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imkf INSTITUT FÜR MASCHINENELEMENTE KONSTRUKTION UND FERTIGUNG
PROFESSUR ADDITIVE FERTIGUNG

Topic Definition for a MASTER THESIS

for

Topic: **Development and Characterization of Multi-Material Components in Powder Bed Fusion via a Dual-Machine Approach**

Additive Manufacturing (AM) has revolutionized modern manufacturing by enabling complex geometries and customized material properties. However, Powder Bed Fusion (PBF) processes, specifically laser or electron beam melting, are typically restricted to single-material fabrication due to machine constraints. The demand for multi-material AM components is rising, particularly in industries requiring functionally graded materials and hybrid structures.
To address the need for multi-material, a novel dual-machine approach is proposed where two different PBF systems will be utilized sequentially to process different materials on a common substrate fixture. This research will focus on designing a universal substrate that fits both machines, ensuring compatibility and precise alignment. Additionally, the mechanical properties of the resulting bi-metallic structures will be evaluated.

The following tasks should be completed:

- Design and fabricate a substrate fixture compatible with two different PBF machines.
- Develop a workflow for sequential multi-material deposition using both machines.
- Conduct mechanical and thermal testing on bi-metallic samples, including tensile, hardness, thermal conductivity, etc.
- Compare different properties of bi-metallic samples with individual material counterparts.
- Analyze results and assess the feasibility of the dual-machine approach for multi-material AM.

Note: Thesis will be in the English language, but the German language for communication is a must.

For the defense of the thesis, a poster and a video must be submitted according to the specifications of the professorship.

Issue:
Submission:
Mentor: Dr. Neel Kamal Gupta

Prof. Dr.-Ing. H. Zeidler
Academic supervisor