U.S. DEPARTMENT OF ENERGY
INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE
United States/European Union

ABSTRACT

Nitride Fuel Fabrication Research

Principal Investigator (U.S.): S. Wilson, Los Alamos National Laboratory

Principal Investigator (Euratom): D. Haas, Joint Research Center Institute for Transuranium Elements

Project Number: 2004-006-E (EC5)

Project Start Date: October 2004

Project End Date: September 2007

Implementation of accelerator driven systems (ADS) for the purpose of burning americium and degraded plutonium may possibly enable a reduction of radio-toxic inventories directed to geological repository by a factor of 100. The ADS is supposed to operate on uranium free fuels, in order to maximize TRU destruction rates, and thus minimize added costs to the nuclear fuel cycle induced by ADS operation and recycling of the higher actinides. The particular choice of fuel type however remains an open question, since very little experience on the performance of uranium free fuels is available.

While oxide fuels have an indisputable advantage in terms of the vast experience accumulated for conventional fuels, the low solubility rate of plutonium oxide in nitric acid appears to require a large scale development of non-aqueous reprocessing methods, with much smaller secondary waste streams than has been achieved up to date.

Uranium free nitride fuels, on the other hand, appear to be compatible with the industrialised PUREX process. They further have the advantage of allowing higher linear ratings, typically a factor of two higher than corresponding oxide or metallic fuels. Thus, the number of fuel pins needed to be fabricated and irradiated in ADS´s can be halved, with a corresponding beneficial decrease in the number of advanced cores and pump systems subject to potential failure.

The lack of data on uranium free nitrides however necessitates a significant R&D program before nitrides can be qualified and validated as a suitable ADS fuel. Completion of this program will result in generation of comparative data on the fabrication and properties of nitrides. This data will provide valuable information on the feasibility of nitrides for plutonium and minor actinide management in ADS reactors.