APS110H1f2024 Sept 25 2024

September 24, 2024 4:38 PM

BCC --> FCC

BCC : Body Centred Cubic (Crystal Structure/Nanostructure)

stress + strain

metal only

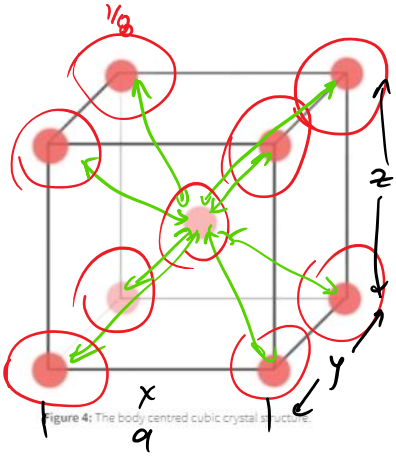


Figure 4: The body centred cubic crystal structure.

$8 \times 1/8$

$CN_{BCC} = 8$

coordination number

1

$n_{BCC} = 2$

$$APF_{BCC} = \frac{n \frac{4}{3}\pi R^3}{a^3}$$

$$= \frac{n \frac{4}{3}\pi R^3}{\left(\frac{4}{\sqrt{3}}R\right)^3} = 0.68$$

R = pm? nm? cm?

metals

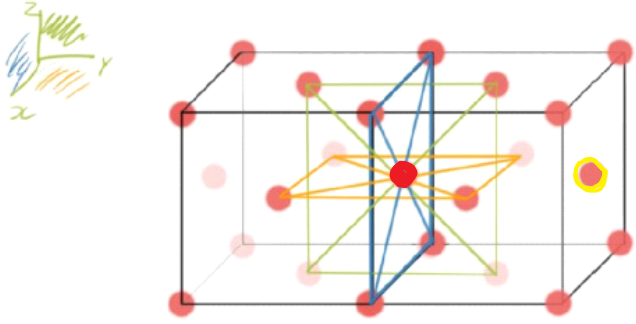
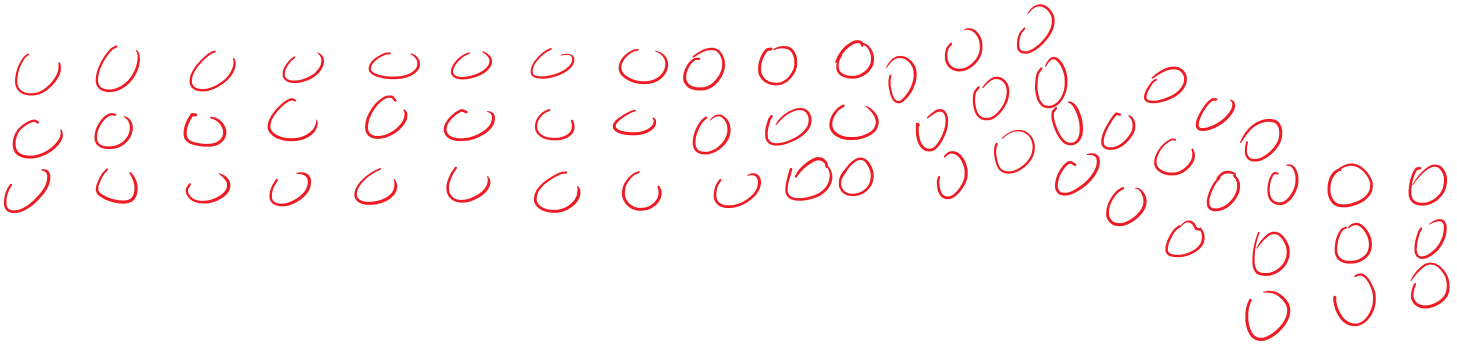


Figure 6: The coordination number for atoms in FCC. The right side face-centred atom makes contact with four atoms in the right side plane, with four atoms in the face-centred positions in the original unit cell, and with four atoms in teh face-centred positions in the unit cell to the right.

$4 \times 1/4 = 1$

$8 \times 1/2 = 4$

$= 5$



Octahedron

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6 = coordinate number

$CN_{bcc} = 6$

$12 \times 1/4 = 3$

$+ 1 = 4$

$8 \times 1/8 = 1$

$6 \times 1/2 = 3$

" 4

Cationic 1+ anionic 1-

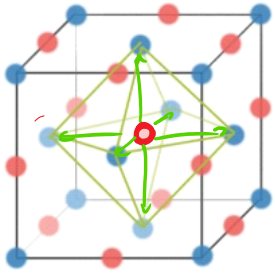
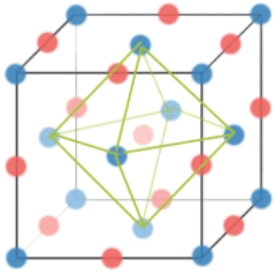


Figure 7: The octahedral interstitial site. Note that all cations, not just the central one, occupy octahedral interstitial sites within rock salt.

4 = 4

balance



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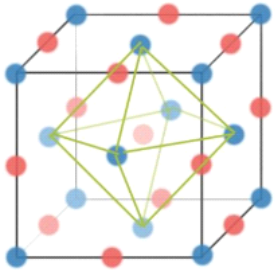

Figure 7: The octahedral interstitial site. Note that all cations, not just the central one, occupy octahedral interstitial sites within rock salt.

CaF_2

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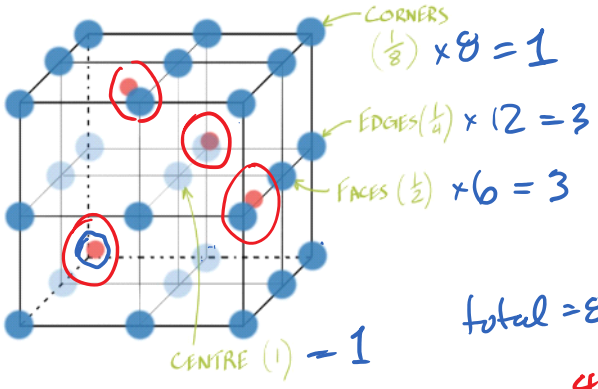
Ca^{2+}

F^{1-}



total = 8. = F^{1-}

4 = Ca^{2+}

CaF_2

Figure 8. There are 8 anions within the calcium fluorite ceramic crystal structure. The fraction of an atom for each position type is shown here.

Ca = 231 pm = 2.31×10^{-8} cm = 0.231 nm

F = 135 pm = 1.35×10^{-8} cm = 0.135 nm

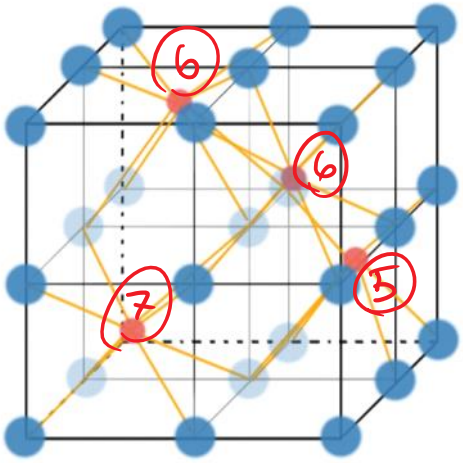


Figure 6. The calcium fluorite ceramic crystal structure. Anions represented as blue dots are in a simple cubic lattice with half of the simple cubic interstitial sites occupied by cations. Cations touch their 8 nearest neighbour anions along the cube diagonals, as illustrated by the orange lines.