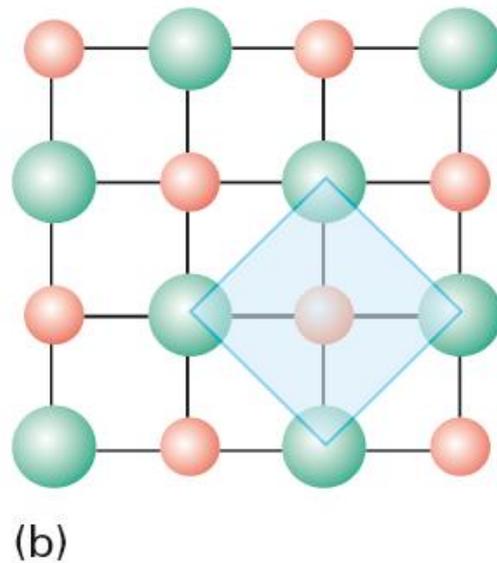
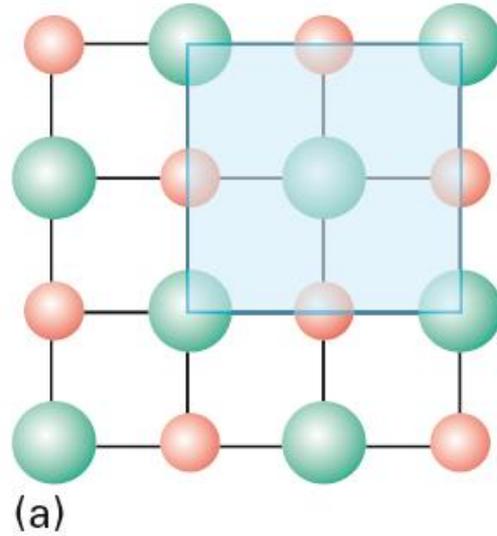


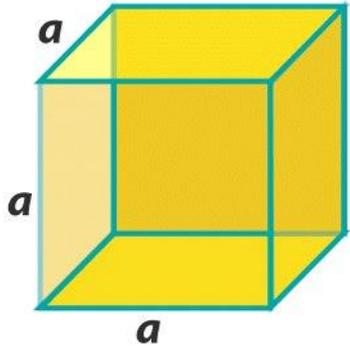
Triangolo di Ketelaar

Celle elementari bidimensionali

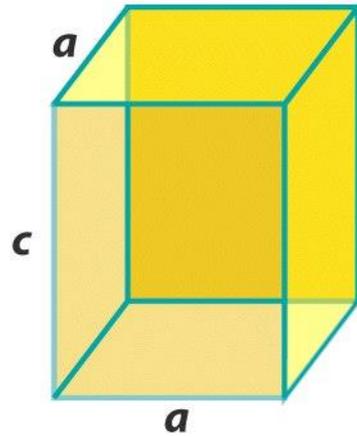


Preferita

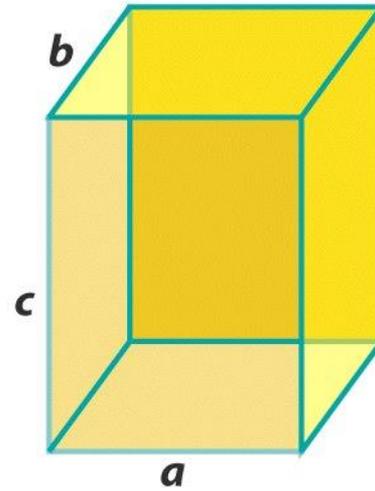
I sette sistemi cristallini



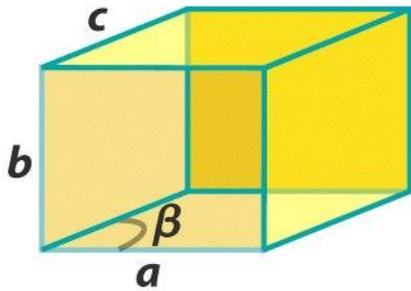
Cubic



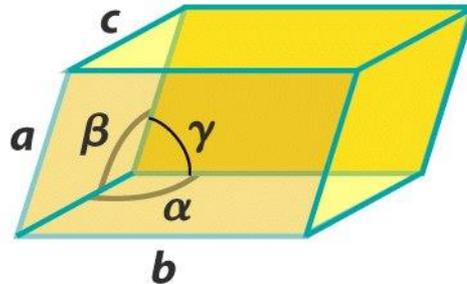
Tetragonal



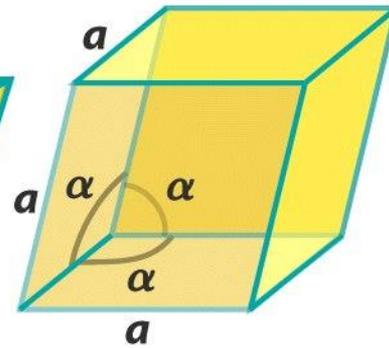
Orthorhombic



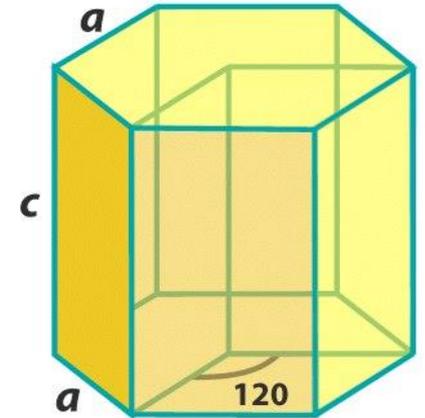
Monoclinic



Triclinic

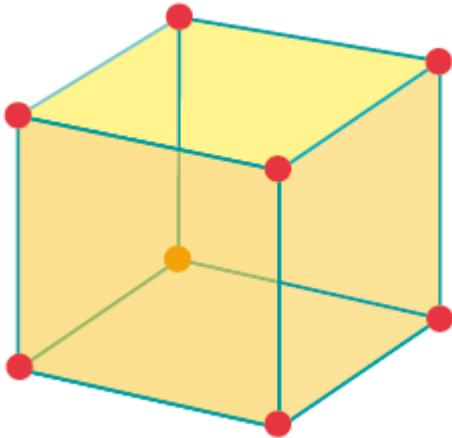


Trigonal

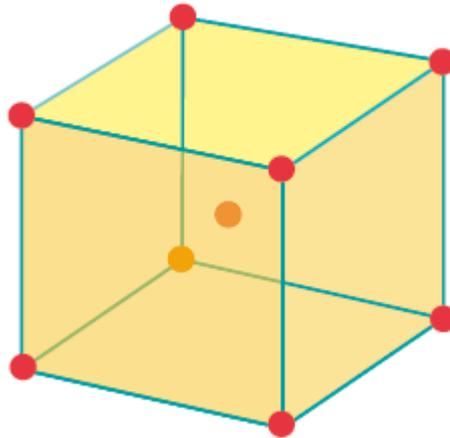


Hexagonal

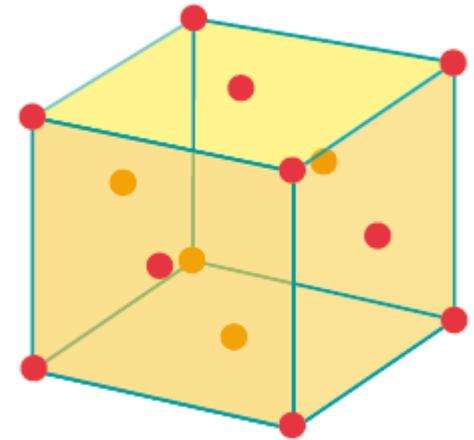
Celle elementari cubiche



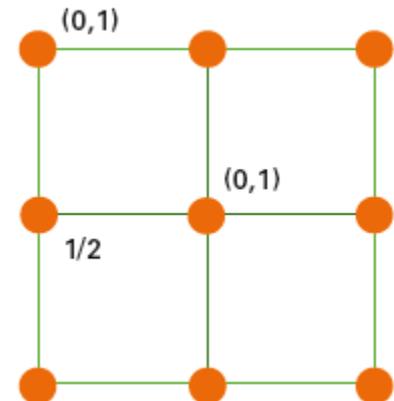
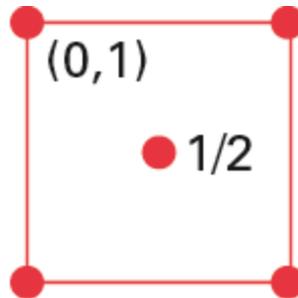
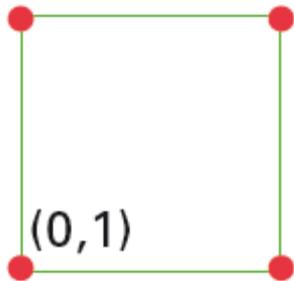
Cubica primitiva, P



