



Find solutions for your homework

Search

ON

home / study / engineering / electrical engineering / analog circuits / analog circuits solutions manuals / semiconductor physics and devices / 4th edition / chapter 1 / problem 3ep

# Semiconductor Physics And Devices | (4th Edition)

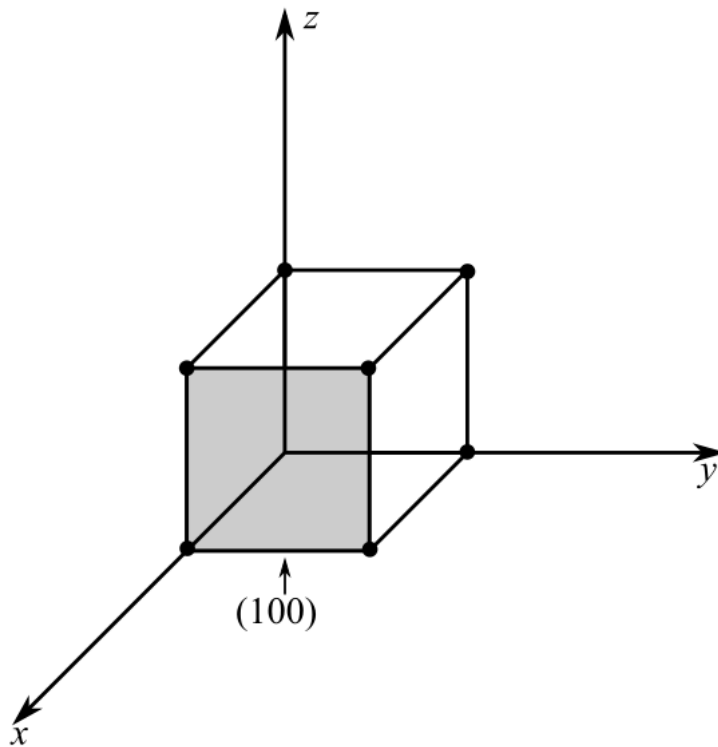
## Problem

The lattice constant of a face-centered-cubic structure is 4.25 Å. Calculate the surface density of atoms for a (a) (100) plane and (b) (110) plane.

## Step-by-step solution

### Step 1 of 6

Draw the diagram for (100) plane of FCC.



[Comment](#)

### Step 2 of 6

From provided figure it can be seen that for FCC lattice in (100) plane has four spheres at the corners, (contributing  $\left(\frac{1}{4}\right)$  to the face) and one sphere at the center.

Therefore, the total number of atoms per lattice plane is equal to,

Total number of atoms per lattice plane = 2.

Write the expression for the area of lattice plane.

$$\text{Area} = a^2$$

Here a is the lattice constant.

Substitute 4.25 Å for a.

$$\text{Area} = (4.25 \text{ \AA})^2$$

$$= \frac{4.25 \text{ \AA}}{10^8 \text{ \AA/cm}} \times \frac{4.25 \text{ cm}}{10^8 \text{ \AA/cm}}$$

$$= 18.06 \times 10^{-16} \text{ cm}^2$$

## Post a question

Answers from our experts for your tough homework questions

Enter question

**Continue to post**

19 questions remaining

## My Textbook Solutions



Semiconductor Physics...  
4th Edition



Discrete-Time Signal...  
3rd Edition



Microelectronics Circuit...  
4th Edition

[View all solutions](#)

Write the expression for Surface density:

$$\text{Surface density} = \frac{\text{Numbers of atoms per lattice plane}}{\text{Area}}$$

Substitute 2 for no. of atoms per lattice plane and  $18.06 \times 10^{-16} \text{ cm}^2$  for Area:

