

Preliminary Neutronics Analysis for the Li₂O Particulate Concept

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Preliminary Neutronics Analysis for the Li_2O Particulate Concept



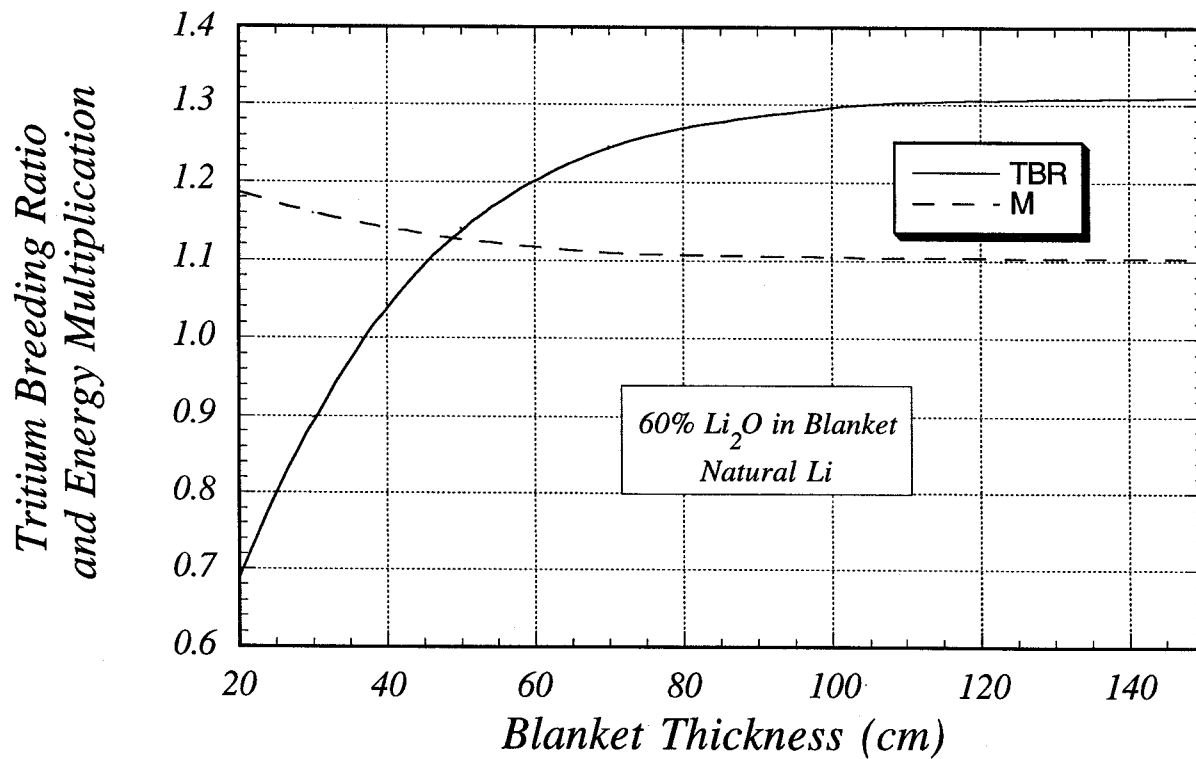
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- 5 cm front blanket layer of Li_2O @30% packing fraction
- 0.5 cm SiC baffle
- Li_2O blanket @60% packing fraction
- 70 cm reflector/shield consisting of 80% 316SS and 20% H_2O
- 1-D calculations for local nuclear parameters
- Effect of blanket thickness and Li enrichment on TBR, M, and SS damage investigated
- Overall TBR and M estimated for tokamaks with different aspect ratios

TBR Increases Reaching a Maximum Value of 1.3 and M Decreases Slightly with Thickness Increase



