CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

This thesis is about the investigation of weld joint (dissimilar Aluminum alloys) microstructures and mechanical properties using MIG welding process. Aluminum is the second important after steel usage because of its characteristic which is high strength stiffness to weight ratio, good corrosion resistance, good formability better conductor of heat and electricity. It has been the best candidate to replace heavier material like steel and copper in automobile because it has the recycling potential. The choice of material is influenced by the requirement to improve the economy of fuel and also the energy consumption.

For example, automotive companies have been given mandate by US Government that they need to minimize vehicle exhaust emission, enhance fuel economy and improve occupant safety (W.S. Miller, 2000). In automotive industry, welding of dissimilar parts of different weld will be much needed because each part (inner and outer panel consist of different aluminum alloys) of car needs to be joined together. The increasing of aluminum and magnesium alloys is mainly caused by the rapid growth of application of material that has the light weight characteristic (D.-A.Wang, 2007). And for this study, MIG (metal inert gas) welding process is chosen to join the welds.The material that will be used is Aluminum alloy AA5052-H32 series and 6061-T6 series for the experiment because they are often used in the industry (W.S. Miller, 2000). While the microstructure and mechanical properties investigation consists of tensile strength, toughness and corrosion resistance of the weld before welding process and weld metal (WM) after MIG welding process.

1.2 PROBLEM STATEMENT

Aluminum alloys may often be used to replace steel in many applications especially in automotive industry welding process (W.S. Miller, 2000). But, the problem is the high difference of thermal conductivity of different aluminum alloys using MIG or TIG will cause problems (Luijendijk, 2000). The lack of fusion of material or excessive melting of material that has lower thermal conductivity is caused by the larger thermal conductivity in arc that flow in material. The other problem in MIG welding between dissimilar weld relates to the transition zone between the metals and the intermetallic compounds (IMC) that produced in this transition zone.

It is very important to investigate the phase diagram of the two metals for the fusion type welding process like MIG welding process. The dissimilar joints only can be made successfully if there is mutual solubility exist between both aluminum alloys. No solubility between the aluminum alloys can give the problem to the joint process. The intermetallic compound formed between dissimilar weld need to be investigated to check their crack sensitivity, ductility and susceptibility to corrosion, etc. The microstructure views need to be done observe the eutectic phase in the intermetallic compound.

The other factor causes problem to the welding of dissimilar aluminum alloys relates to the thermal coefficient of thermal expansion (CTE) of both welds (Luijendijk, 2000). The widely difference between both thermal coefficient of thermal expansion can cause the internal stresses set up in the IMC zone during any temperature change of the welding process. The service failure may soon occur if there is extreme brittleness characteristic in intermetallic zone. The last factor is melting temperatures of the two aluminum alloys (Luijendijk, 2000). If there are differences in melting point, it will cause the other problem. This is of primary interest when a welding process utilizing heat is involved since one metal will be molten long before the other when subjected to the same heat source. The high heat input of welding will make the weld has advantage when welds of different melting temperature and thermal expansion to be joined.

1.3 OBJECTIVES

The objectives of this project are:

1) To investigate the effect of parameters; torch angles, speeds, welding passes and currents to the mechanical properties of weld joints.
2) To predict the optimum parameters based on Taguchi methods analysis and verified with experimental
3) To study the different of mechanical properties and microstructure of weld joint (AA5052-H32 and 6061-T6 aluminum alloys) using the different welding parameters.

1.4 SCOPE OF PROJECT

The scopes of the project are:

1) Welding process of different Aluminum alloys
2) Tensile and impact test investigation
3) Microstructure Analysis of weld joint (weld metal)

1.5 OVERVIEW OF REPORT

Chapter 1 mainly briefs about the background of the project which involves the introduction, problem statements, objectives and scopes of the report. Chapter 2 basically describes more about the studies on microstructure, mechanical properties of aluminum alloy which has been done earlier by other scientists and engineers and Taguchi Method. Whereas Chapter 3 introduces the experimental procedure utilized to characterize the aluminum alloys studies the step by step process that will be done during this project and steps to perform Taguchi analysis with experimental values. Chapter 4 mainly discuss about the results obtained during the experiment. Lastly, Chapter 5 discuss about the conclusions that can be derived from this report and suggest few future recommendations.