ALUMINIUM AND ITS ALLOYS
Melting point of Al 660°C

Light weight, density is about 1/3 that of steel or copper alloys

Certain aluminium have a better strength to weight ratio than that of high strength steel

Have good malleability and formability, high corrosion resistance and high electrical and thermal conductivity.

An ultra pure form of Al is used as photographic reflectors. Non tarnishing characteristics
Non toxic, non magnetic, and non sparking

Electrical conductivity of the electric conductor grade is about 62% that of copper.

Relatively soft and weak. Strength can be increased by cold working, alloying and heat treatment.

High machinability and workability

Aluminium alloys are prone to porosity due to gases dissolved during melting process

Alloy designation: a four digit number for wrought Al and wrought Al alloys
1XXX, 2XXX, 3XXX, 4XXX, ..........., 8XXX
Aluminium copper alloys – 2XXX series
Aluminium Manganese alloys - 3XXX series
Aluminium silicon alloys – 4XXX series
Aluminium Magnesium alloys – 5XXX series
Aluminium Silicon Magnesium alloys – 6XXX series
Aluminium Zinc alloys – 7XXX series
Other element – 8XXX series

CAST Aluminium
1XX.X, 2XX.X, ……,8XX.X

Alloying elements in Commercial Al alloys include Cu, Si, Mg, Mn, and occasionally Zn, Ni, and Cr. The alloying elements may enhance the mechanical properties by
- Solid solution hardening
- Responding to precipitation hardening or
- Strain hardening by cold work

Temper designation: follows the alloy designation and is separated by a dash
- F – as fabricated
- O – Annealed, recrystallized
- H – Strain hardened
  - H1 – Strain hardened only
  - H2 – Strain hardened Then partially annealed
- H3- Strain hardened and then stabilized

- W – Solution heat treated

- T – thermally treated
  - T2 – Annealed (cast products only)
  - T3 – Solution heat treated and then cold worked
  - T4 – Solution heat treated and naturally aged
  - T5 – artificially aged only
  - T6 – solution heat treated and then artificially aged
  - T7 – Solution heat treated and then stabilized
  - T8 – solution heat treated, cold worked and then artificially aged
  - T9 – Solution heat treated, artificially aged and then cold worked
  - T10- Artificially aged and then cold worked
MAGNESIUM AND ITS ALLOYS

- Light weight, high machinability
- The alloys have high strength to weight ratio
- Density of Mg 1 ½ times that of Al
- Mg has HCP structure and therefore ductility of Mg lower than FCC metals but plasticity of the Mg and its alloy improves above 205°C
- ½ of Mg is used in alloys for aircraft and missile
- Also used as alloying elements in many alloys
- Used in photo engraving
- Mg has a chemical activity and is used in production of U and Zr
- Used a sacrificial anode
- Mg and alloys have Poor resistance to corrosion particularly in salt water and salt environment. Electrolytic anodizing used to apply a protective coating
- Ignites rapidly when in finely divided form

ALLOY Designation.
Consists of not more that 2 letters representing the alloy elements specified in the greatest amount
arranged in order of decreasing % or alphabetical order if same % followed by the respective percentages rounded off to whole numbers and a serial letter e.g. AZ81A, AM100A, ZH62A-T5

A Aluminum  H Thorium  Q Silver
B Bismuth  K Zirconium  R Chromium
C Copper  L Lithium  S Silicon
D Cadmium  M Manganese  T Tin
E Rare earth  N Nickel  Y Antimony
F Iron  P Lead  Z Zinc
G Magnesium

TEMPER designation: Same as Al

Alloying elements in Mg.:  Al, Zn, Mn and for special purpose Sn, Zr, Ce, Th, Be
Cu, Fe and Ni are considered impurities

Al 3-10% increase strength, hardness and castability
>10% alloy becomes brittle
Zn used together with Al up to 3% to increase salt water corrosion resistance to offset effects of Fe and Cu.
Implements castabilily
Excess of Zn produces porosity and brittleness
Mn limited solubility in Mg particularly in presence of Al.
1.2% in binary alloy gives best weldability and hot forming characteristics at the expense of strength.
Used in Mg-Al and Mg-Al-Zn alloys upto 0.5% to improve corrosion resistance and weldability without affecting strength.
Si (usually below 0.3%) not soluble in Mg but forms a compound which increases the hardness.
5% Sn in Mg-Al-Mn alloy increase the hammer forging process.

Alloys: Most Mg alloys are ternary alloy but may be considered as based upon four binary alloy system.

- Magnesium Aluminum Based alloys
- Magnesium Zinc Based Alloys
- Magnesium Rare earths based alloys
- Magnesium Thorium Based alloys

Solubility decreases with decrease in temperature, therefore some of the alloys are age hardenable or precipitation hardenable