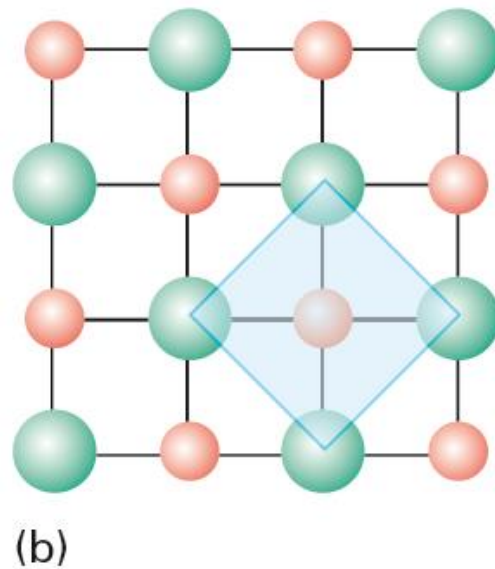
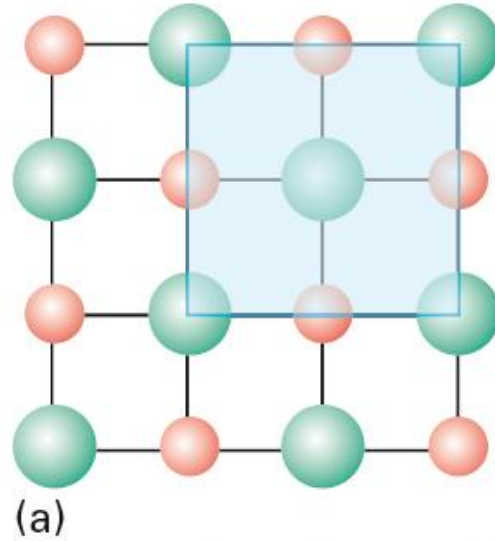