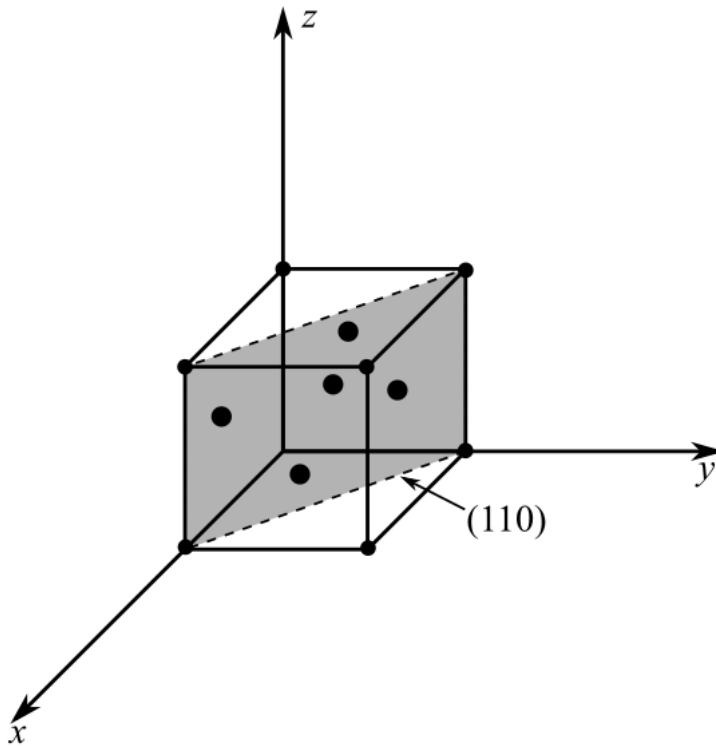
$$\begin{aligned} \text{Surface density} &= \frac{2}{18.06 \times 10^{-16} \text{ cm}^2} \\ &= 1.1 \times 10^{15} \text{ cm}^{-2} \end{aligned}$$

Hence, the surface density for (100) plane of FCC is  $1.1 \times 10^{15} \text{ cm}^{-2}$ .

[Comment](#)

#### Step 4 of 6

Draw the diagram of (110) plane for FCC.



From provided figure it can be seen that for FCC lattice in (110) plane there are four spheres at the corners, (contributing  $\left(\frac{1}{4}\right)$  to the face) and two spheres at the edges contribute  $\left(\frac{1}{2}\right)$  each.

Total numbers of atoms per lattice plane = 2.

[Comment](#)

#### Step 5 of 6

Write the expression for the area of lattice plane.

$$\text{Area} = a^2 \sqrt{2}$$

Substitute  $(4.25 \text{ \AA})^2$  for a .

$$\begin{aligned} \text{Area} &= (4.25 \text{ \AA})^2 \sqrt{2} \\ &= \frac{a}{\cancel{10^8}} 4.25 \text{ \AA} \frac{a}{\cancel{10^8}} \frac{\cancel{10^8}}{\cancel{10^8}} \sqrt{2} \\ &= 2.554 \times 10^{-15} \text{ cm}^2 \end{aligned}$$

[Comment](#)

#### Step 6 of 6



Surface density

Chapter 1, Problem 3EP

15 Bookmarks

Show all steps: ON

Substitute

$$\text{Surface density} = \frac{2}{2.554 \times 10^{-15} \text{ cm}^2}$$

$$= 7.83 \times 10^{-14} \text{ cm}^{-2}$$

Hence, the surface density for (110) plane of FCC is  $7.83 \times 10^{-14} \text{ cm}^{-2}$ .

[Comment](#)

Was this solution helpful?

7

0

## Recommended solutions for you in Chapter 1

### Chapter 1, Problem 4

(a) The lattice constant of GaAs is 5.65 Å. Determine the number of Ga atoms and As atoms per cm<sup>3</sup>. (b) Determine the volume...

[See solution](#)

### Chapter 1, Problem 20

Determine the surface density of atoms for silicon on the (a) (100) plane, (b) (110) plane, and (c) (111) plane.

[See solution](#)

COMPANY

LEGAL & POLICIES

CHEGG PRODUCTS AND SERVICES

CHEGG NETWORK

CUSTOMER SERVICE

