



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)
SNS Kalvi Nagar, Saravanampatti Post
Coimbatore - 641 035



Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NBA & accredited by NAAC with 'A+' Grade, Recognized by UGC

Miller Indices

Introduction:

Crystals are made up of large no. of parallel, equidistant planes, passing through the lattice points called lattice planes.

The 1^{st} distance b/w any two adjacent plane is called interplanar distance (d).

Definition:

Miller indices are the 3 smallest possible integers which have the same ratio as the reciprocals of the intercepts of the plane concerned along the 3 axes.

Procedure:

1. Find the intercepts along the 3 axes
2. Find the coefficient of the intercepts i.e. 3, 4, 2
3. Find the reciprocal of these no $\frac{1}{3}, \frac{1}{4}, \frac{1}{2}$
4. Convert these reciprocal to whole no by (x) by reciprocal with their LCM

$$6 \times \frac{1}{3}, 6 \times \frac{1}{4}, 6 \times \frac{1}{2} \Rightarrow 2 \ 3 \ 3$$

5. Enclose these no in bracket ().

Points to ponder:

- 1) It should be enclosed in bracket $\rightarrow ()$
- 2) There should not be any comma b/w the nos
- 3) If the plane (263) means it should be read as two six three & not as two hundred sixty three.



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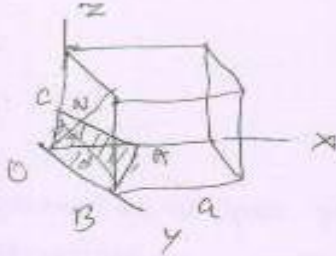
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d spacing in cubic lattice

d spacing is the distance b/w any two successive plane



Consider a cubic crystal with 'a' as length of its cube edge & a plane ABC as shown in figure. This plane belongs to a family of planes whose Miller indices are (hkl)

The \perp line ON from the origin of the cube to the plane ABC represents interplanar spacing (d) of this family.

$$OA \text{ along } ox = a'$$

$$OB \text{ along } oy = b'$$

$$OC \text{ along } oz = c'$$

$$OA : OB : OC = \frac{1}{h} : \frac{1}{k} : \frac{1}{l}$$

$$= \frac{a}{h} : \frac{a}{k} : \frac{a}{l}$$

$$\cos \alpha' = \frac{ON}{OA} = \frac{d}{a/h} = \frac{dh}{a}$$

$$\cos \beta' = \frac{ON}{OB} = \frac{d}{a/k} = \frac{dk}{a}$$

$$\cos \gamma' = \frac{ON}{OC} = \frac{d}{a/l} = \frac{dl}{a}$$

$$\cos^2 \alpha' + \cos^2 \beta' + \cos^2 \gamma' = 1$$

$$\left(\frac{dh}{a}\right)^2 + \left(\frac{dk}{a}\right)^2 + \left(\frac{dl}{a}\right)^2 = 1$$

$$\frac{d^2}{a^2} (h^2 + k^2 + l^2) = 1$$

$$d^2 = \frac{a^2}{h^2 + k^2 + l^2}$$

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$