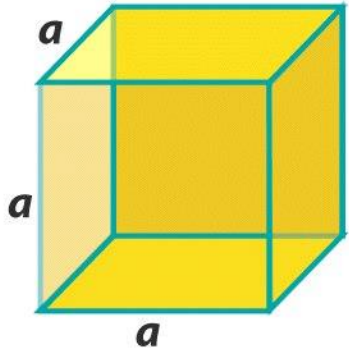
Triangolo di Ketelaar

# Celle elementari bidimensionali

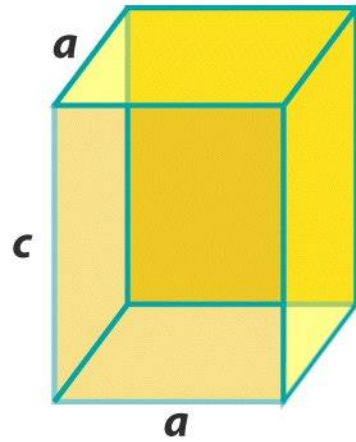


Preferita

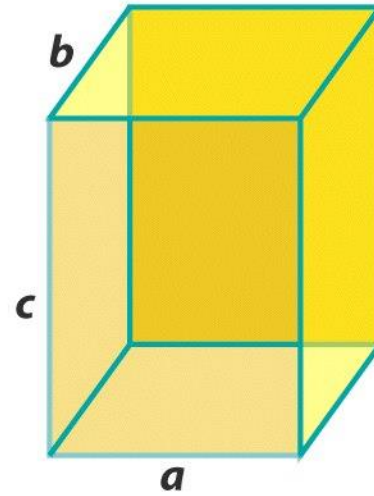
# I 7 sistemi cristallini



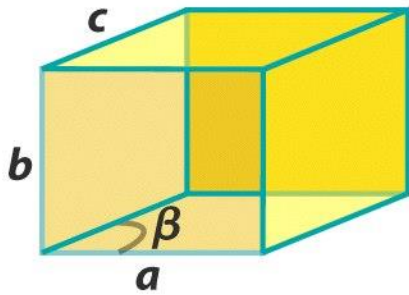
**Cubic**



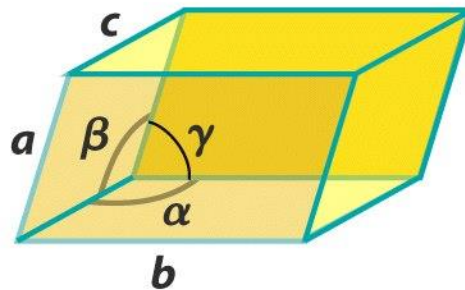
**Tetragonal**



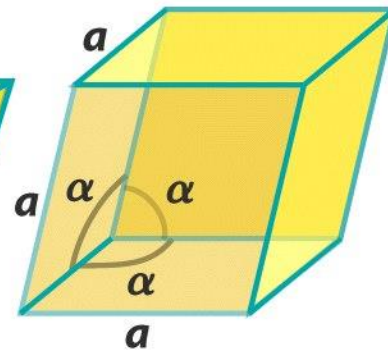
**Orthorhombic**



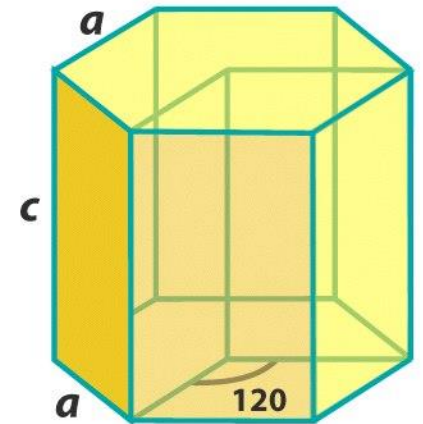
**Monoclinic**



**Triclinic**

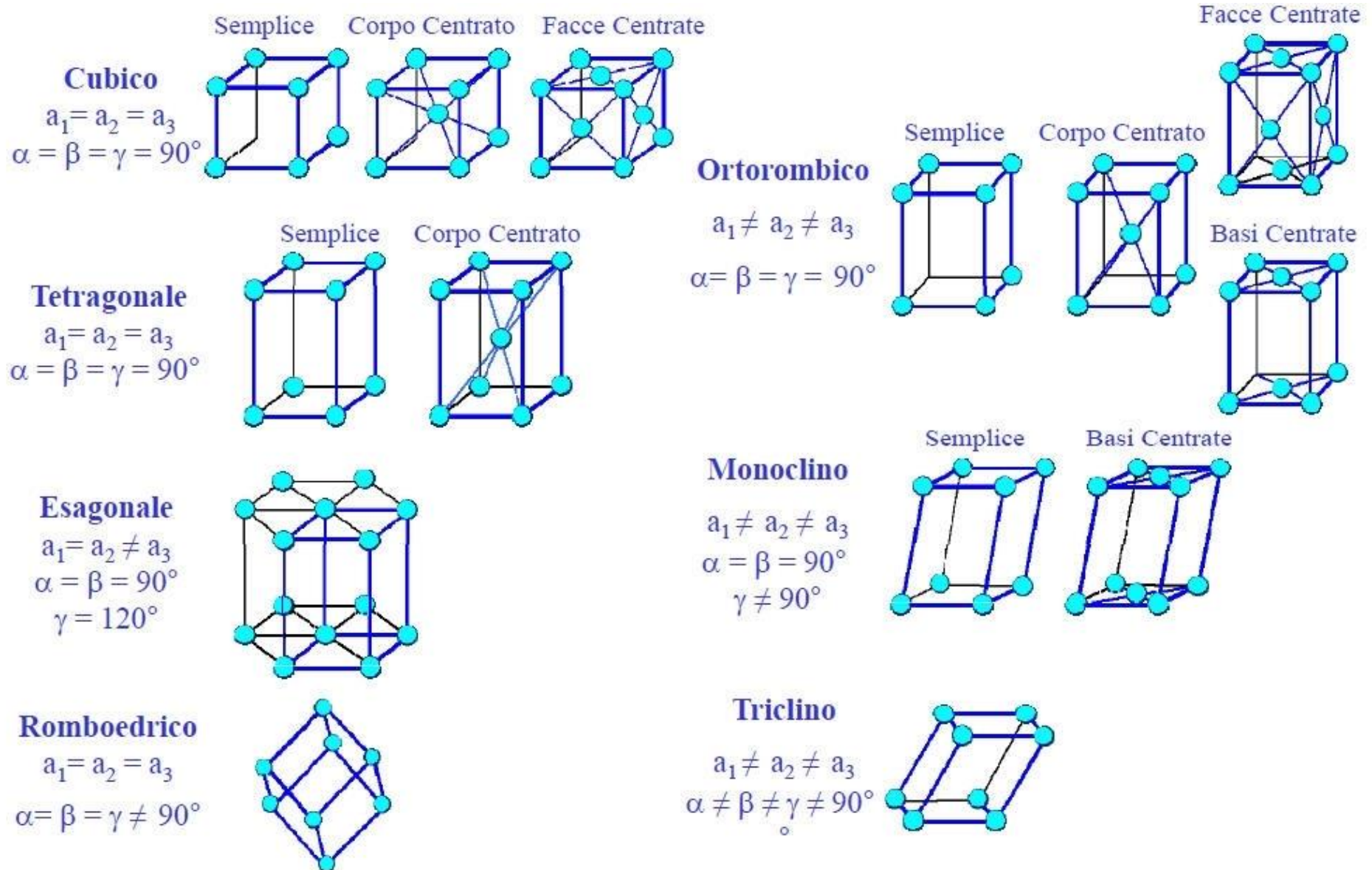


**Trigonal**

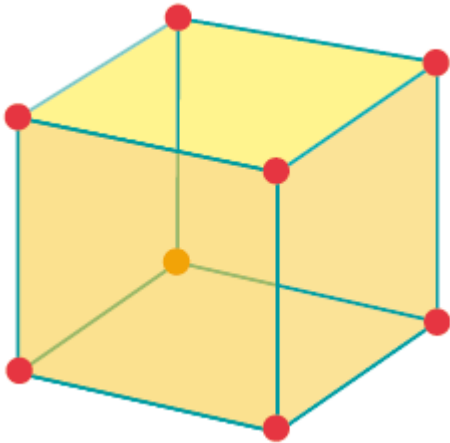


**Hexagonal**

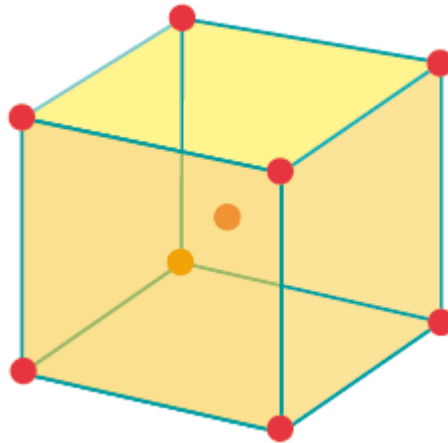
# I 14 reticoli di Bravais



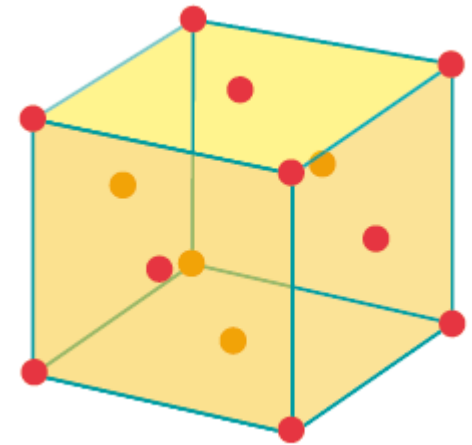
# Celle elementari cubiche



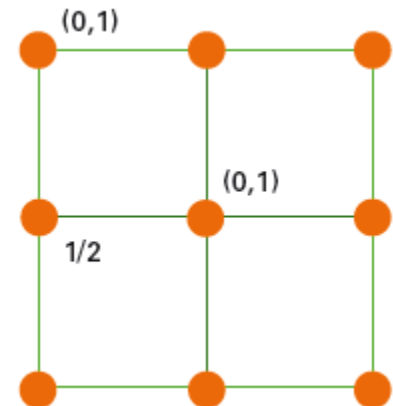
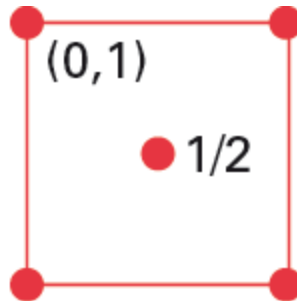
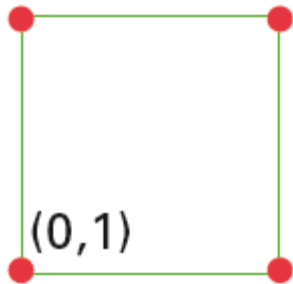
Cubica primitiva, P



