

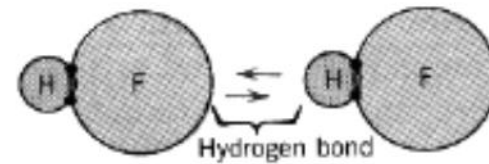
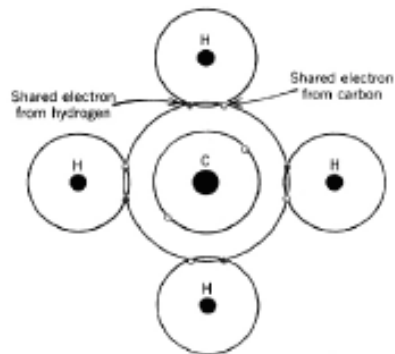
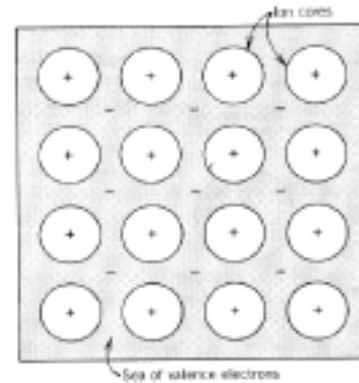
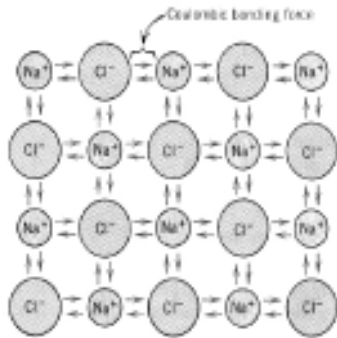
02

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# CIÊNCIA E ENGENHARIA DOS MATERIAIS

Engenharia de Produção / Engenharia Mecânica  
Prof. Luis Fernando Maffeis Martins

