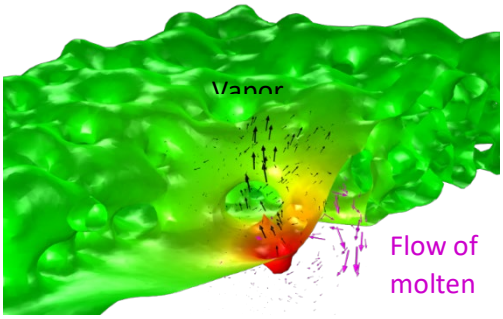
Institute of Applied Physics
Friedrich-Schiller-Universität Jena

Laser assisted powder bed fusion: laser absorption measurement in the melt pool by calorimetry

Backround:

Additive manufacturing (AM) based on the laser assisted powder bed fusion (L-PBF) has become an established process in the industrial environment over the last decade. The layer-by-layer process enables the production of highly complex components which cannot be produced by conventional manufacturing methods such as machining or metal casting.



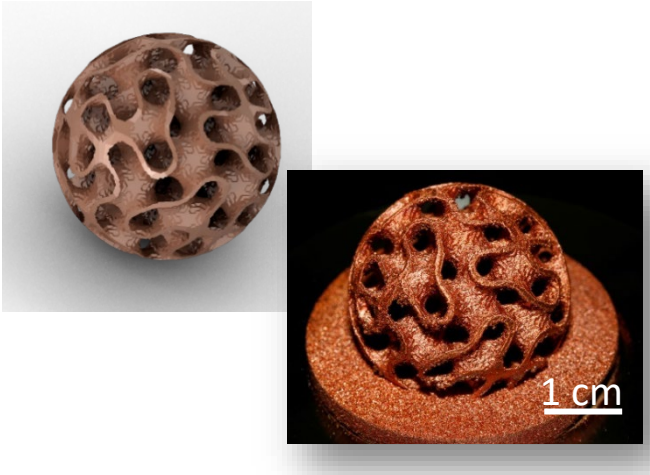
Problem definition:

The L-PBF process is a highly dynamic multiphysical process. Small changes to the manufacturing parameters can have a major impact on the manufacturing result. To obtain a controlled and repeatable process, it is important to understand the physical effects involved. This is where computer models can make an outstanding contribution. For these models, however, it is important to know the boundary conditions exactly. One of the important boundary condition is the knowledge of the laser power absorbed in the process.

Tasks:

The main task is to implement a setup that allows to measure the deposited laser power calorimetrically. Therefore, you will work on the following topic during your thesis:

- Measurement setup design and construction
- Setup and adjustment of laser optics elements
- Validation of the measurement setup
- Measurement of the deposited laser power in some powder samples using different laser sources
- Data processing and visualization



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Literature:

- S. Chowdhury (2022). Laser powder bed fusion: a state-of-the-art review of the technology, materials, properties & defects, and numerical modelling (https://doi.org/10.1016/j.jmrt.2022.07.121)
- J. Trapp (2017). In situ absorptivity measurements of metallic powders during laser powder-bed fusion additive manufacturing (https://doi.org/10.1016/j.apmt.2017.08.006)