Cubica a corpo  
centrato, I

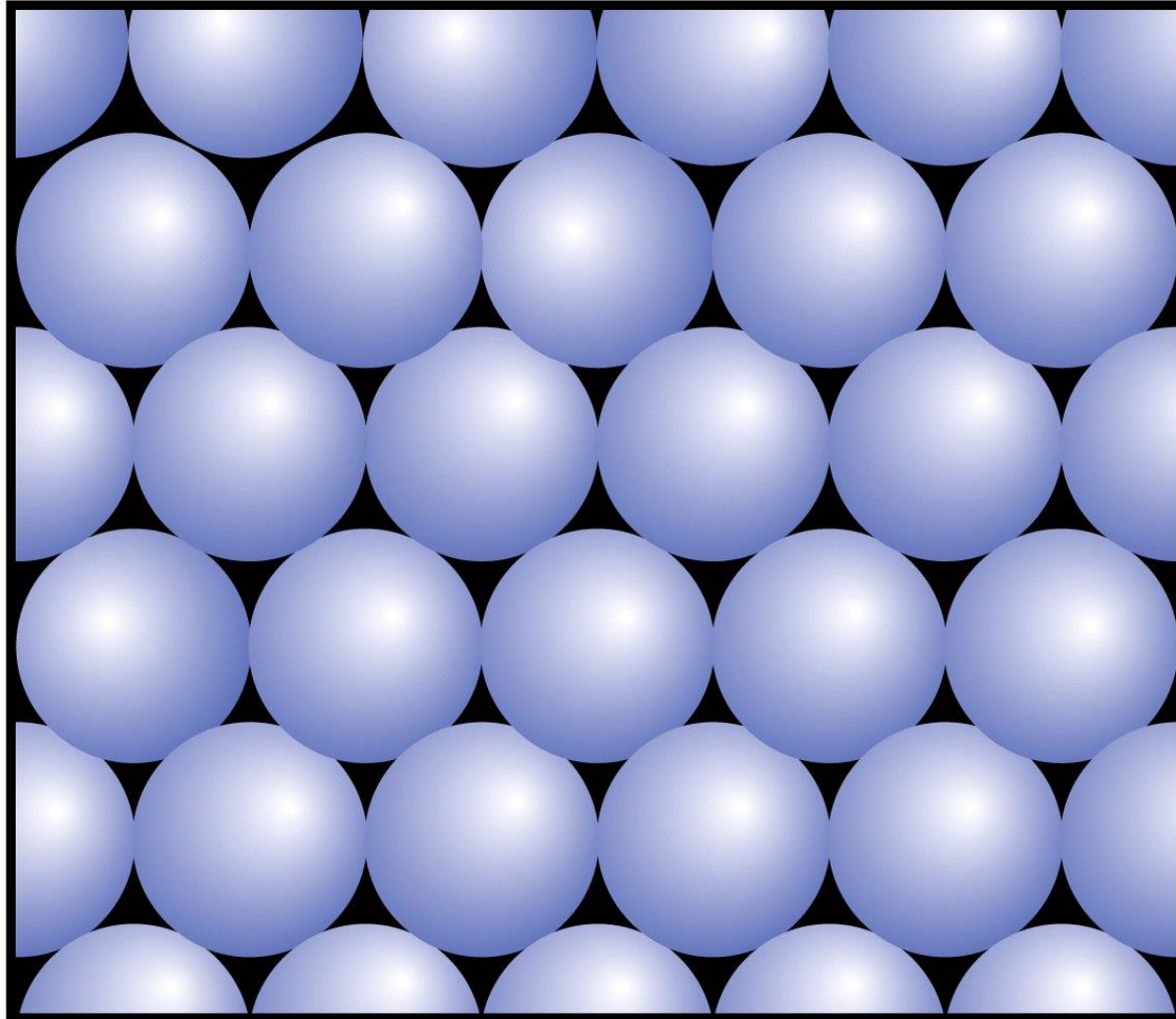


Cubica a facce  
centrate, F

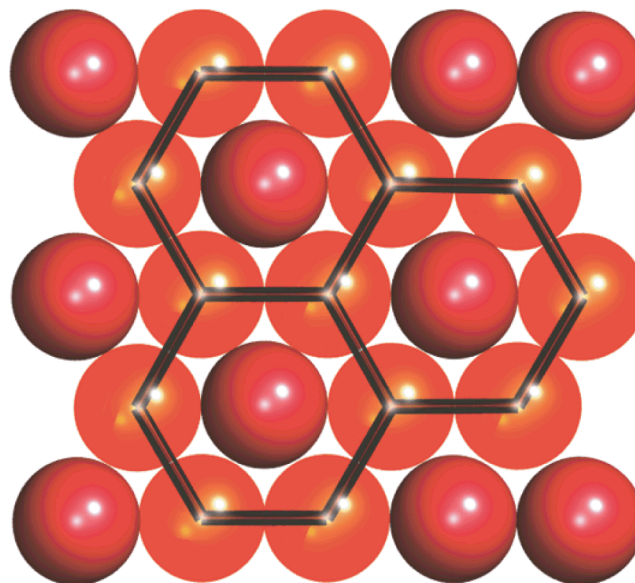


Coordinate frazionarie

# Impaccamento compatto di sfere rigide

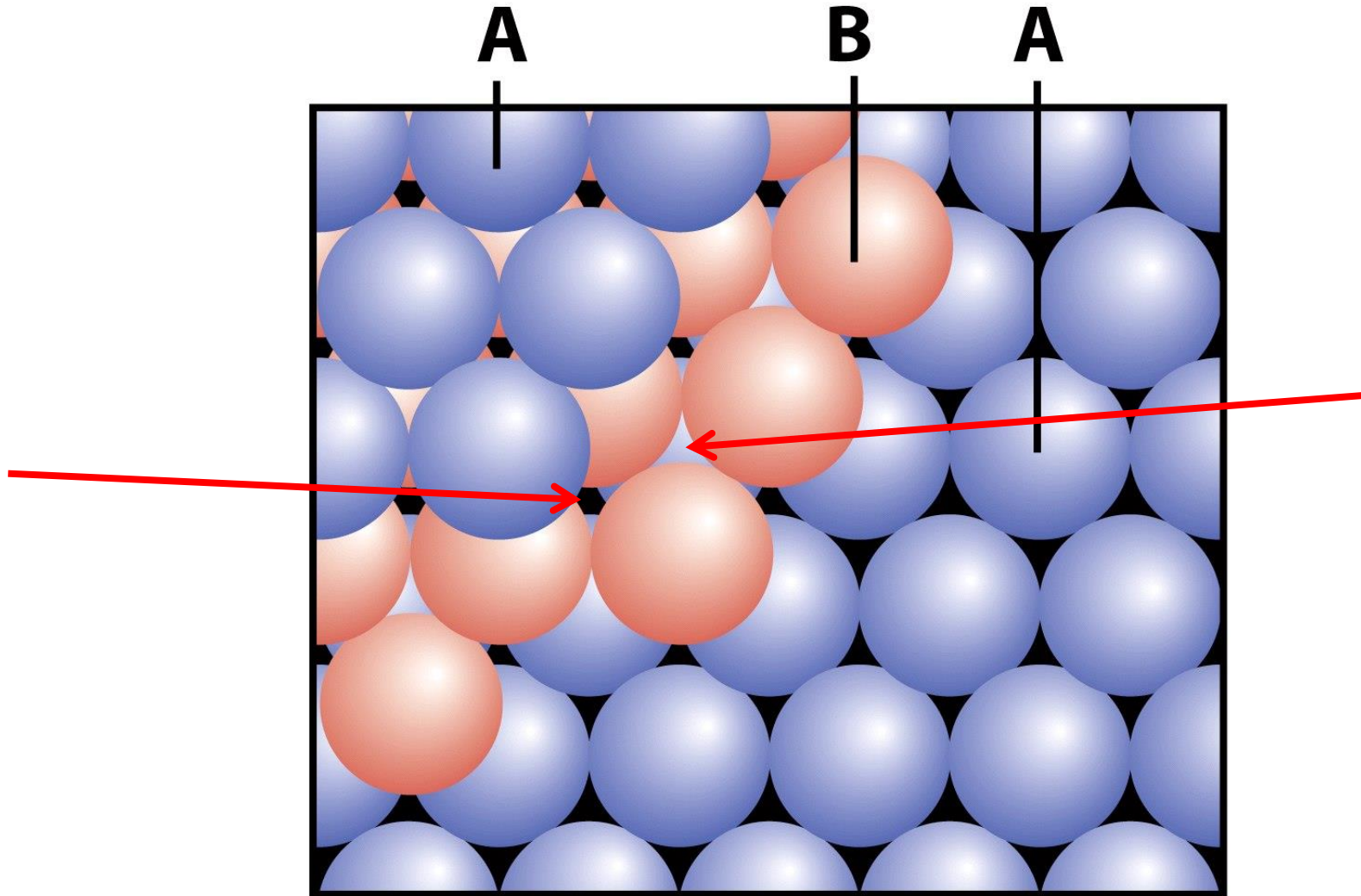


Strato di sfere a impaccamento compatto con evidenza  
la coordinazione esagonale



Politipi a impaccamento compatto: ABAB....

Esagonale compatto (*hcp*)

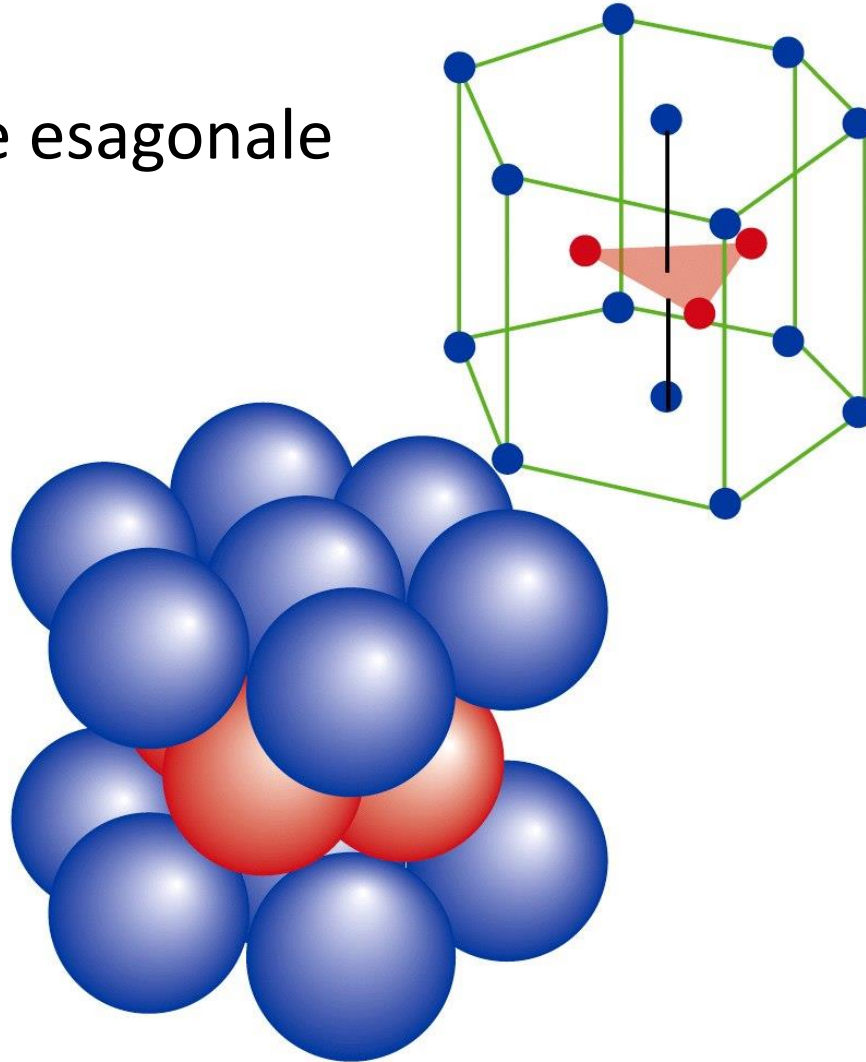




# Impaccamento esagonale compatto (*hcp*)

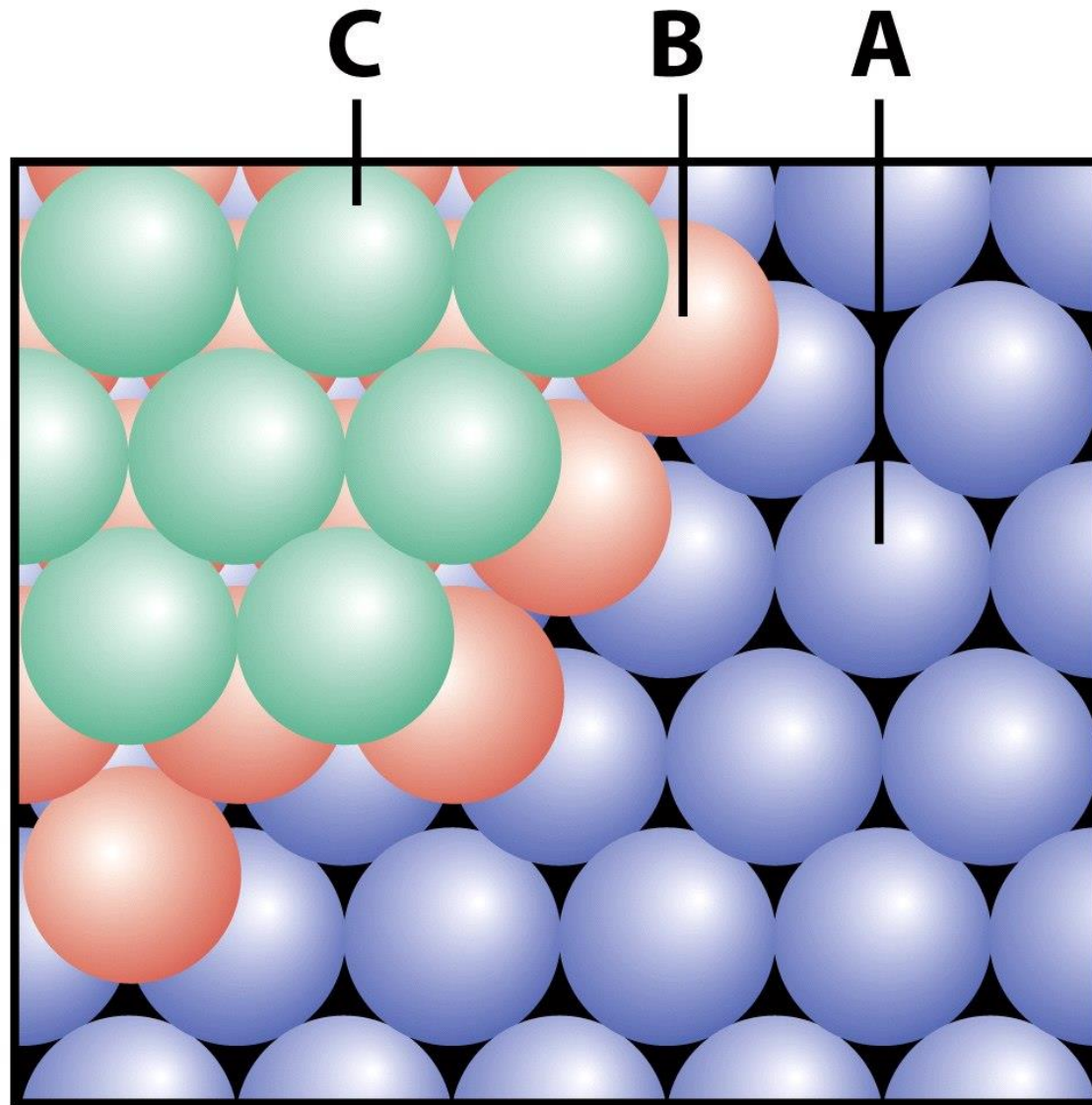
*hexagonally close packed*

Cella elementare esagonale



Politipi a impaccamento compatto: ABCABC....

