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

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Process Monitoring in Metal Additive Manufacturing: Co-axial Multispectral Imaging

Initial situation
The Professorship for Laser-based Additive Manufacturing is researching innovative concepts in Laser-based Powder Bed Fusion of Metals (PBF-LB/M), an additive manufacturing process that creates components by successively melting metal powders in layers with a laser.

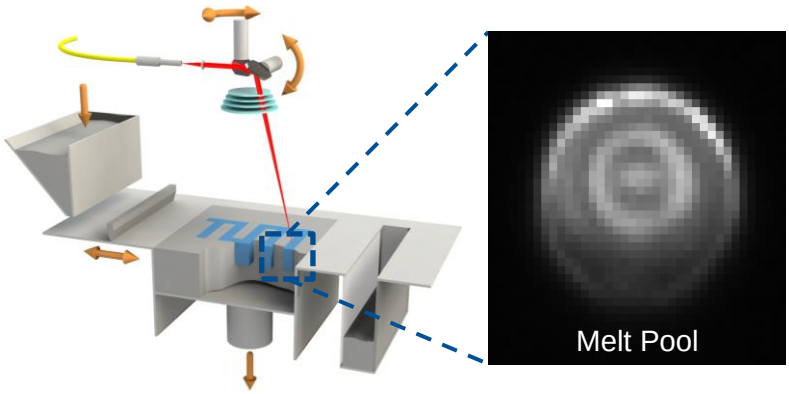
PBF-LB/M offers the potential to produce zero-defect, cost-effective complex metal parts. However, the intricate thermal histories during laser-metal interactions can lead to problematic areas and abnormal microstructures. As a thermally driven process, acquiring accurate temperature distribution data in the laser-material interaction zone is crucial. Here, Multispectral Imaging (MSI) comes into play, which captures various wavelengths of emitted light from the melting pool. Although our self-developed algorithms have demonstrated high accuracy in an off-axial setup, now we transfer our method into an co-axial system.

Aim and content of the work
This thesis predominantly focuses on measuring and analyzing the melt pool in the PBF-LB/M process using MSI. This endeavour will involve devising a conceptual framework and experimental methodology to acquire and understand the melt pool, with the incorporation of a self-developed temperature calculation algorithm. The aspiration is to attain a deep-seated understanding of the melt pool by aligning insights derived from MSI.

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

WP1: Literature review of AM process monitoring and parameter study.

WP2: Augment and refine the existing measurement system to enhance its capability.



WP3: Execute experiments, delivering in-depth insights into the melt pool.

WP4: Validate the results through experiments and the previous off-axial data.

WP5: Isolate and analyze features and dynamics inherent to the melt pool to ascertain their implications and manifestations.

WP6: Discussion and documentation.

Requirements / Application documents
- An Interest in the physics governing laser-metal interactions and AM.

- Communication and problem solving abilities.

- A keen inclination towards experimental design and an analytical approach to research.

- A willingness to spearhead AM experiments.

Please send your application with your **CV**, a brief **motivation letter** and a **current transcript of grades** to:

Contact
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