
Topic Definition for a MASTER THESIS

for

Topic: Experimental and computational analysis of a Bi-metallic component for improving the thermal conductivity

In the realm of manufacturing, the properties of materials play a crucial role in determining the efficiency and effectiveness of various processes. Steel, commonly used in the manufacturing of molds, offers significant strength and durability. However, its relatively low thermal conductivity can pose challenges in applications where heat dissipation is critical. In contrast, copper is known for its excellent thermal conductivity but lacks the mechanical strength provided by steel. This project aims to leverage the complementary properties of both steel and copper by exploring bi-material solutions with different approaches using Directed Energy Deposition – Arc (DED-Arc) utilizing metal wire as feedstock. The primary objective is to enhance the thermal conductivity of the mold manufacturing for injection molding without compromising its structural integrity. A cylindrical block will be tested with steel and with a slot of copper for its conductivity test.

The following tasks should be completed:

- To analyze the heat transfer rate in mold manufactured with steel.
- Develop a setup to deposit the copper in the desired slot to improve conductivity (preferably C-slot).
- To conduct simulation tests and analyze heat transfer rate/thermal conductivity with steel and with a copper slot.
- Standardize the results for simulation work.
- Compare and analyze the results from simulation and experimental values.
- Examine the mechanical properties of the bi-material.

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

Issue:

Submission:

Mentors: Dr. Neel Kamal Gupta
Abid Shah

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