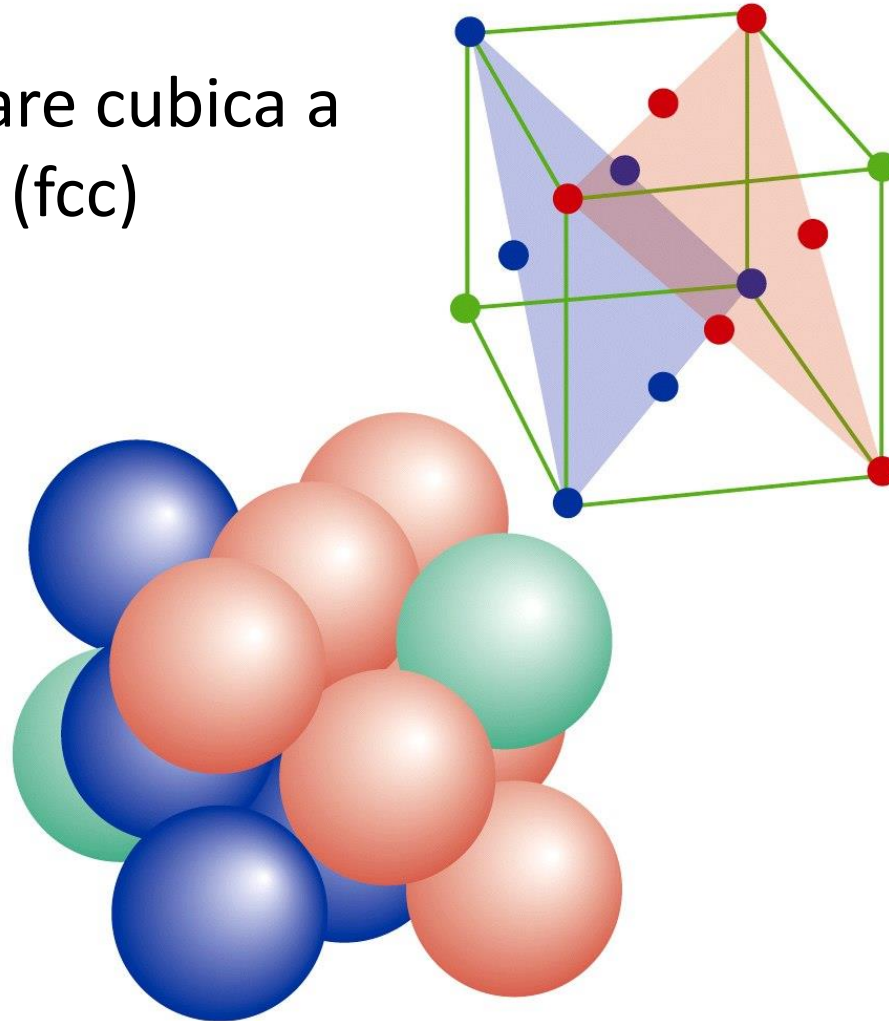
Cubico compatto (*ccp*)



# Impaccamento cubico compatto (*ccp*)

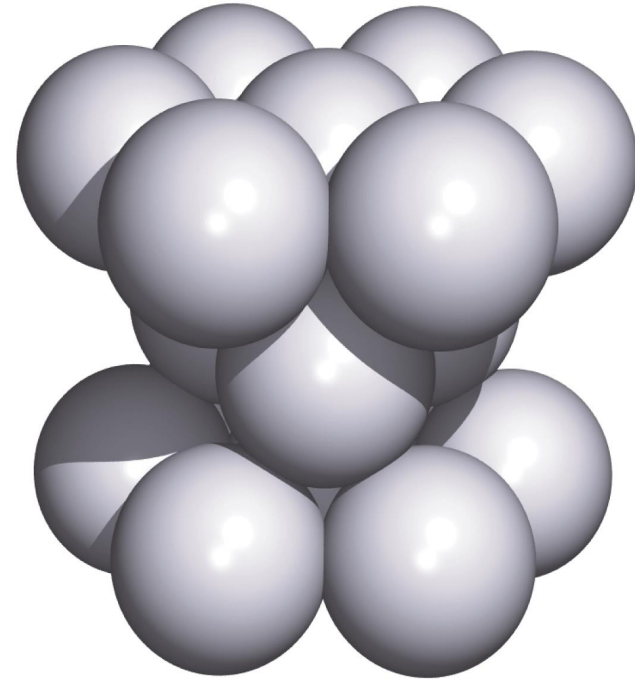
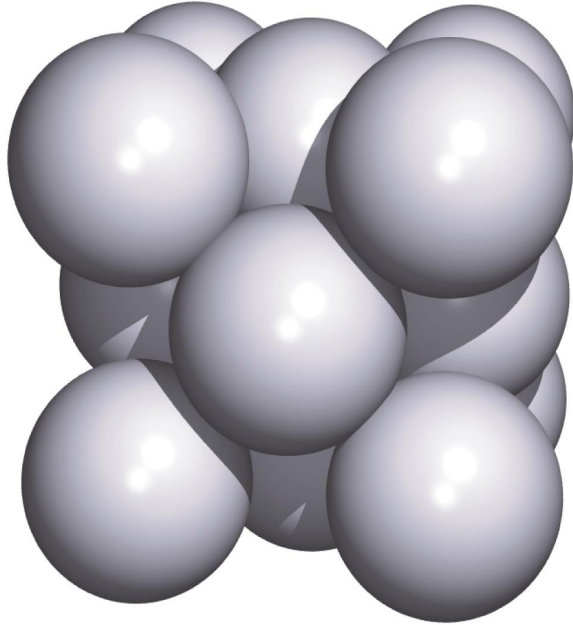
*cubic close packed*

Cella elementare cubica a  
facce centrate (fcc)



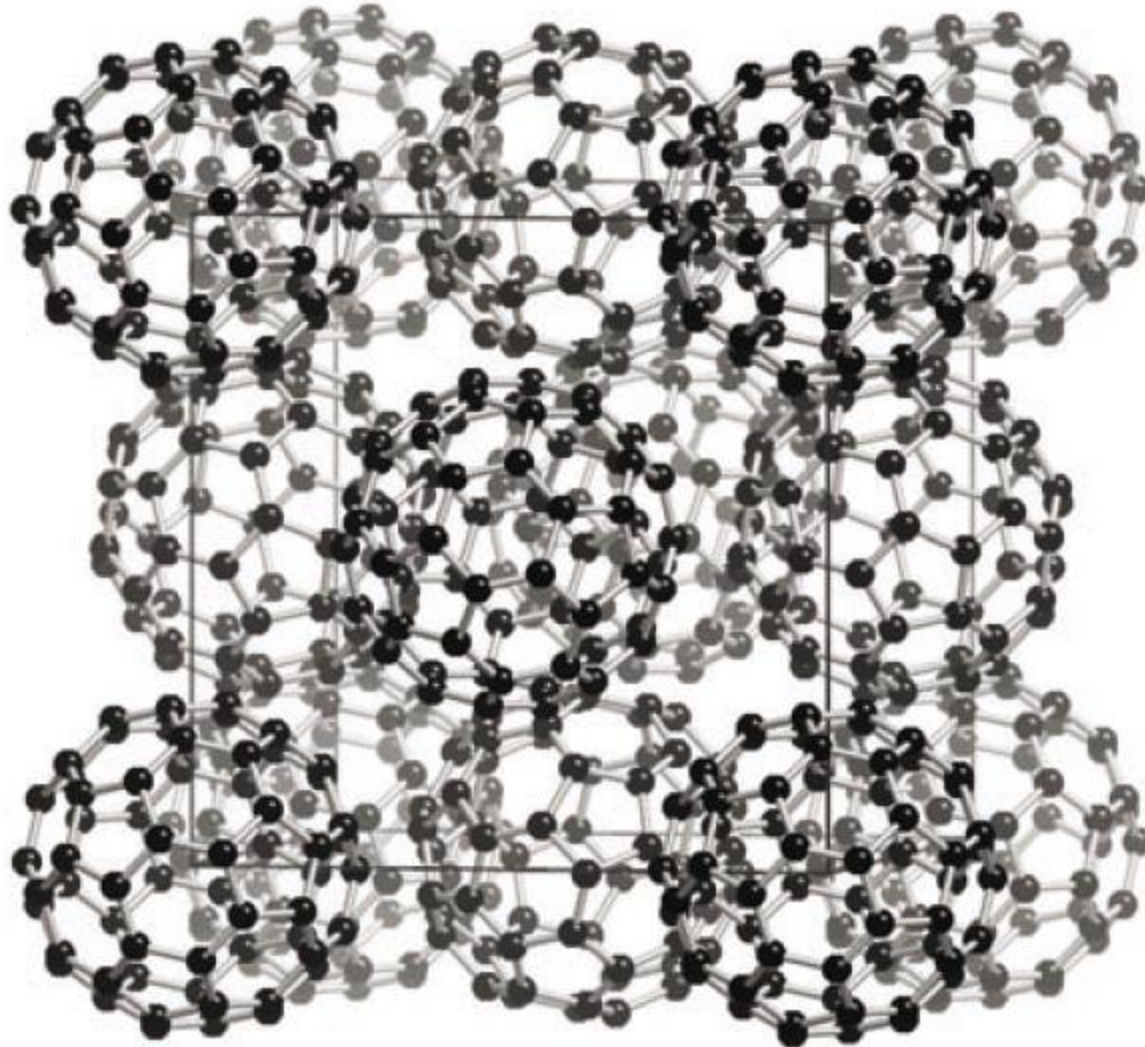
# Celle elementari fcc e hcp a confronto

