EXP CRISTL

1/1

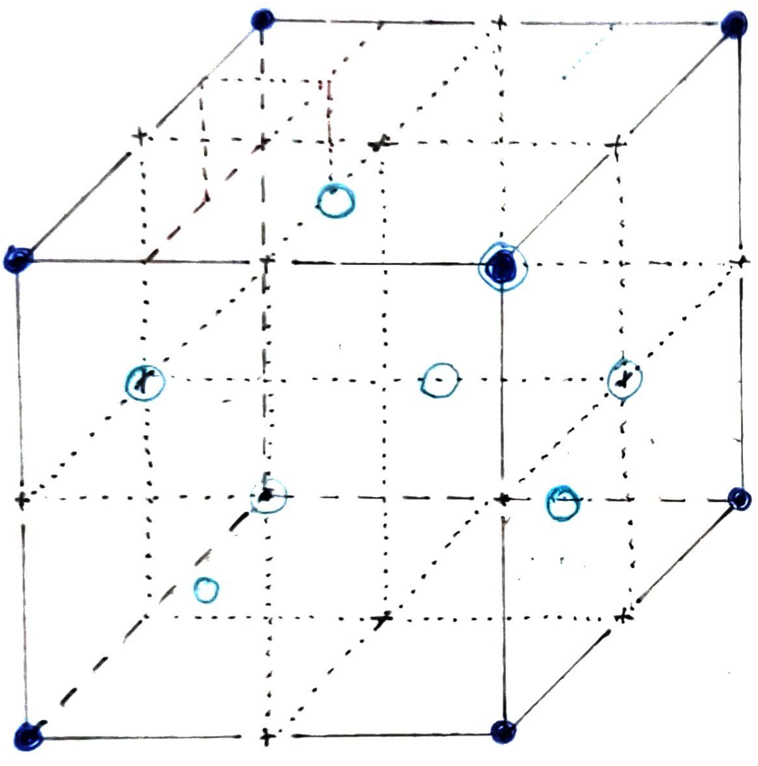
Un corps pur peut exister sous différentes formes cristallines

1/2

#p = #e⁻ = 6

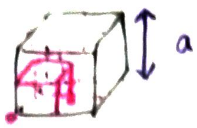
$_6C$: $1s^2 2s^2 2p^2$

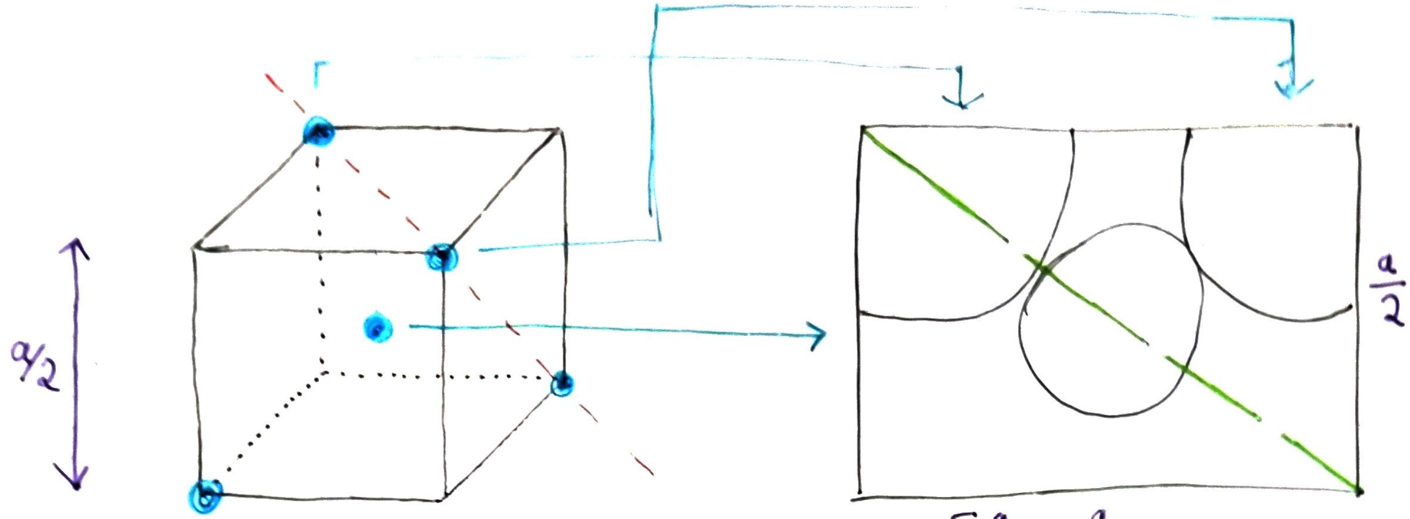
1/3



Atomes / maille:
Coordinence: 4 (en prenant o c'est plus facile)
Forme géométrique: tétraèdre

