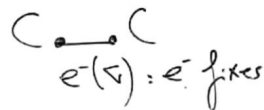


Chap IV

Les cristaux covalents

liaison covalente : liaison tris forte $\Rightarrow T_{fus}$: très élevées

liaison covalente simple



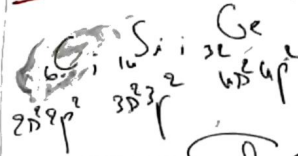
liaison covalente double



$e(\sigma) : \text{fixes}$

$e(\pi) : \text{mobiles : délocalisés}$

I - Structure diamant



ni couche de valence
 donc E_{val} ni colonne (14)

$\Rightarrow$ Structure tétraédrique

Carbone central : AX_4

$\Rightarrow$ Carbone central lié à

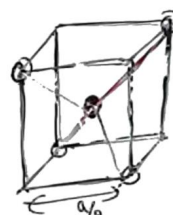
4 voisins $\Rightarrow N_c(C) = 4$ $T_{fus} \approx 3600^\circ C$



Maille C diamant : Cube (a)

Sommets et centres de faces

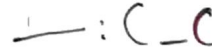
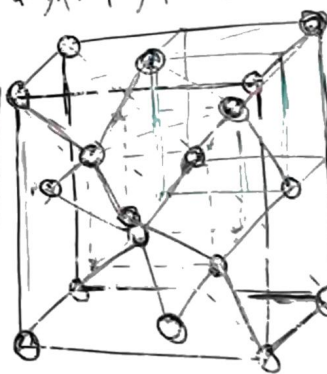
à la moitié des S.T alternés



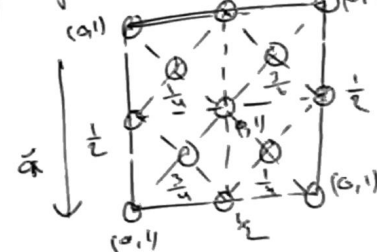
$$Z(C) = 8 \times \frac{1}{8} + 6 \times \frac{1}{2} + 4 \times 1$$

$$Z(C) = 8$$

Coordonnées : $(0,0,0), (\frac{1}{2}, \frac{1}{2}, 0), (\frac{1}{2}, 0, \frac{1}{2}), (0, \frac{1}{2}, \frac{1}{2}), (\frac{1}{4}, \frac{1}{4}, \frac{1}{4}), (\frac{3}{4}, \frac{3}{4}, \frac{1}{4}), (\frac{1}{4}, \frac{3}{4}, \frac{3}{4}), (\frac{3}{4}, \frac{1}{4}, \frac{3}{4})$



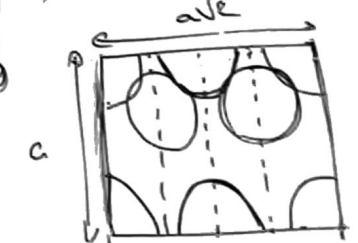
Projection Co de la maille sur (101)



Calcul entre atomes de C :

$$(dc-c)_d = Z R(d) = \frac{a\sqrt{3}}{4}$$

Trace de la maille de C sur (110)



Chap IV

Les cristaux covalents

$$\rho(d) = \frac{Z \cdot M(d)}{N_A \cdot V_{\text{cell}}}$$

$$\rho(d) = \frac{8 \cdot M_c}{N_A \cdot (a_c)^3} = 3,6 \text{ g.cm}^{-3}$$

$$d_{C-C} = \frac{a\sqrt{3}}{4} \Leftrightarrow a = \frac{4}{\sqrt{3}} d_{C-C}$$

$$\rho(d) = \frac{8 \cdot M_c}{N_A \left(\frac{4}{\sqrt{3}}\right)^3 d_{C-C}^3}$$

$$\text{Capacité } C = \frac{V_{\text{occ}}}{V_{\text{cell}}}$$

$$C(d) = \frac{8 \times \frac{4}{3} \pi R^3}{a^3}$$

I - Structure diamant

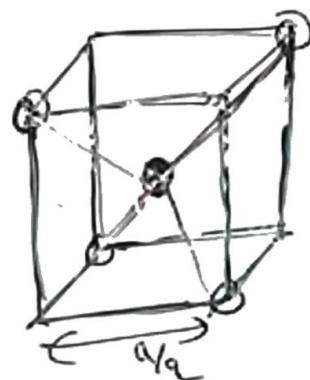
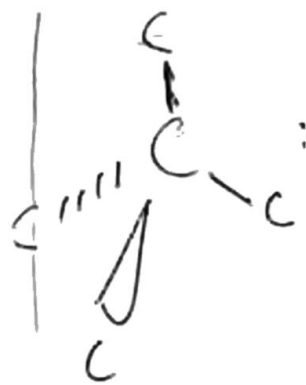
$$d_{C-C} = 2 R(d)$$

$$d_{C-C} = \frac{a\sqrt{3}}{4}$$

$$C = \frac{8 \times \frac{4}{3} \pi \left(\frac{d_{C-C}}{2}\right)^3}{\left(\frac{4}{\sqrt{3}}\right)^3 d_{C-C}^3}$$

