

## EXTRACTION OF ELEMENTAL SULPHUR

- Sulphur from gasoline is further removed in the form of  $\text{H}_2\text{S}$
- **CLAUS PROCESS:** Process of getting elemental sulphur
- What we do in Claus process?
- **First Step:** Partial oxidation of  $\text{H}_2\text{S}$
- $\text{H}_2\text{S} + \text{O}_2 \rightarrow \text{SO}_2 + \text{H}_2\text{O} + \text{unburned H}_2\text{S}$  Exothermic Rex Unit  
Process : Burner
- $\text{H}_2\text{S} + \text{SO}_2 \leftrightarrow \text{S}_2 + 2\text{H}_2\text{O}$  Exothermic Rex
- First unit operation: Burner
- Since non condensable are released.
- $\text{H}_2\text{S}$  is absorbed in amine while other non condensable gases are vent out
- Tail gases contain gases like  $\text{SO}_2$ ,  $\text{CS}_2$  and  $\text{COS}$  which are treated through scot process or are incinerated.
- In the scot process, the  $\text{SO}_2$ ,  $\text{CS}_2$  and  $\text{COS}$  are reduced to  $\text{H}_2\text{S}$  by reducing gases and passed back to the Claus process for further conversion .
- This ensures more than 99 percent conversion
- In order to ensure optimal conversion in the Claus plant, the  $\text{H}_2\text{S}:\text{SO}_2$  ratio should be 2:1. The ratio is measured in the tail gas from the final condenser, and the air flow to the furnace is adjusted to achieve this ratio

## Ammonia Production

- **Thermodynamic condition:** High Pressure, Low temperature
- Requires Catalyst
- Source of Nitrogen : Air
- Source of Hydrogen: Natural Gas

- Steam reforming is used for getting H<sub>2</sub>
- $\text{CH}_4 + \text{H}_2\text{O} \rightleftharpoons \text{CO} + 3\text{H}_2$  (endothermic)
- $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$  (exothermic)
- Major Steps involved:-
- Desulphurization of Natural Gas – To protect downstream catalyst
- Next Step is reforming
- Primary reforming
- Clean Gas + H<sub>2</sub>O  $\rightarrow$  CO + H<sub>2</sub> + CH<sub>4</sub> + H<sub>2</sub>O
- This mixture goes to secondary reformer
- Primary reforming is done in a furnace
- Since temp is lower at the outlet, we partially combust H<sub>2</sub> so that temperature increases again
- Therefore secondary reformer has two chambers : one for combustion and one for Reaction