السلسلة رقم (2): قرائن ميلر و الشبكة المعكوسة. جانفي 2021

التمرين الأول:

برهن أن شعاع الشبكة المعكوسة $\mathbf{G}_{hkl}$ عمودي على المستوى البلوري (hkl)؟

التمرين الثاني:

برهن أن طويلة الشعاع في الشبكة المعكوسة $\mathbf{G}_{hkl}$ يتناسب مع مقلوب البعد العمودي بين المستويات البلورية (hkl)؟

التمرين رقم 3:

برهن ان الكثافة العقدية السطحية للمستويات البلورية المتوازية (hkl) تساوي $\delta=d_{hkl}/v$ بحيث v هو حجم الخلية الأساسية و d_{hkl} هو البعد العمودي بين المستويات؟

التمرين رقم 4:

بالاعتماد على التمرين رقم 3 برهن ان الكثافة العقدية السطحية تكون اكبر ما يمكن للمستويات المتوازية (111) في البلورة المكعبة الممركزة السطوح، و للمستويات (110) للبلورة المكعبة الممركزة الجسم؟

التمرين رقم 5:

Draw the following direction vectors in cubic unit cells:

a. [100] and [110]
b. [112]
c. $[\bar{1}10]$
d. $[\bar{3}2\bar{1}]$
e. Find the angle between [100] and $[\bar{1}10]$
f. Find the angle between [112] and $[\bar{1}10]$

التمرين رقم 6:

Determine the direction indices of the cubic direction shown in Figure EP3.5*a*.

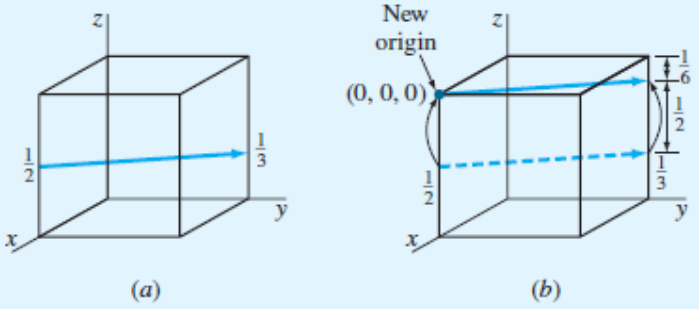

Figure EP3.5

التمرين رقم 7:

Determine the direction indices of the cubic direction between the position coordinates $\left(\frac{3}{4}, 0, \frac{1}{4}\right)$ and $\left(\frac{1}{4}, \frac{1}{2}, \frac{1}{2}\right)$.

التمرين رقم 8:

Draw the following crystallographic planes in cubic unit cells:

a. (101)
b. $(1\bar{1}0)$
c. (221)
d. Draw a (110) plane in a BCC atomic-site unit cell, and list the position coordinates of the atoms whose centers are intersected by this plane.

التمرين رقم 9:

Determine the Miller indices of the cubic crystallographic plane shown in Figure EP3.8*a*.

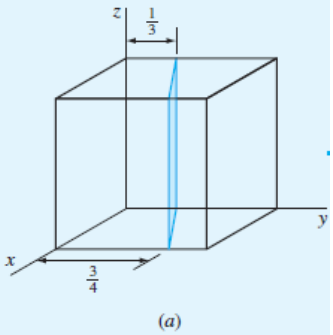

Figure EP3.8

التمرين رقم 10:

Determine the Miller indices of the cubic crystal plane that intersects the position coordinates $(1, \frac{1}{4}, 0)$, $(1, 1, \frac{1}{2})$, $(\frac{3}{4}, 1, \frac{1}{4})$, and all coordinate axes.

التمرين رقم 11:

Copper has an FCC crystal structure and a unit cell with a lattice constant of 0.361 nm. What is its interplanar spacing d_{220}?

التمرين رقم 12:

Copper has an FCC crystal structure and an atomic radius of 0.1278 nm. Assuming the atoms to be hard spheres that touch each other along the face diagonals of the FCC unit cell as shown in Figure 3.7, calculate a theoretical value for the density of copper in mega-grams per cubic meter. The atomic mass of copper is 63.54 g/mol.

