



Discussion: Material Challenges for High Power Spallation Targets

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Increasing damage rates leading to shorter component lifetimes

- Property degradation, e.g., elongation to failure (uniform / total), fracture toughness
- SNS target vessel (Hg / SS316L): 10 dpa “limit” reached in ca. 5000 MW-hrs (~ 1 year at 1 MW)



Limits / engineering codes & standards

- Safety accreditation requirements vs. prudent facility engineering
 - Big impact on flexibility in design, materials & performance
- Material design data needed, regardless (handbooks)

Higher heat loads:

- Potential for higher temperatures, thermal stress and pressure pulses (short pulse)
- Either time averaged / per pulse basis
 - SNS @ 1 MW, 60 Hz, $E_{\text{max}} = 6.6 \text{ J/cc/pulse}$ in Hg; $dT = 3.5 \text{ K/pulse}$
 - 5 MW, 10 Hz: 30x higher per pulse (for same energy, target material)

Other components:

- Moderators, reflector plug, proton beam window will also pose material challenges

Cavitation Damage resistance (SP LM targets)

- SNS experience:
 - Improvements in damage resistance vs. gas mitigation approaches