# Lembrando...



# Classificação dos materiais

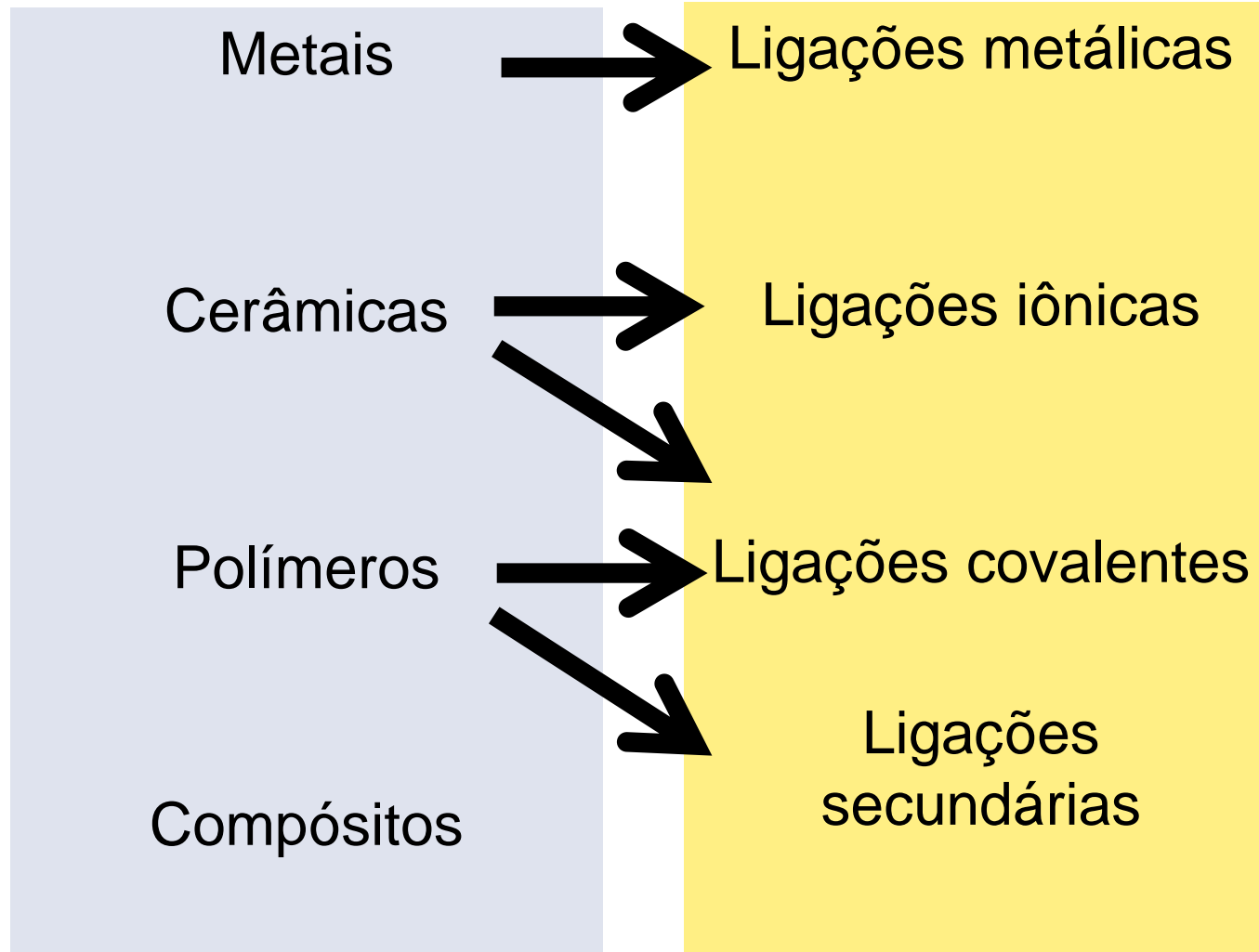
Metais

Cerâmicas

Polímeros

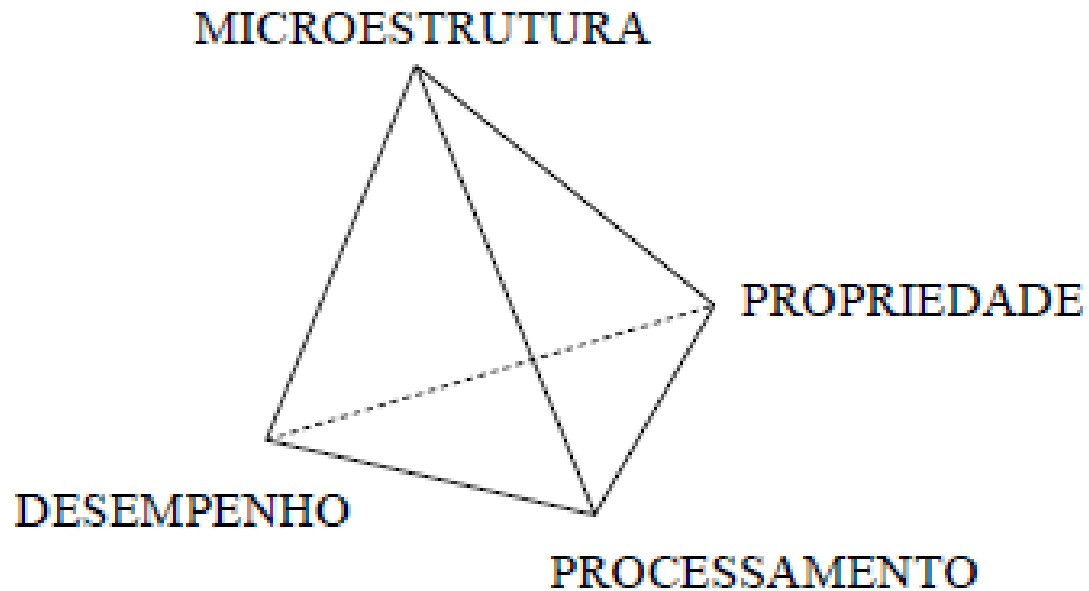
Compósitos

# Classificação dos materiais





# Tetraedro dos materiais



# Estrutura dos sólidos cristalinos

- Materiais sólidos podem ser classificados em função da regularidade com a qual os átomos ou íons são agrupados uns em relação aos outros.



Cristalinos

Não  
cristalinos  
(amorfo)

# Estrutura dos sólidos cristalinos

- Cristal: sólido cujos átomos estão agrupados em um reticulado periódico tridimensional ao longo de grandes distâncias atômicas





# Estrutura dos sólidos cristalinos



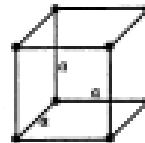
X



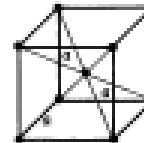
# Estrutura dos sólidos cristalinos



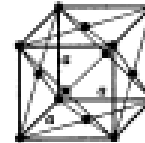
# Reticulados de Bravais



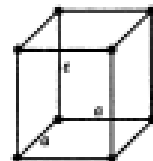
Cúbico Simples (P)



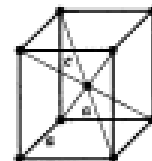
Cúbico de Corpo Centrado (I)