التمرين رقم 13:

Calculate the planar atomic density ρ_p on the (110) plane of the α iron BCC lattice in atoms per square millimeter. The lattice constant of α iron is 0.287 nm.

التمرين رقم 14:

Calculate the linear atomic density ρ_l in the [110] direction in the copper crystal lattice in atoms per millimeter. Copper is FCC and has a lattice constant of 0.361 nm.

التمرين رقم 15:

Calculate the theoretical volume change accompanying a polymorphic transformation in a pure metal from the FCC to BCC crystal structure. Assume the hard-sphere atomic model and that there is no change in atomic volume before and after the transformation.

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Chapter 3, Problem 31

Draw the following directions in a BCC unit cell and list the position coordinates of the atoms whose centers are intersected by the direction vector:
(*a*) [100](*b*) [110](*c*) [111]

Chapter 3, Problem 32

Draw direction vectors in unit cells for the following cubic directions:

(*a*) $[1\,\bar{1}\,\bar{1}]$ (*b*) $[1\,\bar{1}0]$ (*c*) $[\bar{1}2\,\bar{1}]$ (*d*) $[\bar{1}\,\bar{1}3]$

Chapter 3, Problem 33

Draw direction vectors in unit cells for the following cubic directions:

(*a*) $[1\bar{1}2]$ (*c*) $[\bar{3}31]$ (*e*) $[2\bar{1}2]$ (*g*) $[\bar{1}01]$ (*i*) $[321]$ (*k*) $[1\bar{2}\bar{2}]$

(*b*) $[1\bar{2}3]$ (*d*) $[0\bar{2}1]$ (*f*) $[2\bar{3}3]$ (*h*) $[12\bar{1}]$ (*j*) $[10\bar{3}]$ (*l*) $[\bar{2}\bar{2}3]$

Chapter 3, Problem 34

What are the indices of the directions shown in the unit cubes of Fig. P3.34?

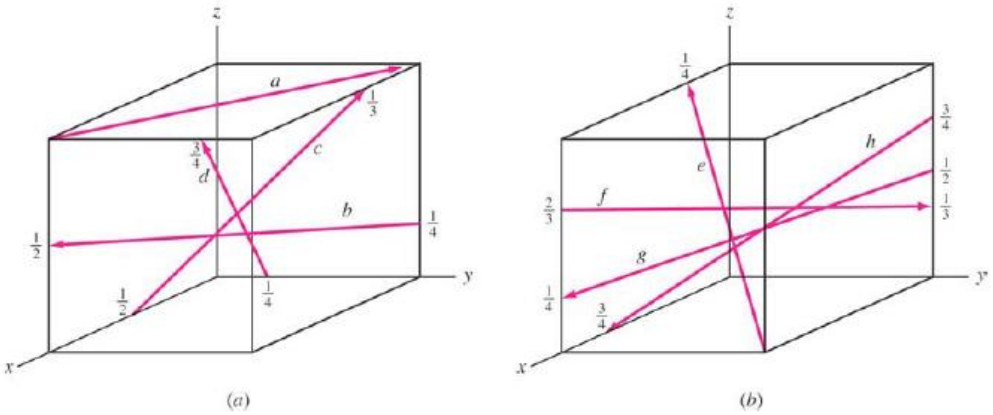

Figure P3.34

Chapter 3, Problem 35

A direction vector passes through a unit cube from the $\left(\frac{3}{4}, 0, \frac{1}{4}\right)$ to the $\left(\frac{1}{2}, 1, 0\right)$ positions. What are its direction indices?

Chapter 3, Problem 36

A direction vector passes through a unit cube from the $\left(1, 0, \frac{3}{4}\right)$ to the $\left(\frac{1}{4}, 1, \frac{1}{4}\right)$ positions. What are its direction indices?

Chapter 3, Problem 37

What are the crystallographic directions of a family or form? What generalized notation is used to indicate them?

Chapter 3, Problem 39

What are the directions of the $\langle 111 \rangle$ family or form for a unit cube?

Chapter 3, Problem 40

What $\langle 110 \rangle$-type directions lie on the (111) plane of a cubic unit cell?