1/4

Un $\frac{1}{8}$ ième du cube devant, bas, gauche 



$$\sqrt{2}\,\frac{a}{2} = \frac{a}{\sqrt{2}}$$

$$d = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{\sqrt{2}}\right)^2}$$

$$= \sqrt{\frac{a^2}{4} + \frac{2a^2}{4}}$$

$$= \frac{\sqrt{3}}{2} a$$

$$= 2 d_{c-c}$$

ie $a = \frac{4}{\sqrt{3}} d_{c-c} = 3{,}56 \cdot 10^{-10}$ m

$= 356$ pm

1/5

$$C = \frac{N \cdot \frac{4}{3} \pi r^3}{V_{maille}}$$

On a $r = \frac{d_{c-c}}{2}$: 

et $N = 8$

donc $C = 0{,}34 = 34\,\%$

1/6

- Très bon isolant électrique
- Très grande dureté

1/7

Liaisons délocalisées (ie $\neg$ covalentes)

1/8

- Se brise en plans, friable
- Conducteur
- Mou

EXECRISTL

3/1

$_{74}W$: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^4$

Aux métaux, bloc d.

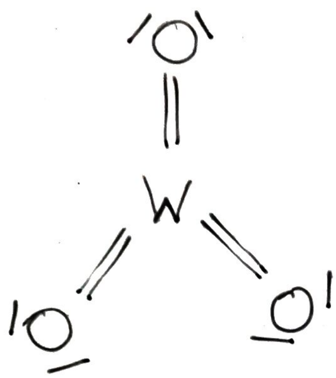
→ 6 $\bar{e}$ de valence

$_8O$: $1s^2 2s^2 2p^4$ → 6 $\bar{e}$ de valence

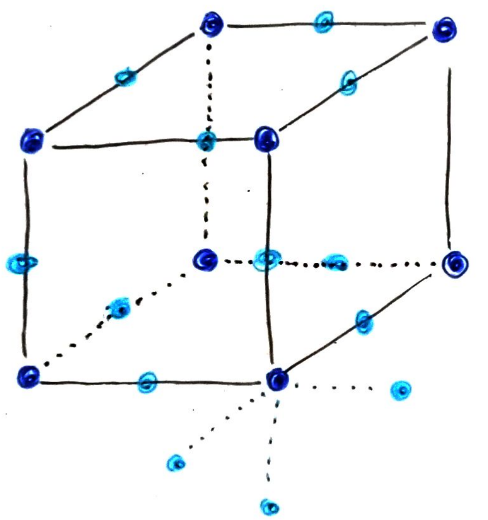
3/2

WO_3 : $6 \cdot 3 + 6 = 24$ $\bar{e}$ de valence

→ 12 doublets



3/3

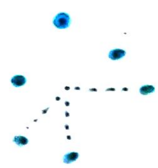


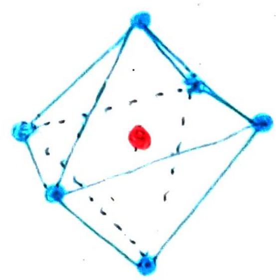
$N_{W^{6+}} = 8 \frac{1}{8} = 1$

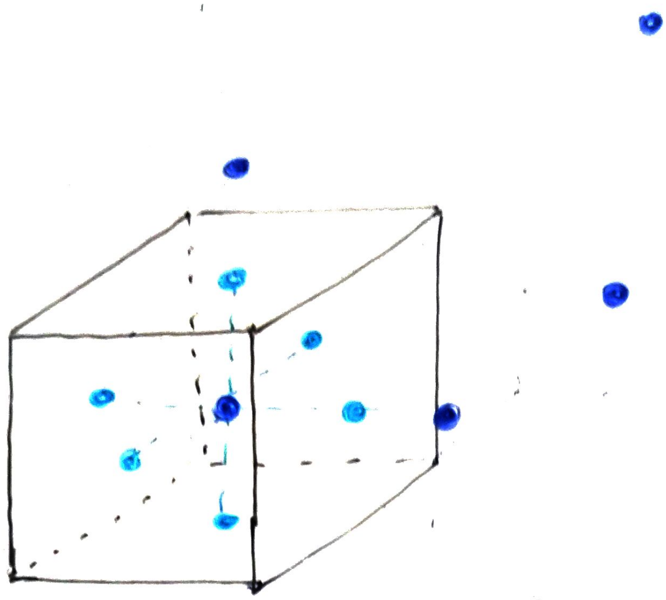
$N_{O^{2-}} = 12 \frac{1}{4} = 3$

} respecte la neutralité