Cubica a corpo
centrato, I

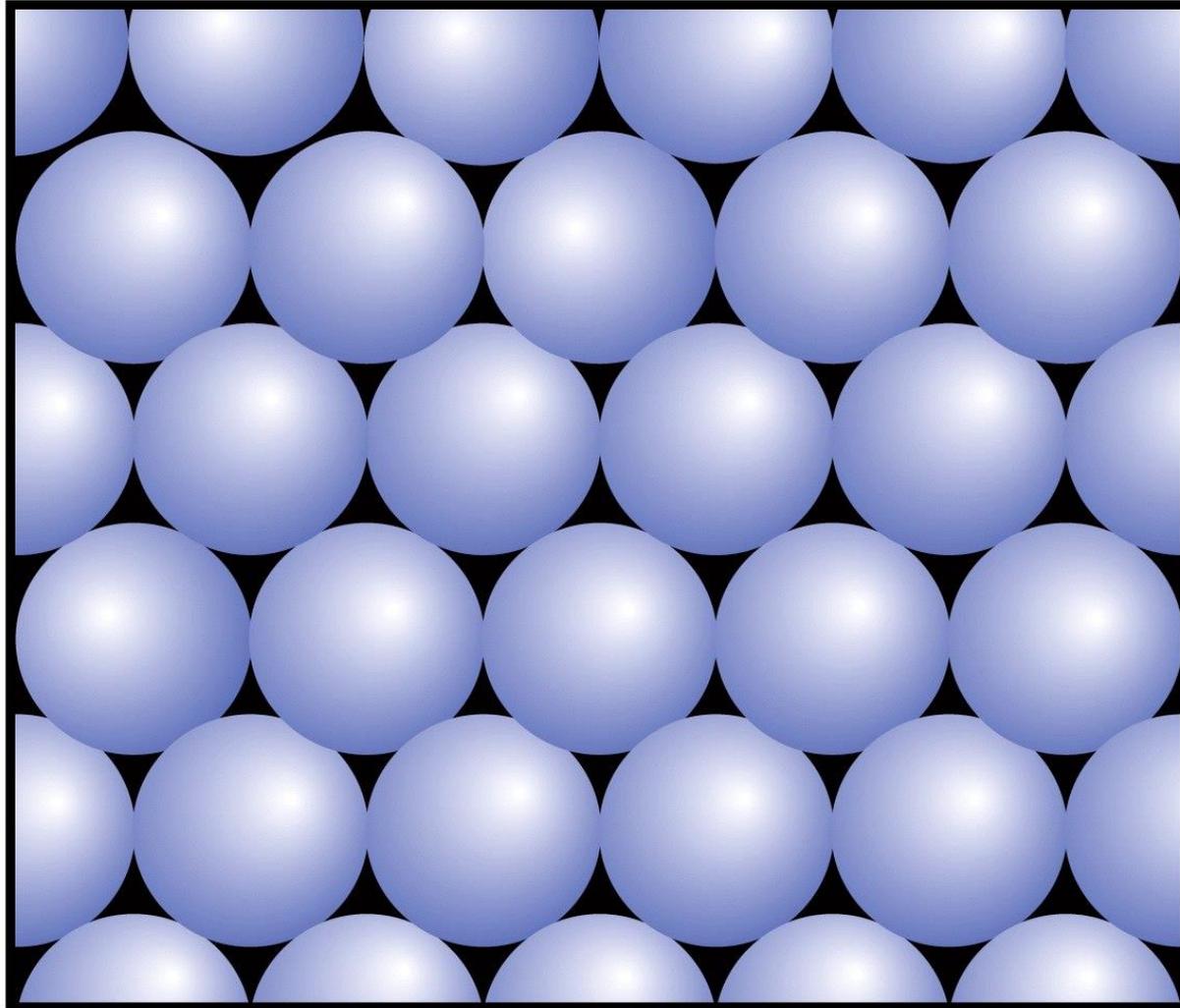


Cubica a facce
centrate, F

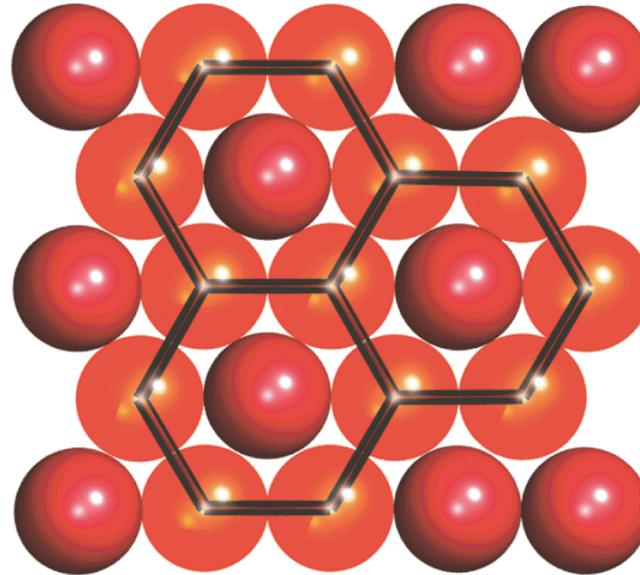


Coordinate frazionarie

Impaccamento compatto di sfere rigide

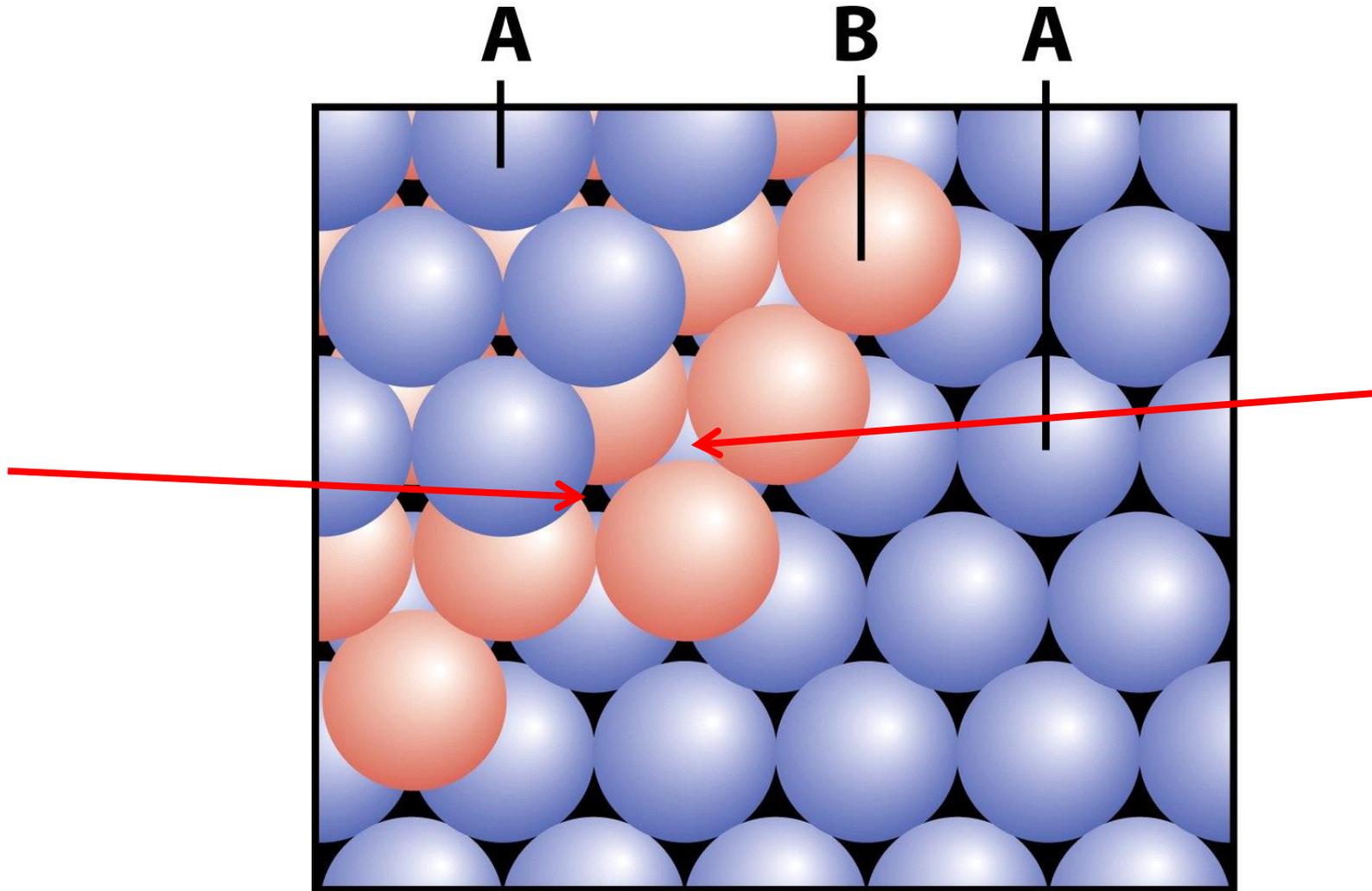


Strato di sfere a impaccamento compatto con evidenza
la coordinazione esagonale



Politipi a impaccamento compatto: ABAB....

