CHAPTER I

INTRODUCTION

1.1 Background

Aluminum becomes one of the most desirable metal and widely used after steels in the world. It has been used almost in all areas of production including automobiles, trains, and aerospaces. Aluminum has better properties than other metals such as lightweight, strong, easy to shape, corrosion resistant, electrical conductors and heat conductors, reflecting hot and non-heat rays, not magnetic, non-toxic, well tough, attractive and capable of reprocessing. Data from industrial demand for domestic aluminum from 2008 - 2012 tends to increase **[1]**. Besides from KEMENPERIN RI data for domestic aluminum demand currently reaches 900 thousand tons per year **[2]**. Most of the aluminum is required in every industrial sector such as the automotive industry for the manufacturing process.

In the automotive industry, it is difficult to obtain high purity aluminum material and free from impurities that can detrimental to aluminum alloys. Aluminum with free from impurities is relatively expensive because it needs a purification process. For the purification process can be carried out from casting or molten metal poured into the mold. The cooling of the liquid and its subsequent solidification can determine whether the cast shape will be properly formed and free-form impurities. Castability has been used to describe certain aspects of flow behavior, the term fluidity is most widely recognized **[3].**

The value of the fluidity is generally used as a measure of the ability to fill the mold of a liquid metal. This is an important factor in casting, especially to avoid the defects that often occur in cast objects. For low fluidity can cause casting to have a short period of time when filling the mold also produce a bad surface to a product. The length unit used for fluidity is a cm or an inch.

Fluidity values can be measured using fluidity test methods. Various fluidity measurement methods have been developed by many researchers such as spiral method, cross-channel method, test pierce method and vacuum method. In this

study, the method used to determine a value of fluidity using spiral test method which has the advantage in measuring the fluidity of metal.

The microstructure of aluminum alloys may be affected by the alloy composition at the time of casting. In this research, Aluminum alloy is silicon (Si) with a concentration of 7%. The microstructure can be changed by adding certain elements to Al-Si alloys which can improve castability, fluidity, mechanical properties and machinability. To improve the mechanical properties of aluminum-silicon alloys can be used as a modifier. Modifiers have a function to improve the phase properties of aluminum-silicon alloy by adding certain elements. These elements will inhibit silicon crystals in the eutectic phase which originally in the form of course needles into granular and finer particles also evenly distributed. In this case, the modifier is samarium (Sm).

The effect addition of samarium element to aluminum-silicon alloy can modify microstructure. This element is a rare earth metal group that helps the solidification process by functioning as a place of nucleation of the grains so that the grain nucleation becomes smaller and smoother. The addition may affect the flowability which further the value can be known by the fluidity test. fluidity test is taking by a spiral test. since fluidity measurements are also sensitive to small changes in thermal properties and surface characteristics of the mold, graphite and metal molds in attempts to minimize variation in these factors **[4]**. In this research, addition rare earth metals samarium take with content 0,01%, 0,05% and 0,1% using variations temperature pouring 670 ^{O}C, 720 ^{O}C and 770 ^{O}C. Based research Fajar Yusra Ramadhan **[16]**, the addition of rare earth metal samarium influences the solidification process with Samarium content 0.1%, 0.3%, and 0.5%. The solidification process has a relation with fluidity test conducted to determine the flowability. To find out more literature, the addition rare earth metal samarium will be shown used spiral test to know about fluidity value related with solidified itself and samarium addition is less than 0.1% to see change for microstructure. Where this research is taking in the Metallurgical Laboratory of Metallurgy Department and Materials Engineering University of Indonesia (FTUI) and Metallurgy Laboratory of Mechanical Engineering at Andalas University.

1.2 Objectives of Research

The main purpose of this research are:

1. To analyze the effect of rare earth metal Samarium concentration with a variation of pouring temperature for Al-7%Si.
2. To observe the microstructure of the material using an optical microscope.

1.3 Benefits of Research

The main benefit of this research are :

1. Able to know the effect of rare earth metals samarium on the fluidity.
2. Able to know the microstructure of material using an optical microscope.

1.4 Scope of Research

1. Master alloy (Al-7Si-5Sm) content as an addition of Samarium to Aluminum-Silicon alloy.
2. Fluidity value determined by a length of the product in a spiral mold.
3. From the test will be observed the microstructure of the material by using an optical microscope.

1.5 Outline of Report

In this final project writings, there are 5 chapters of the writings :

Chapter 1. Introduction. This chapter describes the background of the writings, problem statement, the objectives of the research, benefits, scopes, and the outline of the research.

Chapter 2. Literature Review. This chapter review about the literature of this writings which contains the review about Aluminum, Aluminum-Silicon alloy, Fluidity, factors that affect fluidity, modifier Aluminum Silicon, and rare earth metal and Samarium.

Chapter 3. Methodology. This chapter contains research flowchart and the procedure of the research.

Chapter 4. Result and Analysis. This chapter describes the result of the research and analyzes the Aluminum-Silicon alloy (Al-7%Si) with addition rare earth metal Samarium content in a spiral mold, hardness number, and microstructure.

Chapter 5. Conclusion and Recommendation. This chapter contains a conclusion and advises for the next similar research.