

## SESSION III

### Partitioning

*Chairs: J.P. Glatz (ITU) – J. Laidler (ANL)*

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### SUMMARY

Professor Charles Madic of DEA-DCC (Saclay) presented an overview paper on chemical partitioning in which he described in considerable detail the French processes for the extraction of minor actinides and their separation from lanthanide elements. He noted that the number of aqueous processes is burgeoning and that the processes are becoming too complex. He registered a plea for process simplification and for reduction in the size of process equipment, achievable perhaps by pre-concentration of the solutions to be processed.

Professor Michael Hudson of University of Reading gave a richly detailed description of the structure and characteristics of heterocyclic ligands that can be exceedingly useful in the extraction of lanthanides and minor actinides. He presented a comprehensive model for designing ligands to function as specialized extractants for specific lanthanide elements.

Dr. Jean-Paul Glatz of the European Commission Joint Research Centre/Institute for Transuranium Elements (EC-JRC/ITU) reported on the successful demonstration of minor actinide/lanthanide separations using a nitric acid PUREX raffinate solution containing minor actinides and lanthanides. Bis-triazinepyridine (BTP) was used as the extractant in a 16-stage centrifugal contactor train operating in the counter-current mode. Reasonable decontamination factors and recovery efficiencies were achieved. The work is particularly noteworthy because it is the first demonstration of minor actinide/lanthanide separation using an actual waste stream.

Dr. James Laidler of Argonne National Laboratory presented a paper describing a pyrochemical process being developed for use with a non-fertile metallic transmuted blanket fuel. This chloride volatility process involves digestion of the inert zirconium matrix by formation of volatile  $ZrCl_4$ . Transuranic elements are subsequently recovered from the residual salt by electrowinning. The unit operations comprising this process have all been successfully demonstrated with simulated fuel.

Dr. Jan Uhlir of the Nuclear Research Institute, Rez, Czech Republic, proposed the use of a fluoride volatility method as a continuous or semi-continuous process for partitioning molten salt fuels in a molten salt transmutation reactor scheme. He maintained that a practical near-term application of fluoride volatility processing may be as a means for processing oxide fuels to remove uranium and

recover transuranics for fissioning in a transmuter system. He cited experience in processing BOR-60 oxide fuel at Dimitrovgrad in the 1980s.

The CRIEPI/Transuranium Institute collaborative effort was described by Dr. Jean-Paul Glatz. This study involves the processing of metal alloy fuels (U-Pu-Zr and U-Pu-MA-Ln-Zr) using molten salt electrorefining and reductive extraction. A capability for small-scale hot processing has been established at EC-JRC/ITU, and preliminary experiments have been carried out with the electrorefiner, including both solid and liquid cathode deposition. A molten salt/metal reductive extraction process has been used to demonstrate the cleanup of electrolyte salt as well as for the treatment of high-level liquid waste.

Dr. M. Iizuka of CRIEPI described their work in development of the liquid cadmium cathode. The work was performed with a small (9 mm dia.) cathode crucible, without stirring or agitation. The result was that complete recovery of Pu could be obtained at low current densities and low concentrations, but that Pu loss occurred at higher current densities by rapid growth of dendrites. The work led to a projection of a Pu collection rate of nearly 300 grams per hour in a crucible of practical dimensions, with Pu loadings in the cathode approaching 5 wt.%.