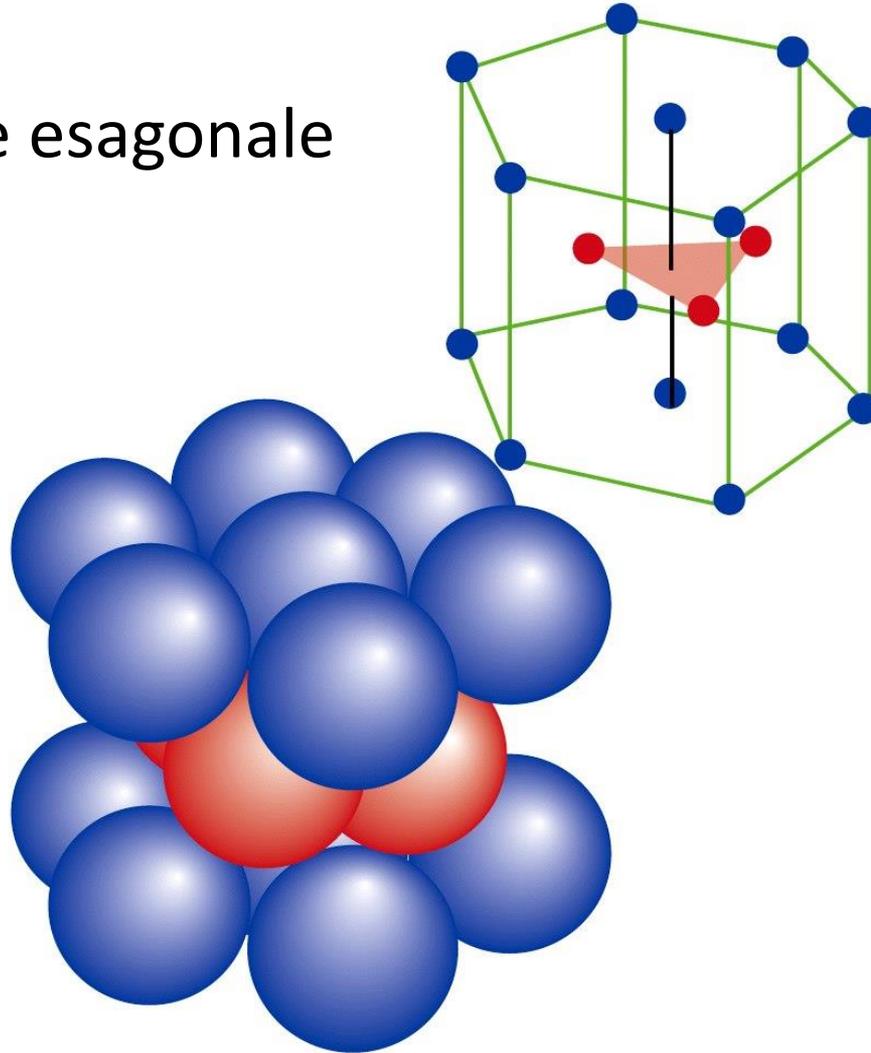
Esagonale compatto (*hcp*)



Impaccamento esagonale compatto (*hcp*)

hexagonally close packed

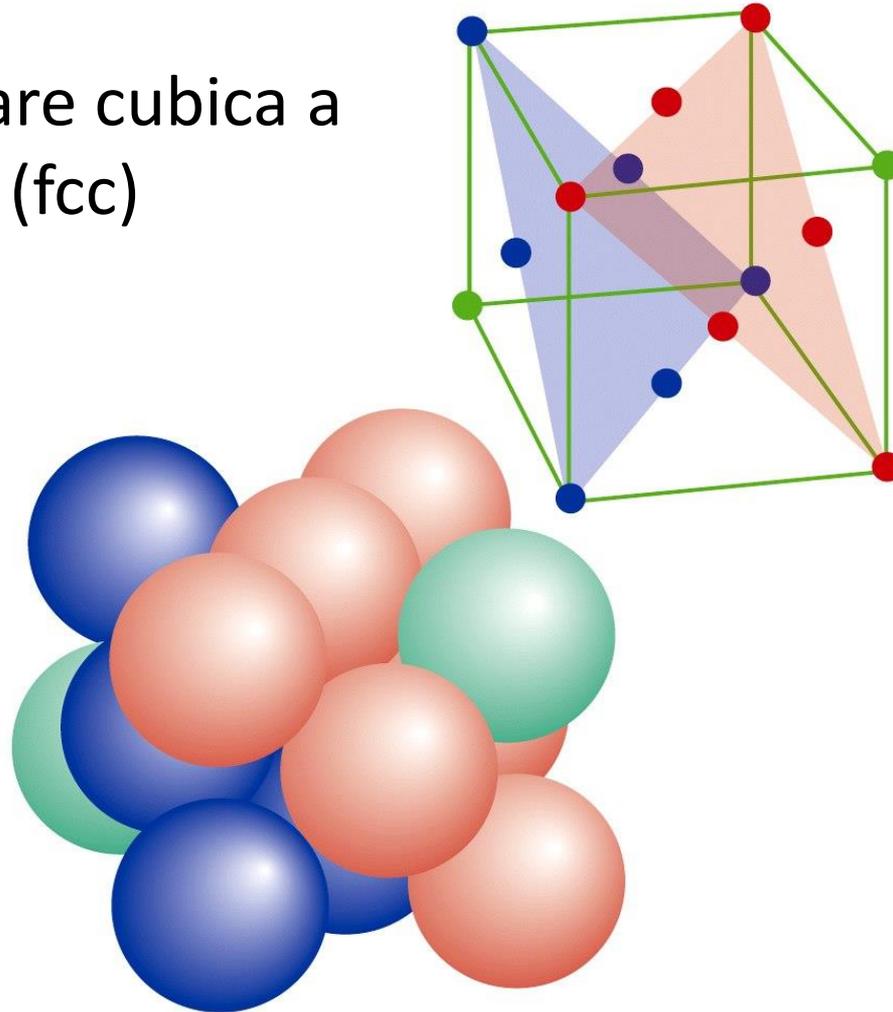
Cella elementare esagonale



Impaccamento cubico compatto (*ccp*)

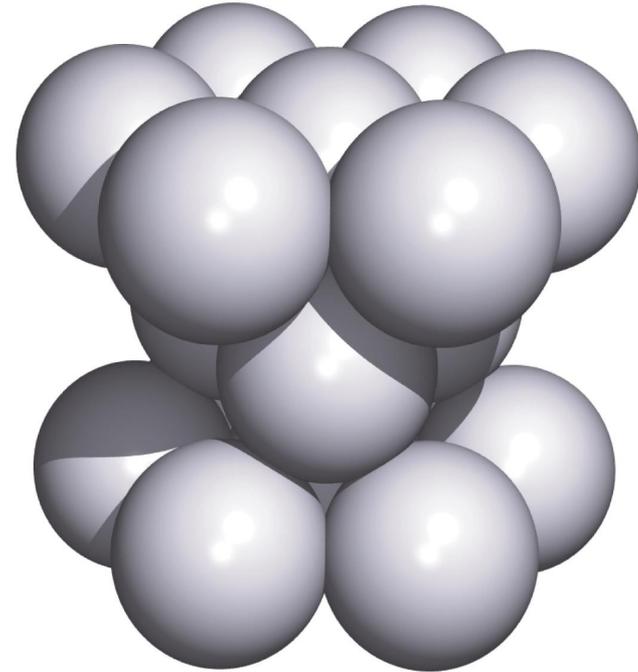
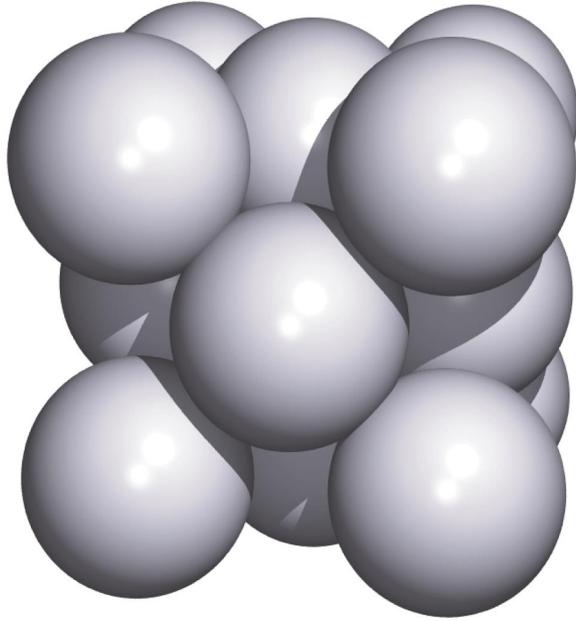
cubic close packed

Cella elementare cubica a
facce centrate (fcc)



