

Morphological Studies of Microstructure of Al-7075 and Al-6063 Thixoformed at 548 °C Using SEM Technique

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Abstract: The Thixo-extrusion process is an advanced technique used for manufacturing the complex and intricate component, which results in the high strength material. Through this study, Aluminum alloy 7075 is formed by thixo-forming extrusion method 548 °C and investigated its microstructure by using SEM technique (Scanning electron microscopy). The traditional ways of extrusion process on Al 7075 is not accomplishes desired properties such as high strength, high yielding etc.

Introduction

Extrusion is one of the manufacturing process in which is in use for last 6 decades in industries for producing various complex shapes. A lot research still going on in this field as this is an effective manufacturing technique used for producing different component. Extrusion is a high temperature process used for manufacturing in different industries. The type of extrusion process depends upon the desired output. Extrusion can be also be used for complex shapes and design. The manufacturing product heated up to a suitable temperature generally near recrystallization temperature and then extrude with a desired shape die. The parameter during the process can be changed according to required properties. During extrusion changeable parameters are temperature, pressure, duration. The extrusion techniques are as follow: cold extrusion forming, Thermal extrusion processing and also called hot extrusion process. Now a day other parameter such as pressure, material flow rate also taking in consideration. Thixoforming is that one of the modern processes now a day's follows.

After machining process analysis of microstructure is done through different process. SEM is one of the technique used for analysis. In X-ray diffraction is used for studying microstructure change after the thixo-forming process. It will carry out at different magnifications. We can also evaluate chemical composition as well as macrostructure analysis using Scanning of electron microscopy technique.

Thixoforming Process: In this process material is heated up to recrystallization temperature (Semi-solid state) then it is passes through suitable shape die for better finishing and enhanced properties.

Atkinson H. et al. Following study author explains the effect of machining on the properties of material. Identification of routing is an important part in manufacturing routes. Semi-solid phase is one of such potential routing. It refines material microstructure by changes its grain to non-dentric grain. The processed material is reheat near recrystallization temperature. T6 aging condition is applied on aluminum alloy changes spheroidal grains.

Yang Y. et al. This article study the fracture behavior on Aluminum 7075. Two different dynamic loading condition applied on material the study failure of material due to fracture. The fracture surfaces generated due to spall test is compared with fracture surfaces generated from a blunt projectile struck in the body of aluminum 7075 alloy plate. Scanning electron microscopes and optical analyses are used to obtained microstructure in this research. Tensile stress is the major cause of fracture. The fracture occurred from a crack and further due to applied load it propagates and complete fracture occurred. The penetration on the surface of aluminum 7075 alloy is done through different stage that includes: (a) plugging stage b) micro cracks c) nucleation stage, d) Tensile fracture stage. Mixed type brittle/ductile fracture was found.

Kilickap E. et al. [9] This article implement response surface methodology and Taguchi for improving the surface finish and minimize the burr height in drilling of Aluminium-7075. Taguchi method is a tool which is used for obtaining results is in cutting parameters. Analysis of engineering problems and modeling is done by Response surface methodology. This paper investigate the effect feed rate and speed rate on surface finishing during drilling operation of Al-7075.

Materials Used:

Aluminium Alloy 7075 which a light weight with strength alloy. Generally used in industries for manufacturing household production, automobile industries, in Aircraft industries. Main composition Al 97 % Rest is Si, Fe, Cu, Mn, Mg, Ti, Pb, Zn, Cr

Scanning Electron Microscope Machine

Scanning Electron Microscope (SEM) machine is used for performing microstructure testing. The machine model No- JSM-6610 LV Manufacturing company by name Jeol, Japan e at IIT, Ropar punjab. Machine maximum magnification resolution at is 3, 00,000x. SEM is performed on samples at two resolutions, 1000x and 1700x.

