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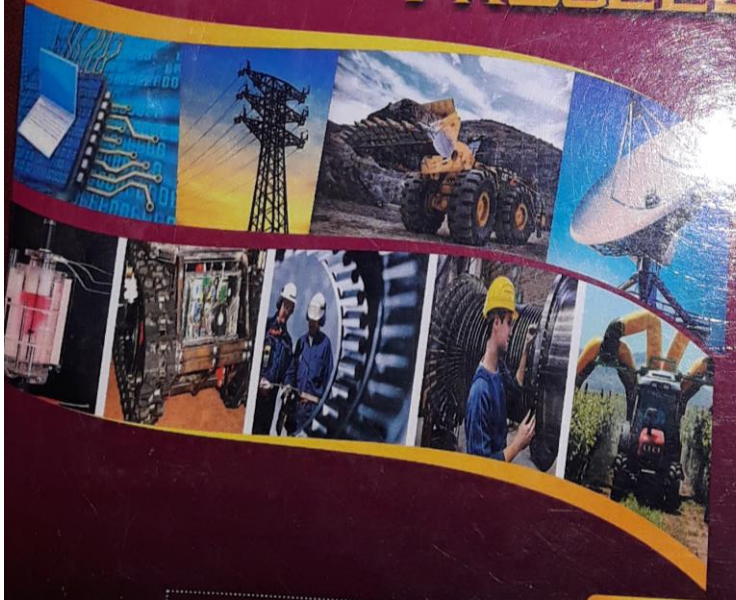
**THEME** THE ROLE OF ENGINEERING AND TECHNOLOGY IN SUSTAINABLE DEVELOPMENT

# BOOK of PROCEEDINGS



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# DEVELOPMENT OF PRODUCTION FRAME WORK TO MITIGATE CORROSION IN UNDER GROUNG TANKS

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**ABSTRACT**

**Corrosion is a major concern for managers of petrol stations. This is because corrosion failure will adversely affect the lifespan of tanks. Leaks caused by corrosion are commonly-identified problems in buried metal tanks which can lead to catastrophic failures, causing significant socio-economic losses. Unlike in the pipelines where periodic inspection of the buried pipelines is vital, in the case of underground tanks appropriate mitigating measures via construction is preferable. The development of corrosion- protection techniques, corrosion-induced deterioration of tanks remains a major problem globally, and billions of dollars are spent every year on cleaning of leakages into water/soil. To date, ways to mitigate corrosion for underground fuel storage tanks has not been explored comprehensively by other researchers. Corrosion mitigation in UST is best achieved through proper development of production frame-work. This was achieved through variation of two major welding parameters (electrode type and current) and subsequent post heat treatment, microstructural examination and corrosion subjection. A current of 80A, 90A and 100A were varied with Electrodes E6010, E6013 and E7018 respectively. A total of 36 coupons were gotten in all. Eighteen (18) coupons were subjected to post heat treatment. Nine coupons in each case of the post heat treated and non-heat treated ones were taken for microstructural examination and the rest were subjected to corrosion in aqueous acidified sandy soil in in bath for 30 days. It was observed that the heat treated coupons has a more refined grain sizes than non-heat treated counterparts equally more corrosion resistance.**

**Keywords:** *Corrosion, Development, Framework, Microstructural, Mitigate, Welding.*

## 1 INTRODUCTION

In many industries today including diesel tank fabrication, engineers are concerned with efficient weldment and ways to prolong the life of the structures. Welding has proven to be the best method of joining metals together. According to Wema (2003), the reasons are not far-fetched. In the first place, weld joints are fluid tight for tanks and vessels. Also, weld structures can be altered easily and economically. It has also been proven that welded joints have considerable corrosion resistance when compared to other joining processes and different types of joints are possible in weld joining processes.

In the construction or production of Underground Storage tank (UST), mild steel plates are welded together. The weld joints and the Heat Affected Zone HAZ) plays a major role in the behavior of the UST in application. HAZ is the adjacent zone to the weld metal. It is the portion of the base metal that has not been completely melted; but whose microstructure or mechanical properties have been altered by the heat of welding. The microstructural features of the welds and the HAZ are responsible for any emerging properties in the weldment.

Mild steel plate like other metallic materials, when subjected to salty environment, it is bound to corrode. Corrosion, which is the deterioration of a metal as a result of chemical reactions between it and the surrounding environment, is severe at the welded and HAZ than the parent material due to compositional variation (Foss, 2008) The cycle of heating and cooling in the welding process affects the microstructure and surface composition of welds and adjacent base metal. Variation in composition occurs due to effects of segregation in micro and macro scales, precipitation of secondary phases, formation of unmixed zones, recrystalization and grain growth in HAZ, contamination of the solidifying weld pool, and dilution at the weld fusion, weld interface and HAZ. The compositional differences create a potential difference between the welded portion and the parent material. In an underground tank, the percolation of water cannot be exempted, the water molecule can penetrate the microscopic pits and crack any exposed metal. The hydrogen atoms present in water molecules can combine with other element or compound like carbon iv oxide ($CO_2$) to form acids, which will eventually cause more steel surface to be exposed. If chloride or carbonates ions are present, as is the case of salt water, the corrosion is likely to occur quickly (Schmitt, 2006). The corrosion of UST is a serious challenge to the industry due to the enormity of consequences. Apart from the losses that would be incurred by the tank owners for reinstallation and clean up, there is fuel loss and the environment is equally contaminated. The contamination is in two folds. Firstly, the contamination of the fuel in the tank which can result to poor efficiency of the fuel. In the second place, the fuel leaking into the soil may percolate into surrounding drinking water resulting to pollution. It is unfortunate that in Nigeria no effort or attention has been paid to this industrial problem. The American Environmental Protection Agency EPA has been