Sulphur system

- The phase diagram of sulphur is somewhat more complicated than that of water although both are one component systems.
- A phase is defined as "a homogeneous, physically distinct and mechanically separable portion of the system, which is separated from other such parts of the system by definite boundary surface"

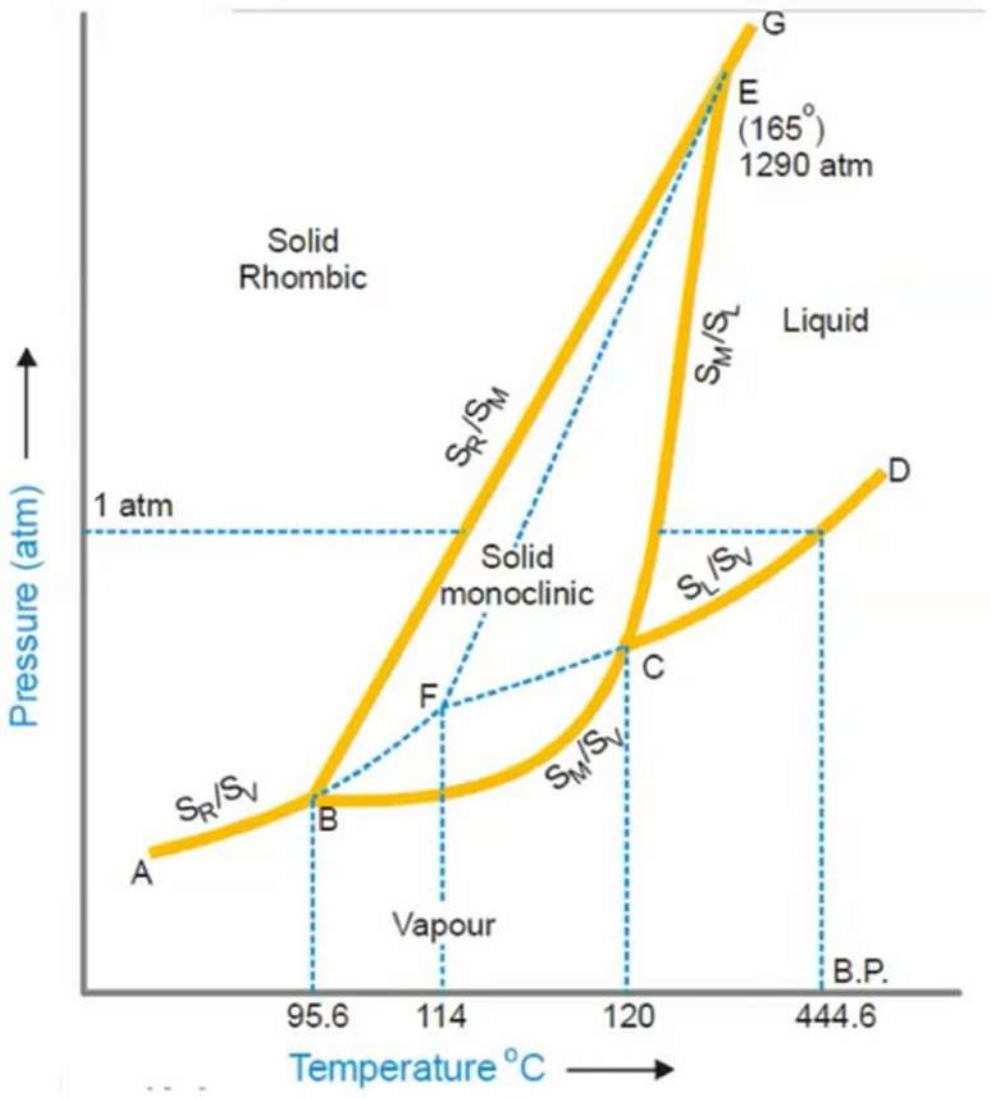
Sulphur can exist in four different phases:

- (i) Two well-defined crystalline allotropic forms in the solid state, e.g.,
- Monoclinic sulphur, S_m
- Rhombic sulphur, S_r
- Liquid Sulphur, S_l.
- Sulphur Vapour, S_v

