Termodinamički potencijali

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1. unutarnja energija

$$U = U(S, V)$$

$$T = \left(\frac{\partial U}{\partial S}\right)_V \quad p = -\left(\frac{\partial U}{\partial V}\right)_S$$

2. entalpija

$$H = H(S, p) = U + pV$$

$$T = \left(\frac{\partial H}{\partial S}\right)_p \quad V = \left(\frac{\partial H}{\partial p}\right)_S$$

3. slobodna energija

$$F = F(T, V) = U - TS$$

$$p = -\left(\frac{\partial F}{\partial V}\right)_T \quad S = -\left(\frac{\partial F}{\partial T}\right)_V$$

4. Gibbsov potencijal

$$G = G(T, p) = H - TS$$

$$V = \left(\frac{\partial G}{\partial p}\right)_T \quad S = -\left(\frac{\partial G}{\partial T}\right)_p$$

- Maxwellove termodinamičke jednadžbe

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial p}{\partial S}\right)_V$$

$$\left(\frac{\partial T}{\partial p}\right)_S = \left(\frac{\partial V}{\partial S}\right)_p$$

$$\left(\frac{\partial p}{\partial T}\right)_V = \left(\frac{\partial S}{\partial V}\right)_T$$

$$\left(\frac{\partial V}{\partial T}\right)_p = -\left(\frac{\partial S}{\partial p}\right)_T$$

- $T\mathrm{d}S$ jednadžbe

$$T\mathrm{d}S = C_V \mathrm{d}T + T\left(\frac{\partial p}{\partial T}\right)_V \mathrm{d}V$$

$$T\mathrm{d}S = C_p \mathrm{d}T - T\left(\frac{\partial V}{\partial T}\right)_p \mathrm{d}p$$

$$T\mathrm{d}S = C_V \left(\frac{\partial T}{\partial p}\right)_V \mathrm{d}p + C_p \left(\frac{\partial T}{\partial V}\right)_p \mathrm{d}V$$

- osnovna termodinamička jednadžba

$$T\mathrm{d}S \geq \mathrm{d}U + p\mathrm{d}V$$

- jednadžbe za unutarnju energiju

$$\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial p}{\partial T}\right)_V - p$$

$$\left(\frac{\partial U}{\partial p}\right)_T = -T\left(\frac{\partial V}{\partial T}\right)_p - p\left(\frac{\partial V}{\partial p}\right)_T$$

- opća termodinamička jednadžba

$$\mathrm{d}U = C_V\mathrm{d}T + \left[T\left(\frac{\partial p}{\partial T}\right)_V - p\right]\mathrm{d}V$$

- jednadžbe za toplinske kapacitete

$$C_p - C_V = T\left(\frac{\partial p}{\partial T}\right)_V\left(\frac{\partial V}{\partial T}\right)_p$$

$$C_p - C_V = -T\left(\frac{\partial V}{\partial T}\right)_p^2\left(\frac{\partial p}{\partial V}\right)_T$$