

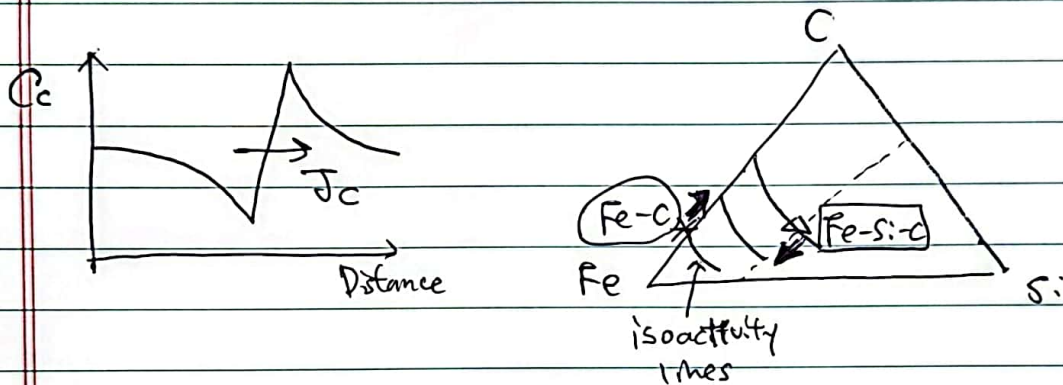
1)

$$\frac{D_{Csi}}{D_{Cc}} = 0.185 \quad D_{Csi} > 0 \rightarrow E_c^{Si} > 0 \rightarrow Y_c \uparrow$$

Addition of Si increases  $a_c$  and  $\mu_c$  ( $\mu_c = \mu_c^0 + RT \ln a_c$ )

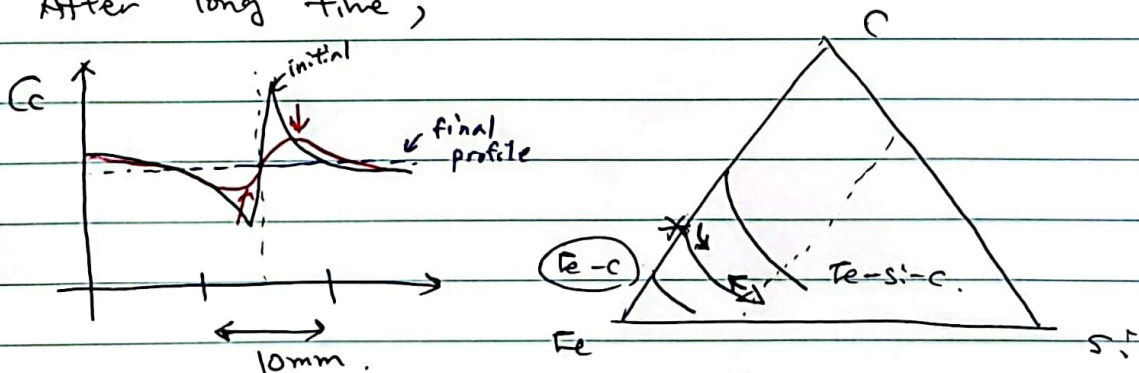
$$J_c = -M_c \cdot C \cdot \nabla \mu_c$$

Diffusion path is from ~~where Si~~ Fe-Si-C to Fe-C of carbon



$D_{Cc} > D_{SiSi} \rightarrow$  Si contents of each side don't change much.  
When both sides are on the same isoactivity line,  
there is no chemical potential gradient.

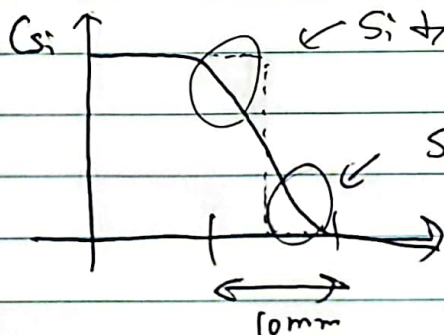
After long time,



$$C_{Si} \uparrow \leftarrow Si \leftrightarrow a_c \rightarrow X_c \uparrow$$

$$Si \uparrow \rightarrow a_c \uparrow \rightarrow X_c \uparrow$$

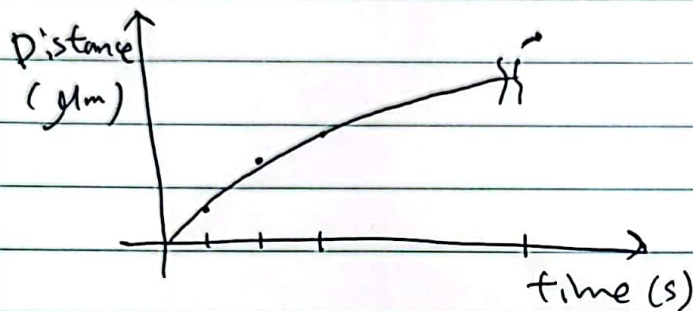
- Diffusion path will follow the isoactivity line.



2. Length scale =  $10 \mu\text{m}$  # of grids = 100.

(a)  $T = 1173 \text{ K}$ .

$D_B = 1.187 \times 10^{-9} \text{ cm}^2/\text{s}$ .

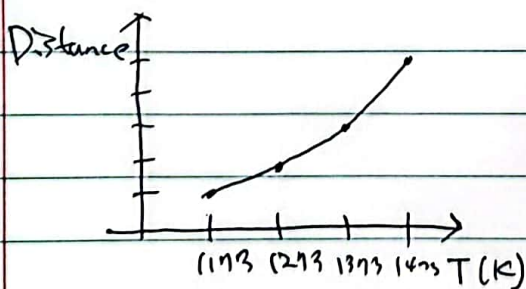


|       |                    |
|-------|--------------------|
| 1 S   | 0.3 $\mu\text{m}$  |
| 5 S   | 0.7 $\mu\text{m}$  |
| 10 S  | 1 $\mu\text{m}$    |
| 100 S | 3.23 $\mu\text{m}$ |

Distance  $\sim \sqrt{\text{Injection time}}$

(b) time = 10 s ,

|                        |                                                    |                      |
|------------------------|----------------------------------------------------|----------------------|
| ① $T = 1173 \text{ K}$ | $D_0 = 1.187 \times 10^{-9} \text{ cm}^2/\text{s}$ | 1.0 $\mu\text{m}$ .  |
| ② $T = 1273 \text{ K}$ | $D_0 = 3.903 \times 10^{-9}$                       | 1.82 $\mu\text{m}$   |
| ③ $T = 1373 \text{ K}$ | $D_0 = 1.079 \times 10^{-8}$                       | 3.13 $\mu\text{m}$   |
| ④ $T = 1473 \text{ K}$ | $D_0 = 2.699 \times 10^{-8}$                       | 5.25 $\mu\text{m}$ . |



Distance  $\sim \sqrt{D} \sim e^{-\frac{1}{2T}}$

(c)

$D = D_0 \exp(-Q/RT)$

$Q = 147723 \text{ J}$