Numero di coordinazione 12

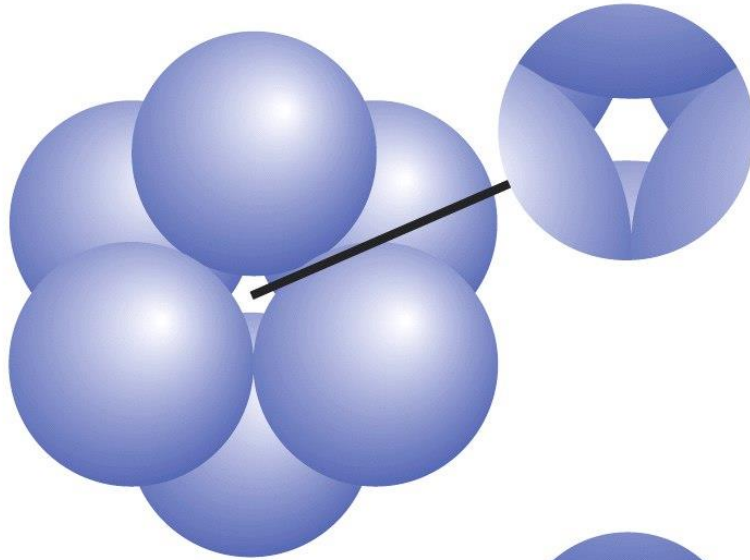


Spazio vuoto = 26%

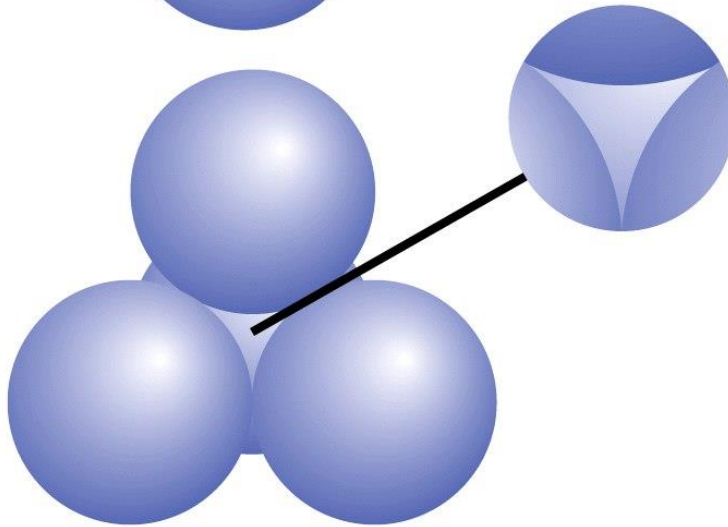
# Arrangiamento ccp di $C_{60}$



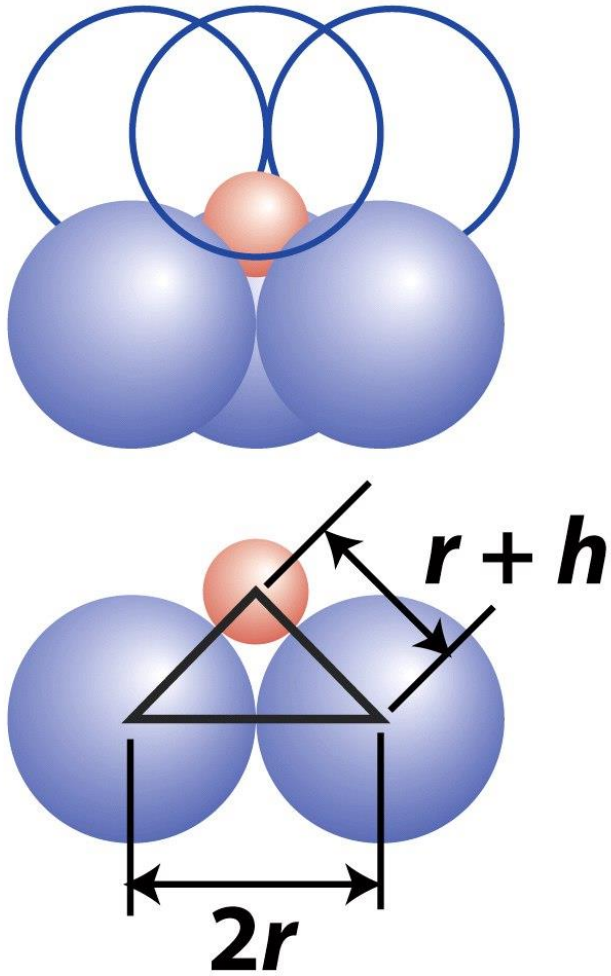
# Interstizi negli impaccamenti compatti



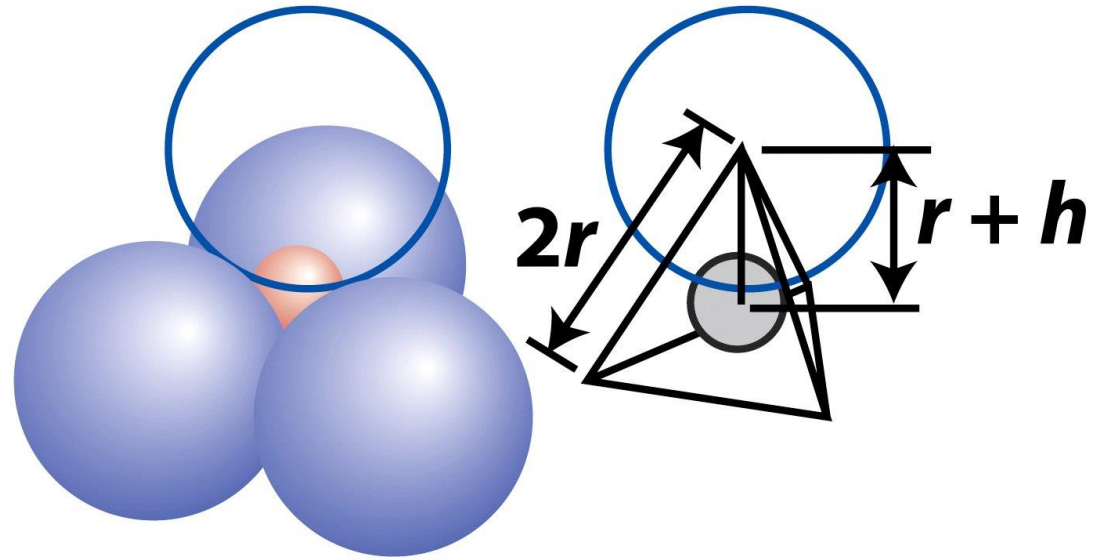
Interstizio ottaedrico  
 $r_h = 0.414r$



Interstizio tetraedrico  
 $r_h = 0.225r$

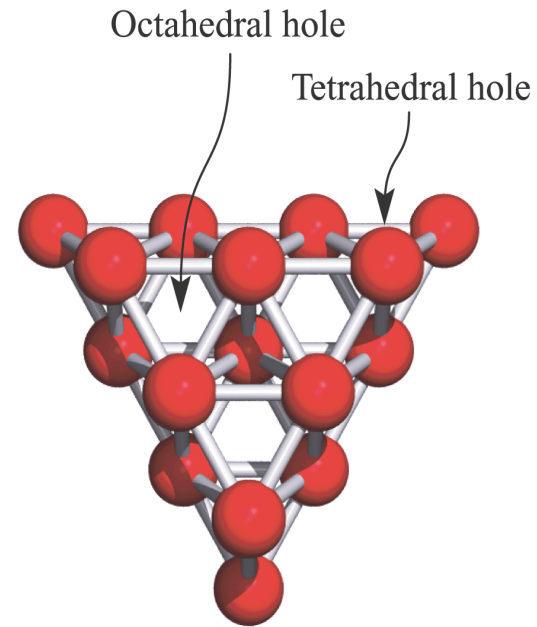
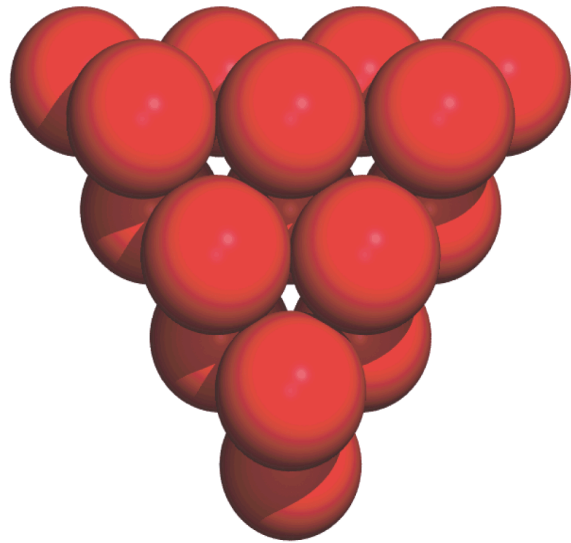


