

PROBLEM FORMULATION

This chapter identifies the literature gaps and uses them as motivation to establish the objectives for this research work. A research plan, including the objective and methodology used to perform this study, is also provided to form a background for experimentation details and results discussed in further chapters.

3.1. MOTIVATION FOR THIS RESEARCH

Based on the gaps found in the reviewed literature, the following points were considered as motivations for this research work:

- No significant work was found on developing competitive SMAW electrodes for fabricating weld between pipeline steel and super duplex stainless steel with application in offshore structures.
- Limited characterization of SMAW coating for their properties and establishing correlation between coating constituents, coating properties and weld performance.
- No effort was found to directly utilize mining waste in welding consumables development, making the process environmentally sustainable.
- Availability of limited investigations on candidate filler metals that can be used for fabricating dissimilar super duplex / API pipeline steel GTA weld.
- Super duplex stainless steel is sensitive to heat treatment as it leads to quick precipitation of intermetallic/secondary phases. The information about the effect of these probable phases on wear and corrosion behavior in the actual service environment is limited.

3.2. RESEARCH OBJECTIVES

This research work is aimed at the experimental characterization of dissimilar metal welds for offshore application. This study's joint of interest is between pipeline steel API X70 and super duplex stainless steel 2507. The primary research objectives are:

- Design and development of shielded metal arc welding (SMAW) coated electrode for fabricating dissimilar super duplex stainless steel 2507/ API X70 pipeline steel welds.
- Characterization of developed electrode coatings for physicochemical, thermophysical, wettability, and structural properties.
- Experimental characterization of mining waste red ochre, and its direct utilization as a SMAW electrode coating constituent.
- Fabrication of dissimilar super duplex stainless steel 2507/API pipeline steel X70 using laboratory-developed and commercial electrodes. Mechanical, metallurgical, corrosion and tribological characterization of fabricated welds for laboratory-developed SMAW electrodes' performance assessment.
- Fabrication of super duplex stainless steel 2507/API X70 pipeline steel using gas tungsten arc welding (GTAW) process employing two candidates, austenitic 309L and

super duplex 2594 filler metals. Mechanical, metallurgical, and corrosion investigations on the fabricated weld.

- Investigating the effect of heat treatment on wear and corrosion behavior of super duplex stainless steel 2507.

3.3. WORK PLAN

The work plan for this research work is given in Figure 3.1.

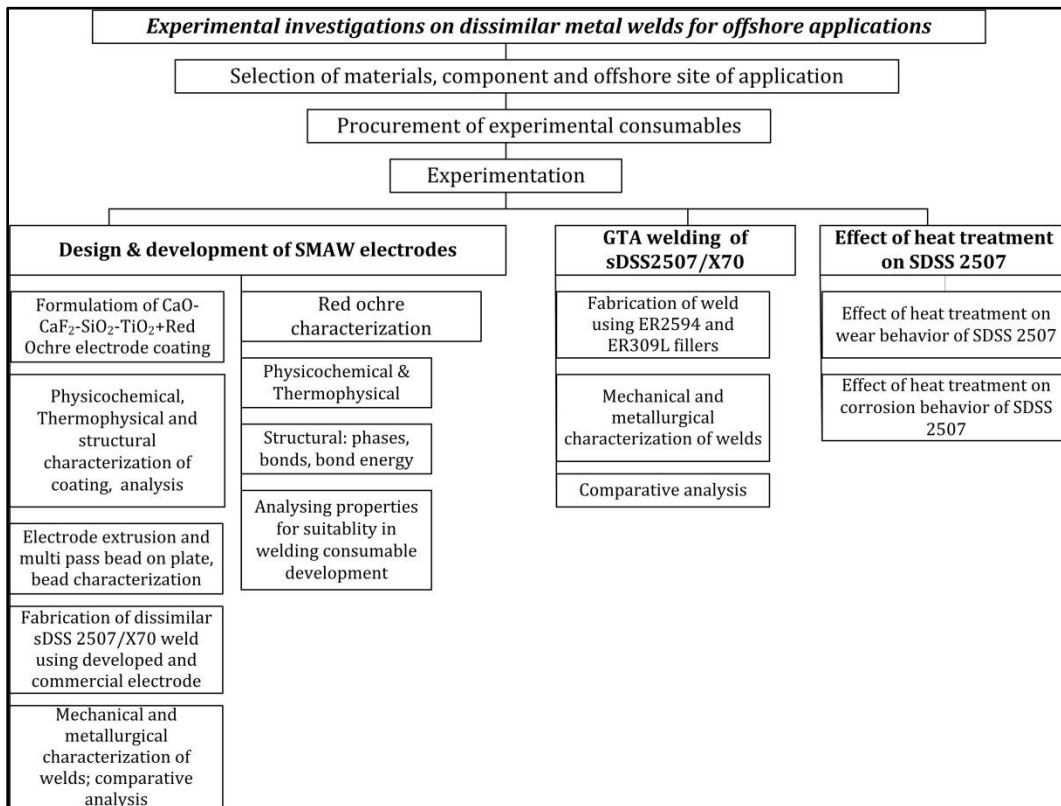


Figure 3.1: Work Plan

Summary of Chapter 3:

This chapter presented the motivation for choosing the research topic, which is derived from the gaps in the reviewed literature. The research objectives broadly refer to the development of SMAW electrodes, comprehensive characterization of electrode coatings, utilization of mining waste as electrode coating constituent, and investigations on the candidate filler metals for fabricating API X70/SDSS 2507 weld using GTAW process.