Technical University of Munich
TUM School of Engineering and Design
Professorship of Laser-based Additive Manufacturing

Professorship of Laser-based Additive Manufacturing

Additive Manufacturing of Pure Tungsten (BA/SA/MA)

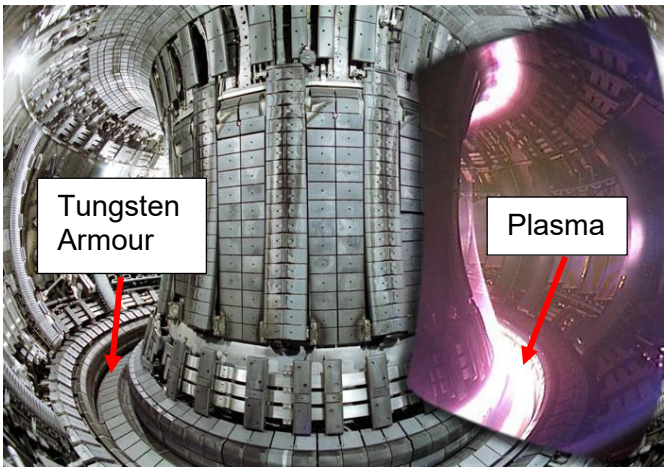
Initial situation

At the Professorship of Laser-based Additive Manufacturing, the research team works on advancing laser-driven additive processes for high-performance metallic materials. Powder bed fusion of metals using a laser beam (PBF-LB/M) enables the fabrication of highly complex metallic structures without tooling. Pure tungsten (W) is of high interest in nuclear fusion research, where its exceptional melting point, thermal conductivity, and resistance to sputtering make it a strong candidate for plasma-facing components.

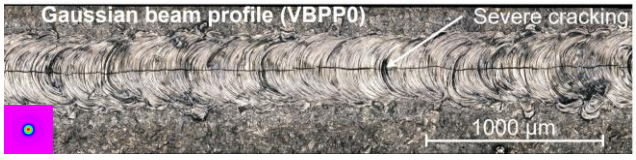
However, due to its high melting temperature, very high brittleness at room temperature, and strong tendency to develop large thermal gradients, the PBF-LB/M processing of pure W remains extremely challenging.

Aim and content of the work

The aim of this thesis is to identify and evaluate a suitable process window for the PBF-LB/M processing of pure tungsten using advanced laser beam shaping and oscillation strategies. Based on previous internal experiments, the work focuses on understanding crack formation mechanisms within the material and correlating them with the underlying process parameters.



Typical application of tungsten parts within the JET nuclear fusion reactor [https://www.euro-fusion.org/jet/]



Tungsten single weld line crack

The following work packages (WP) form the content of the thesis:

WP1: Literature review on PBF-LB/M of refractory metals, laser beam shaping, and oscillation strategies
WP2: Evaluation of existing internal experiments and derivation of potential process windows
WP3: Experimental fabrication of W samples using selected parameter sets
WP4: Microstructural and crack analysis (e.g., metallography, microscopy, …)
WP5: Correlation of processing conditions with cracking mechanisms and identification of optimization approaches
WP6: Documentation and presentation of results

Requirements / Application documents

-Initiative and creativity
-Interest in the subject area of additive manufacturing
-reliability

Please send your application with a short motivation letter and a current transcript of grades to:

Contact

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