1. A. $\frac{2\pi}{\lambda}$ 이용

$C(x,0) = (38at\%\ A_n) + (12at\%\ A_n)\cos\beta x$

$C(x,t) = (38at\%\ A_n) + (12at\%\ A_n)\, e^{R(\beta)t}\cos\beta x$

Fick's second law

$$\frac{\partial C}{\partial t} = \tilde{D}\frac{\partial^2 C}{\partial x^2}$$

$$\begin{cases} \frac{\partial C}{\partial t} = R(\beta)(12at\%A_n)\, e^{R(\beta)t}\cos\beta x \\ \frac{\partial^2 C}{\partial x^2} = -\beta^2 (12at\%A_n)\, e^{R(\beta)t}\cos\beta x \end{cases}$$

$$-\beta^2 \cdot \tilde{D} = R(\beta)$$

$[C_{max} - C_{min} = 2\%]$

$$C_{max} - C_{min} = 2 (12 \text{ at\% } Au) \exp(R(D) \cdot t)$$

$$\alpha^2$$

$$\left[\begin{array}{ll} \cos B\lambda = 1 & \rightarrow C_{max} \\ \cos B\lambda = -1 & \rightarrow C_{min} \end{array} \right]$$

$$\Rightarrow 2 \cdot (12 \text{ at\% } Au) \exp(R(B)\, t) = 2\%$$

$$\tilde{\Gamma} = -\tilde{D} \cdot B^2$$

$$\tilde{D} = 10^{-23}\ m^2 s$$

$$B = \frac{2\pi}{\lambda} = \pi \times 10^9\ m^{-1}$$

$$t = 2.5 \times 10^4\ \text{sec}$$

(b) Cahn's modified diffusion eq

$$\frac{\partial C}{\partial t} = \tilde{D}\frac{\partial^2 C}{\partial x^2} - \frac{2k\tilde{D}}{f''}\frac{\partial^4 C}{\partial x^4}$$

$$\frac{\partial C}{\partial t} = R(\beta)\,(12at/A_4)\exp(R(\beta)t)\cos\beta x$$

$$\frac{\partial^2 C}{\partial x^2} = -\beta^2\,(12at/A_4)\exp(R(\beta)t)\cos\beta x$$

$$\frac{\partial^4 C}{\partial x^4} = \beta^4\,(12at/A_4)\exp(R(\beta)t)\cos\beta x$$

$$\Rightarrow \frac{\partial C}{\partial t} = -\exp(R(\beta)t)\cdot\cos\beta x\;\tilde{D}\cdot\beta^2 \cdot (12at/A_4)\left(1+\frac{2k\beta^2}{f''}\right)$$

> 0 이므로

$$\Rightarrow \quad R(\beta) = -\tilde{D}\beta^2\left(1 + 2\frac{\kappa\beta^2}{f''}\right)$$

$$C_{max} - C_{min} = 2\%$$

$$= 2\cdot(12at\%\ Au)\exp(R(\beta)t)\ \cos\beta x$$

$$R(\beta) = -\tilde{D}\beta^2\left(1 + 2\frac{\kappa\beta^2}{f''}\right)$$

$D = 10^{-23}\ m^2/s$

$\beta = 10^9\pi\ m^{-1}$

$f'' = 5\times10^9\ J/m^3$

$\kappa = -2.6\times10^{-11}\ J/m$

$$\Rightarrow \quad t = 2.8\times10^4\ \text{sec}$$

(c)

(b)는 (a)와 같게 interfacial E

term이 추가됨. spinodal decomposition에서는

Interfacial E 항이 크게 영향을 미치므로

(a) (b) 값의 결과(시간)가 크게 다를 것이라

예측할 수 있으나, orderins을 선호하는

이유로 spinodal decomposition이

발생하지 않아 큰 차이가 발생 하지

않음.

따라서 (a) (b)의 차이는 유의미

하지 않다.