Phase Transformations HW#7
2018?347 권현석

1.

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

$$\frac{\partial C}{\partial t} = 12 R(\beta) e^{R(\beta)t} \cos\beta x. \quad \cdots (1)$$

$$\frac{\partial^2 C}{\partial x^2} = -12\beta e^{R(\beta)t} \cos\beta x. \quad \cdots (2)$$

Time it takes for diffusion to proceed to the extent that maximum composition difference = 2at% Au

$$\Rightarrow \exp(R(\beta)t) \le \frac{1}{12}$$

$$t = -\ln 12 \frac{1}{R(\beta)}$$

(a) From (1), (2),

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

$$t = \ln 12 \frac{1}{\tilde{D}\beta^2}$$

$$= \ln 12 \frac{1}{10^{-23}(m^2/s) \cdot (10^9 \times \pi)^2 (m^{-1})^2}$$

$$= 27177.4 \ (s)$$

(b) $\frac{\partial^4 C}{\partial x^4} = 12\beta^4 \exp[R(\beta)t] \cos\beta x$

$$R(\beta) = -\tilde{D}\beta^2 - \frac{2K\tilde{D}\beta^4}{f''}$$

$$t = \frac{\ln 12}{\tilde{D}\beta^2 + \frac{2K\tilde{D}\beta^4}{f''}}$$

$$= \frac{\ln 12}{(10^{-23})(10^9 \cdot \pi)^2 \left\{1 + \frac{2 \times (-3.6 \times 10^{-11})}{5 \times 10^9} \cdot (10^9 \cdot \pi)^2\right\}}$$

$$= 28057.3 \ (s)$$

(c) As the current system favors bonds between unlike atoms, spinodal decomposition between the elements is unlikely to happen.

Therefore, (b) that considers interfacial energy is more appropriate.

CamScanner로 스캔하기