ACSEPT – a successful story in actinide separation process development in EUROPE

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Abstract

All along the last four years, the FP7 EURATOM Collaborative Project ACSEPT (Actinide recycling by SEParation and Transmutation) has coordinated the European Research on aqueous and pyro-actinide chemical separation processes. A clear structuration of the work and an enthusiastic collaboration between Partners has allowed significant progress in actinide separation process development.

In the field of aqueous reprocessing, four hot-test demonstrations have been carried out based on chemical systems developed in former European Projects (NEWPART, PARTNEW, EUROPART) or directly in ACSEPT. Process flowsheets are now available for the regular SANEX, the innovative SANEX, the 1 cycle SANEX and the GANEX concepts (some of them being more elaborate alternatives to reference existing processes) paving the way for further optimisation. This progress was made possible thanks to a well driven organic synthesis work. It allowed the testing of more than 150 new molecules and the selection of about 5 of them for further process development. In addition, specific issues related to advanced fuel cycles involving materials with high Pu loading or minor actinides were addressed such us MOX dissolution or co-conversion into solid forms suitable for fuel fabrication.

In the field of pyrochemical process development, two reference core of process were selected within EUROPART (the electrorefining on solid aluminium cathode in molten chloride and the liquid-liquid reductive extraction in molten fluoride/liquid aluminium). In ACSEPT, the work has been continued with a focus on key process steps such as the exhaustive electrolysis allowing a quantitative recovery of the transuranics after the electrorefining or the actinide back extraction from an aluminium alloy, crucial step for the two reference processes. In addition, a specific effort has been allocated to the head-end step (oxide pre-reduction, thermal treatment), the salt recycling (chloride salt purification by precipitation, fluoride salt purification by distillation) and the specific salt waste conditioning.

This experimental work has been completed by cross cutting studies, such as system studies, scale up studies, corrosion studies and online process monitoring developments for molten salts. The MARIOS irradiation performed in FAIRFUELS was also designed in ACSEPT to allow a better schedule of this long run experiment.

In parallel, one of the major successes of ACSEPT has also been its investment in people with the funding of two post-doctoral positions and of a dozen of student exchanges between partners allowing these students to broaden their field of competences and to increase collaboration between partners. Specific workshops and seminars were also organised to allow a better exchange between partners.

At one week of the end of the project, this paper will highlight the main achievements of ACSEPT and will identify and propose tracks for future developments meeting the requirements of EURATOM work-program. Based on the successful work performed in ACSEPT, a new project proposal has been submitted to EC that would allow the community to optimise the selected separation processes and demonstrate and increase their safety on sound scientific bases.