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2022MMB1391.

Aluminium

Heat Treatment of Aluminium by Precipitation Hardening

→ Heat Treatment

Heat Treatment is a group of industrial, thermal and metalworking procers. It is controlled procers used to alter the microstructure of metals and alloys such as steel, iron, alluminium to impart properties which benefit the working life and applications of the component. The properties include surface hardness temperature, resistance, ductility and strenght.

→ Types OF Heat Treatment

There are 4 types heat treatment commonly used in Aluminium namely:-

- Precipitation Hardening
- Ageing
- Annealing
- Homogenizing

→ Precipitation Hardening

It is a strenghthing procers which involves formation of tiny particles of secondary phase within the material matrix. The procers begins within the addition of small amount of

a solute element such as Mg, Zr, Cu etc.

→ Ageing

It refers to the process of allowing the Material to sit at room temperature for an extended period to enhance its mechanical strength and other properties.

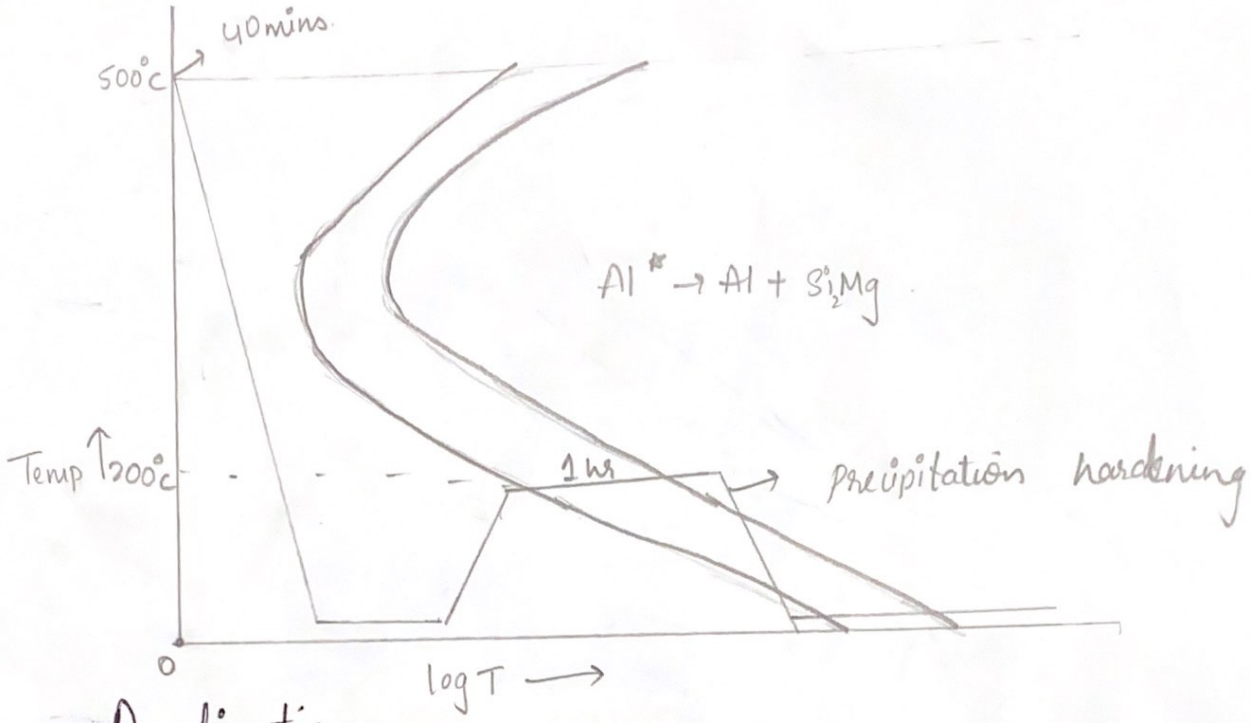
→ Annealing

It is a type of heat treatment in which metal is heated to a certain temperature and then it is cooled slowly or you can say heated metal is left in the furnace to cooled which is called furnace cooling. It is frequently utlized to soften a metal for cold working to improve properties like conductivity.

→ Homogenizing.

In Alumina, refers to the process of uniformly distributing impurities and alloying elements within a batch of Alumina powder or an alumina based ceramic material. It is just done under melting point.

→ TTT daigram



→ Applications

- Improve hardness, strength and increase wear resistance.
- Relive internal stress
- Improve corrosion resistance
- Increase ductility and toughness.

→ Limitations

- It can damage some materials
- It can be expensive
- can cause distortion in materials

→ Procedure

These are the following process we performed in our lab

- We heated the alloy in muffle furnace at 520°C for 40mins and quenched it in water.

- Then we aged the material by re-heating it at 200°C and then holded it there for 1, 2 and 4 hrs depending upon the sample.
- After the heat treatment was completed, we then polished the sample with sand paper paper of 250, 400, 600, 800, 1000, 1200 and 1500 particles per unit area.
- For cloth polish we used 3-5 micron daimond aerosol, but due to many scratches we changed it to 0.5-1 micron daimond paste.
- The etchant used was Kellars Reagent with the composition of 95% distilled water, 2.5% H_2SO_4, 1.5% HCl and 1% HF.