Interstizio ottaedrico  
 $r_h = 0.414r$



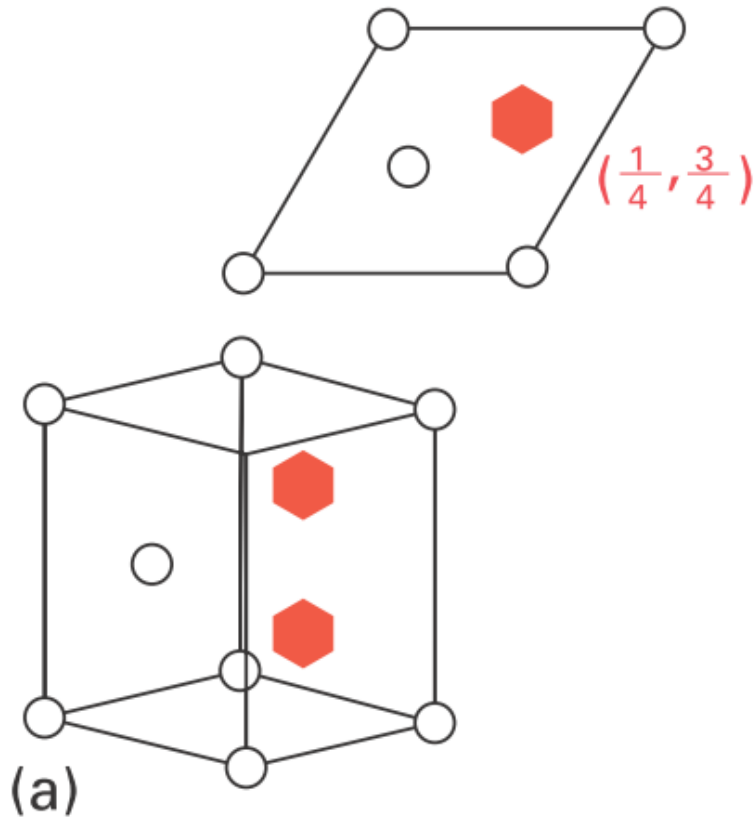
Interstizio tetraedrico  
 $r_h = 0.225r$

# Interstizi ottaedrici e tetraedrici

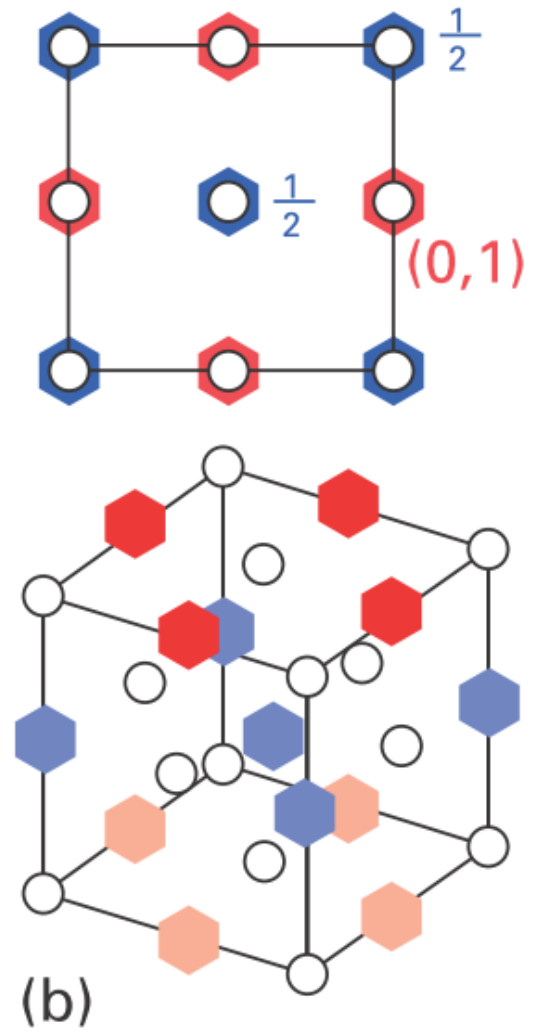




# Interstizi ottaedrici nelle strutture compatte

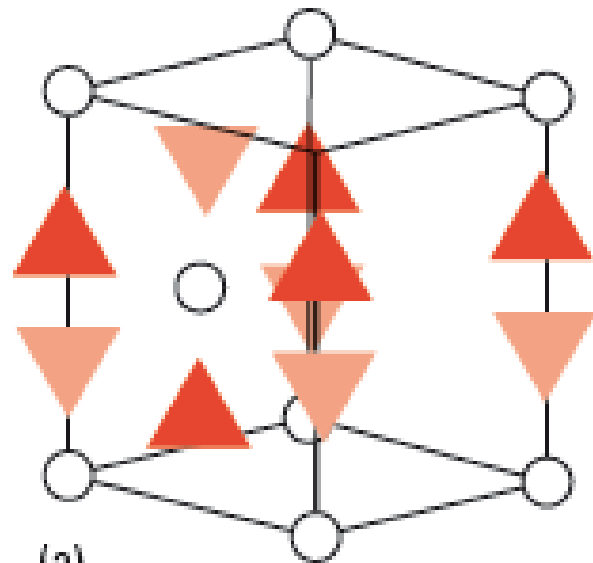
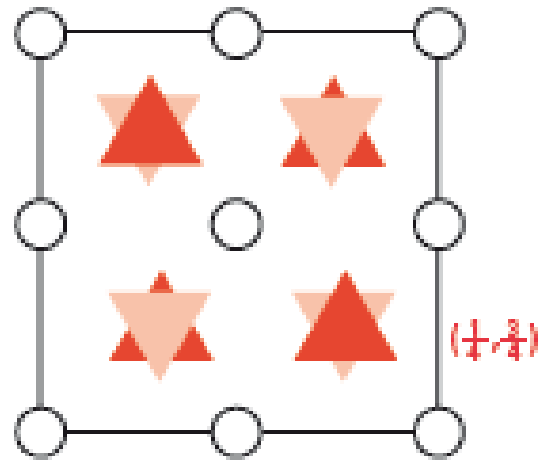
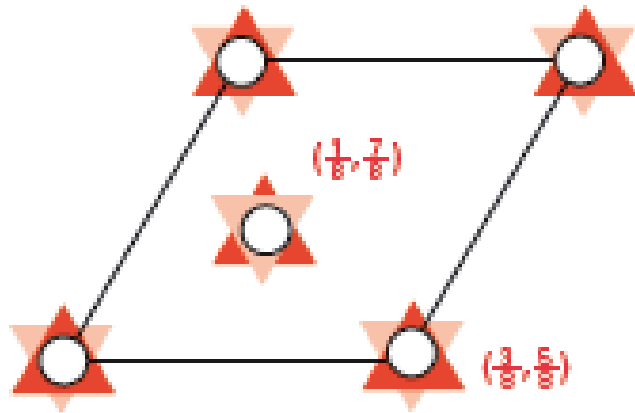


hcp



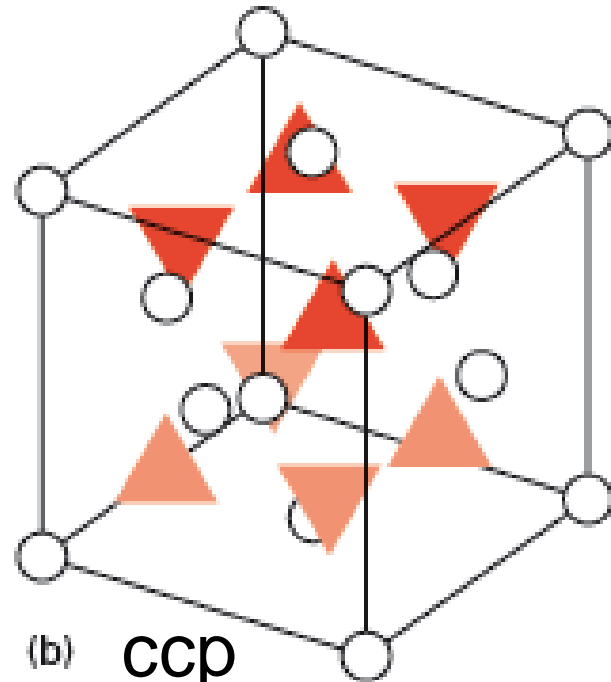
ccp

# Interstizi tetraedrici nelle strutture compatte



(a)

hcp



(b)

ccp

# Le strutture dei metalli

$$\rho_{\text{Os}} = 22,61 \text{ g cm}^{-3}$$

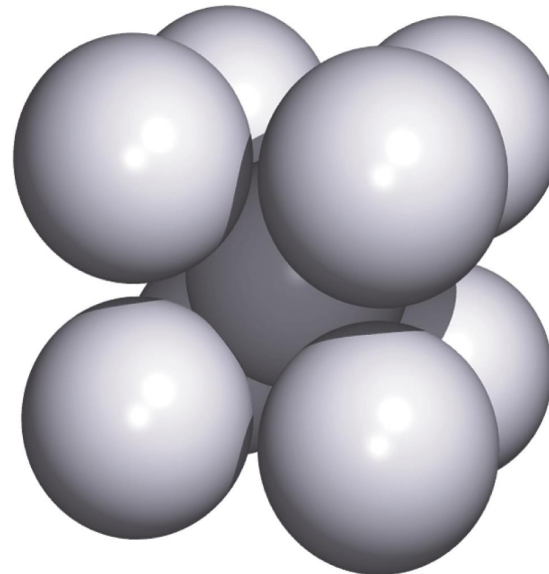
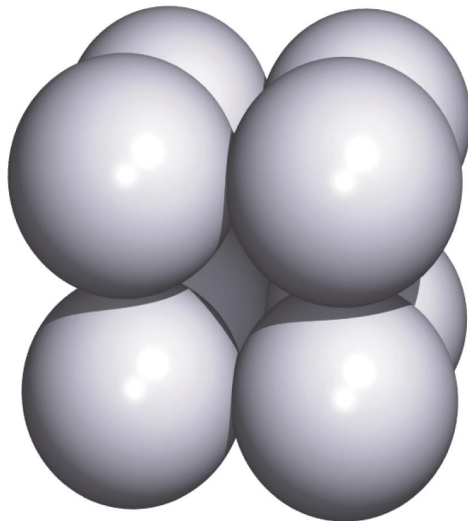
$$\rho_{\text{Pb}} = 11,3 \text{ g cm}^{-3}$$

