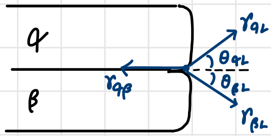
HW#6 20212568 강승연

1 (a)



$$\gamma_{q\beta} = \gamma_{qL}\cos\theta_{qL} + \gamma_{\beta L}\cos\theta_{\beta L} \cdots (1)$$

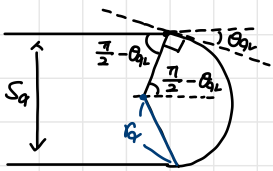
$$\gamma_{qL}\sin\theta_{qL} = \gamma_{\beta L}\sin\theta_{\beta L} \cdots (2)$$

case 1) If the layer tip doesn't have curvature, $\theta_{qL} = \theta_{\beta L} = 90°$

by eqn.(1) $\quad \gamma_{q\beta} = \gamma_{qL}\cdot 0 + \gamma_{\beta L}\cdot 0 = 0 \Rightarrow$ impossible.

$\therefore$ Each layer has a curvature

(b)



$$S_q = 2r_a\cos\theta_{qL} \qquad S_\beta = 2r_b\cos\theta_{\beta L}$$

$$\gamma_{qL}\sin\theta_{qL} = \gamma_{\beta L}\sin\theta_{\beta L}$$

$$\Rightarrow \gamma_{qL}^2\sin^2\theta_{qL} = \gamma_{\beta L}^2\sin^2\theta_{\beta L}$$

$$\Rightarrow \gamma_{qL}^2(1-\cos^2\theta_{qL}) = \gamma_{\beta L}^2(1-\cos^2\theta_{\beta L})$$

$$\Rightarrow \cos\theta_{\beta L} = \sqrt{\frac{\gamma_{\beta L}^2 - \gamma_{qL}^2 + \gamma_{qL}^2\cos^2\theta_{qL}}{\gamma_{\beta L}^2}}$$

$$\therefore \gamma_{q\beta} = \gamma_{qL}\cos\theta_{qL} + \gamma_{\beta L}\sqrt{\frac{\gamma_{\beta L} - \gamma_{qL}^2 + \gamma_{qL}^2\cos^2\theta_{qL}}{\gamma_{\beta L}^2}}$$

$$\Rightarrow \gamma_{q\beta} = \gamma_{qr}\frac{S_q}{2r_a} + \sqrt{\gamma_{\beta L}^2 - \gamma_{qL}^2 + \gamma_{qL}^2\frac{S_q^2}{4r_a^2}}$$

$$\Rightarrow \gamma_{\beta L}^2 - \gamma_{qL}^2 + \gamma_{qL}^2\frac{S_a^2}{4r_a^2} = \gamma_{q\beta}^2 + \gamma_{qL}^2\frac{S_\alpha^2}{4r_a} - 2\gamma_{q\beta}\gamma_{qL}\frac{S_a}{2r_\alpha}$$

$$\Rightarrow \frac{1}{r_\alpha} = \frac{\gamma_{q\beta}^2 - \gamma_{\beta L}^2 + \gamma_{qL}^2}{S_q\gamma_{q\beta}\gamma_{qL}} \Rightarrow r_q = \frac{S_q\gamma_{q\beta}\gamma_{qL}}{\gamma_{q\beta}^2 - \gamma_{\beta L}^2 + \gamma_{qL}^2}$$

$$\& \; r_\beta = \frac{S_\beta\gamma_{q\beta}\gamma_{\beta L}}{\gamma_{q\beta}^2 - \gamma_{qL}^2 + \gamma_{\beta L}^2}$$

Same way of r_q

(c) Cylinder $\Rightarrow$ Capillary effect ; $\frac{\gamma}{r} V_m$

$$\Delta G_{capillary} = \frac{\gamma_{\alpha L}}{r_\alpha} V_\alpha + \frac{\gamma_{\beta L}}{r_\beta} V_\beta$$

$$= \frac{V_\alpha (\gamma_{\alpha\beta}^2 + \gamma_{\alpha L}^2 - \gamma_{\beta L}^2)}{S_\alpha \gamma_{\alpha\beta}} + \frac{V_\beta (\gamma_{\alpha\beta}^2 + \gamma_{\beta L}^2 - \gamma_{\alpha L}^2)}{S_\beta \gamma_{\alpha\beta}}$$

Assume that $\frac{V_\alpha}{S_\alpha} = \frac{V_\beta}{S_\beta} = \frac{V_m}{S}$

$$\Delta G_{capillary} = \frac{2\gamma_{\alpha\beta} V_m}{S} = \Delta G_{IF}(S)$$