

Professorship of Laser-based Additive Manufacturing

Additive Manufacturing of CM247 Super-Alloy (BA/SA/MA)

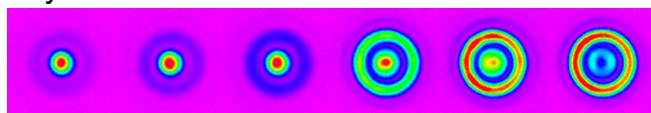
Initial situation

At the Professorship of Laser-based Additive Manufacturing, the research team focuses on advancing laser- and powder bed-based additive manufacturing processes. Powder bed fusion using a laser beam (PBF-LB/M) enables the production of highly complex, functionally optimized metallic components with unprecedented design freedom.

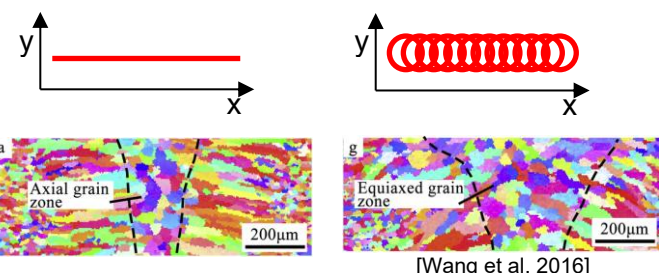
Nickel-based superalloys such as CM247 are of particular interest for high-temperature aerospace and energy applications due to their excellent creep resistance and mechanical strength. However, their processing via PBF-LB/M remains challenging because of their susceptibility to cracking and the complex solidification behavior during laser melting.

Aim and content of the work

The aim of the thesis is to identify and evaluate a suitable process window for PBF-LB/M processing of different compositions of CM247 using advanced beam shaping and laser oscillation strategies. Building on existing internal experiments, the microstructure shall be tailored to improve mechanical properties by adjusting the laser-material interaction and thermal history.



Different Laser Beam shapes with ring/core power distribution



Continuous wave (left) and circular oscillation (right) laser scan trajectory and corresponding microstructure



Example of a nickel-superalloy nozzle

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

- WP1:** Literature review on PBF-LB/M of nickel-based superalloys, laser beam shaping, and oscillation strategies
- WP2:** Analysis of existing internal experiments and definition of process parameter windows
- WP3:** Experimental manufacturing of samples using selected process windows
- WP4:** Microstructural characterization (e.g., metallography, porosity analysis)
- WP5:** Evaluation of microstructure-property relationships and derivation of optimization measures
- 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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