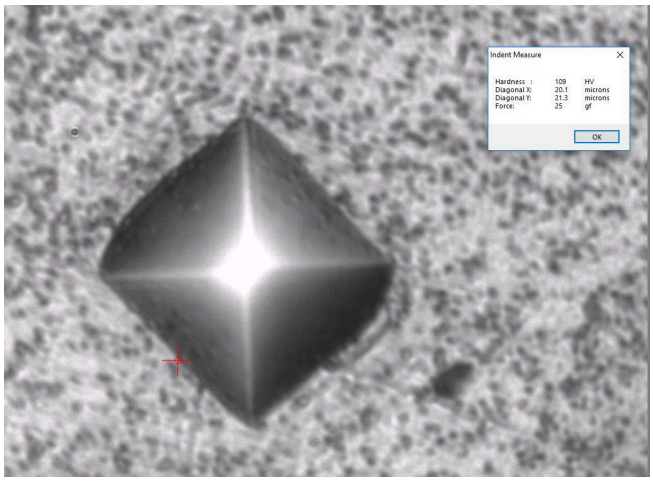
→ Hardness Measurement.

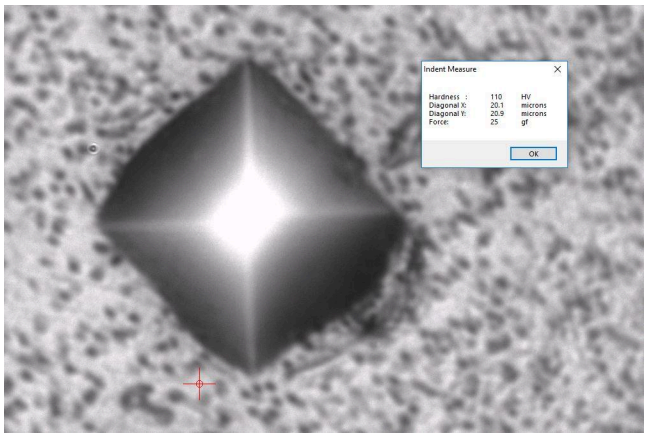
For hardness Test we used VICKER's hardness Test in which sample is placed on VICKER'S Testing machine. Then automated daimond indentor marked indent on it by applying force of 25 gf. After making grove we measure the daignol lenght of groove automatically by application and then hardness value were calculated using formulae.

$$HV = 1.854 \times \text{force} \times (\text{daignol})^2$$

from this force formula

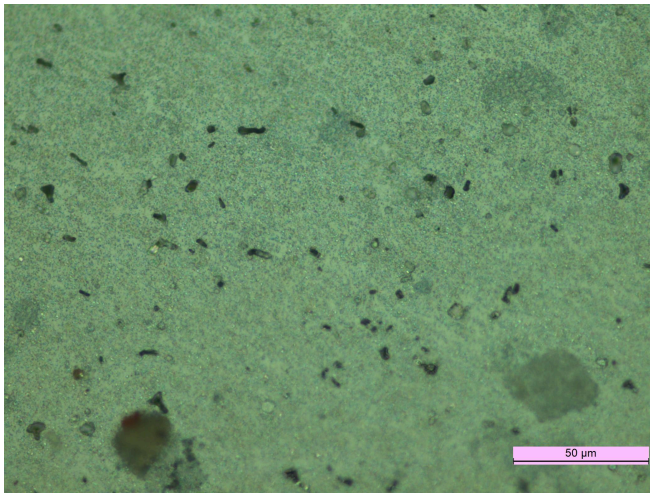
$$HV = 110 + HV.$$

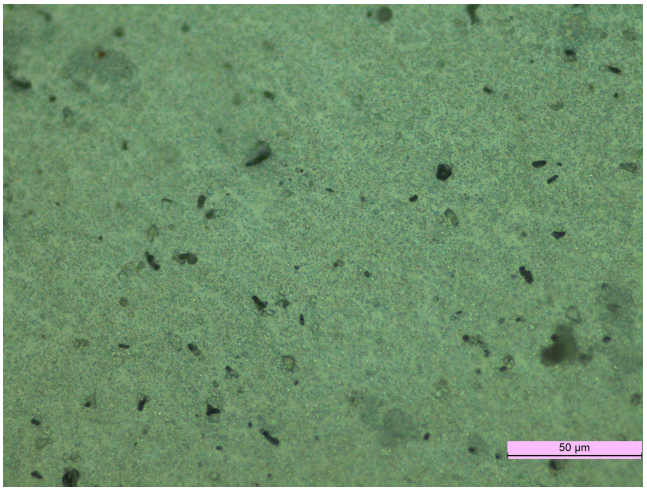




Hardness of the given sample is 110 HV

Microscopic Images Of Sample





From the above we can say that my average grain size is 3.5 micron

Conclusion

From the above we can conclude that the hardness of sample is 110HV and the precipitate formed was of copper of size 3.5 micro meter.
From this we can easily conclude the the sample given to me was Peak Aged sample.