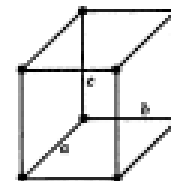
Cúbico de Faces Centradas (F)



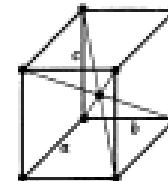
Tetragonal Simples (P)



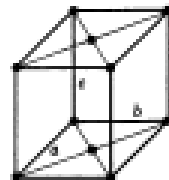
Tetragonal de Corpo Centrado (I)



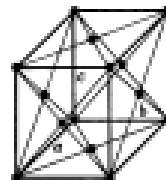
Ortorômbico Simples (P)



Ortorômbico de Corpo Centrado (I)



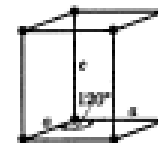
Ortorômbico de Base Centrada (C)



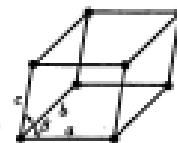
Ortorômbico de Faces Centradas (F)



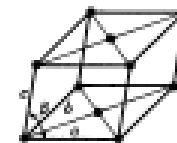
Rombôidrico (R)



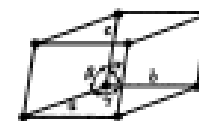
Hexagonal (P)



Monoclinico Simples (P)



Monoclinico de Base Centrada (C)



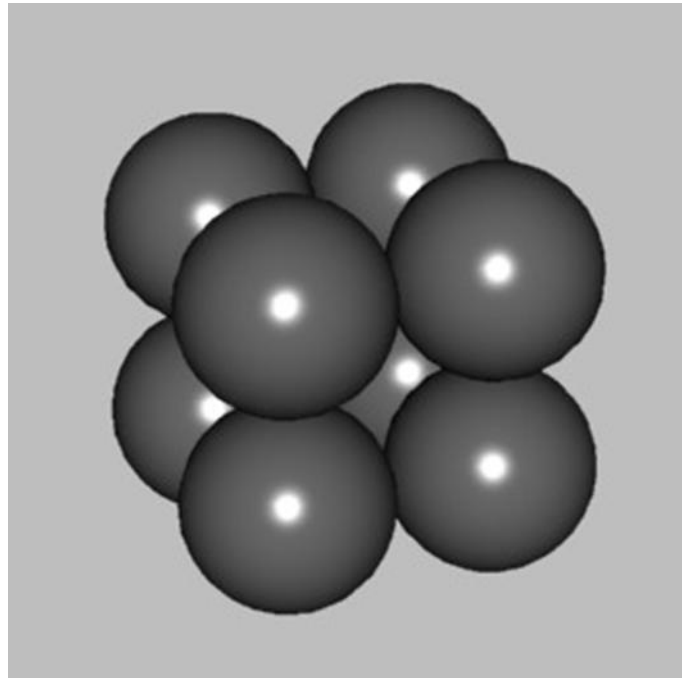
Triclinico (P)

# Reticulados de Bravais

Sistema	Parâmetros de rede	Ângulos
cúbico	$a = b = c$	$\alpha = \beta = \gamma = 90^\circ$
tetragonal	$a = b \neq c$	$\alpha = \beta = \gamma = 90^\circ$
ortorrômbico	$a \neq b \neq c$	$\alpha = \beta = \gamma = 90^\circ$
romboédrico	$a = b = c$	$\alpha \neq \beta \neq \gamma \neq 90^\circ$
hexagonal	$a = b \neq c$	$\alpha = \beta = 90^\circ; \gamma = 120^\circ$
monoclínico	$a \neq b \neq c$	$\alpha = \gamma = 90^\circ; \beta > 90^\circ$
triclínico	$a \neq b \neq c$	$\alpha \neq \beta \neq \gamma \neq 90^\circ$

