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1. sebuah kristal hexagonal dengan panjang kisi a = 3,2 A, c = 5,4 A.

   Tentukan jarak antar bidang untuk indeks miller (1 0 0) , (0 0 1) , (1 1 1)

2. Sebuah kristal monoklinik dengan panjang kisi a = 4,7 A , b = 5,2 A , c = 3,4 A , α = 60, β = 90 tentukan jarak antar bidang untuk indeks miller (1 0 0) , (0 0 1) , (1 1 1)

3. Sebuah kristal triklinik dengan panjang kisi a = 4,7 A , b = 5,2 A , c = 3,4 A , α = 120, β = 90 γ = 90 tentukan jarak antar bidang untuk indeks miller (1 0 0) , (0 0 1) , (1 1 1)

Jawab:

1. Dik : **a = 3,2 A**

      c = 5,4 A

Dit : tentukan jarak antar bidang untuk index miller :

   1.1) **h = 1 , k = 0, l = 0**

$$= \frac{1}{d^2} = \frac{4}{3}\left(\frac{h^2 + k^2 + l^2}{u^2}\right) + \frac{l^2}{c^2}$$

$$= \frac{4}{3}\left(\frac{1^2 + 0^2 + 0^2}{(3,2)^2}\right) + \frac{0^2}{(5,4^2)}$$

$$= \frac{4}{3}\left(\frac{1 + 0 + 0}{1,2}\right) + 0$$

$$= \frac{1}{d^2} = \frac{4}{3}\left(\frac{1}{1,2}\right)$$

$$= \frac{4}{3.\,1\,,2}$$

$$= 0,13$$

$$d = \frac{1}{\sqrt{0.1}} = \frac{1}{0,3} = 2{,}75 \ 1/A^2$$

1.2) $h = 0$, $k = 0$, $l = 1$

$$= \frac{4}{3}\left(\frac{0^2 + 0.0^2 + 1^2}{(3.2)^2}\right) + \frac{1^2}{(5,4^2)}$$

$$= \frac{4}{3}\left(\frac{0}{(3.2)^2}\right) + \frac{1^2}{2,1}$$

$$= \frac{1}{d^2} = 0 + 0{,}03 = 0{,}03$$

$$d = \frac{1}{\sqrt{0.0}} = \frac{1}{0,1} = 5{,}88 \ I \ / \ A^2$$

1.3) $h = 1$, $k = 1$, $l = 1$

$$= \frac{4}{3}\left(\frac{1^2 + 1.1^2 + 1^2}{(3.2)^2}\right) + \frac{0^2}{(5,4^2)}$$

$$= \frac{4}{3}\left(\frac{3}{(3.2)^2}\right) + 0{,}03$$

$$= \frac{4}{1,2} + 0{,}03 = 0{,}39 + 0{,}03$$

$$= \frac{1}{d^2} = 0{,}42$$

$$d = \frac{1}{\sqrt{0,4}} = \frac{1}{0,6} = 1{,}54 \ I \ / \ A^2$$

2. Dik : **a = 4,7 A**

   b = 5,2 A

   c = 3,4 A

   α = 60

   β = 90

Dit : tentukan jarak antar bidang indeks miller :

2.1) **h = 1, k = 0, l = 0**

$$= \ \frac{1}{d^2} = \frac{1}{\sin^2\beta}\left(\frac{h^2}{a^2} - \frac{k^2 \sin^2\beta}{b^2} + \frac{1^2}{c^2} - \frac{2hl\ \cos\beta}{ac}\right)$$

$$= \ \frac{1}{1^2} = \frac{1}{(4,7)}\left(\frac{1^2}{4,7} - \frac{0^2 1^2}{(5,2)^2} + \frac{0^2}{(3,4)^2} - 0\right)$$

$$1 = \left(\left(\frac{1}{2,\ 0} - 0\ +\ 0\ -\ 0\right)\right)$$

$$= \ \frac{1}{d^2} = 1\ (0.5)\ =\ 0,5$$

$$d = \frac{1}{\sqrt{0.5}}\ =\ 0,7\ 1\ /\ A^2$$

2.2) **h = 0 , k = 0, l = 1**

$$= \ \frac{1}{d^2} = \frac{1}{\sin^2\beta}\left(\frac{h^2}{a^2} - \frac{k^2 \sin^2\beta}{b^2} + \frac{1^2}{c^2} - \frac{2hl\ \cos\beta}{ac}\right)$$

$$= \ \frac{1}{d^2} = \frac{1}{1^2}\left(\frac{0^2}{(4,7)^2} - \frac{0^2 1^2}{(5,2)^2} + \frac{1^2}{(3,4)^2} - \frac{2.0.0}{(4,7)(3,4)}\right)$$

$$= 1 \left(0 - 0 + \frac{1}{(3,4)^2} - 0 \right)$$

$$= 1 \left(\frac{1}{11,56} \right)$$

$$= 0,09$$

$$d = \frac{1}{\sqrt{0,09}} = \frac{1}{0,3} = 3,33 \ 1/A^2$$

2.3) **h = 1, k = 1, l = 1**

$$= \frac{1}{d^2} = \frac{1}{sin^2\beta} \left(\frac{h^2}{a^2} - \frac{k^2 sin^2 \ \beta}{b^2} + \frac{1^2}{c^2} - \frac{2hl \ cos \ \beta}{ac} \right)$$

