organization of a meeting to establish the general conditions for the commercial introduction of advanced fuels.

 - To organize a meeting for discussing the results of in-pile tests of advanced fuels and high burnup and heat generation rates.