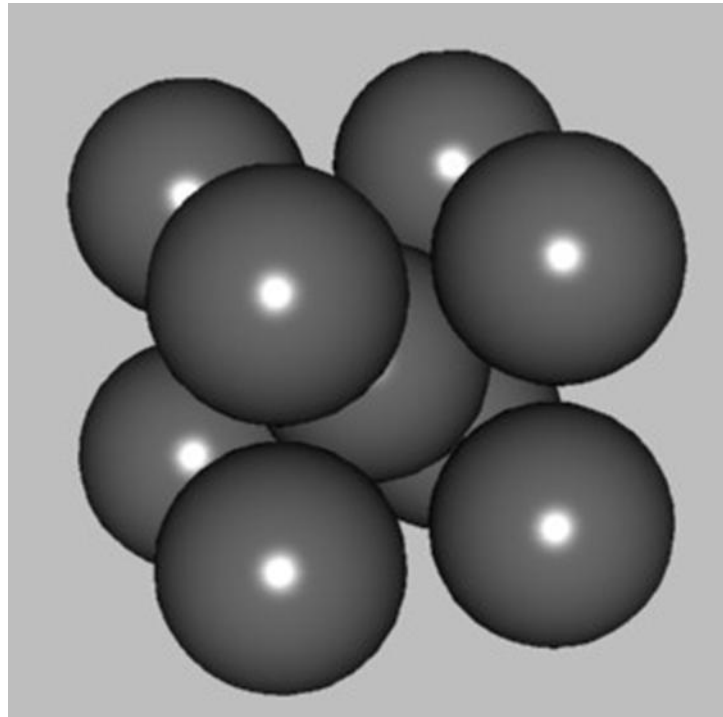
# Principais estruturas cristalinas

- Cúbica simples



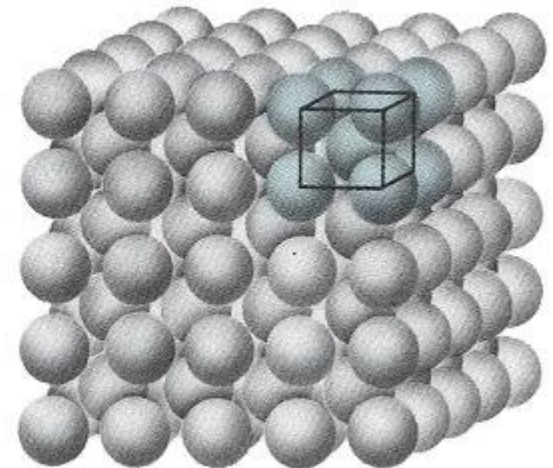
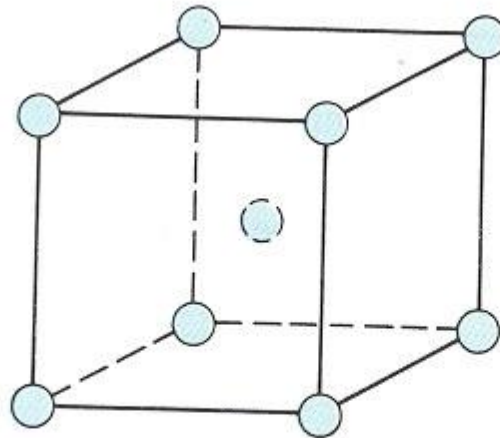
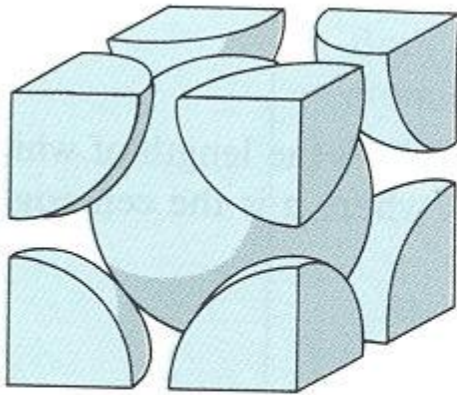
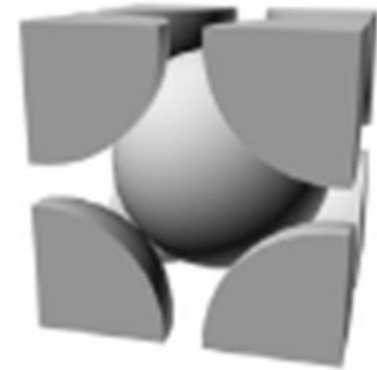
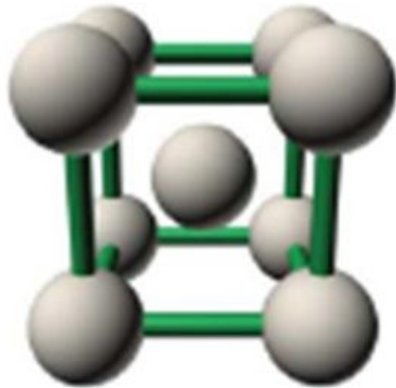
# Principais estruturas cristalinas