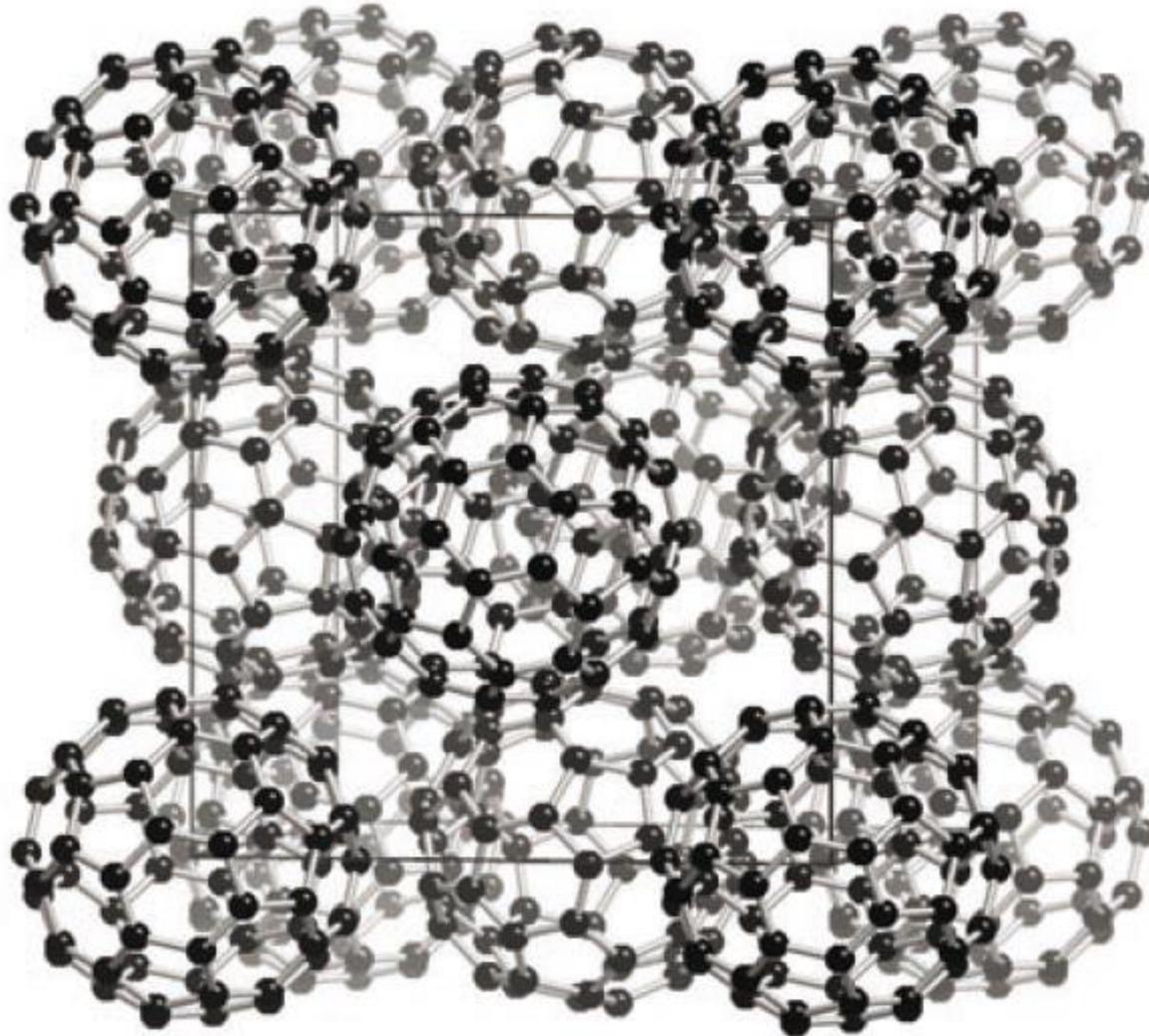
Celle elementari fcc e hcp a confronto

Numero di coordinazione 12

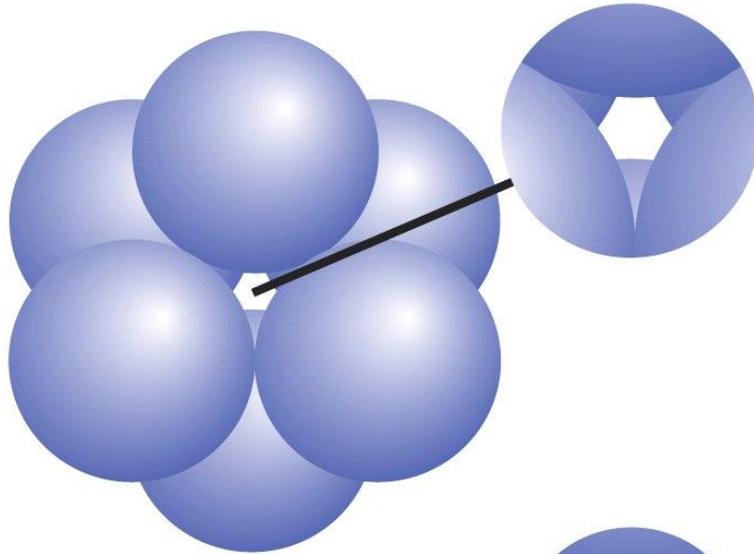


Spazio vuoto = 26%

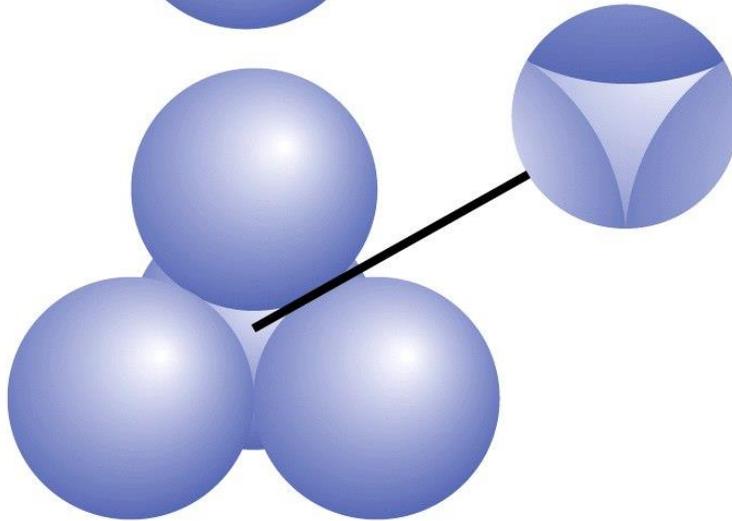
Arrangiamento ccp di C_{60}



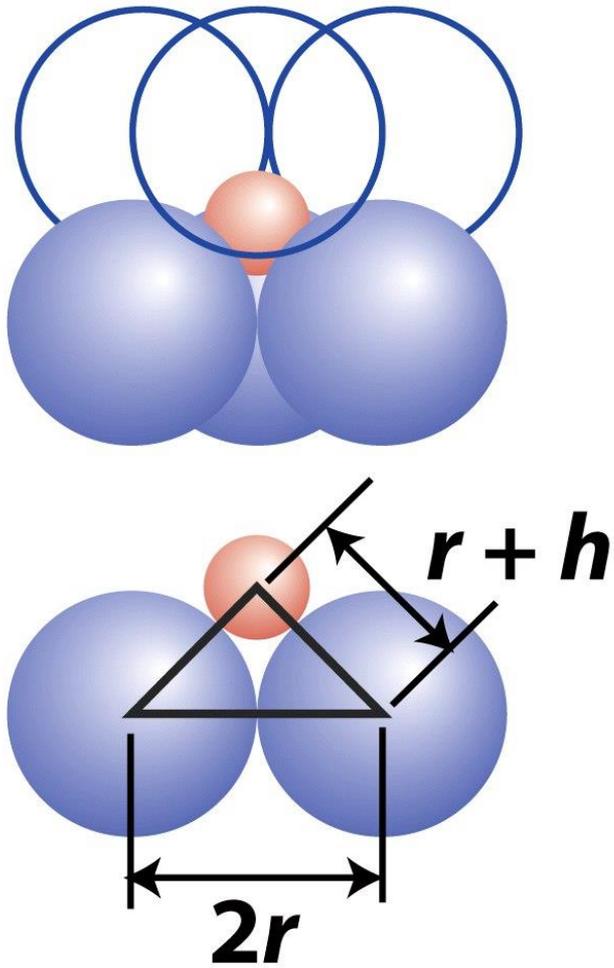
Interstizi negli impaccamenti compatti



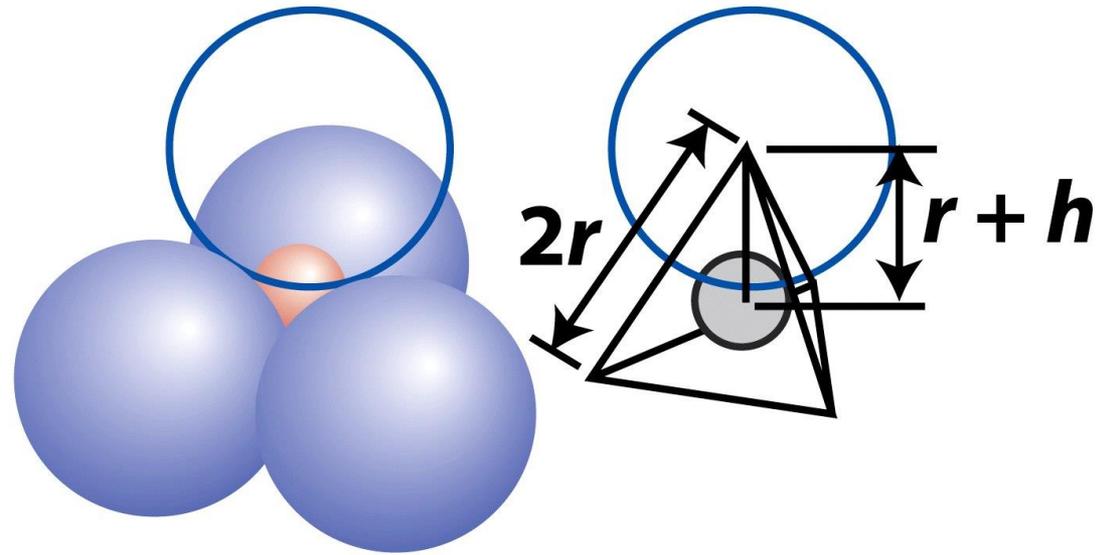
Interstizio ottaedrico
 $r_h = 0.414r$



Interstizio tetraedrico
 $r_h = 0.225r$

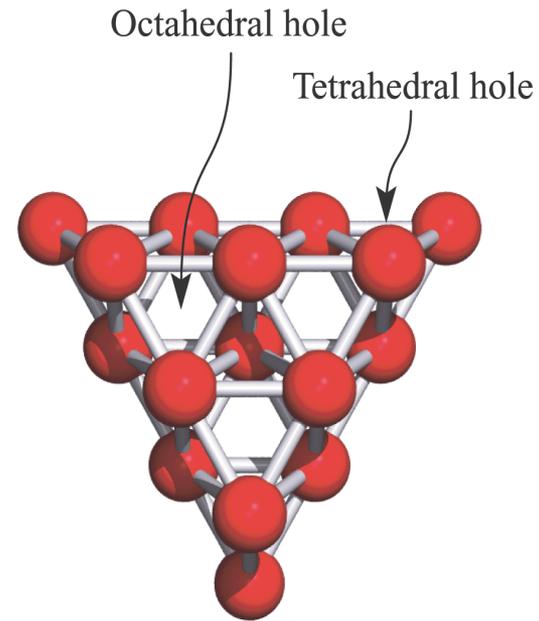
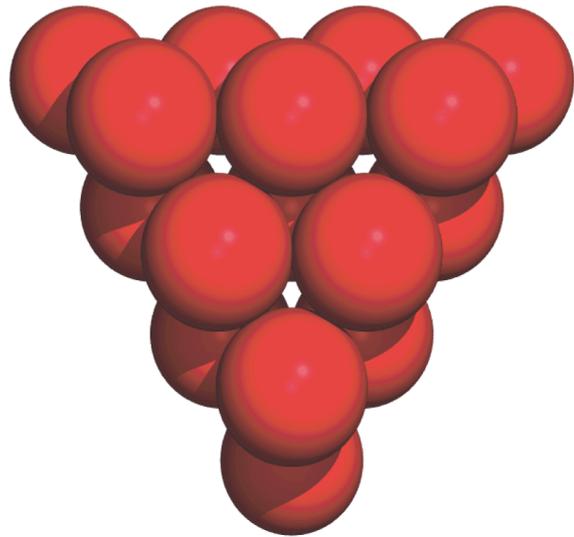