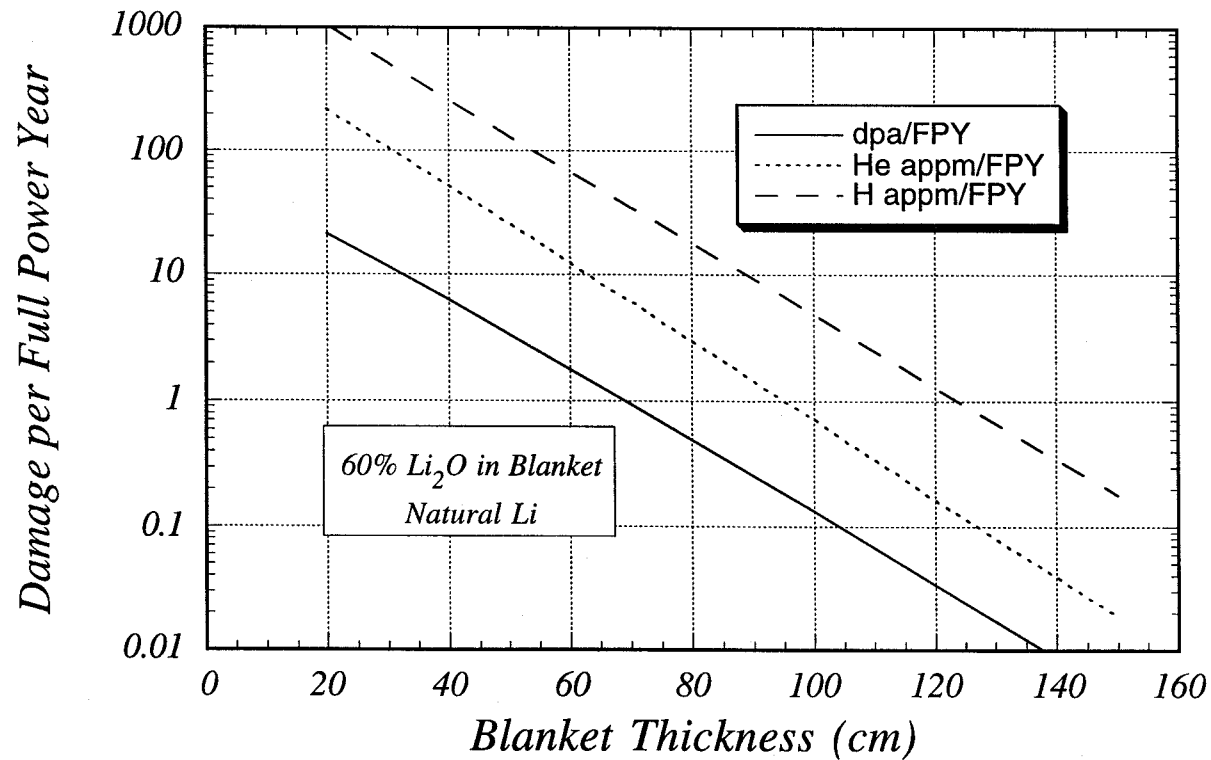
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SS Damage and Gas Production Decrease by an Order of Magnitude for Each Additional 35 cm Blanket Thickness