- Cúbica de corpo centrado - CCC



# Principais estruturas cristalinas

- Cúbica de corpo centrado - CCC

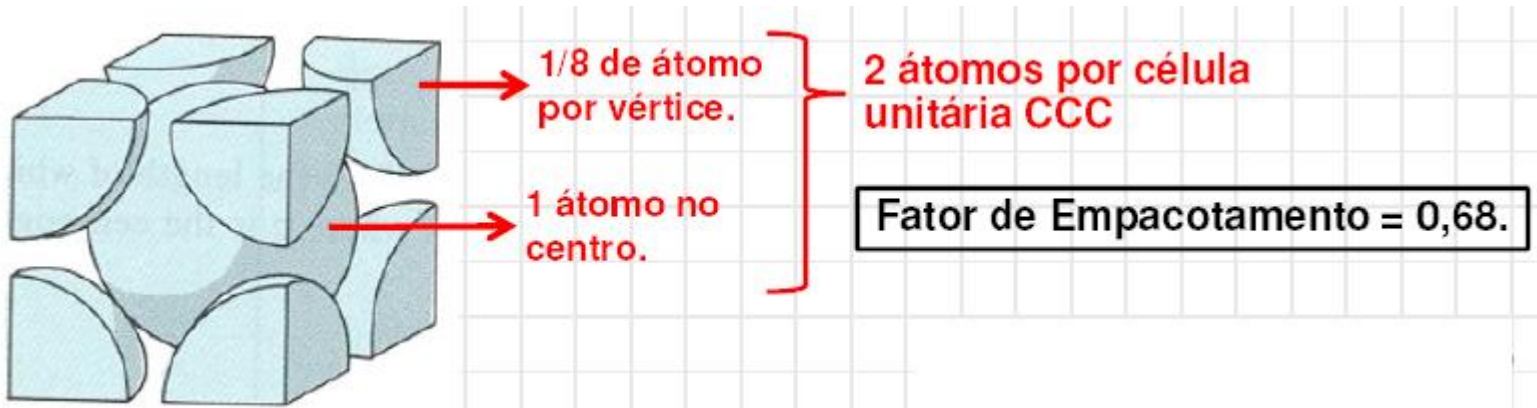


(a)

(b)

# Principais estruturas cristalinas

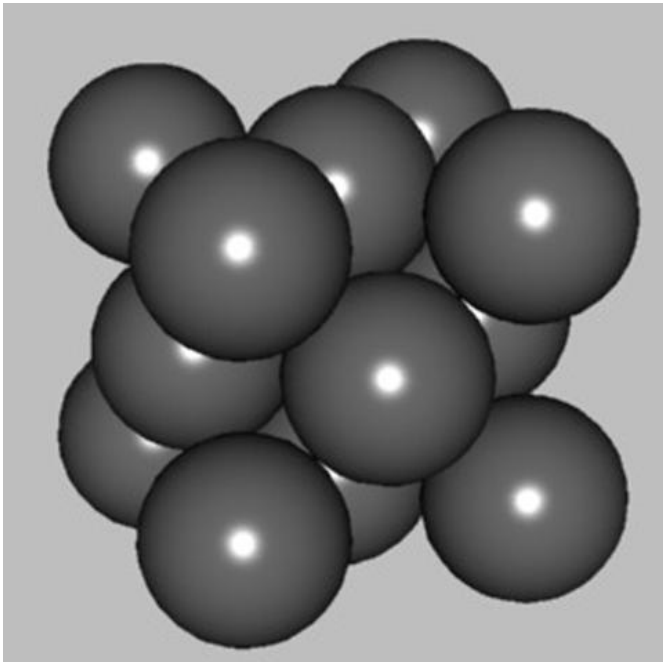
- Cúbica de corpo centrado - CCC





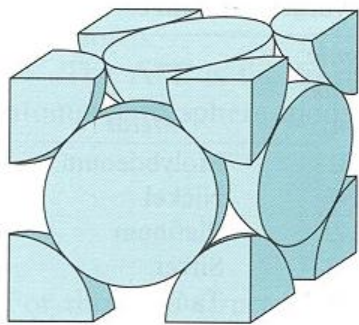
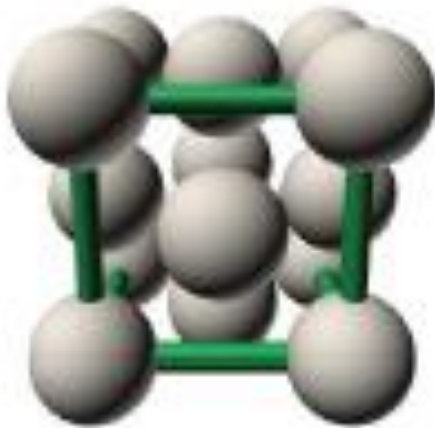
# Principais estruturas cristalinas

