

## SESSION IV

### Transmutation – General

*F. Varaine and M. Salvatores (CEA-Cadarache, France)*

#### Papers presented

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#### **Phenix: The Irradiation Programme for Transmutation Experiments**

*J. Guidez (CEA-Nuclear Energy Direction, France), D. Warin (CEA-Saclay), P. Chauchepat (NUSYS, France), B. Fontaine et al. (PHENIX, France), A. Zaetta, F. Sudreau (CEA-Cadarache, France)*

#### **Pebble Bed Reactors for Once Through Nuclear Transmutation**

*P.T. León et al. (U.T.S – UPM, Spain)*

#### **An Assessment of Thermal-spectrum Transmutation Systems**

*C.G. Bathke et al. (LANL, USA)*

#### **Water and Lead-Bismuth Experiments: Fluent and Star-CD Simulation**

*A. Peña et al. (University of the Basque Country, Spain)*

#### **New Nuclear Data Libraries for Pb and Bi Isotopes**

*A.J. Koning et al. (NRG Petten, Netherlands)*

#### **Russian Programme of the Minor Actinide Nuclear Data Measurements and Evaluation**

*L.I. Ponomarev (Kurchatov Institute, Russia)*

#### **Status of Partitioning and Transmutation in India: Research, Development and Technology**

*B. Raj (Centre for Atomic Research, India)*

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#### **Summary**

The papers in this session did cover several different topics, without a defined focus:

- The first paper (presented by J. Guidez) summarized experiments to be performed in the PHENIX reactor in France. The reactor is presently shut down for standard refuelling operations, after ending the 51<sup>st</sup> cycle (which ran with an excellent load factor). Several experiment are or will be loaded, relevant to the demonstration of the waste transmutation:
  - In the physics (i.e. nuclear data assessment) area: the PROFIL – R and – M irradiations of pure Pu and MA isotope samples.
  - “Heterogeneous” once-through transmutation mode: ECRIX-B and-H experiments (Am on an inert matrix). CAMIX and COCHIX experiments (different fabrication processes).

- “Homogeneous” transmutation mode: METAPHIX (CRIEPI owner of the results), for full TRU recycling in a metal fuel. CAPRIX (high Pu content).
- Long Lived Fission Products: ANTICORP-1 (Tc-99).

The FUTURIX experiments (a CEA,DOE,ITU collaboration) will deal both with Pu-Am (nitride and oxide) fuels and with inert matrices of interest for Gen-IV GFR fuels.

- The second paper (presented by P. Leon) presented the concept of a pebble bed HTR in a once-through mode to reduce the radiotoxicity of MA produced in LWRs. The approach is to “break” the chain of successive neutron captures beyond Pu-242, in order to avoid the Am and Cm build-up. A parametric study was realized to optimise the ratio (capture Pu-242)/(fission Pu-239), by adjusting the kernel diameter of the TRISO particle. The simulation was performed with MCNP at BOL. A specific ratio was selected, but it was pointed out that future work should confirm the performance during irradiation, due to the expected significant variation of the spectrum and criticality management. The paper did also show some thermal-hydraulics simulations with the FLUENT code, to confirm the possible high outlet temperatures (for hydrogen production).
- The fourth paper (presented by A. Pena) gave an intercomparison of two CFD codes. The configurations chosen for that purpose, were related to, respectively, a water and a LBE experiment. The study was not intended to be a real analysis of the experiments, but rather a pure intercomparison of codes. With the parameters initially chosen for the analysis, some rather large discrepancies were found, and more work is needed for a full validation of models.

The fifth and sixth papers dealt with nuclear data issues:

- The paper by A. Koning *et al.* presented a complete evaluation of Pb and Bi isotopes, made with the model code TALYS. The results were compared to differential experiments, and the performance of the new evaluation was found to be very satisfactory, with an improvement with respect to the evaluations in the major data files. Some calculations of a few integral experiments were also presented, giving again rather satisfactory results. Work is planned to evaluate covariance matrices, but in the discussion a preliminary indication was given on (n,2n) and (n,n') reactions uncertainty, which looks consistent with the requirement of 10-20% accuracy for design purposes.
- Finally, the paper by L. Ponomarev presented a proposal for a very comprehensive experimental program which should give access to most MA nuclear data in a wide energy range. Several Russian Institutions and installations would be involved, both for differential and integral experiments of high accuracy. This very valuable program should now find appropriate sources of financing, and there was the request to the major international laboratories involved in waste transmutation studies, to express their interest and support.

As a final comment, the remark was made that at this workshop, relatively few oral presentations were made in the crucial fields of materials and HLM technology, and it was recommended to take this point into account for future workshops.