$$= \frac{1}{d^2} = 1 \left(\frac{1}{22,09} - \frac{1}{27,04} + \frac{1}{11,56} - 0 \right)$$

$$= 1 \ (0,05 - 0,04 + 0,09)$$

$$= 1 \ (0,08)$$

$$d = \frac{1}{\sqrt{0,08}} = \frac{1}{0,28} = 3,57 \ 1/A^2$$

3. Dik : **a = 4,7 A**

   b = 5,2 A

   c = 3,4 A

   α = 120

   β = 60

   Ŷ = 90

3.1) h = 1, k = 0 , l = 0

$$\frac{1}{d^2} = \frac{h^2}{v^2}(S_{11}h^2 \ + \ S_{22}K^2 + S_{33}l^2 + 2S_{12}hk \ + 2S_{23}kl$$
$$+ \ 2S_{12}hl \ )$$

$$\frac{1}{d^2} = \frac{1^2}{8,1}\left((5,4)^2 \ + \ (3,4)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 \ + (4,7)^2 \ + (3,4)^2\right.$$

$$+ \left(\frac{\sqrt{3}}{2}\right)^2 0 \ + \ (4,7)^2 \ (5,2)^2 \ 1^20$$

$$+ \ 2 \ (4,7)(5,2)(3,4)^2\left(-\frac{1}{2} \ \frac{\sqrt{3}}{2} - 0\right)1.0$$

$$+ \ 2(4,7)^2(5,2)(3,4)\left(\frac{1}{2}0 - \left(-\frac{1}{2}\right)\right)0.0$$

$$\left.+ \ 2(4,7)(5,2)^2(3,4)\left(0 - \frac{1}{2} - \frac{1}{2}\right)1.0\right)$$

$$= \frac{1}{83,1}\left((27,04)(11,56)\frac{3}{4} + 0 + 0 + 0 + 0 + 0\right)$$

$$= \frac{1}{83,1}\left(312,58\frac{3}{4}\right)$$

$$= \frac{1}{83,1}(234,44)$$

$$= \frac{1}{d^2}(2{,}82)$$

$$d = \frac{1}{\sqrt{2{,}82}} = \frac{1}{1{,}68} = 0{,}61 \ 1/A^2$$

3.2) h = 0 , k = 0, l = 1

$$\frac{1}{d^2} = \left(\frac{0}{8{,}1}\right)\left((5{,}2)^2 \ (3{,}4)^2 \left(\frac{\sqrt{3}}{2}\right)^2 . 0 + 0 \ (4{,}7)^2 (5{,}2)^2 (1)^2 . 1\right.$$
$$+ \ 0 \ + \ 0 \ + \ 0 \ )$$

$$= \left(\frac{0}{8{,}1}\right)(0 \ + \ 0 + 0 \ (22{,}09) \ (27{,}04). \ 1 \ + \ 1 \ + \ 0 \ + \ 0 \ + \ 0 \ )$$

$$= 0(597{,}31)$$

$$\frac{1}{d^2} = 0$$

3.3) h = 1, k = 1, l = 1

$$\frac{1}{d^2} = \left(\frac{1}{8{,}1}\right)\left((5{,}2)^2 \ (3{,}4)^2 \left(\frac{\sqrt{3}}{2}\right)^2 . 1^2 + (4{,}7)^2 (3{,}4)^2 \left(\frac{\sqrt{3}}{2}\right)^2 . 1^2 \right)$$

$$(4{,}7)^2 (5{,}2)^2 (1)^2 (1)^2 + (4{,}7)(5{,}2)(3{,}4)^2 \left(-\frac{1}{2}.\frac{1}{2} - 0 + (4{,}7)(5{,}2)(3{,}4)\right)$$

$$\left(\frac{1}{2}.0 \ - \ \left(-\frac{1}{2}\right) + (4{,}7)(5{,}2)^2 (3{,}4) \left(0. -\frac{1}{2} -\frac{1}{2}\right)\right)$$

$$= \left(\frac{1}{8{,}1}\right)\left((27{,}04)(11{,}56)(\frac{3}{4}). 1 + (22{,}09)(11{,}56)(\frac{3}{4}). 1 \right.$$
$$+ (22{,}09)(27{,}04)1.1 \ + (4{,}7)(5{,}2)(11{,}56)(-0{,}25)$$
$$+ (22{,}09)(5{,}2)(3{,}4) \left(\frac{1}{2}\right) + (4{,}7)(27{,}04)(3{,}4)(-\frac{1}{2}))$$

$$= \left(\frac{1}{8{,}1}\right) ((234{,}44) + (191{,}52) + (597{,}31) - (70{,}63) + (195{,}28) - (216{,}05))$$

$$= \left(\frac{1}{8{,}1}\right) (931{,}87)$$

$$d = \frac{1}{\sqrt{1\,,2}} = \frac{1}{3{,}3} = 0{,}3 \; 1/A^2$$