

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Background of Study**

Carbon steel has been widely used by most of the fabricators to fabricate the pressure vessel. The various type of carbon steel has made the fabricators have numbers of choices in choosing the appropriate material according to the vessel services. Welding has been used to join and bond the edge of the material. The proper selection of welding types, filler metals and weld seam design will optimize the structure design and minimize the production costs. However, defects, such as porosity, lack of fusion, crack and lack of penetration are commonly found in the weld seam and these defects will require big expenses to replace.

Currently, studies of weld repairs mainly focus on steel structures, and examine factors, such as repair welding residual stress and mechanical properties of the repaired joints. However, in this project, the microstructures characteristics and mechanical properties of weld repairs in SA 516 Grade 70 carbon steel using shielded metal arc welding will be studied systematically, contributing to an in-depth understanding to enable the practical application of welding repair to carbon steel structures.

## **1.2 Problem Statement**

Many weld repair procedures and basic practices limit the number of weld repair to a maximum of two times on the same spot. This is due to the probability of microstructure degradation as result of repeating welding and also possibility of unbalanced mixtures between the elements in the parent material with the elements in the stick electrode. These two causes might change the properties of the weld and the parent material, also the integrity of the weld. This might be a problem when the weld spot had to repair more than two times, otherwise the product might be rejected by client and it will be a great loss.

## **1.3 Objectives and Scope of Study**

The main objective of this project is to study and examine the microstructure characteristic, mechanical properties and elements distribution of the weld plate. These three features, before and after each four times welding repair, will be compared and analyzed. The scope of study for this project will mainly focused on the behavior of material's microstructure, the changes in mechanical properties of the weld plates and the element distribution in the weld plates, before and after the weld repair.

The weld joint design will be designed according to the ASME and AWS standards. The details of the welding process such as current, voltage and electrode will followed the specifications in the Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR), done by Chip Ngai Engineering Works Sdn. Bhd., which also according to the ASME and AWS standards.

For the three features, microstructure behavior will be examined under optical microscope and Scanning Electron Microscopy (SEM) while element distribution in the weld plates also will be examined by SEM. Mechanical properties of the weld plates will be tested using Charpy V-Notch Test for toughness.