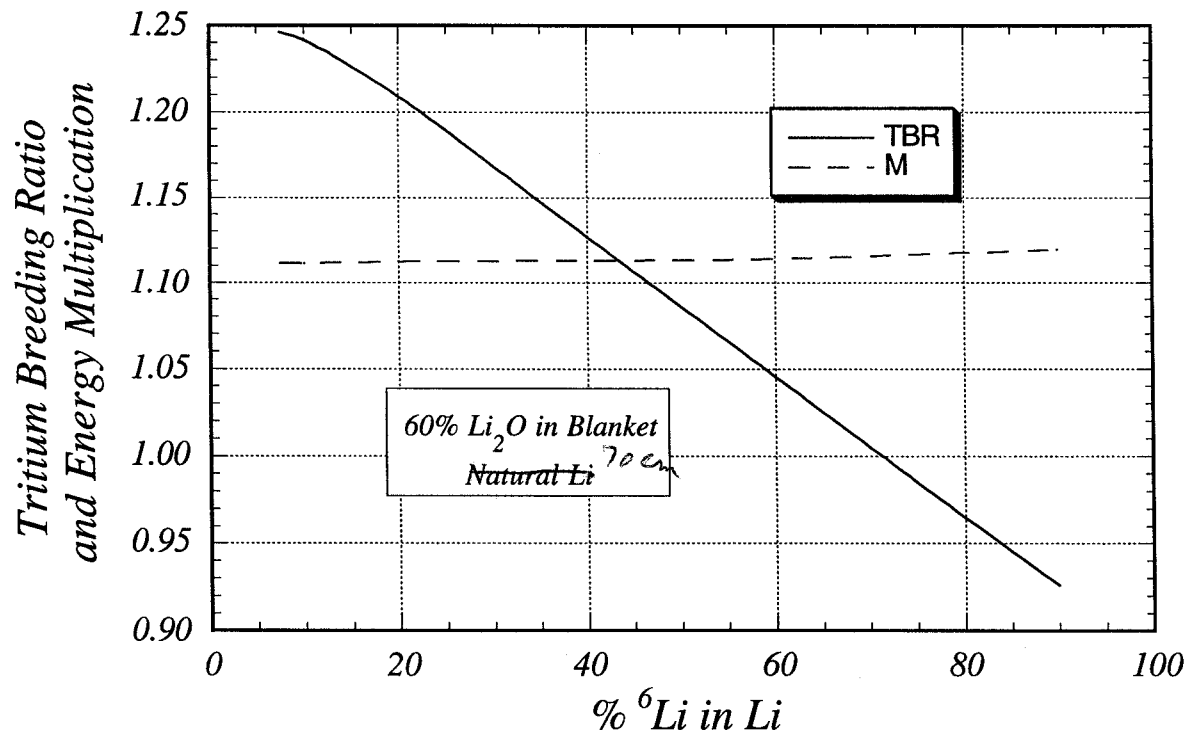
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Enriching the Li Results in Significant Decrease in TBR and Negligible Increase (<1%) in M



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Preliminary Neutronics Parameters for Outboard Blanket



- Total blanket thickness 70 cm
- Natural Li
- Local TBR 1.25
- Local M 1.11
- SiC baffle (not structure member) will require replacement
 - 61 dpa/FPY \Rightarrow 1800 dpa @ end-of-life
 - 6683 He appm/FPY
 - 4629 H appm/FPY
- 316SS structure is lifetime component
 - 0.95 dpa/FPY \Rightarrow 29 dpa @ end-of-life
 - 6.15 He appm/FPY
 - 34.7 H appm/FPY

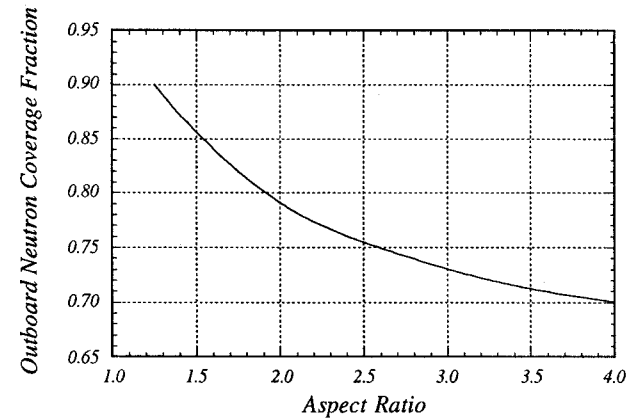
Preliminary Estimate of Overall TBR



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- Overall TBR depends on neutron coverage fraction of the regions surrounding the plasma and blanket thickness in each region

- NCF depends on aspect ratio



- Low Aspect Ratio (ARIES-ST A= 1.6)

84% OB, 9% IB, 7% div

70 cm OB, 20 cm IB, 20 cm div \Rightarrow 1.16 overall TBR

- High Aspect Ratio (ARIES-IV A= 4)

70% OB, 20% IB, 10% div

70 cm OB, 30 cm IB, 20 cm div \Rightarrow 1.13 overall TBR

Neutronics Summary



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- Increasing blanket thickness results in increasing TBR with a maximum value of 1.3 and a slight decrease in M
- For total OB blanket thickness of 70 cm local TBR is 1.25 and local M is 1.11
- 316SS structure is lifetime component
- Overall $TBR > 1.1$ is achievable in typical low and high aspect ratio designs