Modeling and Simulation of Online Reprocessing in the Thorium-Fuelled Molten Salt Breeder Reactor

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Abstract

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1. Introduction

- Background and motivation from the thesis.
- Brief Molten Salt Reactor (MSR) overview and 1 paragraph history.
- Molten Salt Breeder Reactor (MSBR) advantages. Objectives from the thesis.
- Changed simulation time 40 years (or more).
- Figure 2.3: Isotopic build-up in ^{232}Th and ^{238}U breeding systems.
- Literature review from Section 2.3 without multiphysics + existing full-core simulations (Park et al., Skirpan et al.)

2. Methods

- MSBR design description.
- SERPENT2 very short overview (couple paragraphs).

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- Full-core model description.
- Online reprocessing method. Advantages and disadvantages of batch-wise approach. SaltProc capabilities description.

3. Results

- K-eff over 40 years of simulation with <15pcm uncertainty.
- Dynamics isotope composition from initial to equilibrium composition.
- Dynamics of fissile vs non-fissile isotopes over 40 years.
- Neutron spectrum for both states and separately for Zone I and Zone II (probably, even Zone II-A and II-B).
- Power distribution plot (without breeding, too much pics).
- Control rod worth & Six factor analysis & temperature coefficients.
- ^{232}Th refill rate.
- Bried discussion (2-3 paragraph).

4. Conclusion

Condensed copy-paste of the thesis conclusion.

- Full-core model which is better the most exists. Importance of full-core approach for multi-region designs.
- K-eff dynamics and explanation of this dynamics.
- Spectral shift explanation.
- Why spectral shift causes safety parameters worsening and power profile changes.
- ^{232}Th rate is in a good agreement with references.

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