The Effect of Ln(III)/An(III) Separation on Feasibility of TRU Recycling

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One of the main goals of Generation IV nuclear energy systems is to minimize and manage nuclear wastes through partitioning and transmutation of transuranic elements (TRU).

TRU recycling requires the availability of the reprocessing technologies that can provide separation of TRU and fission products (FP) from the spent fuel efficiently and economically. The existing industrial scale aqueous reprocessing technology using solvent extraction techniques can recover U and Pu with sufficient yields. However, high recovery yields are also required for other minor actinides if the waste management objectives are to be reached.

One of the most significant challenges in aqueous processes is the separation of trivalent actinides (An(III)) from trivalent lanthanide fission products (Ln(III)) due to their chemical similarity. Recently proposed[1-4] trivalent actinides-lanthanides separation methods are very complex therefore can significantly increase the cost of reprocessing.

In this study, we investigate the basic feasibility of recycling Ln(III) fission products together with An(III) TRU without separating them as commonly assumed. TRU recycling in thermal and fast spectrum will be considered.

The objective of this study is to evaluate the effect of Ln(III) separation on major fuel cycle and core operation parameters, such as initial fissile material loadings, cycle lengths,

reactivity coefficients, and TRU destruction efficiency and compare them with the similar cases where Ln(III) are separated and not recycled.

The neutronic calculations will be performed with two-dimensional transport and depletion code BOXER[5] and the BGCore[6] system, currently under development at Department of Nuclear Engineering, Ben-Gurion University of the Negev.

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