

## UNIT – III

### FERROUS AND NON- FERROUS METALS.

#### 3.2 TOOL STEEL :

This used as material for mechanical working tools. Tool steels are metals used to make tools and dies for cutting, forming and bending operations.

##### Properties :

Hardness.

Toughness.

Wear resistance.

Red hardness.

Depth of hardening.

Machinability.

Non – deforming.

##### Types of tool steel :

###### cold work tool steel :

a) Water hardening steels :

C→0.6 to 1.4 %,balance is iron .

Oil hardening steels:

C→0.6 to 1.4 %,(w + Mn+ Cr+Mo + V) < 5% (Alloys).

Air Hardening steels:

C→0.6 to 1.4%,(W +Mn +Cr+Mo+v) > 5% (Aloys).

High carbon High Chromium steels :

C→>1.5%,Cr →12%,Alloys < 5%,balance is iron.

### **Hot work Tool Steels :**

a) Chromium type (cr):

$C \rightarrow 0.35 \text{ to } 0.55\%$ ,  $Cr \rightarrow 3 \text{ to } 7\%$  ,  $(w + Mo + V) < 5\%$ .

b) Tungsten type : (w)

$C \rightarrow 0.3 \text{ to } 0.5\%$ ,  $Cr \rightarrow 2 \text{ to } 12\%$  ,  $w \rightarrow 9 \text{ to } 18\%$ .

a) Molybdenum type (Mo):

$C \rightarrow 0.55 \text{ to } 0.065\%$ ,  $(Mo + Cr + V + w) \rightarrow 14 \text{ to } 20\%$ .

### **High speed tool steels :**

a) T – series (Tungsten)

$C \rightarrow < 0.12\%$ ,  $W \rightarrow < 20\%$ , Cr , V.

M- Series (Moly bdenum) :

$C \rightarrow < 0.12\%$ ,  $Mo \rightarrow < 10\%$ , Cr, N.

### **Special purpose Tool steels :**

Shock resisting type :

$C \rightarrow < 0.5\%$ , (Mn, Cr, w, Mo, V, Si).

Low alloy type :

Cr, w, V, Mo, Ni.

Carbon – tungsten type :

$C \rightarrow > 1\%$  .

d) Mould Steels :

$C \rightarrow < 0.2\%$  , Cr , Ni.

**Application :**

Taps, drills, reamer, die working, tool, milling cutter, tools, gauges, punches, bearings, dies, blades, Hammers.

**3.2.1 HSLA STEEL : (HIGH STRENGTH LOW ALLOY STEEL)**

High-strength low-alloy steel (HSLA) is a type of alloy steel that provides better mechanical properties or greater resistance to corrosion than carbon steel. HSLA steels vary from other steels in that they are not made to meet a specific chemical composition but rather to specific mechanical properties. To improve the strength to weight ratio of steels, 0.2 % of Cu is added to improve corrosion resistance. HSLA steels are not hardened by heat treatments.

**Composition:**

C→0.2 %, Mn→ 1.25%, Si→ 0.3 %, Cr→ 0.01%, V → 0.01 %

**Properties :**

Good yield strength.

Good corrosion resistance.

High machinability.

High formability and ductility.

**Application :**

Bridges, towers support, columns in high – rise, buildings and pressure vessels.

**3.2.2 MARAGING STEEL :**

Maraging steel is a steel alloy, containing up to 25 per cent nickel and other metals, strengthened by a process of slow cooling and age hardening.

**Composition :**

Ni → 18%, Co→ 7%, Ti →0.2%, C→0.05%, Al → 0.1 %.

**Properties :**

High tensile strength.

High toughness.

High impact hardness.

Very suitable for surface hardening by nitriding.

**Applications :**

Flexible drive shaft for helicopters.

Barrels for rapid firing guns.

Die casting dies.

Extrusion rams.

Pressure Vessels.