METHODOLOGY AND PROCEDURE

1. Firstly Aluminium is Heated to suitable temperature up to 548⁰C
2. Then Extrusion done with help of desired shape die.
3. Material is cooled down and cut in specific dimension.
4. Specimen is prepared by polishing machine with the help of different grid emery paper and abrasive slurry.
5. Specimen polish till mirror image appear on specimen..
6. Then SEM is performed.

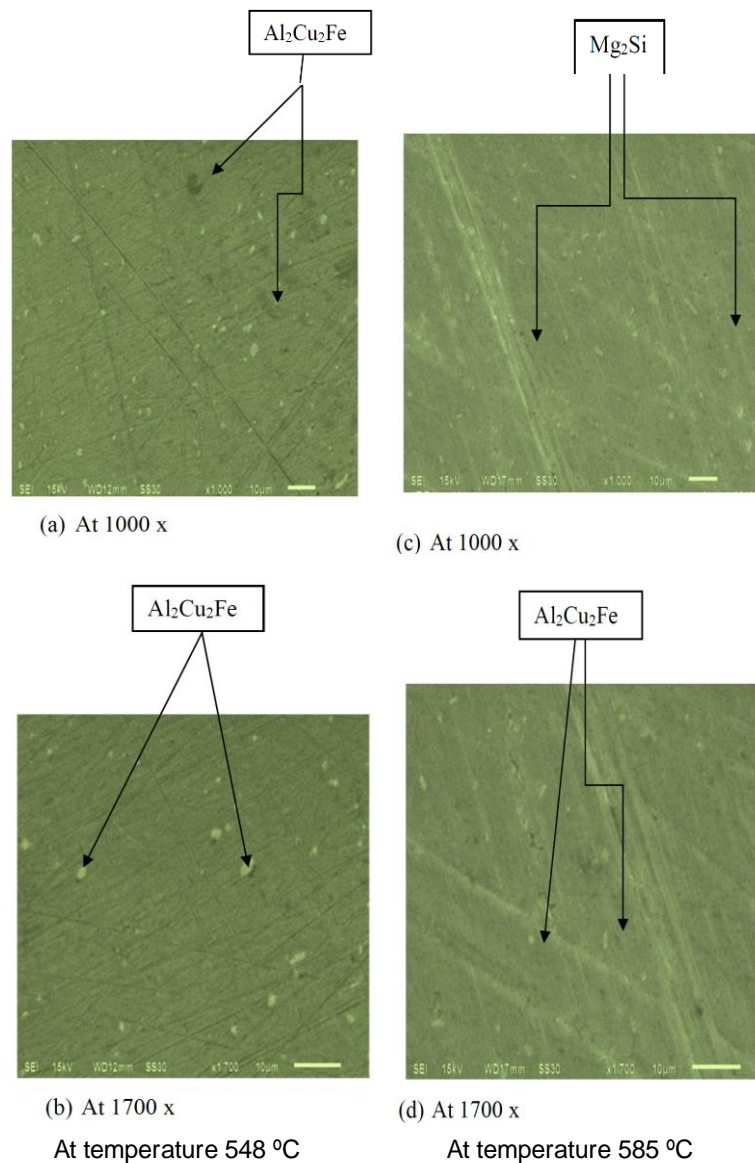
Microstructure analysis

Microstructure analysis is performed on selected samples using Scanning Electron Microscope to observe the change in microstructure after Thixo-forming. The standard procedure is followed in preparing sample as follows and magnifications resolution taken are 1000 x and 1700x.

