IPAC'24 - 15th International Particle Accelerator Conference



Contribution ID: 800 Contribution code: THPS45

Type: Poster Presentation

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

Thursday 23 May 2024 16:00 (2 hours)

The proton beam power limit for a solid-tungsten spallation target is largely determined by beam induced thermomechanical structural loads and decay heat power deposition, while its lifetime is limited by radiation damage and fatigue life of the target materials. In this paper, we studied the power limits of a stationary water-cooled solid tungsten target concept. Tantalum clad tungsten was considered as a reference case. Being a low activation material, zircaloy 2 cladding option was studied and its decay heat driven power limit was compared with the reference case. Zirconium alloys have proven operations records in spallation target and nuclear fission environments, supported by materials data obtained from post irradiation examinations. Recent study also demonstrated feasibility of diffusion bonding zirconium to tungsten using vanadium foil inter layer. Particle transport simulations code FLUKA was used to calculate energy

deposition and decay heat power deposition in the target, based on the 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 flow, thermal, and structural analyses to determine the beam intensity limit on the target concept studied. The decay heat deposition data were used to calculate the transient temperature evolution in the tungsten volumes in a loss of coolant accident (LOCA) scenario to determine its beam power limit. For a 1.3 GeV proton beam, the power

limit on a stationary target was 400 kW for a tantalum clad target model and 800 kW for a zircaloy 2 clad target model.

Footnotes

Funding Agency

Paper preparation format

LaTeX

Region represented

North America

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