

The role of pyrochemical processing in a NetZero economy in the UK

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The programme described here is part of a UK government investment in Nuclear to be delivered by a collaboration of UK Government, The UK National Nuclear Laboratory (NNL), Industry and Academia. The programme will contribute to international understanding of development and demonstration requirements for pyro-processing as well as emerging applications for salt separations enabling a broad base of future fuel recycling. This paper will outline the programme and present early findings.

Electrorefining as an actinide separation technique offers potential to provide useful fissionable material as part of a closed fuel cycle. It is specifically designed for irradiated metallic fuel, but other fuel types can be processed with pre-treatment; it uses a molten chloride salt electrolyte such as a eutectic mixture of lithium chloride and potassium chloride. The production of a baseline flowsheet model and demonstration of key engineering aspects such as scalability and in-line process monitoring will raise the technology readiness level of pyro-processing technology in the UK.

Basic molten salts data capture is limited in the UK, data will be generated by NNL and university partners through post-doctoral research programmes and physical properties and materials data captured in a centralised database. This will not only be used longer term to develop potential future facilities but is being used directly to inform other areas of the wider pyro-processing project such as the flowsheet development and pilot-scale demonstrator work packages.

A lab-scale Pu-active pyro-processing rig being developed providing a key UK capability. This rig will provide new data on the behaviour of Pu and other components in the molten salt. It will complement the concept design of a pilot-scale rig is being developed to investigate the engineering practicalities of operating a full-scale pyro-processing plant such as scalable pumping systems, instrumentation and control (process and accountability), materials of construction etc. this will also allow us to assess the impact of introducing a fluoride-based salt matrix.

The activities and outputs from the Salt Engineering and Salt Science activities will enable NNL to evaluate, on behalf of the UK, the case for recycle in advanced fuel cycles at a broad level and set out the potential drivers or switching points between advanced aqueous and pyro-processing technologies. The results will inform the direction of any follow-on project through the development of a future UK roadmap in pyro-processing and identify opportunities for international collaboration and leveraged investment.

Country/Int. organization

United Kingdom of Great Britain and Northern Ireland

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