$\text{coord}_{W^{6+}/O^{2-}} = 6$



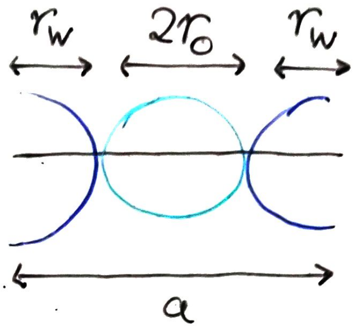




3/3/c

$$C = \frac{1\,\frac{4}{3}\pi r_W^3 + 3\,\frac{4}{3}\pi r_O^2}{a^3}$$

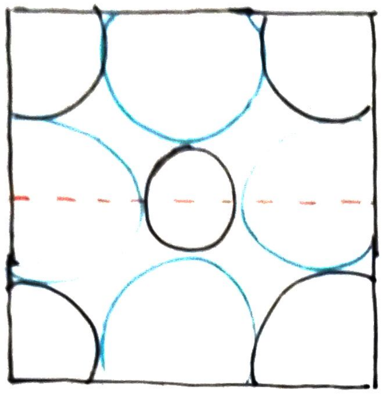
dans  :



d'où $a = 2(r_W + r_O)$

donc $$C = \frac{\frac{4}{3}\pi r_W^3 + 4\pi r_O^2}{8(r_W + r_O)^3} \approx 51\,\%$$

Site au centre d'une face :

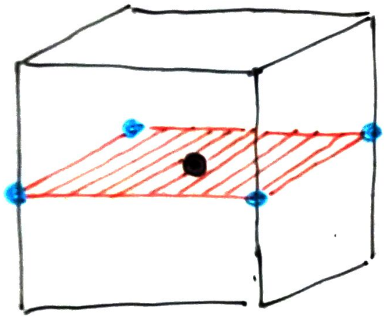


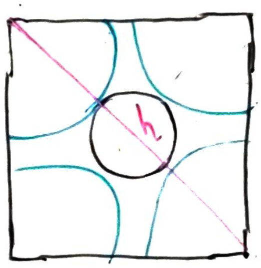
$$a = 2r_{site} + 2r_O$$

$$\Rightarrow r_{site} = \frac{a}{2} - r_O$$

$$= 62 \text{ pm}$$

(avec $a = 388$ pm)





$$h = 2r_{O^{2-}} + 2r_{site}$$

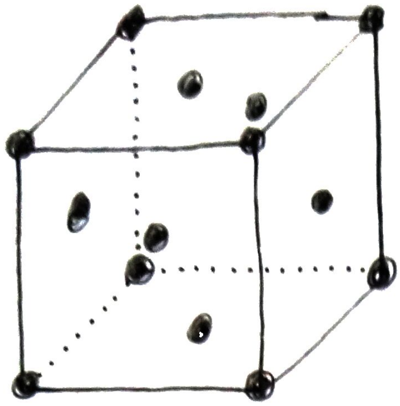
$$= \sqrt{2}\, a$$

$$r_{site} = \frac{\sqrt{2}}{2} a - r_{O^{2-}}$$

$$= \frac{a}{\sqrt{2}} - r_{O^{2-}}$$

$$= 142 \text{ pm}$$

4/1



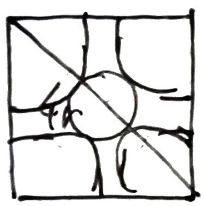
a

4/2

$$N = 8\frac{1}{8} + 6\frac{1}{2} = 4$$

$$\rho_{Cu} = \frac{NM}{\mathcal{N}_A V_{maille}} = \frac{NM}{\mathcal{N}_A a^3}$$

$$\Rightarrow a = \sqrt[3]{\frac{NM}{\mathcal{N}_A \rho_{Cu}}} = \sqrt[3]{\frac{4 \cdot 65.55 \cdot 10^{-3}}{6.02 \cdot 10^{23} \cdot 8920}} = 360 \text{ pm}$$



a

$$4r_{Cu} = \sqrt{2}a \Rightarrow r_{Cu} = \frac{a\sqrt{2}}{4} = 128 \text{ pm}$$