$$C(d) = \frac{\pi \sqrt{3}}{16}$$

$$C(d) = 0,34$$



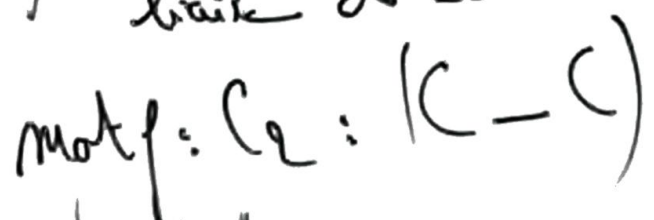
$C(d)$: mode F

$$\vec{r} = \left(m \vec{a} + n \vec{b} + p \vec{c} \right)$$

$$\left| \frac{\vec{a} + \vec{b}}{2}; \frac{\vec{a} + \vec{c}}{2}; \frac{\vec{b} + \vec{c}}{2} \right|$$

4 motifs par maille

1 motif covalent par deux atomes de C liés par une liaison de covalence



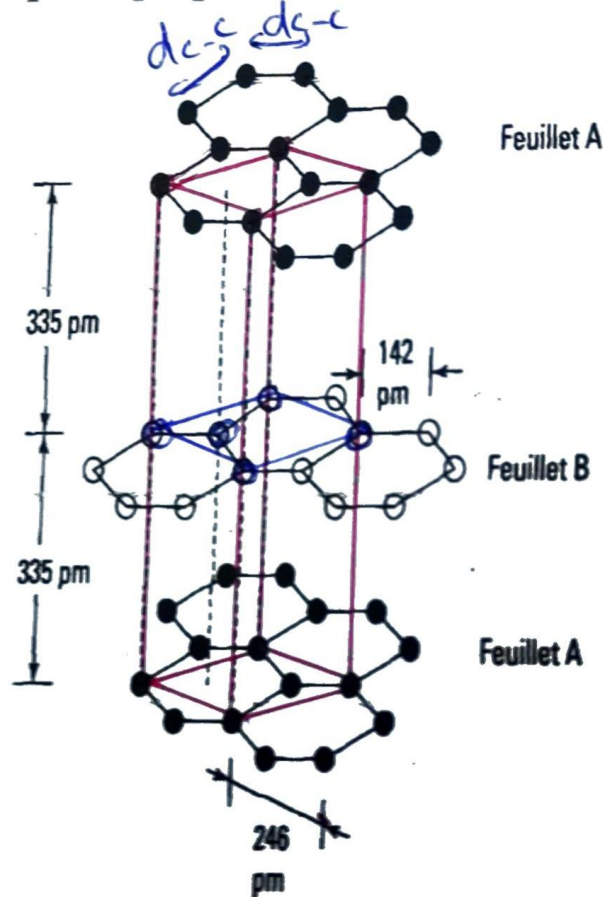
(huiles graphitiques).

$$a = d_{c-c} \sqrt{3}$$

$$d_{c-c} = \frac{a}{\sqrt{3}}$$

$$d_{c-c} = \frac{a\sqrt{3}}{3}$$

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



$$\begin{cases} a = b = 246 \text{ pm} \\ c = 670 \text{ pm} \\ d_{c-c} = \frac{a}{\sqrt{3}} \\ d_{c-c} = 142 \text{ pm} \end{cases}$$

Chap IV

Les cristaux covalents

II - Structure graphite

$$\rho_{gr} = \frac{Z \cdot M(c)}{N_A V_{cell}}$$

$$Z = \underbrace{8 \times \frac{1}{8}}_A + \underbrace{8 \times \frac{1}{2}}_B + 1 \times 1 + 4 \times \frac{1}{4}$$

$$Z = 4$$

$$(0,0,0); (\frac{1}{3}, \frac{2}{3}, 0); (\frac{2}{3}, \frac{1}{3}, 0); (0,0, \frac{1}{2})$$

$$\rho_{gr} = \frac{4 M(c)}{N_A a^2 c \frac{\sqrt{3}}{2}}$$

Capacité

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

$$d_{c-c} = \frac{a}{\sqrt{3}}$$

$$C_{gr} = \frac{Z \cdot \frac{4}{3} \pi R^3}{a^2 c \cdot \frac{\sqrt{3}}{2}} = \frac{4 \times \frac{4}{3} \pi (\frac{d_{c-c}}{2})^3}{3(d_{c-c})^2 c \cdot \frac{\sqrt{3}}{2}}$$

$$C_{gr} = \frac{4 \pi (d_{c-c})}{9 \sqrt{3} c} = 0,17$$

C_{gr} s.r hexagonal: mode (P)

$$\vec{T} = m\vec{a} + n\vec{b} + p\vec{c} : 1 \text{ motif}$$

$$= 1 \text{ motif s.c. l'axe } c \text{ par la base de } \dots$$

Remarque

$$I_1(C_d) \approx 1$$

$$I_1(C_g) \approx 1$$

$$I_1 \approx d_{c-c}$$

$$d_{c-c} < d_{c-c} \quad \text{or} \quad d_{c-c} < d_{c-c}$$