TUGAS FISIKA ZAT PADAT I

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1. Tentukan volume bidang Dan fraksi volume kristal

a. Face centered cubic (FCC)

Jawab:

$$dik = Vol\ fcc = \frac{a^3}{4}$$

$$Vol\ bol = \frac{4}{3}\pi r^3$$

$$kisi\ persel = 8\ x\ \frac{1}{8} + \frac{6}{2}$$

$$V_{bidang} = V_{bola} \times kisi\ persel$$

$$= 8 \times \left(\frac{1}{8} \times \frac{4}{3}\pi r^3\right) + \frac{6}{2} \times \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\pi \times \frac{a^3}{8} + 4\ \frac{a^3}{8}$$

$$= \frac{1}{6}\pi\ a^3 + \frac{1}{4}\pi\ a^3$$

$$= \frac{4}{24}\pi\ a^3 + \frac{6}{24}\pi\ a^3$$

$$= \frac{10}{24}\ \pi\ a^3$$

$$= \frac{5}{12}\ \pi\ a^3$$

$V_{fraksi}\ (f)$:

$$V_{fraksi} = V_{bidang} / V_{kubus}$$

$$= \tfrac{5}{12}\pi\ a^3 \times \tfrac{4}{a^3}$$

$$= \tfrac{20}{12}\pi = \tfrac{10}{6} = \tfrac{5}{3}\pi = 5{,}2$$

b. Body centered cubic (BCC)

$$dik = V_{kubus} = \frac{a^3}{2}$$

$$V_{bola} = \frac{4}{3}\pi\ r^3$$

$$kisi\ persel = 8 \times \frac{1}{8} + 1$$

$$r = \frac{a}{2}$$

V_{bidang} = kisi persel× V_{bola}

$$= 8\times \left(\tfrac{1}{8} \cdot \tfrac{4}{3}\pi r^3\right) + 1\tfrac{4}{3}\pi r^3$$

$$= \tfrac{4}{3}\pi r^3 + \tfrac{4}{3}\pi r^3$$

$=\frac{4}{3}\pi\frac{a^3}{8}+\frac{4}{3}\pi\frac{a^3}{8}$

$=\frac{4}{3}\cdot\frac{1}{8}a^3\pi+\frac{4}{3}\cdot\frac{1}{8}\pi a^3$

$=\frac{1}{6}a^3\pi+\frac{1}{6}a^3\pi$

$=\frac{2}{6}a^3\pi$

$=\frac{1}{3}a^3\pi$

Fraksi volum (f)

F = vol bidang / vol kubus

$=\frac{1}{3}a^3\pi\cdot\frac{1}{a^3/2}$

$=\frac{1}{3}a^3\pi\cdot\frac{2}{a^3}\pi$

= 2,09

c. Struktur intan

total atom yang berada dalam unit sel = 1 + 3 + 4 = 8

untuk segitiga X W Y maka

$XY^2 = XW^2 + WY^2$

$XY^2 = \left(\frac{a}{2}\right)^2 + \left(\frac{a}{4}\right)^2$

$XY^2 = \frac{2a^2}{16} = \frac{a^2}{8} \rightarrow pers(1)$

Untuk segitiga X, Y, Z maka:

$XZ^2 = XZ^2 + YZ^2$

$2r^2 = XY^2 + \left(\frac{a}{2}\right)^2 \rightarrow pers(2)$

Subsitusi pers (1) Dan pers (2) sehingga:

$4r^2 = \frac{a^2}{8}+\frac{a^2}{16}$

$4r^2 = \frac{3a^2}{16}$

$a^2 = \frac{64r^2}{3} \rightarrow a = \frac{8r}{\sqrt{3}}$

Karena didalam unit sel terdapat 8 atom maka:

$$\boldsymbol{V_{bidang} = 8 \times \frac{4}{3}\pi r^2 = \frac{32\,\pi r^3}{3}}$$

Volume unit sel

$$V = a^2$$

$$V = \frac{8^2 r^3}{3\sqrt{3}}$$

$$\boldsymbol{fraksi\ volume = \frac{V\ atom\ dalam\ unit\ sel}{V\ unit\ sel} \frac{\frac{32\,\pi r^3}{3}}{\frac{8^3 r^3}{3\sqrt{3}}} = \frac{\sqrt{3}}{16} = 0,34}$$

d. Hexagonal close packed

dik : $V_{HCP} = \frac{\sqrt[3]{3}a^2 C}{2}$

$$c = \sqrt{\frac{8}{3}}$$

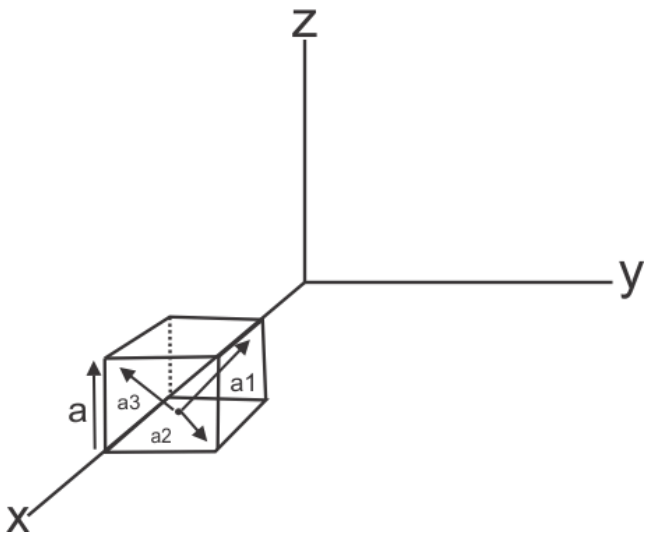
2r = a

$$r = \frac{a}{2}$$

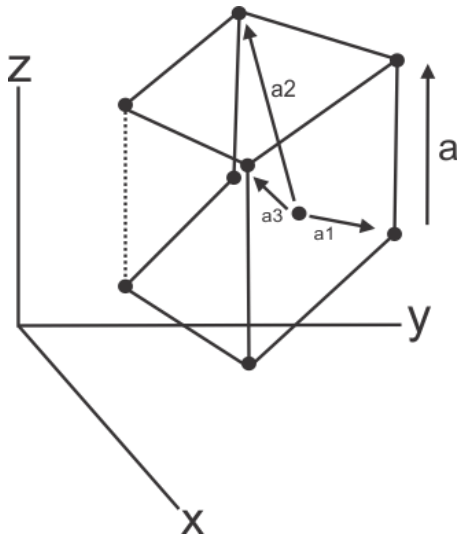
kisi persel = $\left(6 \times \frac{1}{6} + \frac{1}{2}\right) 2 + 3 = 6$

$V_{bola} = \frac{4}{3}\pi r^3$

2. Tentukan vektor translasi kristal BCC
   a. Translasi ke sumbu X 2 sel satuan



b. Translasi diagonal sumbu X 2 sel Dan sumbu Z 1 sel



c. Translasi diagonal sumbu Y 2 sel sumbu Z 3 sel dan sumbu X – 3