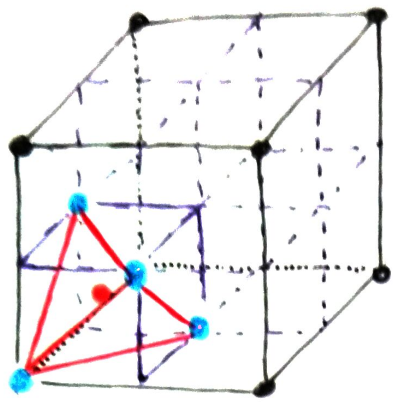
4/3

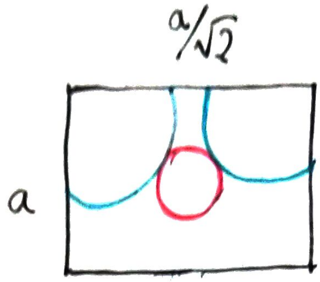
$$C = \frac{4\,\frac{4}{3}\pi r_{Cu}^3}{a^3} = \frac{4\,\frac{4}{3}\pi\left(\frac{a\sqrt{2}}{4}\right)^3}{a^3} = \frac{\pi}{3} \cdot \frac{\sqrt{2} \cdot 2}{4} = 74\,\%$$

4/4

Coordinance : 12

4/5





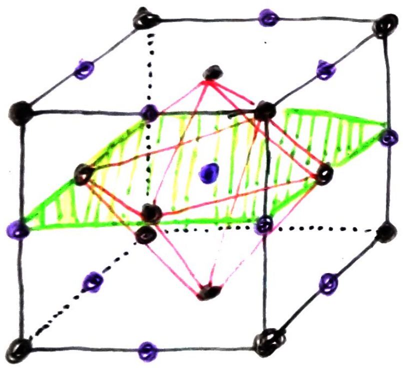
$$r_{Cu} + 2r_t + r_{Cu} = \sqrt{\left(\frac{a}{\sqrt{2}}\right)^2 + a^2} = \frac{\sqrt{3}}{2}a$$

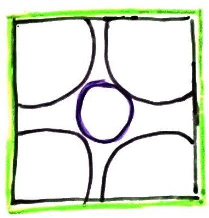
ie $2r_t = \frac{\sqrt{3}}{2}a - 2r_{Cu}$

ie $r_t = \frac{\sqrt{3}}{4}a - r_{Cu} = 29\text{ pm}$

4/6

$$N = 1 + 12\frac{1}{4} = 4$$



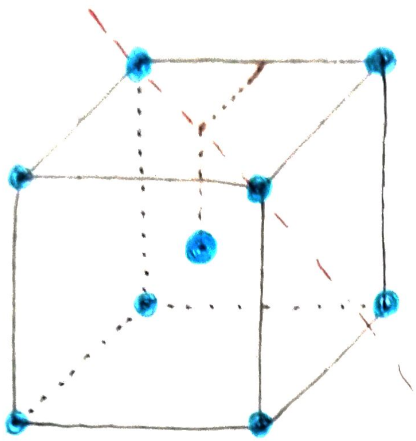


$a = 2r_{Cu} + 2r_o$

$\Rightarrow r_o = \frac{2r_{Cu}}{\sqrt{2}} - r_{Cu} = 53\text{ pm}$

Si c'était un alliage d'insertion, on aurait beaucoup plus que 30%, avec

5/1



5/2

$$8 \times \frac{1}{8} + 1 = 2$$

5/3

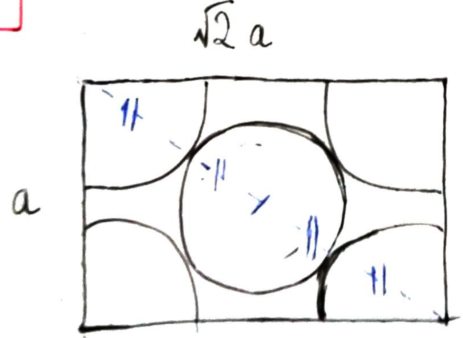
$$\rho = \frac{N M}{\mathcal{N}_A V_{maille}} = \frac{2 \cdot 92{,}9 \cdot 10^{-3}}{6{,}02 \cdot 10^{23} (330 \cdot 10^{-12})^3} = 8588 \ kg \cdot m^{-3}$$

