1. CSL 이란 orientation을 다르게 가진 grain이 우면에 격자가 일치하면서 misfit이 줄어들고 낮은 에너지 상태를 가지는 lattice를 칭한다.

이때 degree of fit 은 same domain 에서 1, 격자점이 일치하면 도가 낮아진다

이때 degree of fit 은 다음으로 정의된다.

$$\left(\frac{\text{number of coincidence}}{\text{number of total lattice}}\right) \text{ in elementary cell}$$

2.

$$\frac{X_i^\phi}{X_n^\phi} = \frac{X_i^\beta}{X_n^\beta} e^{-\Delta G_i^{seg}/RT}$$

$$X_i^\phi = \frac{X_i^\beta}{X_n^\beta} X_n^\phi \cdot e^{-\Delta G_i^{seg}/RT}, \quad \sum_{i=1}^{n-1} X_i^\phi X_n^\beta + X_n^\phi X_n^\beta = \sum_{j=1}^{n-1} X_j^\beta X_n^\phi e^{-\frac{\Delta G_j^{seg}}{RT}}$$

$$\frac{X_n^\beta\left(\sum_{i=1}^{n-1} X_i^\phi + X_n^\phi\right)}{X_n^\phi\left(\sum_{j=1}^{n-1} X_j^\beta e^{-\frac{\Delta G_j^{seg}}{RT}} + X_n^\beta\right)} = 1 \Rightarrow \frac{X_n^\phi}{X_n^\beta} = \frac{\sum_{i=1}^{n-1} X_i^\phi + X_n^\phi}{\sum_{j=1}^{n-1} X_j^\beta e^{-\frac{\Delta G_j^{seg}}{RT}} + X_n^\beta}$$

$$\sum_{i=1}^{n-1} X_i^\phi + X_n^\phi = (X_1^\phi + X_2^\phi + \dots X_n^\phi) - \underbrace{\cancel{X_n^\phi + X_n^\phi}}_{\text{cancel out}} = 1$$

$$\therefore \frac{X_n^\phi}{X_n^\beta} = \frac{1}{\sum_{j=1}^{n-1} X_j^\beta \left(e^{-\frac{\Delta G_j^{seg}}{RT}} - 1\right) + \sum_{j=1}^{n-1} X_j^\beta + X_n^\beta}$$

$$= \frac{1}{\sum_{j=1}^{n-1} X_j^\beta \left(e^{-\frac{\Delta G_j^{seg}}{RT}} - 1\right) + 1}$$

$$X_i^\phi = \frac{X_n^\phi}{X_n^\beta} X_i^\beta e^{-\frac{\Delta G_i^{seg}}{RT}} = \frac{X_i^\beta e^{-\frac{\Delta G_i^{seg}}{RT}}}{1 + \sum_{j=1}^{n-1} X_j^\beta \left(e^{-\frac{\Delta G_j^{seg}}{RT}} - 1\right)}$$