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Design and Fabrication of a EUROFER97–316L Tritium Breeding Module Incorporating Solid Li_2TiO_3 Ceramics

As a part of LIBRTI programme, the University of Birmingham has designed and manufactured a Tritium Breeding Module (TBM). The module is required to house a solid Li_2TiO_3 breeder block capable of producing tritium under neutron irradiation, which can subsequently be captured using a bubbler system and quantified via liquid scintillation techniques. Helium–hydrogen purge gas (95% He, 5% H_2) is supplied through 316L stainless-steel pipework integrated into a EUROFER97 chamber. The dissimilar joints between the 316L tubing and EUROFER97 body were produced using TIG welding in air, ensuring a fully sealed assembly; alternative joining approaches, including laser welding in argon, have also been evaluated.

The TBM geometry was iteratively refined to optimise internal gas flow, minimise tritium trapping sites, and enhance flushing efficiency. This ensures uniform purge-gas circulation through the breeder material and effective tritium recovery. Following fabrication, helium leak testing was performed to confirm the integrity of the enclosure and the welded interfaces. This presentation will outline the design rationale and manufacturing considerations that underpin reliable tritium extraction.

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