FUSION FOR ENERGY

TECHNOLOGY OFFER

Manufacturing of high-density tungsten parts with complex geometries using E-PBF technology

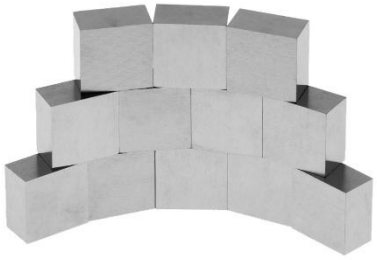
Tungsten is essential for extreme environments thanks to its high melting point, density, and radiation resistance. However, producing near-fully dense tungsten parts with controlled microstructure and complex geometries remains a major challenge. Conventional manufacturing and alternative additive technologies typically suffer from porosity, cracking, or severe design limitations. Through developments supported by Fusion for Energy (F4E), Freemelt has demonstrated a solution that overcomes these constraints.

The development

Freemelt has developed and validated an Electron Beam Powder Bed Fusion (E-PBF) manufacturing capability specifically suited for tungsten. The process operates under ultra-high vacuum and at elevated powder bed temperatures, enabling stable processing of tungsten with densities exceeding 99.97%, low contamination, and controlled grain structure. Unlike other additive manufacturing technologies, Freemelt's E-PBF systems allow the production of both simple and highly complex tungsten geometries without compromising material integrity. The technology has been successfully applied to ITER-relevant tungsten tiles and blocks, meeting strict requirements on density, purity, and microstructural quality.

Advantages

- Cost competitive compared with traditional manufacturing methods
- Resilience, European supply chain from mine to part
- Tungsten components with density above 99.9%
- Reduced residual stresses and high material purity
- Relevant for fusion, medical radiation shielding, X-ray systems, space, and high-temperature applications.



Fusion Tungsten parts produced by Freemelt

Collaboration opportunities

Freemelt offers this technology to research and industrial partners interested in advanced tungsten components for extreme environments, and is open to collaborations on application development, qualification, and industrial scale-up.

Fusion for Energy Technology Transfer Programme

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