2020 2255

김선규

1. $\cdot \Delta G_v$ (w/k)

- ~~sh~~ spherical nucleus

a) liquid - solid interfacial energy for tin

- $\Delta G = -\frac{4}{3}\pi r^3 \Delta G_v + 4\pi r^2 \gamma$

- $I = f_0 N_0 \exp\left(-\frac{\Delta G^*}{kT}\right)$

  $\ln I = \ln f_0 N_0 + \left(-\frac{\Delta G^*}{kT}\right)$

- $\left.\frac{\partial \Delta G}{\partial r}\right|_{r^*} = 0 \Rightarrow r^* = \frac{2\gamma}{\Delta G_v}, \quad \Delta G^* = \frac{16}{3}\pi \frac{\gamma^3}{(\Delta G_v)^2}$

  $n^* = \frac{32\pi}{3v}\left(\frac{\gamma}{\Delta G_v}\right)^3 \quad \left(\frac{4}{3}\pi r^3 = nv\right)$

- The slope of $\ln I$ vs. $1/T$ at 113°C $= -23.8 \times 10^3 K = -\frac{\Delta G^*}{k\,(1.38 \times 10^{-23} J/K)}$

  $\Delta G^* = -3.28844 \times 10^{-19} J$

  $= \frac{16}{3}\pi \frac{\gamma^3}{(\Delta G_v)^2}$

$\therefore \gamma^3 = -3.28844 \times 10^{-19} \times \frac{3}{16} \times \frac{1}{\pi} \times (-10^8 J m^{-3})^2$

$\gamma = 0.0581\ J\,m^{-2}$

b) r^*?

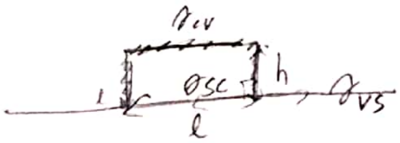
$r^* = \frac{2\gamma}{\Delta G_v} = \frac{2 \cdot 0.0581\ J m^{-2}}{+10^8\ J\ m^{-3}} = 1.1618 \times 10^{-9} = 1.1618\ nm$

c) $n^* = \frac{32\pi}{3v}\left(\frac{\gamma}{\Delta G_v}\right)^3, \quad v = V_m = \frac{4}{3}\pi r_{tin}^3 = \frac{4}{3}\pi \cdot (1.5 \times 10^{-10})^3 = 1.414 \times 10^{-29}\ m^3$

$= \frac{32\pi}{3 \times (1.414 \times 10^{-29})} \times \left(\frac{0.0581}{10^8}\right)^3 = \cancel{4448}$ 465개

CamScanner로 스캔하기

2.



$$\gamma_{vs} = \gamma_{sc} + \gamma_{cv}\cos\theta \quad (\theta = 90^\circ)$$
$$= \gamma_{sc}$$

- $\Delta G = -V_{cubic}\cdot \Delta G_v + \sum A_i \gamma_i$

$$= -V_{cubic}\cdot \Delta G_v + 4\cdot l\cdot h\cdot \gamma_{cv} + l^2\gamma_{cv} + l^2\gamma_{sc} - l^2\gamma_{vs}$$
$$= -l^2 h\cdot \Delta G_v + 4\cdot l h\,\gamma_{cv} + l^2\gamma_{cv} + \cancel{l^2\gamma_{sc}} - \cancel{l^2\gamma_{sc}}$$

- $\dfrac{\partial \Delta G}{\partial h} = 0, \quad \dfrac{\partial \Delta G}{\partial l} = 0$

$$\frac{\partial \Delta G}{\partial h} = -l^2\Delta G_v + \gamma_{cv}(4l) = 0$$
$$l^2\Delta G_v - 4l\gamma_{cv} = 0$$
$$l(l\Delta G_v - 4\gamma_{cv}) = 0 \quad \Rightarrow \quad \boxed{l^* = \frac{4\gamma_{cv}}{\Delta G_v}}$$

$$\frac{\partial \Delta G}{\partial l} = -2lh\cdot \Delta G_v + 4h\gamma_{cv} + 2l\gamma_{cv} = 0$$
$$\downarrow l = l^*$$
$$= -\frac{8\gamma_{cv}}{\cancel{\Delta G_v}}\cdot \cancel{\Delta G_v}\cdot h + 4h\gamma_{cv} + \frac{8\gamma_{cv}}{\Delta G_v}\cdot \gamma_{cv}$$
$$= -4h\gamma_{cv} + 8\frac{\gamma_{cv}^2}{\Delta G_v} = 0 \quad \Rightarrow \quad \boxed{h^* = \frac{2\gamma_{cv}}{\Delta G_v}}$$

- $\Delta G^* = -l^{*2}h^*\cdot \Delta G_v + 4\cdot l^* h^*\gamma_{cv} + l^{*2}\gamma_{cv}$

$$= -\frac{16\gamma_{cv}^2}{\Delta G_v^2}\cdot\frac{2\gamma_{cv}}{\Delta G_v}\cdot \Delta G_v + \gamma_{cv}\left(\frac{16\gamma_{cv}}{\Delta G_v}\cdot\frac{2\gamma_{cv}}{\Delta G_v} + \frac{16\gamma_{cv}^2}{\Delta G_v^2}\right)$$
$$= -\frac{32\gamma_{cv}^3}{\Delta G_v^2} + \frac{48\gamma_{cv}^3}{\Delta G_v^2} = \boxed{\frac{16\gamma_{cv}^3}{\Delta G_v^2}}$$