Struttura cristallina	Elemento
Esagonale compatta (hcp)	Be, Ca, Co, Mg, Ti, Zn
Cubica compatta (ccp)	Ag, Al, Au, Cd, Cu, Ni, Pb, Pt
Cubica a corpo-centrato (bcc)	Ba, Cr, Fe, W, metalli alcalini
Cubica primitiva (cubica-P)	Po

} 26% vuoto

32% vuoto

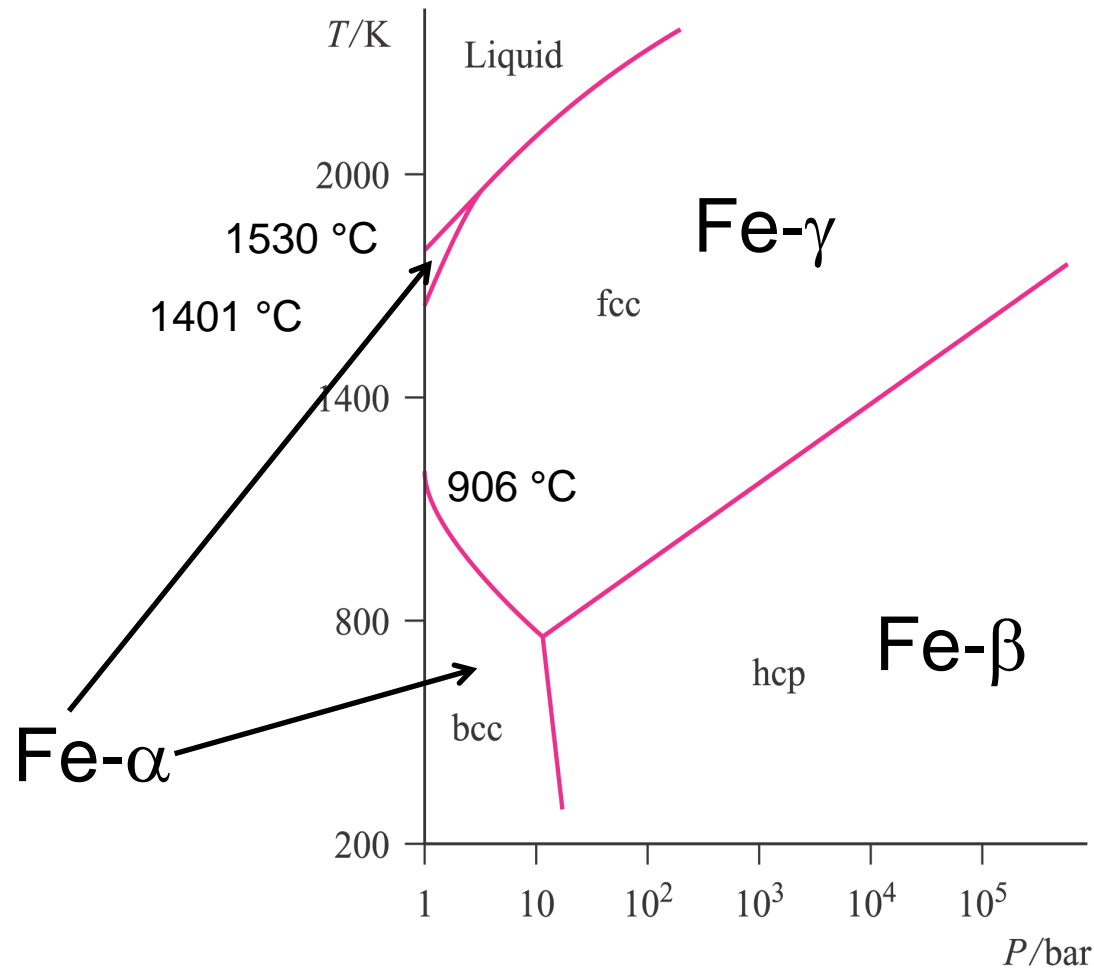
Cubica  
primitiva



bcc



# Polimorfismo del ferro



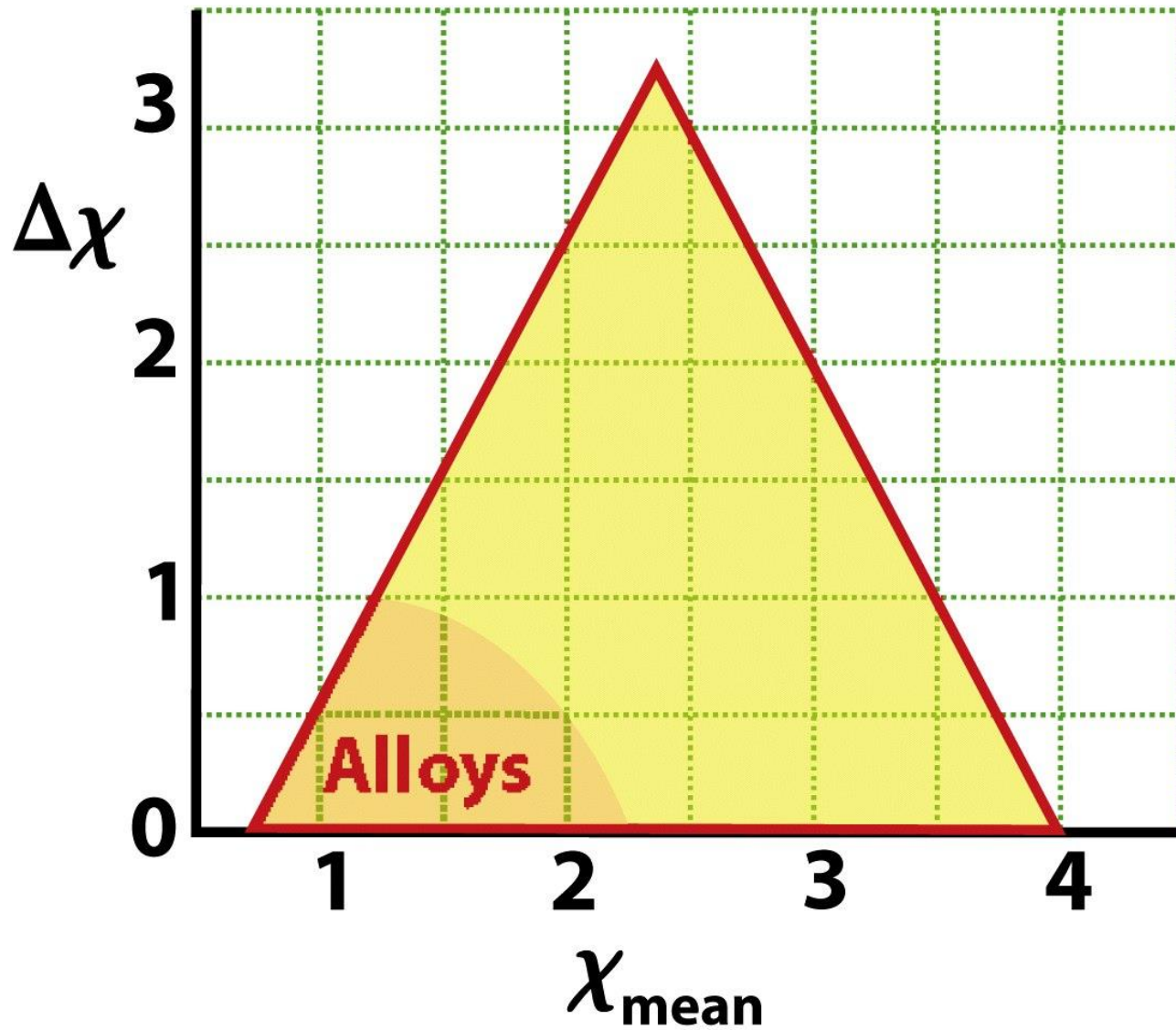
*Polimorfismo = la capacità di adottare forme cristalline diverse in condizioni di pressione e temperatura differenti*

# Correzione di Goldschmidt dei raggi atomici

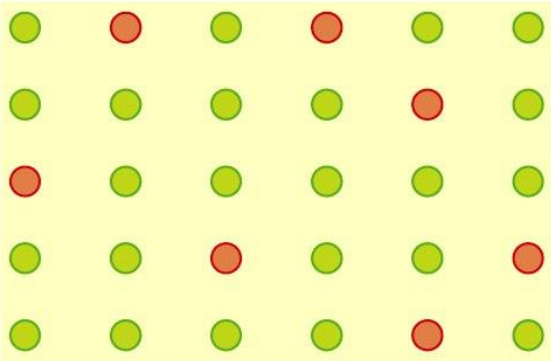
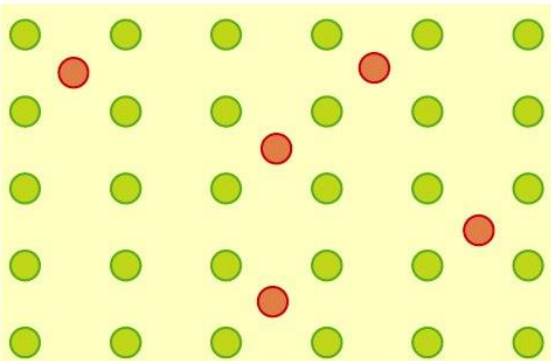
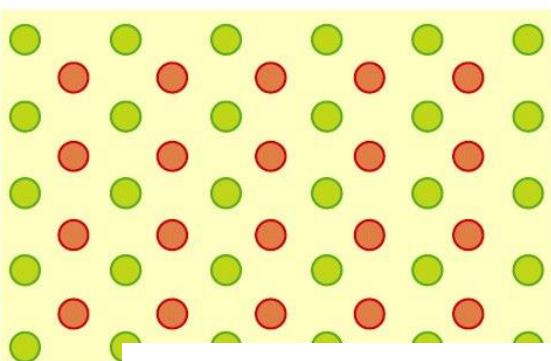
Coordination number	Relative radius
12	1
8	0.97
6	0.96
4	0.88