- Cúbica de faces centradas - CFC

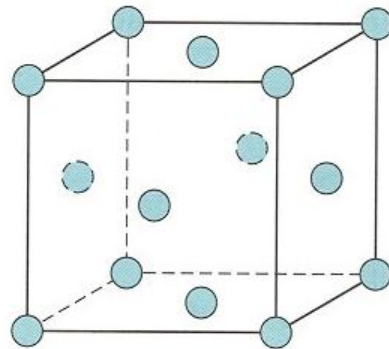


# Principais estruturas cristalinas

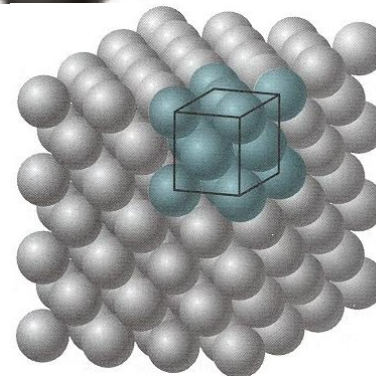
- Cúbica de faces centradas - CFC



(a)

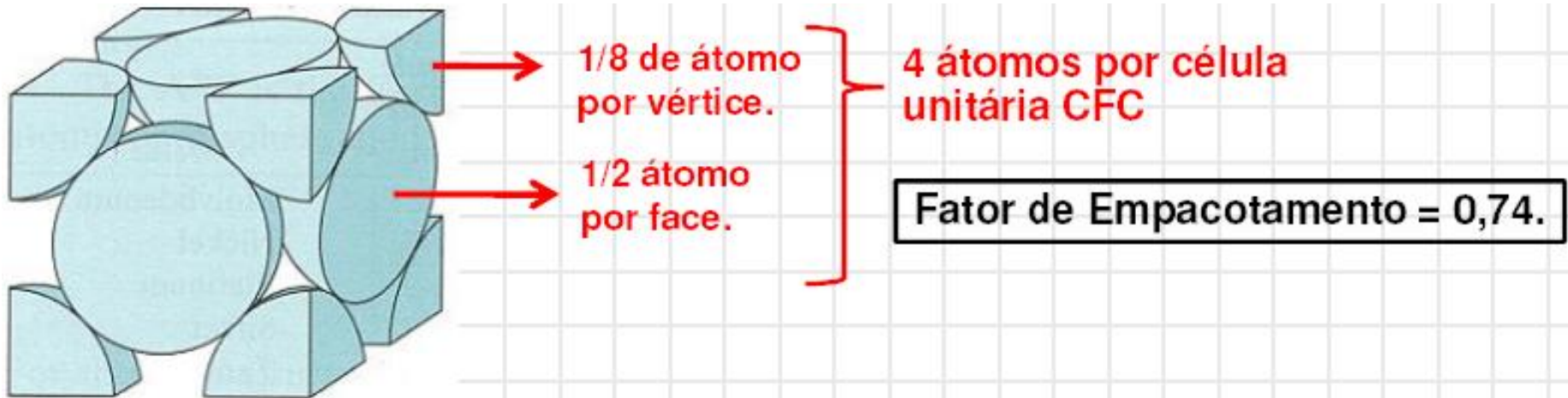


(b)



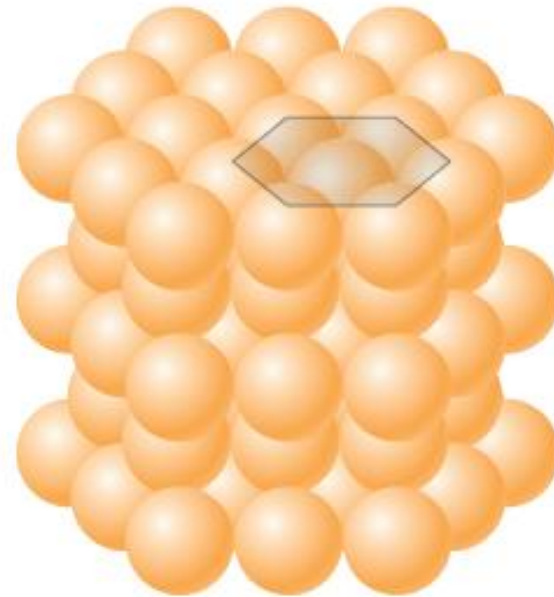
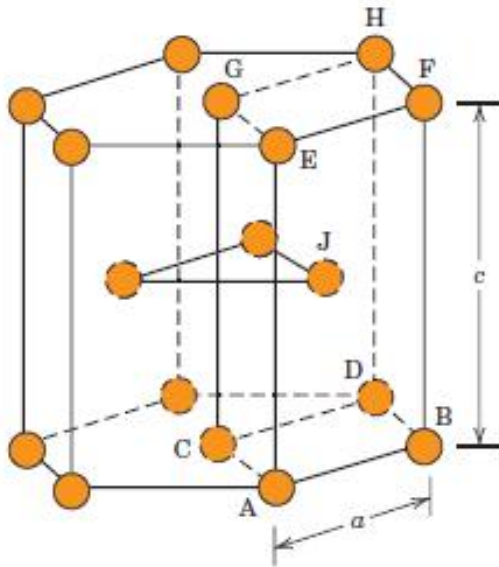
# Principais estruturas cristalinas