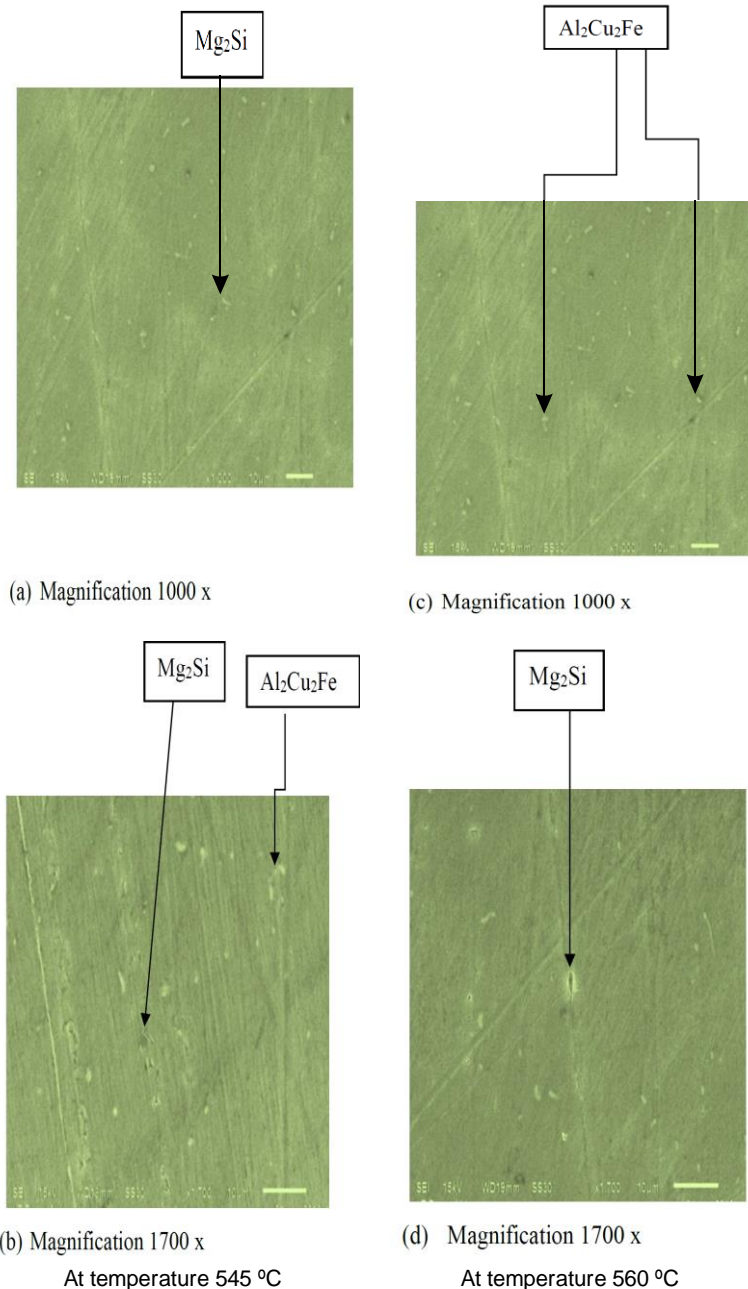
Preparing Samples for SEM

Following are the steps involve in making sample for SEM:

- First of all sample are to be cut of dia. 15 mm.
- Wire Brushes is used for cleaning the sample
- Remove all debris particle with help of a clean cotton cloth.
- Polish of sample with the help of polishing machine by using different grid emery paper course to fine (100, 220, 300, 400, 600, and 1000) for surface finishing and abrasive slurry.



SEM Images for Al-7075



SEM Images for Al-6063

Conclusions

On the basis of above study we have come to following conclusions:

The micro structural characteristics images of the Al-7075 and Al-6063 are displayed in the above figures. There are elongated grains and intermediate particle in AL 6 series. Due to preheating process Recrystallization of grains occurred. This single stage heating up to recrystallization temperature gives us recrystallized grain structure is obtained when heating at 550 °C to 600 °C. The formation of $\text{Al}_2\text{Cu}_2\text{Fe}$ and Mg_2Si phase is there after solidification as solidification take place at slow rate. It is found from the above figures that solute segregation is there in intercellular spacing. These SEM micrographs revealed some dark and white marks that could correspond to the $\text{Al}_2\text{Cu}_2\text{Fe}$ and Mg_2Si phases respectively.

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