CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The manufacturing industries nowadays using the latest modern technology for optimize the quality material so the manufacturers focused on the quality and productivity of the product material. Laser hardening is one of process that can enhance the microstructure material. One of the laser techniques use vastly by manufactures are the use of Nd:YAG laser is where it is challenging due to different effects can be achieved with a marking laser on most metals by optimizing the laser power, speed, pulse frequency, and focus. However, the use of thermal simulation for taking laser simulation had the advantage of thermal modelling of laser processing is well established. Previous researchers have implemented thermal model simulations to investigate the laser heating of surfaces and the thermal stress development at different processing parameters. A three-dimensional finite element model is developed using ANSYS to study the thermal behavior of the molten pool. (C.Karatas, 2007)

In engineering application where to enhance the surface properties of material , need to endure higher temperature, wear or surface medication need to be considered due to practicality, cost and time consumption. Thus laser processing has also been proven to be capable of producing adherent, hard, wear, corrosion, fatigue and fracture

resistant on a diverse range of materials. In other words, the crystal structure of metals' surfaces can actually be modified into very fine no equilibrium microstructures as a result of rapid solidification via laser surface modification. In laser surface hardening for hot forming die applications, the most important microstructure formed on surface on the temperature distribution. A three-dimensional finite element modelling of laser surface modification is presented. The design capabilities of the ANSYS parametric design language (APDL) were employed for this purpose. The temperature profile found in simulation of the surface material was validated experimentally. The laser hardening was done using pulse mode and parameters were varied to maximize hardness.

1.2 PROBLEM STATEMENT

In laser surface process using modified die forming, several factors are affecting the heat affected zone (HAZ) which are investigate the study the melt pool characteristics and the temperature distribution at the solid/liquid interface thermal simulation of the modified surface of gray cast iron and Steel SS 104 using thermal simulation by setting parameters in this simulation ANSYS. The input energy must be in lower input energies for causing the surface melting instead using high input energies can cause vaporization occur in pulse mode. Thus, thermal distribution and the cooling rates associated with the process are affecting the microstructure on surface material. The influence of liquid-solid phase transition during the solidification and following solid-solid phase transformations may investigated using thermal analysis methods.

1.3 PROJECT OBJEECTIVES

The objective of this study is to develop a finite element based computational model to determine the temperature distribution at the solid/liquid interface and study the penetration depth characteristics.

1.4 PROJECT SCOPES

To achieve the project objectives, was conducted using ANSYS 14.0 software. The simulations were conducted for 2 different materials which were SS 400 and Gray Cast iron. After modeling the specimen in CAD, FEM analysis of penetration depth and surface temperature distribution was conducted using transient heat transfer. The analysis was done after setting up all parameter and boundary condition. Then model simulation was validate by comparing the result of experiment at works done by others.