- Cúbica de faces centradas - CFC



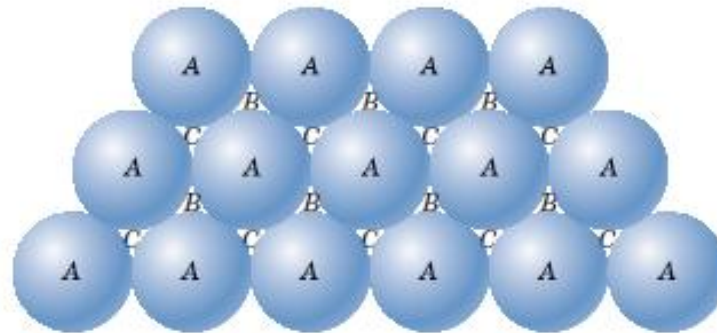
# Principais estruturas cristalinas

- Hexagonal compacta - HC

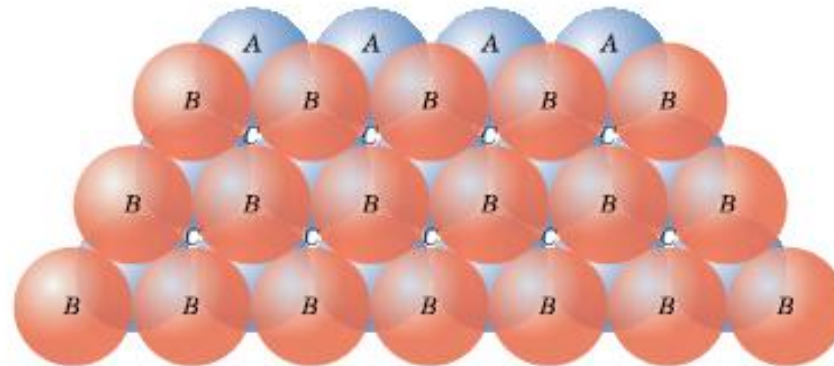


# Principais estruturas cristalinas

- Hexagonal compacta - HC



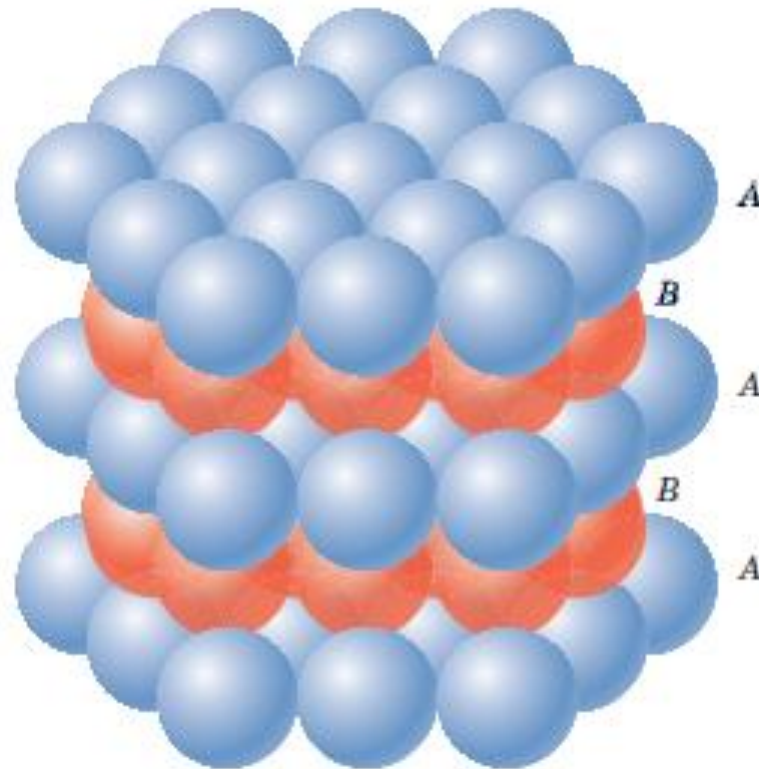
(a)



