

Properties of Materials BTM 2413

CHAPTER 9:
Aluminum and Its Alloys
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Introduction

- Aims
 - To introduce the Aluminium and its alloys from engineering material point of view....
- Expected Outcomes
 - Describe the general characteristics of aluminum
 - Identify properties, heat treatments and fabrication methods of aluminum.....
 - Identify the alloy designation method of aluminum
 - Know the alloy selection criteria of aluminum....
- Other related Information
- References
 - Kenneth G Budinsky & Michael G Biddinsky, Engineering Materials: Properties and Selection, Ed 9, Prentice Hall



Advantages of Using Aluminum

- Very light weight as compared to other metals
- Better thermal and electrical conductivity than most of the metals
- Higher strength to weight ratio
- Can be hardened by treatments such as anodizing and hard coating
- Most aluminum alloys are weld able
- Antirust properties
- High reflectivity
- Good machinability
- Can be die casted and formed easily
- Shows non magnetic properties
- Non toxic in nature
- Has one third stiffness of steel



Aluminum Alloy

- An Aluminum alloy is produced by mixing pure aluminum with different alloying elements to produce an entire range of materials.
- Each alloy is intended to maximize a particular characteristic required in the range of applications. These characteristics include strength, ductility, formability, machine-ability, or electrical conductivity.



Aluminum Alloys

- Pure Commercial aluminum is a white and lustrous metal. It is light in weight and shows good corrosion resistance..
- Following are used in Aluminum alloys
 - manganese,
 - magnesium,
 - chromium,
 - magnesium and silicon,
- In wrought Al alloy usually the alloying element percent is less than 6 to 7 %.



Types, Characteristics and Uses

- Air craft industry where weight is a major concern, Aluminum is widely used. It's strength to weight ratio is very good. In addition its resistance to corrosion and relative ease of fabrication makes it more attractive..
- Light weight is the extremely important characteristic.
- Melting point of pure commercial Aluminum is 658 deg C
- It is nonmagnetic in nature, and is an excellent electrical conductor
- Strength of pure commercial Aluminum is 13,000 psi.
- This can be made more (doubled) by process such as rolling or other cold working processes..
- Structural strength is increased by alloying with other metals and performing heat treatment on alloys.



Classification of Al alloys

- Aluminum alloys can be classified as
 - a. Casting alloys
 - b. Wrought alloys



Heat Treatment of Aluminum

- Following are the heat treatments given to Al alloys
- Preheating or homogenizing,
 - Its purpose is to reduce chemical segregation of cast structures and to improve their workability
- Annealing,
 - The reason for annealing is to soften strain-hardened (work-hardened) and heat treated alloy structures, to relieve stresses, and to stabilize properties and dimensions
- Solution heat treatments,
 - to effect solid solution of alloying constituents and improve mechanical properties
- Precipitation heat treatments,
 - to provide hardening by precipitation of constituents from solid solution. (A solid solution is a solid-state solution of one or more solutes in a solvent)