Interstizio ottaedrico
 $r_h = 0.414r$

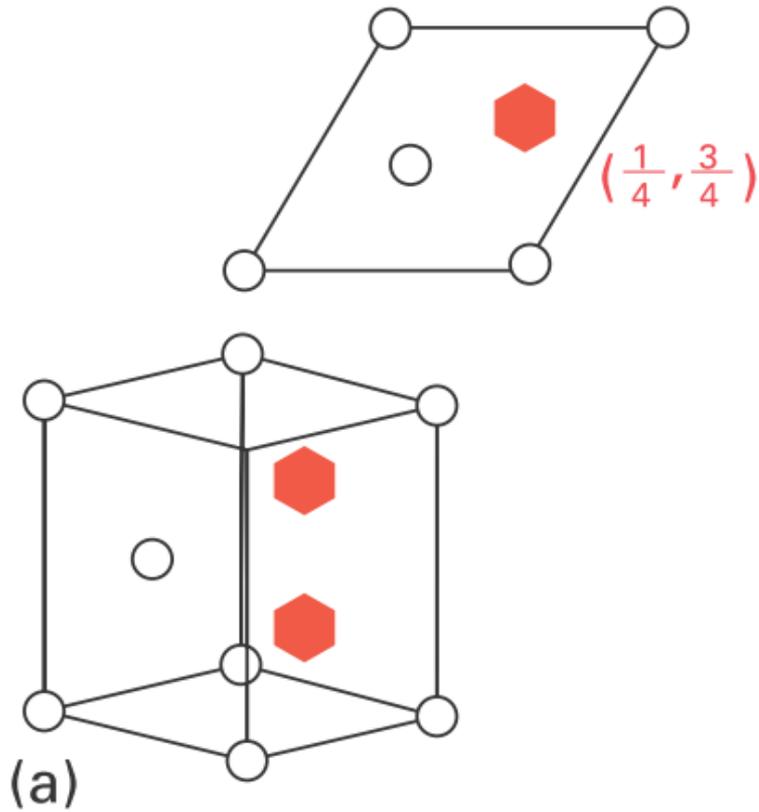


Interstizio tetraedrico
 $r_h = 0.225r$

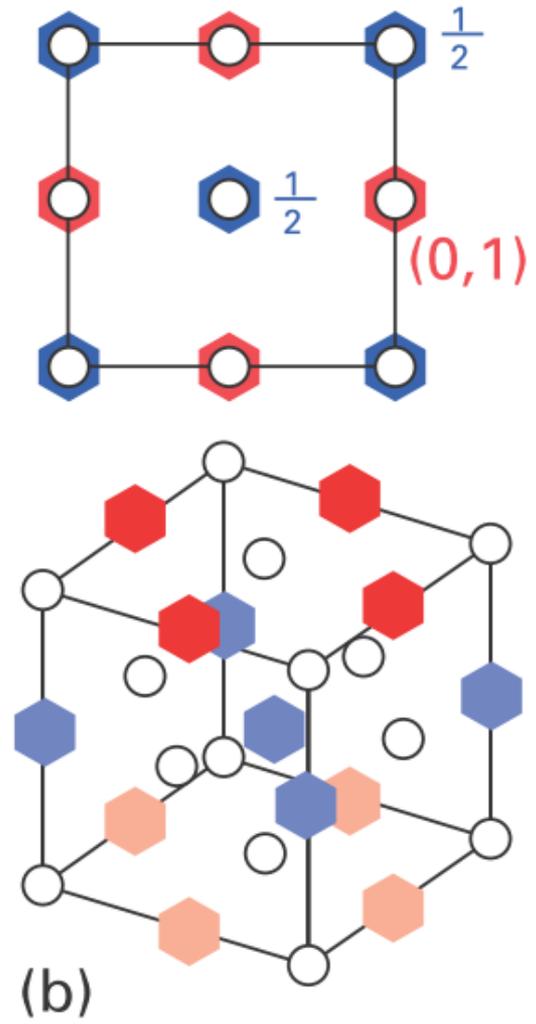
Interstizi ottaedrici e tetraedrici



Interstizi ottaedrici nelle strutture compatte

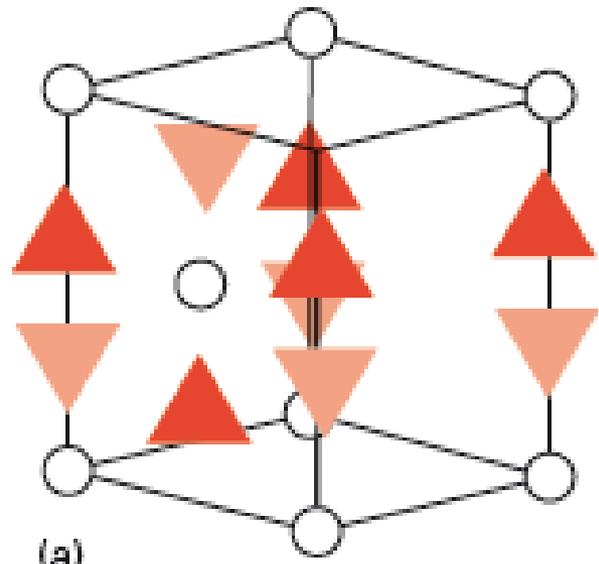
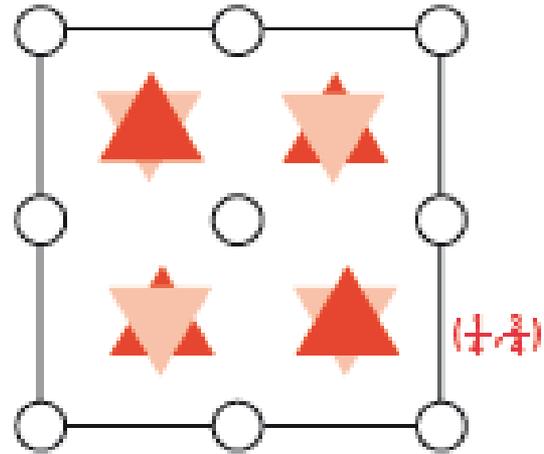
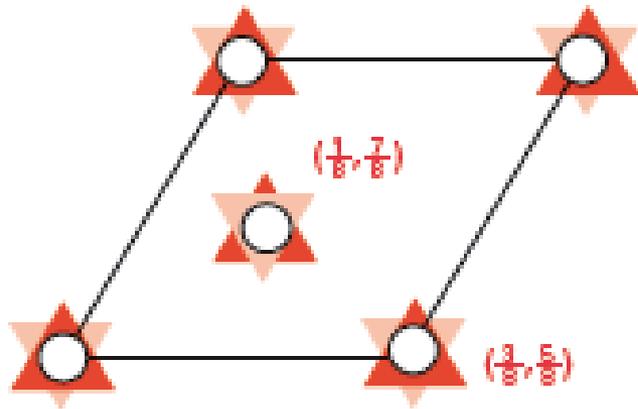


hcp

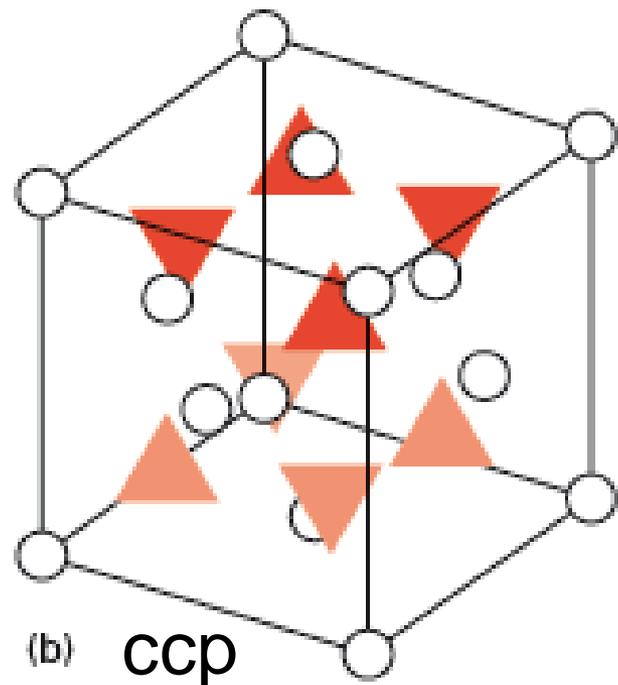


ccp

Interstizi tetraedrici nelle strutture compatte



(a) hcp



(b) ccp

Le strutture dei metalli

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

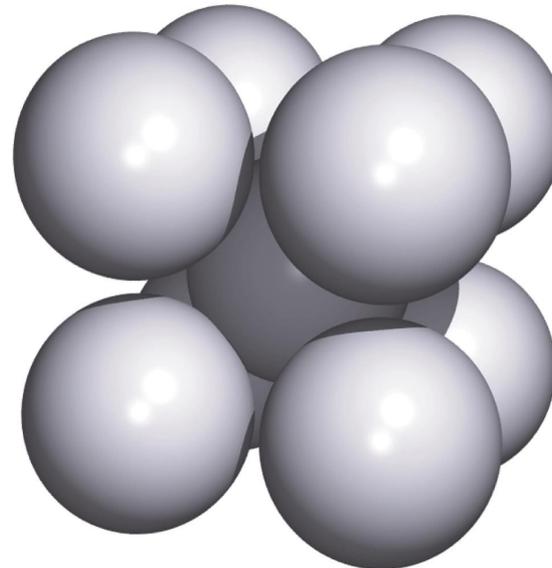
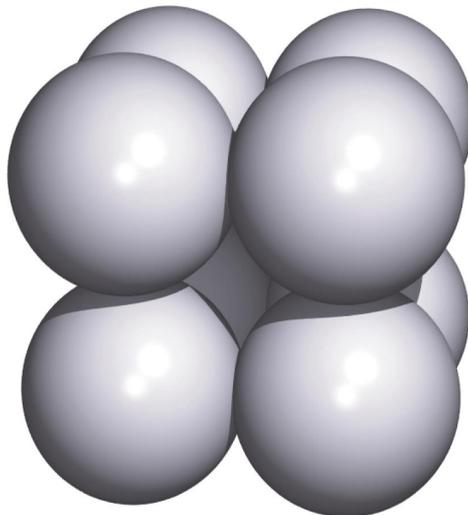
$$\rho_{\text{Pb}} = 11,3 \text{ g cm}^{-3}$$