(b)

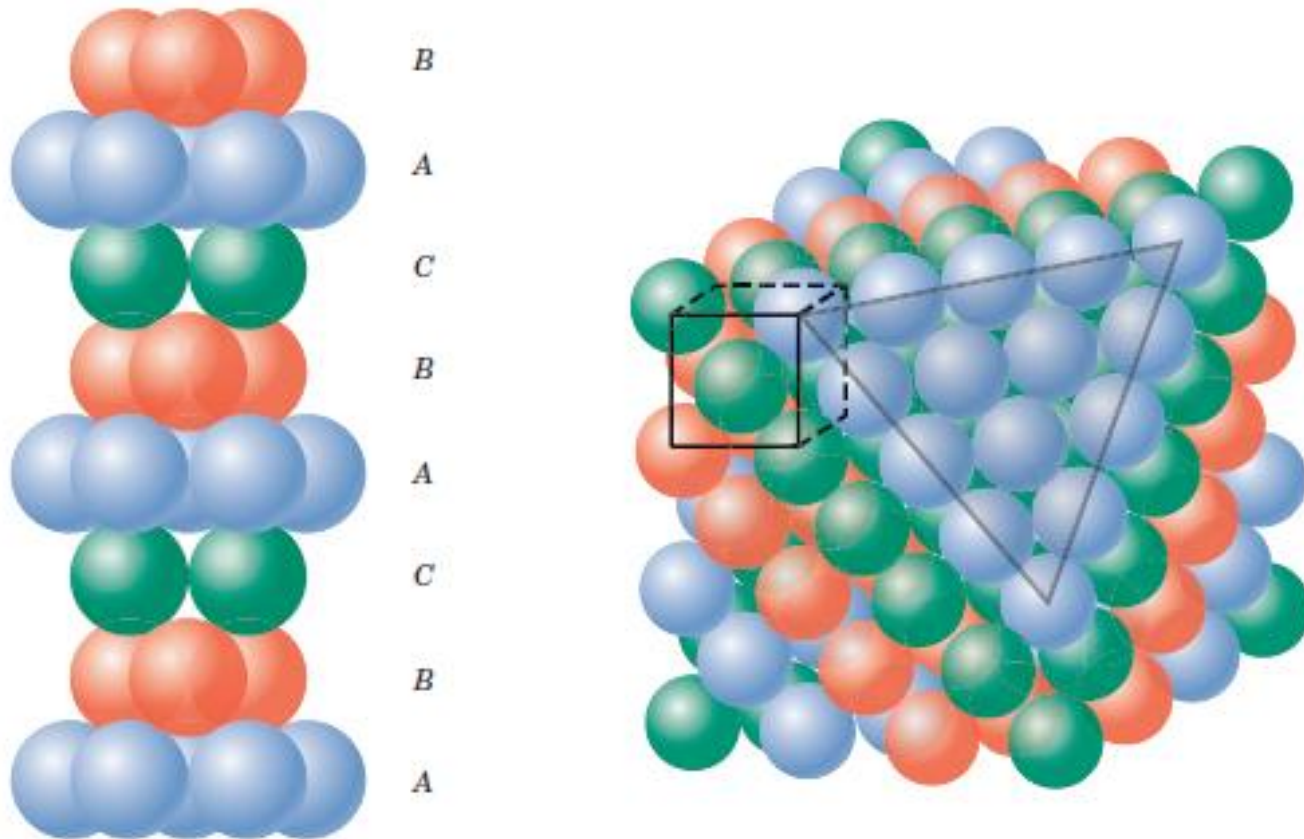
# Principais estruturas cristalinas

- Hexagonal compacta - HC



# Principais estruturas cristalinas

- Cúbica de faces centradas



# Principais estruturas cristalinas

Estrutura	Metal
CFC	Ag, Al, Au, Ca, Co- $\beta$ , Cu, Fe- $\gamma$ , Ni, Pb, Pd, Pt, Rh, Sr
HC	Be, Cd, Co- $\alpha$ , Hf- $\alpha$ , Mg, Os, Re, Ru, Ti- $\alpha$ , Y, Zn, Zr- $\alpha$
CCC	Ba, Cr, Cs, Fe- $\alpha$ , Fe- $\delta$ , Hf- $\beta$ , K, Li, Mo, Na, Nb, Rb, Ta, Ti- $\beta$ , V, W, Zr- $\beta$