Components & Phase Rule

- All the four phases can be represented by the only chemical individual “SULPHUR” itself.
- Hence an one component system.
- Phase rule (F= C-P+2) becomes:

$$F = 3 - P$$

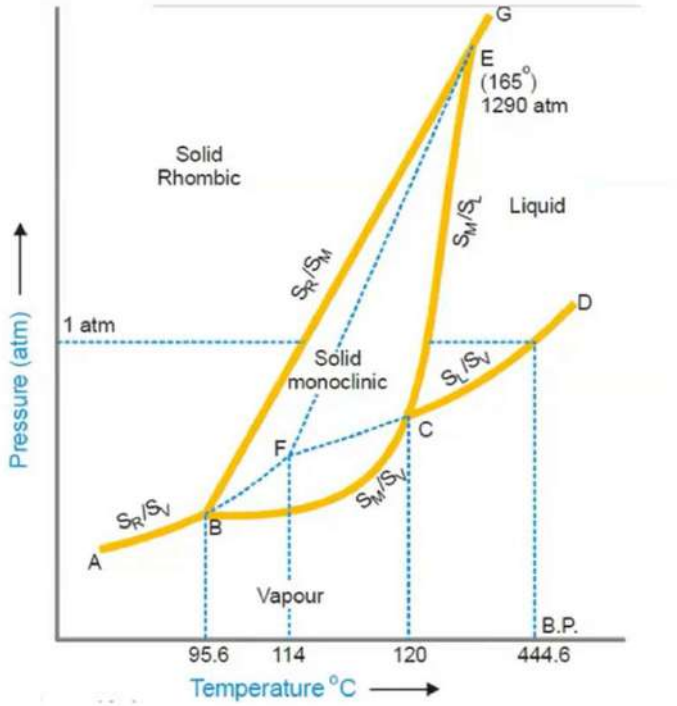

G
E
(165°)
1290 atm
Solid
Rhombic
Liquid
S_M/S_L
S_R/S_M
D
1 atm
Solid
monoclinic
S_L/S_V
C
F
S_M/S_V
S_R/S_V
B
A
Vapour
B.P.
95.6
114
120
444.6
Pressure (atm)
Temperature °C

Curves In Phase Diagram

- Curve AB: Sublimation Curve of Rhombic Sulphur
- Curve BC: Sublimation Curve of Monoclinic Sulphur
- Curve CD: Vapour Pressure Curve of Liquid Sulphur
- Curve CE: Fusion Curve of Monoclinic Sulphur
- Curve BE: Transition Curve Solid Sulphur
- Curve EG: Fusion Curve of Rhombic Sulphur

- At any curve, phase rule becomes,

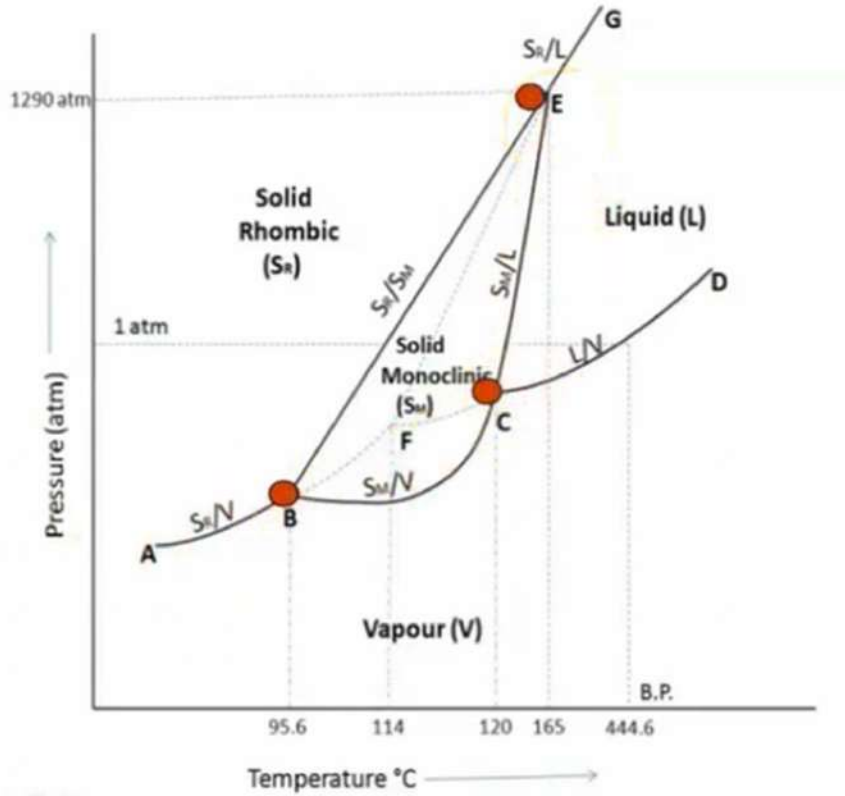
  F= 3-P = 3-2 = 1 (Monovarient)