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

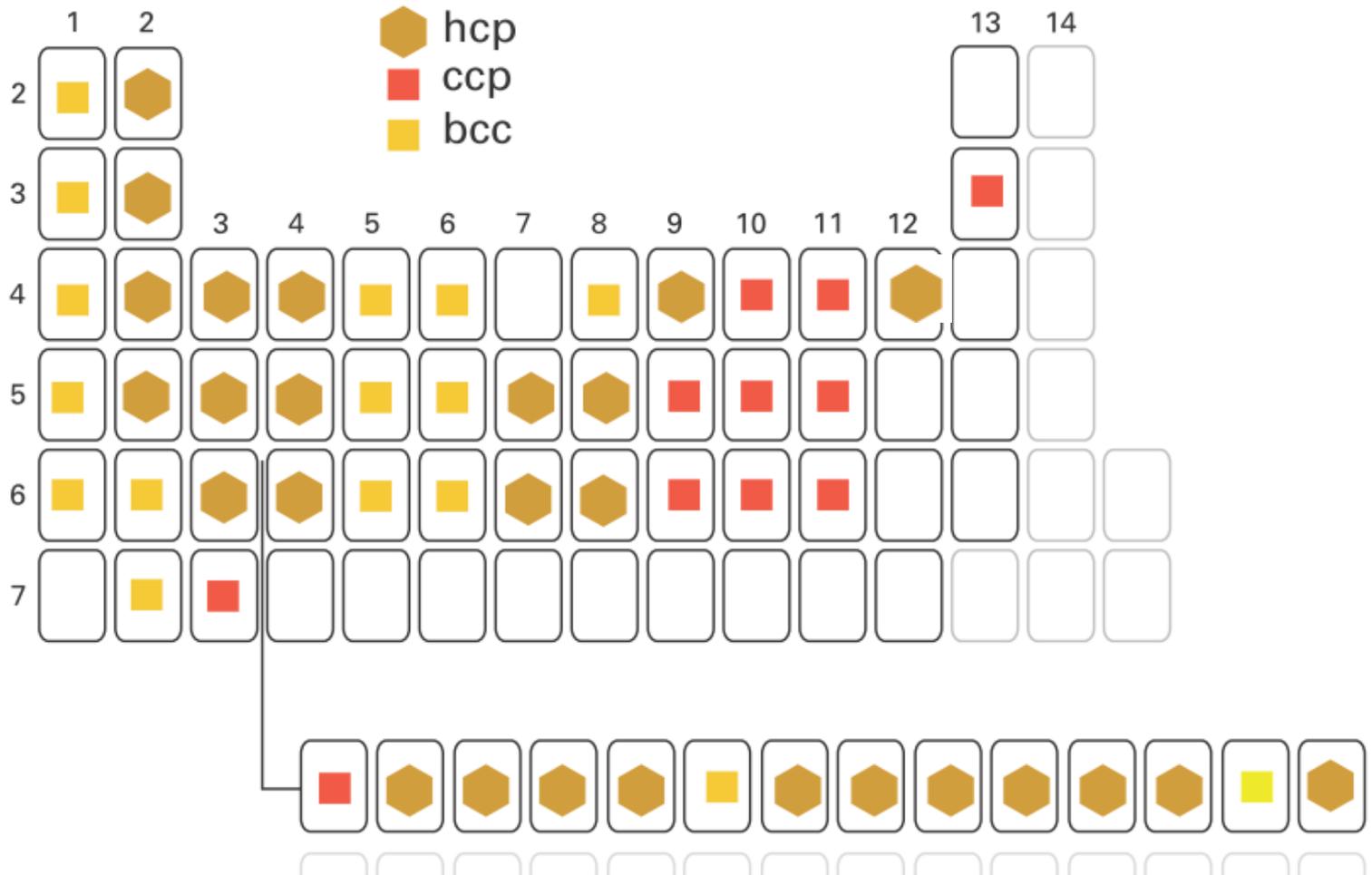
} 26% vuoto

32% vuoto

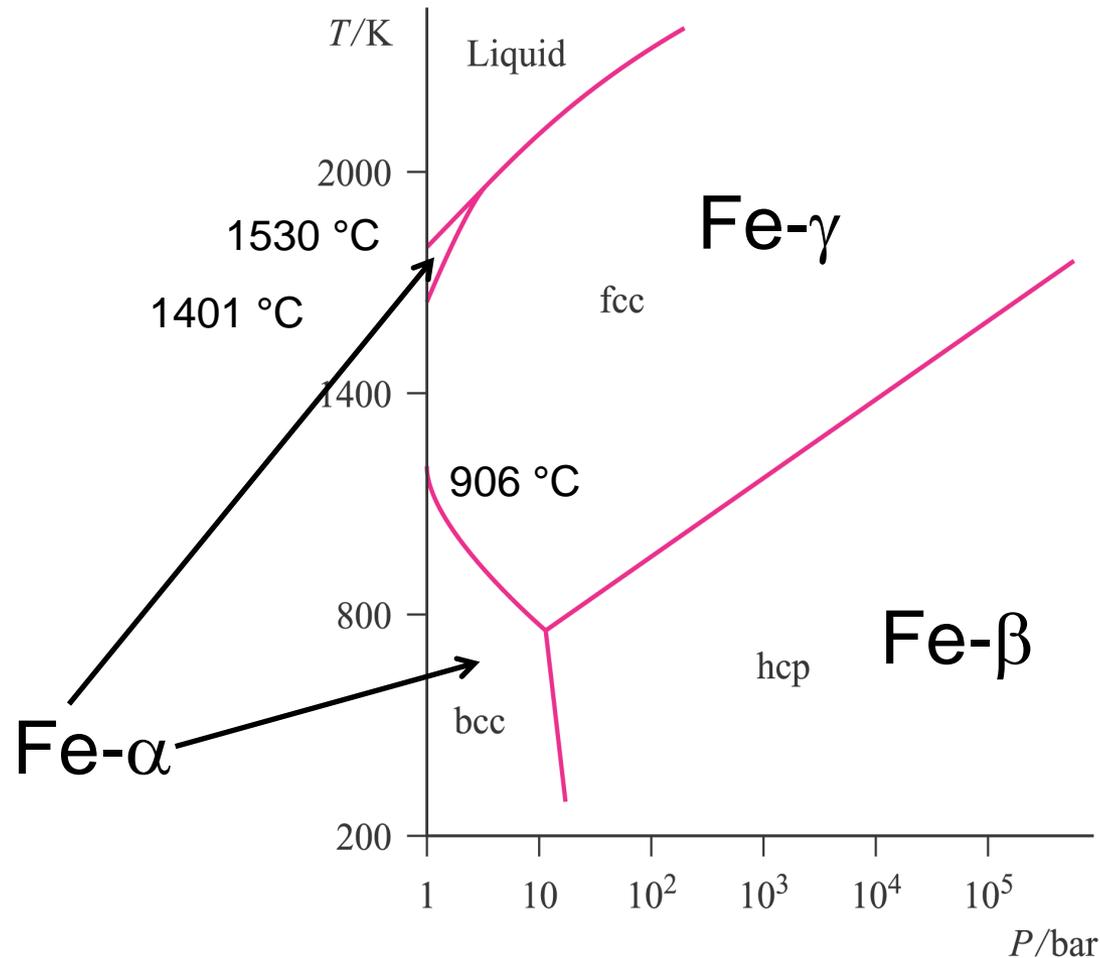
Cubica
primitiva



bcc



Polimorfismo del ferro



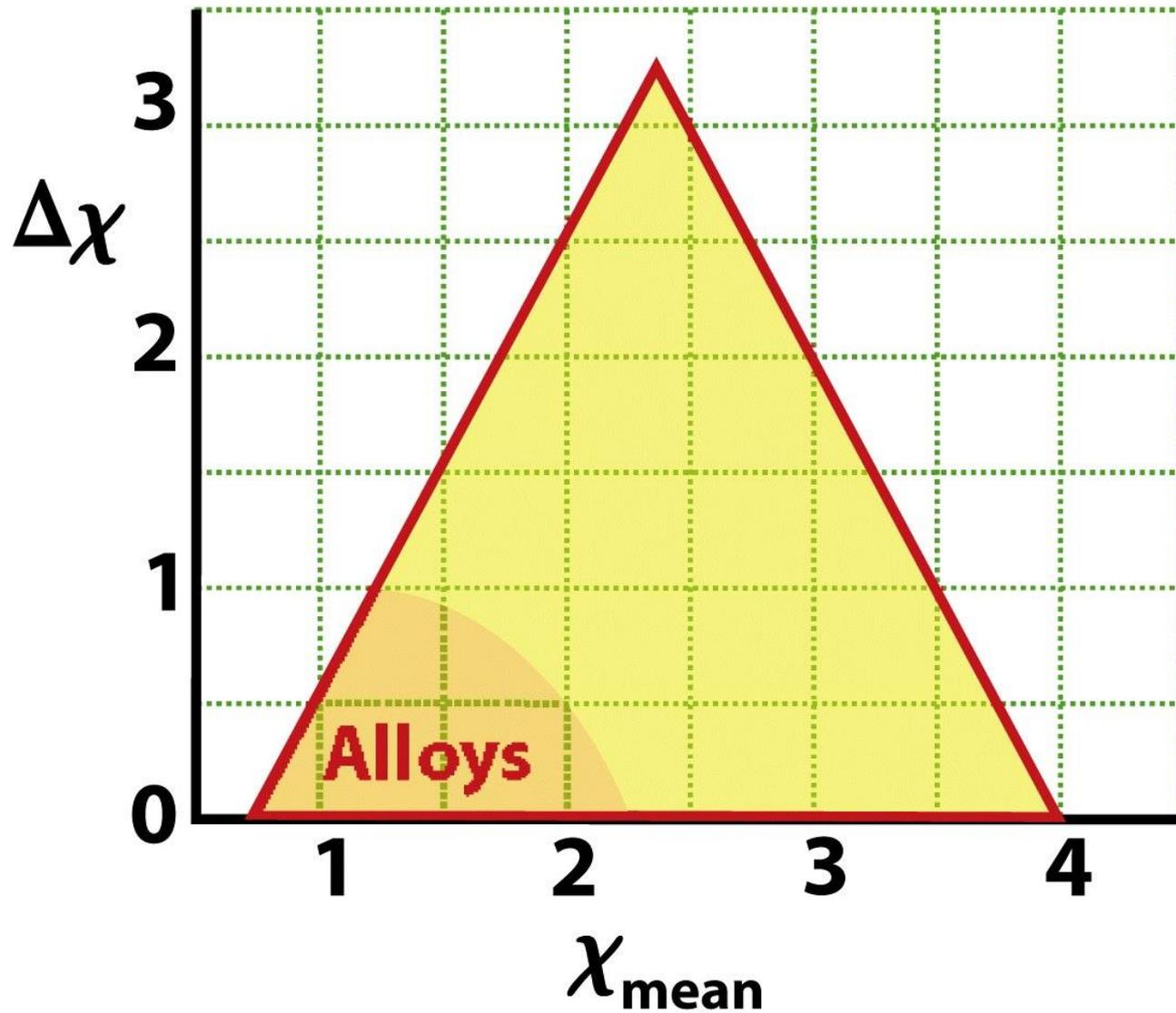
Polimorfismo = la capacità di adottare forme