atom $\rightarrow$ sphere $\Rightarrow$ $Vol = \frac{4\pi}{3} R^3$

$\downarrow$

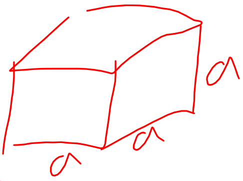
atomic Radius

atomic Dimen.

unit Cell

$\Downarrow$

$Vol = a^3$



a = unit cell dimension

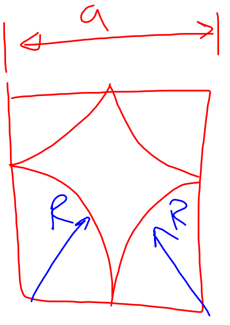
Case 1

8 corners $\times \frac{1}{8}$ atom vol.

= 1 full atom inside unit cell

$$APF = \frac{1 \cdot \times \frac{4\pi}{3} R^3}{a^3} \Rightarrow R = f(a)$$

or $a = f(R)$



Side of unit cell

$$\Big\} \Rightarrow a = 2R \Rightarrow R = \frac{a}{2} = 0.5a$$

$$0.52 \Rightarrow 52\%$$

BCC $\frac{1}{8}\times 8+1=2 \Rightarrow \boxed{n=2}$

$$\boxed{4R=\sqrt{3}\,a}$$

APF = 68%

$\underline{\text{FCC}}$: $\boxed{n = 4}$

$6 \times \frac{1}{2} + 1 = 4$

$\boxed{4R = \sqrt{2}\, a}$

APF = 74%

① $R = ?$ $\quad \underset{\sim}{Ir} \Rightarrow FCC \Rightarrow n = 4$

$4R = \sqrt{2}\,a$

$\Downarrow$

$\boxed{\rho, A, N_A}$

Know

$$\overset{\checkmark}{\rho} = \frac{\overset{4 =}{n} \cdot \overset{\checkmark}{A}}{V_c \cdot N_A}\ \checkmark$$

$$\begin{tikzcd}
V_c \arrow[d, Rightarrow] & & R = \frac{\sqrt{2}\,a}{4} \\
a^3 \arrow[r, "fcc"] & 4R = \sqrt{2}\,a \arrow[ur] &
\end{tikzcd}$$

$$\text{nano} = 10^{-9}$$

$$R = 1.36\times10^{-8}\ \frac{\text{cm}}{100} = 1.36\times10^{-8}\times10^{-2}\ \text{m}$$

$$\frac{\text{nano}}{10^{-9}} = 1$$

$$= 1.36\times10^{-10}\ \text{m}\left(\frac{\text{n}}{10^{-9}}\right)$$

$$= 1.36\times10^{-1}\ \text{nm}$$

$$\boxed{= 0.136\ \text{nm}}$$

②

$R = 0.143\ nm$

$= 0.143 \times 10^{-9} \times 100\ cm$

$\boxed{R = 0.143 \times 10^{-7}\ cm} = 1.43 \times 10^{-8}\ cm$

$\rho, A, N_A \Rightarrow$ known ✓

FCC or BCC ?

$$\overset{\checkmark}{\rho} = \frac{\overset{?}{n} \cdot A^{\checkmark}}{V_c \cdot N_A^{\checkmark}}$$

$$\underset{a^3 \; ?}{\Big\downarrow}$$

Assume FCC $\Rightarrow n = 4$, $4R = \sqrt{2}\, a$

find $\rho \rightarrow$ compare with the given

BCC $\Rightarrow n = 2$, $4R = \sqrt{3}\, a$

compare $\Rightarrow$ matches

Imperfections in Solids

$$N_V = N \cdot \exp\left(-\frac{Q_V}{K \cdot T}\right)$$

Feb 9-9:06 AM

1) Two material : m_1 & m_2

$$C_1 = \frac{m_1}{\sum m = m_1 + m_2} \times 100\%$$

$$C_2 = \frac{m_2}{m_1 + m_2} \times 100\% \times \cancel{\frac{g}{g}}$$

Q? 3 material

$$C_1 = \frac{m_1}{m_1 + m_2 + m_3} \times 100\%$$

C_2

C_3

Feb 9-9:12 AM

2) atom %

$\frac{n}{\sum n} \leftarrow$ No. of moles

$$n = \frac{m}{A}$$

$\hookrightarrow$ This is NOT No. of atoms/unit cell

3)

Composition Conversion

C''

⇓

Applications in Diffusion will be covered

Q

N_v ? / m^3

$T = 900°C + 273 \Rightarrow K$

$Q_v = 0.98$ ev/atom $\Rightarrow K = \ldots$ ev/atom

the second one

$\rho, A, N_v \Rightarrow$ Given

$$N_v = N \exp\left(-\frac{Q_v^{\checkmark}}{k \cdot T^{\checkmark}}\right)^{\checkmark}$$

$$N \downarrow \frac{N_A^{\checkmark} \cdot \rho^{\checkmark}}{A^{\checkmark}}$$

$$N_v = 3.52 \times 10^{18}\ \text{Vacancy}/\text{cm}^3$$

$$= \frac{\frac{3.52 \times 10^{18}}{\text{cm}^3}}{10^6} \quad = 3.52 \times 10^{18} \times 10^{6}/\text{m}^3$$

$$= 3.52 \times 10^{24}\ \text{Vac.}/\text{m}^3$$

Q2

$$n = \frac{m}{A}$$

$Zn + Cu \Rightarrow A$: Given

$$\left.\begin{aligned} C'_1 &= \frac{n_1}{\Sigma n} \times 100\% \\ C'_2 &= \frac{n_2}{\Sigma n} \times 100\% \end{aligned}\right\} \quad C'_1\% + C'_2\% = 100\%$$