Chapter 3, Problem 41

What $\langle 111 \rangle$-type directions lie on the (110) plane of a cubic unit cell?

Chapter 3, Problem 42

How are the Miller indices for a crystallographic plane in a cubic unit cell determined? What generalized notation is used to indicate them?

Chapter 3, Problem 43

Draw in unit cubes the crystal planes that have the following Miller indices:

(*a*) $(1\,\bar{1}\,\bar{1})$ (*c*) $(1\bar{2}\,\bar{1})$ (*e*) $(3\bar{2}1)$ (*g*) $(20\,\bar{1})$ (*i*) $(\bar{2}32)$ (*k*) $(3\,\bar{1}2)$

(*b*) $(10\bar{2})$ (*d*) $(21\bar{3})$ (*f*) $(30\bar{2})$ (*h*) $(\bar{2}1\bar{2})$ (*j*) $(13\bar{3})$ (*l*) $(\bar{3}3\,\bar{1})$

Chapter 3, Problem 44

What are the Miller indices of the cubic cyrsyallographic planes shown in Fig. P3.44?

Chapter 3, Problem 45

What is the notation used to indicate a family or form of cubic crystallographic planes?

Chapter 3, Problem 46

What are the {100} family of planes of the cubic system?

Chapter 3, Problem 47

Draw the following crystallographic planes in a BCC unit cell and list the position of the atoms whose centers are intersected by each of the planes:
(*a*) (100)(*b*) (110)(*c*) (111)

Chapter 3, Problem 48

Draw the following crystallographic planes in an FCC unit cell and list the position coordinates of the atoms whose centers are intersected by each of the planes:
(*a*) (100)(*b*) (110)(*c*) (111)

Chapter 3, Problem 49

A cubic plane has the following axial intercepts: $a = \frac{1}{3},\ b = -\frac{2}{3},\ c = \frac{1}{2}$. What are the Miller indices of this plane?

Chapter 3, Problem 50

A cubic plane has the following axial intercepts: $a = -\frac{1}{2},\ b = -\frac{1}{2},\ c = \frac{2}{3}$. What are the Miller indices of this plane?

Chapter 3, Problem 51

A cubic plane has the following axial intercepts: $a = 1,\ b = \frac{2}{3},\ c = -\frac{1}{2}$. What are the Miller indices of this plane?

Chapter 3, Problem 52

Determine the Miller indices of the cubic crystal plane that intersects the following position coordinates:
$(1, 0, 0);\ (1, \frac{1}{2}, \frac{1}{4});\ (\frac{1}{2}, \frac{1}{2}, 0)$.

Chapter 3, Problem 53

Determine the Miller indices of the cubic crystal plane that intersects the following position coordinates: $(\frac{1}{2}, 0, \frac{1}{2})$; (0,0,1); (1,1,1).

Chapter 3, Problem 54

Determine the Miller indices of the cubic crystal plane that intersects the following position coordinates: $(1, \frac{1}{2}, 1)$; $(\frac{1}{2}, 0, \frac{3}{4})$; $(1, 0, \frac{1}{2})$.

Chapter 3, Problem 55

Determine the Miller indices of the cubic crystal plane that intersects the following position coordinates: $(0, 0, \frac{1}{2})$; (1,0,0); $(\frac{1}{2}, \frac{1}{4}, 0)$.

Chapter 3, Problem 56

Rodium is FCC and has a lattice constant a of 0.38044 nm. Calculate the following interplanar spacings: (*a*) d_{111} (*b*) d_{200} (*c*) d_{220}

Chapter 3, Problem 57

Tungsten is BCC and has a lattice constant a of 0.31648 nm. Calculate the following interplanar spacings: (*a*) d_{110} (*b*) d_{220} (*c*) d_{310}

Chapter 3, Problem 58

The d_{310} interplanar spacing in a BCC element is 0.1587 nm. (*a*) What is its lattice constant *a*? (*b*) What is the atomic radius of the element? (*c*) What could this element be?

Chapter 3, Problem 59

The d_{422} interplanar spacing in an FCC metal is 0.083397 nm. (*a*) What is its lattice constant *a*? (*b*) What is the atomic radius of the metal? (*c*) What could this metal be?

