Contribution ID: **800** Contribution code: **THPS45** Type: **Poster Presentation**

Proton beam power limits for stationary water-cooled tungsten target with different cladding material options

Thursday, 23 May 2024 16:00 (2 hours)

The proton beam power limit on a spallation target is largely determined by beam induced thermomechanical structural loads and decay heat generation within the target, and its lifetime is limited by radiation damage and fatigue behavior of the spallation materials. In this paper, we present the power limits for a stationary water-cooled solid tungsten target concept with different tungsten cladding material options that include tantalum, zircaloy or stainless steel. These cladding materials have proven operations records in spallation target and nuclear fission environments, supported by materials data gathered from post irradiation examinations. Particle transport simulations code FLUKA was used to calculate energy deposition and decay heat in the target, based on beam parameters technically feasible at the Second Target Station of the Spallation Neutron Source at Oak Ridge National Laboratory. The energy deposition data were used for coupled flow, thermal, and structural analyses of the target to determine its beam intensity limit. The decay heat data were used to calculate the transient temperature evolution in the tungsten volume in a loss of coolant accident scenario to determine its beam power limit. The beam power limit on the target was determined by the maximum surface temperature of tungsten, which is limited by 800℃ due to risk of safety hazards caused by volatilization of tungsten oxides in steam environment above this threshold temperature.

Footnotes

Funding Agency

Paper preparation format

LaTeX

Region represented

North America

Primary author: LEE, Yong Joong (Oak Ridge National Laboratory)

Presenter: LEE, Yong Joong (Oak Ridge National Laboratory)

Session Classification: Thursday Poster Session

Track Classification: MC7: Accelerator Technology and Sustainability: MC7.T20 Targetry and Dumps