CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Heat treatment is an operation or combination of operations involving heating at a specific rate, soaking at a temperature for a period of time and cooling at some specified rate. The aim is to obtain a desired microstructure to achieve certain predetermined properties (physical, mechanical, magnetic or electrical). This main objective of this thesis is to study the influence of heat treatment on the microstructure and mechanical properties of aluminum alloys.

The process of heat treating is the method by which metals are heated and cooled in a series of specific operations that never allow the metal to reach the molten state. The purpose of heat treating is to make a metal more useful by changing or restoring its mechanical properties. Heat treating can make a metal harder, stronger, and more resistant to impact. Also, heat treating can make a metal softer and more ductile. The one disadvantage is that no heat-treating procedure can produce all of these characteristics in one operation. Some properties are improved at the expense of others; for example, hardening a metal may make it brittle.

Aluminum (nonferrous metal) is a white, lustrous metal, light in weight and corrosion resistant in its pure state. It is ductile, malleable, and nonmagnetic. Aluminum combined with various percentages of other metals, generally copper, manganese, and magnesium, form the aluminum alloys that are used in aircraft construction. Aluminum alloys are lightweight and strong but do not possess the corrosion resistance of pure aluminum and are generally treated to prevent

deterioration. "Alclad" is an aluminum alloy with a protective coating of aluminum to make it almost equal to the pure metal in corrosion resistance.

Several of the aluminum alloys respond readily to heat treatment. In general, this treatment consists of heating the alloy to a known temperature, holding this temperature for a definite time, then quenching the part to room temperature or below. During the heating process, a greater number of the constituents of the metal are put into solid solution. Rapid quenching retains this condition, which results in a considerable improvement in the strength characteristics.

Aluminum alloy's lightweight performance delivers great benefit in transport applications such as aerospace, cars, ships, trains and buses. The metal's excellent characteristics help give automotive and other transport users improved driving performance as well as increasing fuel economy and reducing emissions. Another significant advantage of aluminum alloy is its corrosion resistance. This characteristic is valuable for products used in architecture, construction, civil engineering, transport, heat exchangers and many other applications.

1.2 PROJECT OBJECTIVE

This paper is about influence of heat treatment on the microstructure and mechanical properties of aluminum alloys. The objectives of the project are:

(i) To study and analyze the effect of solution heat treatment and natural aging mechanism.
(ii) To investigate the microstructure changes and mechanical properties of aluminum alloys 6061.

1.3 PROBLEM STATEMENT

Aluminum is subject to internal stresses and strains when it is overheated, the tendency of the metal to creep under these stresses tends to result in delayed distortions. For example, the warping or cracking of overheated aluminum automobile

cylinder heads is commonly observed. Stresses in overheated aluminum can be relieved by heat treating the parts in an oven and gradually cooling it in effect annealing the stresses. Heat treatment can change the material properties in terms of its strength and resistance properties. The change in microstructure of the material when heat treated can influence the mechanical properties and the microstructure of the aluminum alloy.

1.4 PROJECT SCOPE

The scopes of this project are:

(i) Solution heat-treated and naturally aged; T4 type tempers.
(ii) Study the microstructure of aluminum alloys 6061 using optical microscope.
(iii) Investigation on the mechanical properties using tensile and hardness test.