Chapter 3, Problem 60

How are crystallographic planes indicated in HCP unit cells?

Chapter 3, Problem 61

What notation is used to describe HCP crystal planes?

Chapter 3, Problem 62

Draw the hexagonal crystal planes whose Miller-Bravais indices are:

(*a*) $(10\bar{1}1)$ (*d*) $(1\bar{2}12)$ (*g*) $(\bar{1}2\bar{1}2)$ (*j*) $(\bar{1}100)$

(*b*) $(01\bar{1}1)$ (*e*) $(21\bar{1}1)$ (*h*) $(2\bar{2}00)$ (*k*) $(\bar{2}111)$

(*c*) $(\bar{1}2\bar{1}0)$ (*f*) $(1\bar{1}01)$ (*i*) $(10\bar{1}2)$ (*l*) $(\bar{1}012)$

Chapter 3, Problem 63

Determine the Miller-Bravais indices of the hexagonal crystal planes in Fig. P3.63.

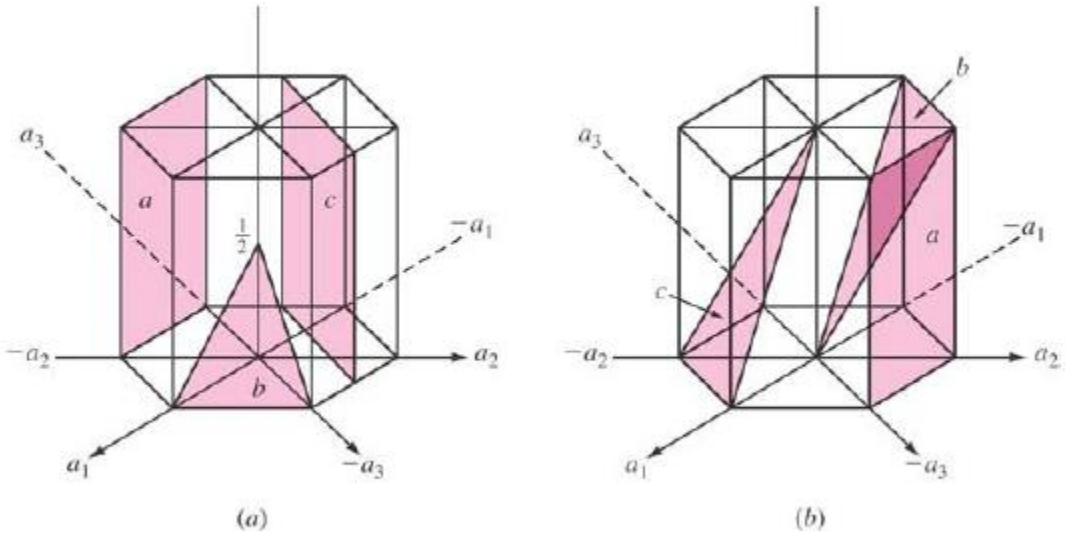

Figure P3.63

Chapter 3, Problem 73

Calculate the planar atomic density in atoms per square millimeter for the following crystal planes in BCC chromium, which has a lattice constant of 0.28846 nm: (*a*) (100), (*b*) (110), (*c*) (111).

Chapter 3, Problem 74

Calculate the planar atomic density in atoms per square millimeter for the following crystal planes in FCC gold, which has a lattice constant of 0.40788 nm: (*a*) (100), (*b*) (110), (*c*) (111).

Chapter 3, Problem 75

Calculate the planar atomic density in atoms per square millimeter for the (0001) plane in HCP beryllium, which has a lattice constant $a = 0.22856$ nm and a c constant of 0.35832 nm.

Chapter 3, Problem 76

Calculate the linear atomic density in atoms per millimeter for the following directions in BCC vanadium, which has a lattice constant of 0.3039 nm: (*a*) [100], (*b*) [110], (*c*) [111].

Chapter 3, Problem 77

Calculate the linear atomic density in atoms per millimeter for the following directions in FCC iridium, which has a lattice constant of 0.38389 nm: (*a*) [100], (*b*) [110], (*c*) [111].

انتهى