Contribution ID: **6** Type: **Poster**

Preliminary Evaluation of Alloying Significance of Neutron Target for High Brilliance Neutron Source

Tuesday, 25 February 2025 16:24 (1 minute)

Accelerator-based neutron sources are critical infrastructures in today's scientific research and industrial fields, with the neutron source target being the key component determining the performance of the neutron source. Traditional accelerator neutron source targets typically use homogeneous elemental materials with high neutron yield as the target material. These materials face challenges in terms of operational lifespan under high-temperature and high-radiation environments. The design of next-generation high brilliance neutron sources demands target materials with better thermal conductivity, longer irradiation lifespan, and superior corrosion resistance. Tungsten has its high neutron yield, and tungsten alloys exhibit these advantageous properties. We employs the Monte Carlo method to calculate neutron yield, radioactivity and radiation damage of two common tungsten alloys, W-TiC and W-ZrC. The results indicate that, with minor doping to improve mechanical properties and manufacturability, the performance of tungsten alloys can also meet the requirements for high-brilliance neutron targets, provide reference for the development of the next generation neutron target.

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Funding Agency

National Natural Science Foundation of China (Grant No. 12175319, 12475170)

Abstract classification - track type

Instrumentation and Hardware

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Session Classification: Poster Session 1