Separation of Minor Actinides in the *Partitioning & Transmutation* Context

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Plutonium and the minor actinides (neptunium, americium, curium) control the long-term radiotoxicity of spent nuclear fuels. If these elements are submitted to nuclear transmutation in ADS or fast reactors the long-term radiotoxicity (and the heat load to a geological repository) could be substantially alleviated.

Before transmutation, the actinides must be separated from the fission products, especially those having large neutron capture cross sections. Both hydrometallurgical and pyrometallurgical separations may be used for this task (i.e., “Partitioning”). Hydrometallurgy makes use of selective complexing agents which extract the metal ions to be separated into an organic phase immiscible with the aqueous feed phase. The advantages are mainly the large experience already gathered from industrial applications and that there is high degree of chemical flexibility. However, new advanced fuels types or transmutation targets under development might have a low solubility in aqueous solutions. In addition, very high burn-ups and short cooling times may cause radiolysis of organic solvents. In this case, pyrometallurgy is better suitable as it utilises highly stable liquid metals and molten salts in combination with electrochemistry to achieve separation.

Capabilities and drawbacks of both separations techniques are discussed with respect to their applicability in the P&T context. Additionally, the interface between Partitioning and Transmutation will be addressed, i.e., aspects of fuel or target dissolution and refabrication.