cristalline diverse in condizioni di pressione e temperatura differenti

Correzione di Goldschmidt dei raggi atomici

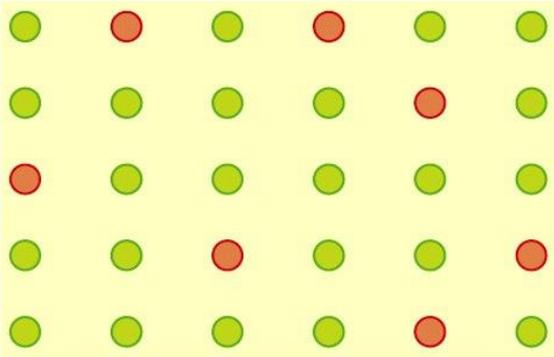
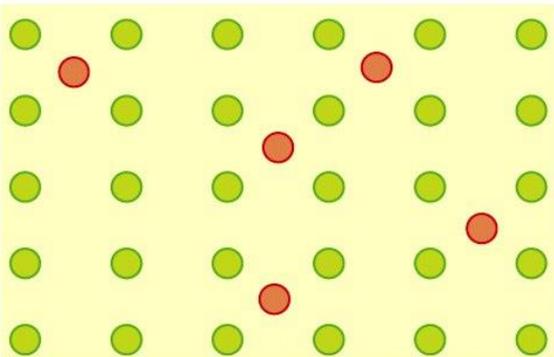
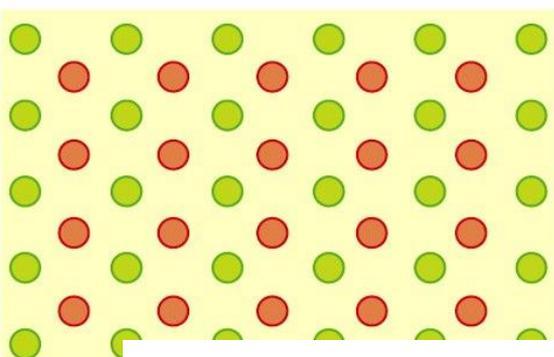
Coordination number	Relative radius
12	1
8	0.97
6	0.96
4	0.88