$$\approx 8570 \ kg \cdot m^{-3}$$

5/4

$$d = \frac{\rho}{\rho_{eau}} = \frac{8588}{1000} = 8{,}6$$

5/5



$4r =$ diagonale

$= \sqrt{a^2 + 2a^2} = \sqrt{3}\,a$

d'où $r = \sqrt{3}/4 \ a = 142$ pm

5/5

$$C = \frac{N \frac{4}{3}\pi r^3}{V_{maille}} = 68\%$$

La CFC est plus compacte

6/1

(a): $8\frac{1}{8} + 6\frac{1}{2} = 4 \quad O^{2-}$

$12\frac{1}{4} + 1\frac{1}{1} = 4 \quad Li^{+}$

c'est instable : impossible

(b): $8\frac{1}{8} + 6\frac{1}{2} = 4 \quad O^{2-}$

$= 8 \quad Li^{+}$

c'est stable : celle-ci est la bonne

$(Li^{+}_{8} O^{2-}_{4})$ ie Li_2O

6/2+3 CFC, sites tétras occupés par Li^{+}

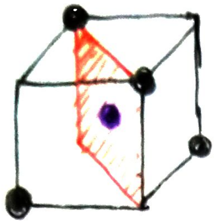
6/4 $M_{Na} = 6{,}02 \cdot 10^{23}\ mol^{-1}$

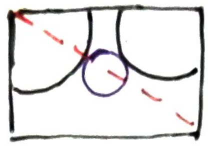
1. Trouver a

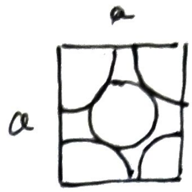
2. Chercher endroits où ça vient tangenter : au tétrahèdre sur les faces ?

6/4

$\frac{1}{8}$ de cube :







$$4r_o = \sqrt{2}a$$

$$2r_o + 2r_{site} = \frac{\sqrt{3}}{2}a$$

$$2r_{site} = \frac{\sqrt{3}}{2}\frac{4r_o}{2} - 2r_o$$

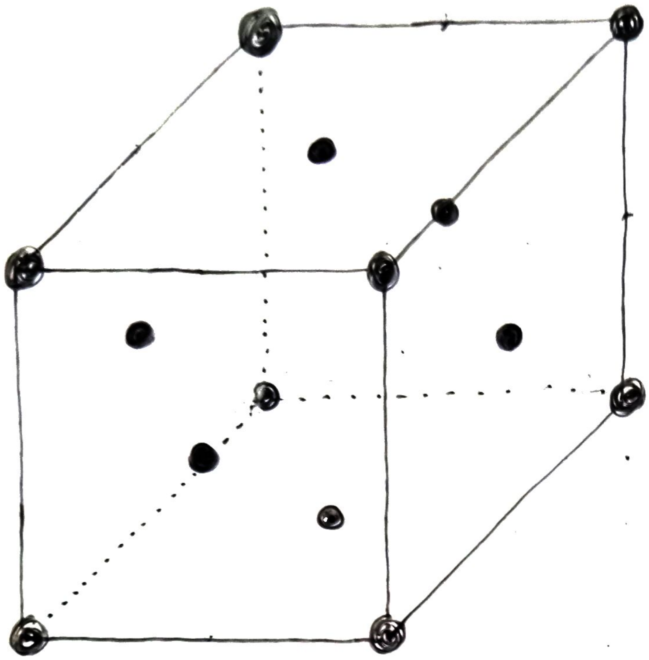
$$= r_o\left(2\frac{\sqrt{3}}{\sqrt{2}} - 2\right)$$

ie $r_{site} = r_o\left(\frac{\sqrt{3}}{\sqrt{2}} - 1\right) = 31$ pm

Or $r_{Li} = 76$ pm

Les ions O^{2-} ne sont pas tangents aux faces car $r_{Li} > r_{site}$

7/1



EX⊆ CRISTL

7/4

$$\mu = \frac{N M}{\mathcal{N}_A V} = \frac{4M}{\mathcal{N}_A a^3}$$

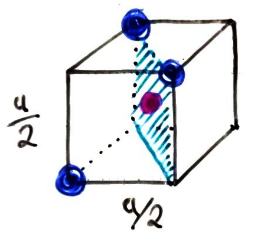
7/5 Il y a 8 sites tétraédriques aux centres des 8 $\frac{1}{8}$ de cube (On peut trouver jusqu'à 8 impuretés)

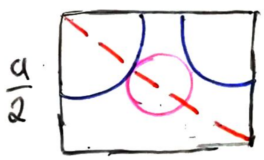
Dans la maille :

- 4 Pt
- 8 X

D'où Pt_4X_8 (ou PtX_2)

7/6 Sous-cube devant, en bas, à gauche.





$$? = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \sqrt{2}\,\frac{a}{2} = \frac{a}{\sqrt{2}}$$

$$R_{Pt} + 2R_X + R_{Pt} = \frac{\sqrt{3}}{2}a$$

$$= \frac{\sqrt{3}}{2}\,\frac{4R_{Pt}}{\sqrt{2}}$$

ie $$R_X = \left(\frac{\sqrt{3}}{\sqrt{2}} - 1\right)R_{Pt}$$