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Strategies to Improve ISIS TS2 Target Life

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ABSTRACT

The working front of a target of ISIS Target Station 2 (TS2) is an assembly of a tungsten core clad with tantalum enclosed within a tantalum water cooling jacket. The aim of the tantalum cladding is to prevent the tungsten coming in contact with the pressurised and fast cooling water. However, a gamma spectral analysis on the cooling water after a target has failed shows the evidence of transmuted products of tungsten such as 175Hf, 172Lu, 182Ta and 187W in the water. An electron beam weld joint on the tantalum cladding was identified as one of the areas of weakness. The penetration of the weld using the existing method was found to be inadequate and the grains of the weld line were found to be significantly enlarged. A failure of the cladding through the weld joint would cause the target life to be significantly shortened.

In order to improve the weld penetration, a study using different settings of the weld parameters such as weld current, oscillation and focus of the beam has been carried out. The study concluded that maximum weld penetration could be achieved using a combination of high weld power, sub surface focus of the electron beam and low material volume around the weld line.

A modification in the design of the front of the target has also been undertaken to ensure full penetration at the weld joints. This will prevent water coming in contact with Tungsten through the welding joint. In addition recent EB welding trials with a revised strategy, using multiple passes electron beams at different energies, have been successful in achieving 1350 μm weld penetration. An increase in the longevity of TS2 target and improvements in cooling water quality have been achieved after the modifications.