*correzione di Goldschmidt = raggio metallico (ipotetico) in una struttura a impaccamento compatto con coordinazione 12.*

# Leghe metalliche



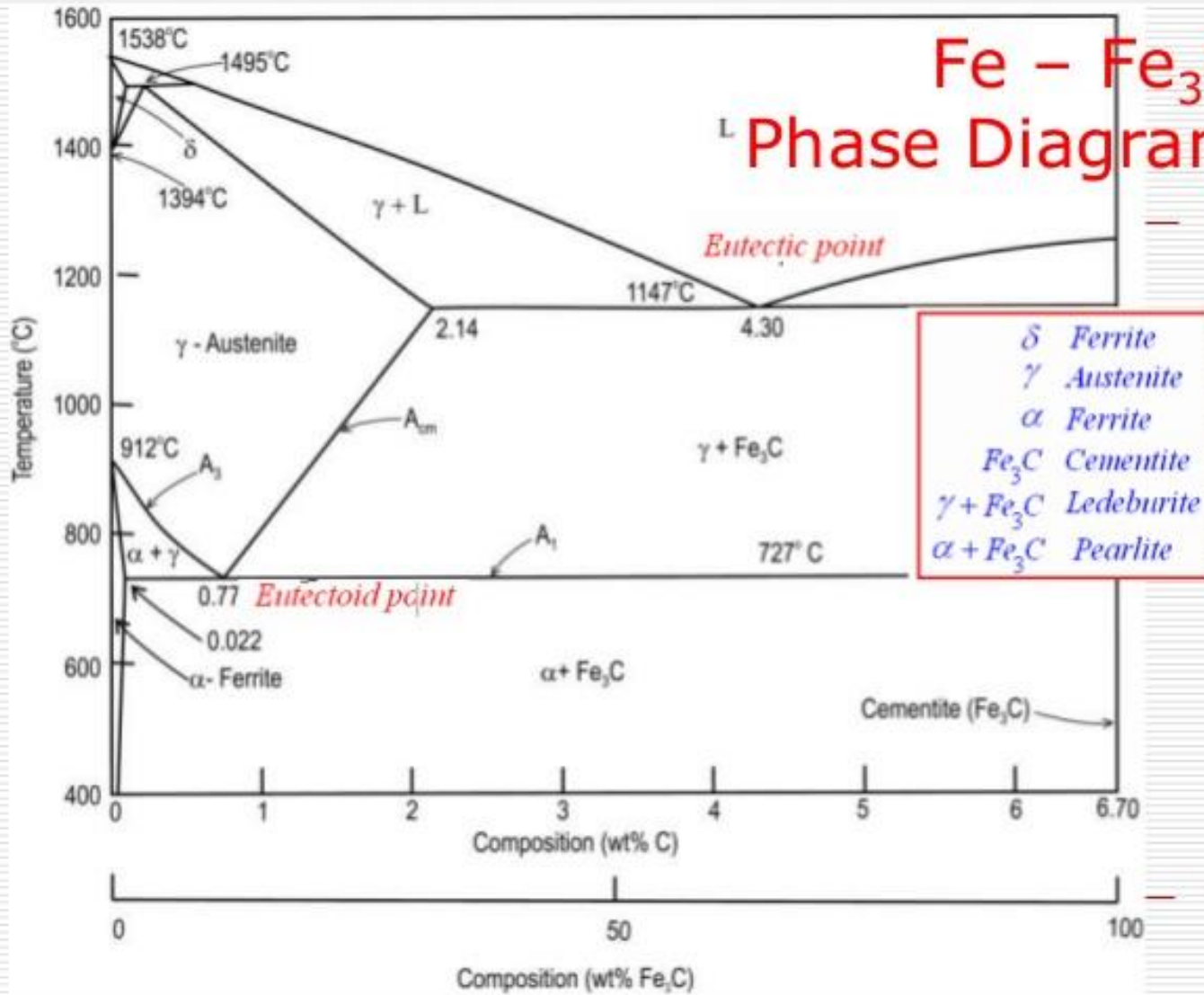
# Leghe metalliche

- (a)  Soluzioni solide **sostituzionali**  
 $\Delta r < 15\%$   
(e.g. Cu/Ni, Cu/Sn/Pb (85/10/5, bronzo),  $\text{Cu}_{1-x}/\text{Zn}_x$ ,  $0 < x < 0.38$  (ottoni  $\alpha$ ), acciai inox)
- (b)  Soluzioni solide **interstiziali** (con nonmetalli) o composti non-stechiometrici  
 $r < 0.414R$   
e.g. Fe/C (acciai al carbonio)
- (c)  Composti interstiziali  
 $r < 0.414R$   
e.g. WC



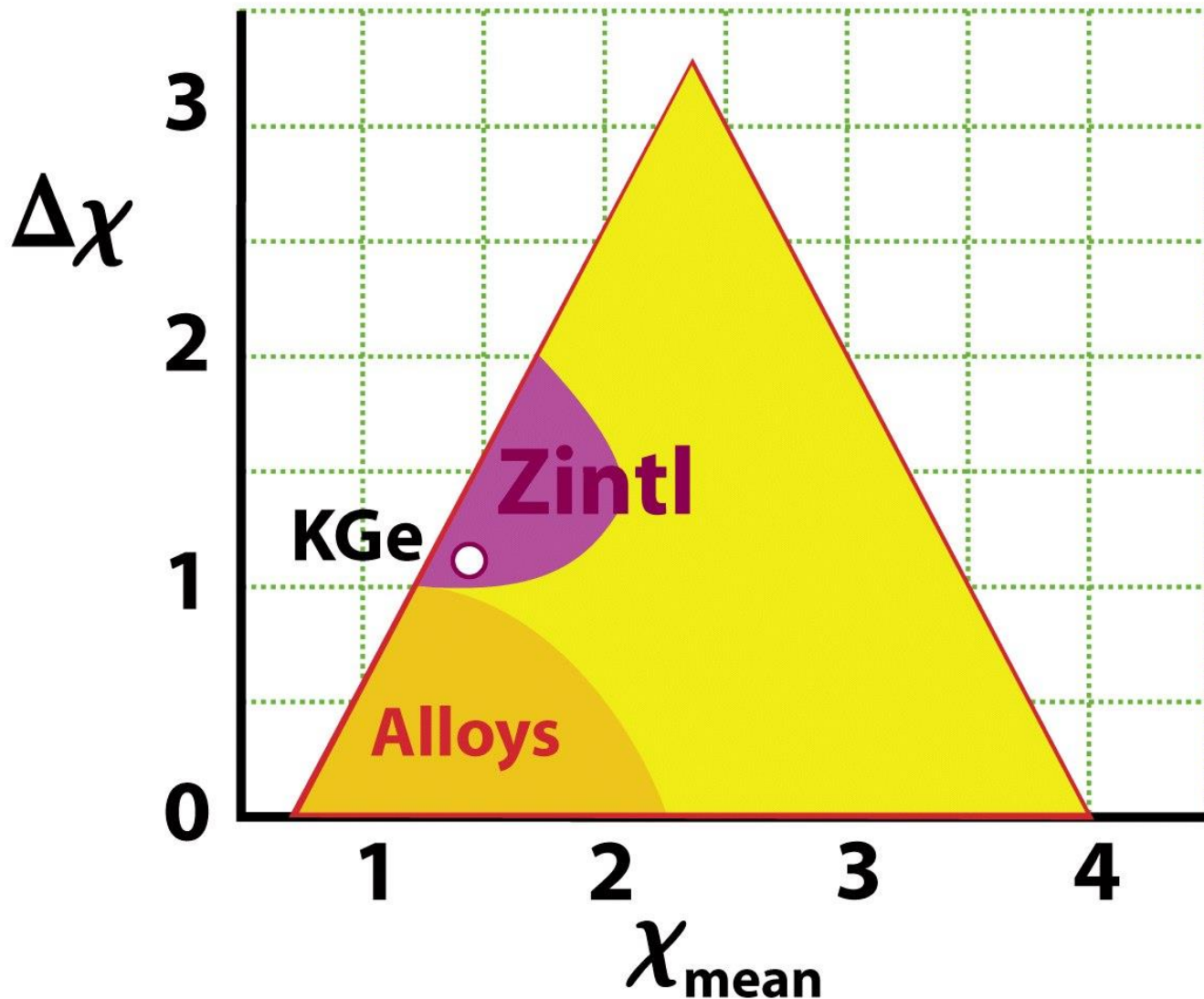


# Fe - Fe<sub>3</sub>C Phase Diagram



# Composti intermetallici o *fasi di Zintl*

*ottone- $\beta$*  ( $\text{CuZn}$ ),  $\text{MgZn}_2$ ,  $\text{Cu}_3\text{Au}$ ,  $\text{NaTl}$ ,  $\text{Na}_5\text{Zn}_{21}$



# Struttura della *fase di Zintl* KGe

