

Topic Definition for a MASTER THESIS

for

**Topic: Directed Energy Deposition of Bimetallic Steel Components for Naval Applications**

Additive Manufacturing (AM) has evolved from a prototyping technique into a robust manufacturing approach for metallic components, enabling greater design flexibility, improved material efficiency, and shorter production lead times. Within metal AM technologies, Directed Energy Deposition - Arc (DED-Arc) has gained relevance for large-scale, high-deposition rates and cost-effectiveness. DED-Arc has been well established for a single material but limits its properties; a multi-material approach complements each other, and the components manufactured with it excel over monolithic materials in various aspects. A multi-material approach includes composite components or components with homogeneous mixing, depending on the machine setup. Steel, one of the most widely used materials across industries, has significant potential for Naval applications. A combination of mild steel and stainless steel can yield a cost-effective yet strong and corrosion-resistant solution.

A critical challenge, however, lies in achieving a reliable and controllable metallurgical interface, which governs the mechanical performance, corrosion behaviour, and long-term integrity of such bimetallic components. This research objective aims to develop a solution to investigate the bi-metal approach by combining mild steel and stainless steel using DED-Arc and evaluating the bi-metal's properties relative to the individual materials.

The following tasks should be completed:

- Deposition of individual sample with stainless steel and mild steel, and optimising parameters for the bimetallic sample deposition using DED-Arc.
- Evaluation of mechanical properties, such as tensile strength, hardness distribution, and metallurgical properties, including grain size and its orientation and corrosion behaviour of individual samples.
- Detailed study of the bimetallic interface, including dilution behaviour, mechanical and metallurgical properties.
- Examine mild steel and stainless steel samples individually and compare their properties with those of the bimetallic sample.
- Evaluation of cost and material efficiency with single and bi-metal approach.

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

**Issue:**  Klicken oder tippen Sie, um ein Datum einzugeben.  
**Submission:**  Klicken oder tippen Sie, um ein Datum einzugeben.  
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