Triple Points

- Triple Point **B**
- Triple Point **C**
- Triple Point **E**

- At any Triple Point, phase rule becomes:
  F = 3-P = 3-3 = 0
  (nonvarient)



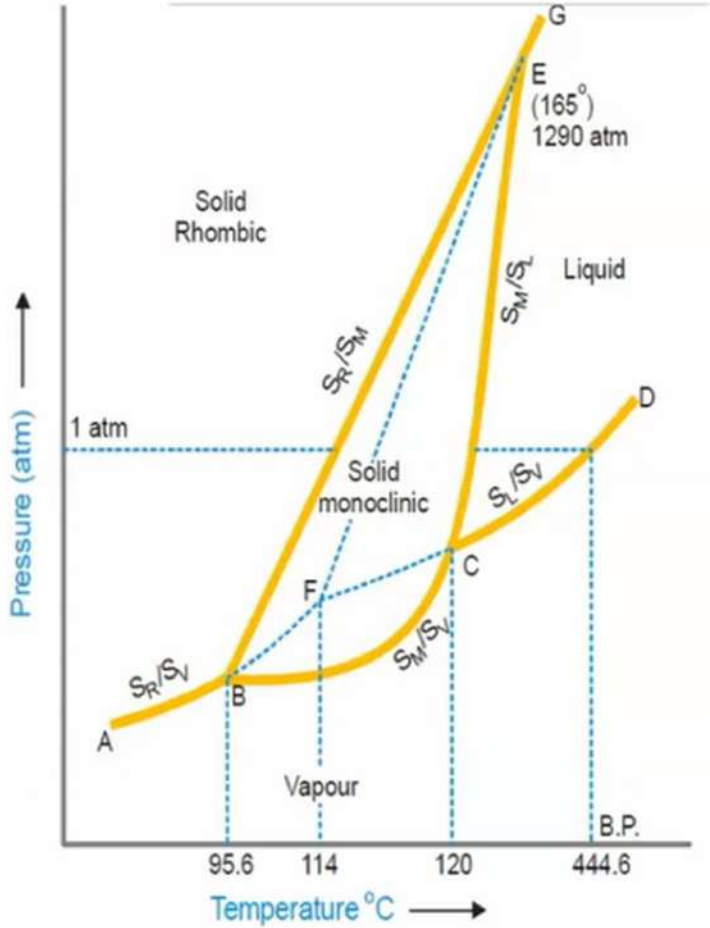
Areas in Phase Diagram

- Area ABEG (Rhombic Sulphur)
- Area BCEB (Monoclinic Sulphur)
- Area DCEG (Sulphur Liquid)
- Area ABCD (Sulphur Vapours)

- In an area, Phase Rule becomes:

$$F = 3-P = 3-1 = 2$$

(bivariant)



Metastable Equilibrium

- 3 Dashed curve:
  - curve BF (sublimation curve of metastable S_R)
  - curve CF (vapour press. Curve of supercooled liquid sulphur)
  - curve FE (fusion curve of metastable S_R)
- One triple point F
- 3 areas:
  Area ABFE (Metastable S_R)
  Area ABFCD (Sulphur vapours)
  Area DCFE (supercooled liquid sulphur)