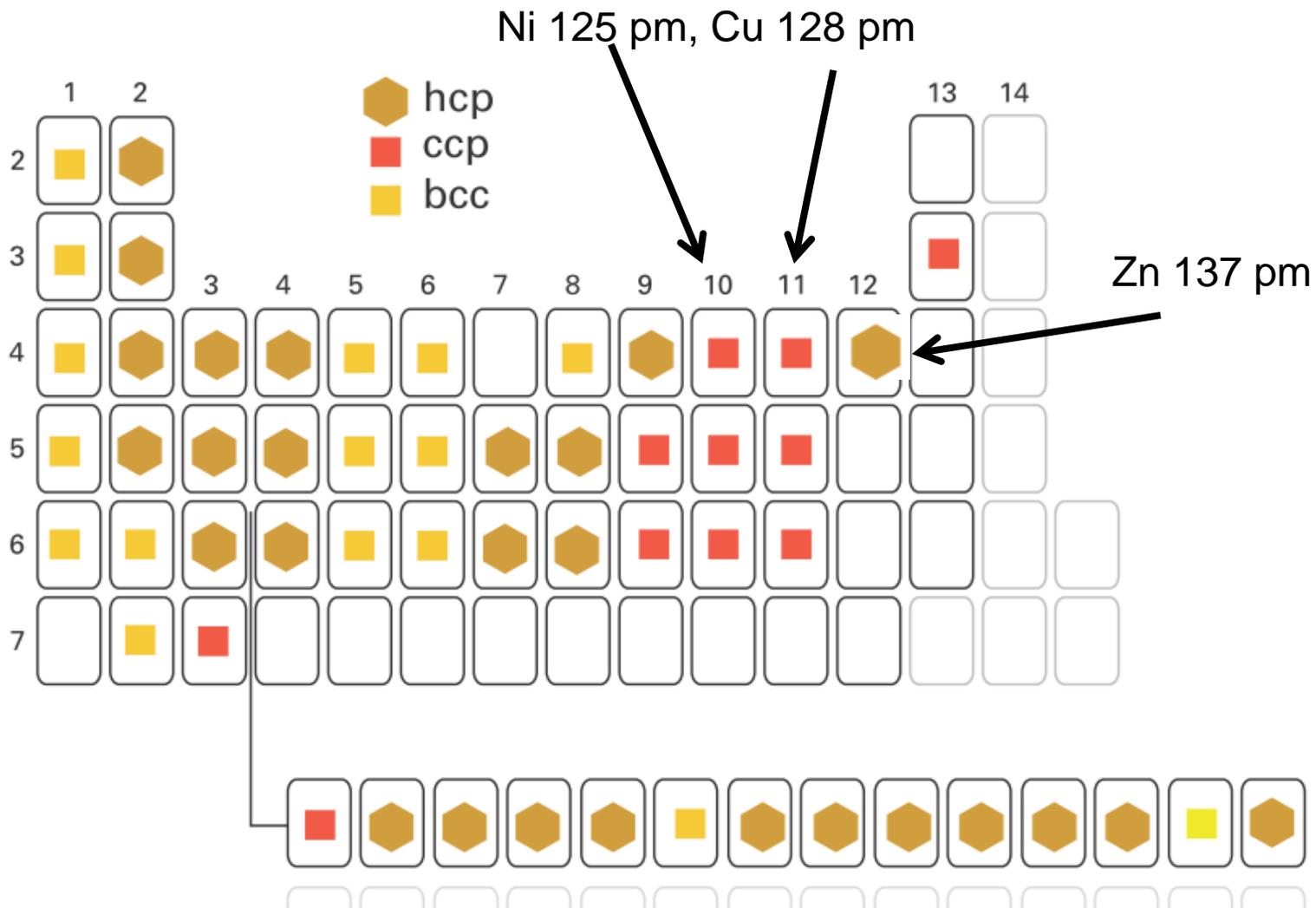
correzione di Goldschmidt = raggio metallico (ipotetico) in una struttura a impaccamento compatto con coordinazione 12.

Leghe metalliche



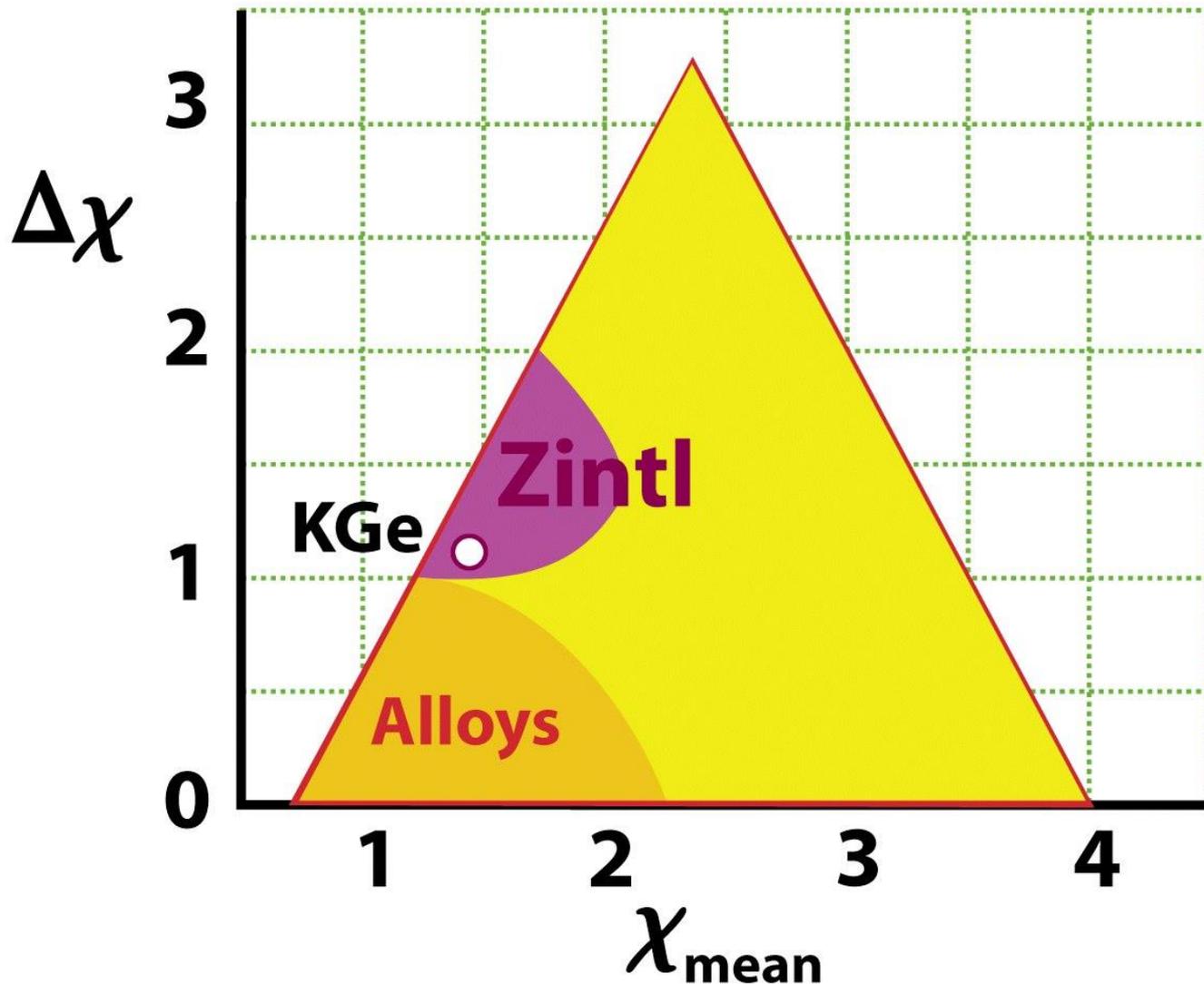
Leghe metalliche

- (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 α), 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



Composti intermetallici o *fasi di Zintl*

ottone- β (CuZn), MgZn_2 , Cu_3Au , NaTl , $\text{Na}_5\text{Zn}_{21}$



Struttura della *fase di Zintl* KGe

