



## HEAT TREATMENT OF ALLOYS (STEEL)

### Heat treatment

The process of heating and cooling of solid steel articles under controlled conditions

### Purpose

- ❖ To improve magnetic & electrical properties
- ❖ To refine grain structure
- ❖ To remove imprisoned trapped gases
- ❖ To remove internal stresses
- ❖ To improve fatigue and corrosion resistance

### Type of heat treatment of alloys (Steel)

- ❖ Annealing
- ❖ Hardening
- ❖ Tempering
- ❖ Normalizing
- ❖ Carburizing
- ❖ Nitriding

### Annealing

- ❖ Means Softening
- ❖ Heating metal to high temperature
- ❖ And slow cooling in a furnace

### Purpose

- ❖ Increase machinability
- ❖ To remove imprisoned gases

### Types

- ❖ Low temperature annealing ( process annealing)
- ❖ High temperature annealing ( full annealing )



## Low temperature annealing

- ❖ Heating steel below the lower critical temperature
- ❖ And slow cooling

### Purpose

- ❖ Improve machinability
- ❖ Remove stresses
- ❖ Increases ductility
- ❖ Increases shock- resistance
- ❖ Reduce hardness

## High temperature annealing

- ❖ Heating alloy about 30-50°C above the higher critical temperature
- ❖ Holding it that temperature for sufficient time for internal changes
- ❖ And cool to room temperature

### Purpose

- ❖ Increases ductility
- ❖ Machinability
- ❖ It makes alloy softer and tougher

## Hardening

- ❖ Heating alloy beyond the critical temperature
- ❖ And suddenly cooling it in oil or water

### Purposes

- ❖ Increases resistance to wear
- ❖ Increases abrasion resistance
- ❖ For making cutting tools

## Tempering

- ❖ Heating already hardened steel to temperature lower than own hardening temperature
- ❖ Then slow cooling
- ❖ To retain strength and hardness reheating temp should be less than 400°C



## Purpose

- ❖ Removes stresses and strains
- ❖ Reduces brittleness
- ❖ Reduces hardness
- ❖ Increases toughness
- ❖ Increases ductility
- ❖ High temper cutting tools

## Normalizing

- ❖ Heating alloy above its higher critical temperature &
- ❖ Allowing it to cool gradually in air.

## Purpose

- ❖ Recovers homogeneity
- ❖ Refines grains
- ❖ Removes internal stresses
- ❖ Increases toughness
- ❖ Normalized used in engineering works

## Carburizing

- ❖ Alloy articles heated with charcoal in a cast iron box to about 950°C
- ❖ Allowed to keep sufficient time in iron box itself
- ❖ Carbon gets absorbed
- ❖ Allowed to cool slowly
- ❖ Outer skin of the alloy article covered with high-carbon

## Purpose

- ❖ To produce hard wearing surface

## Nitriding

- ❖ Heating alloy in presence of ammonia to about 550°C
- ❖ Dissociation of ammonia produces  $N_2$
- ❖ And  $N_2$  combines with alloy to form hard nitride

## Purpose



# SNS COLLEGE OF TECHNOLOGY



❖ To get super hard surface