

AD2

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ABSTRACT

1 Introduction

2 Results

2.1 Chap 1

$$\sigma = \frac{ne^2\tau}{m^*} \quad (1)$$

At it is a monovalent metal and the FCC-Unit cell contains 4 atoms the concentration of the conduction electrons N can be calculated as:

$$N = \frac{4}{a^3} =$$

So for the collision time τ follows:

$$\tau = \frac{\sigma \cdot m^* \cdot a^3}{4e^2}$$

Fermi

$$f(E) = \frac{1}{e^{(E-E_F)/kT} + 1} \quad (2)$$

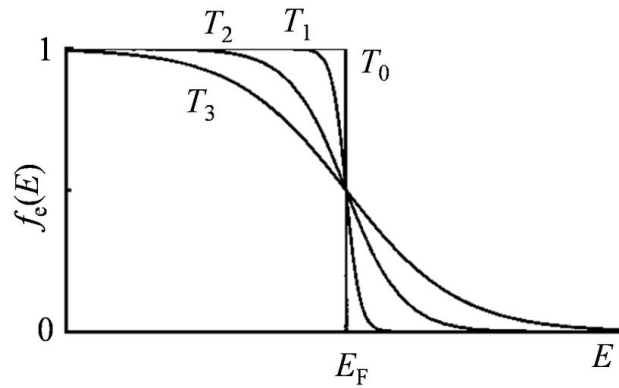


Figure 1: Fermi-Dirac distribution function at different temperatures: $T_3 > T_2 > T_1$ (and $T_0 = 0$ K). At the absolute zero temperature (T_0), the probability of an electron to have an energy below the Fermi energy E_F is equal to 1, while the probability to have higher energy is zero.

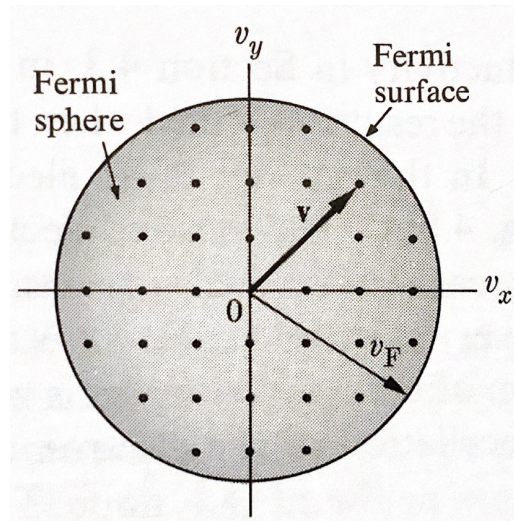


Figure 2: The Fermi surface and the Fermi sphere [1, asdfadf]

Cyclotron

$$-e(\vec{v} \times \vec{B}) = m \frac{d\vec{v}}{dt} \quad (3)$$

Plasma Frequency

$$\omega_P = \frac{Ne^2}{\epsilon_L m^*} \quad (4)$$

2.2 Chap 2

2.3 Chap 3

Question 1

The carrier distribution function in CB für an intrinsic semiconductor is given as the product:

$$g_e(E)f(E)$$

with

$$g_e(E) = \frac{1}{2\pi^2} \left(\frac{2m_e^*}{\hbar} \right)^{\frac{3}{2}} (E - E_C)^{\frac{1}{2}}$$

$$f(E) = \frac{1}{e^{(E-E_F)/k_B T} + 1} \approx e^{-\frac{E-E_F}{k_B T}}$$

So for the maximum

$$\frac{d}{dE} \left(\frac{1}{2\pi^2} \left(\frac{2m_e^*}{\hbar} \right)^{\frac{3}{2}} (E - E_C)^{\frac{1}{2}} e^{-\frac{E-E_F}{k_B T}} \right) = 0$$

By dividing through the constant factors:

$$\frac{d}{dE} \left((E - E_C)^{\frac{1}{2}} e^{-\frac{E-E_F}{k_B T}} \right) = 0$$

$$\frac{1}{2}(E - E_C)^{-\frac{1}{2}} e^{-\frac{E-E_F}{k_B T}} + \frac{-1}{k_B T} (E - E_C)^{\frac{1}{2}} e^{-\frac{E-E_F}{k_B T}} = 0$$

And finally

$$E = E_C + \frac{k_B T}{2}$$

Question 2

3 Conclusion

References

- [1] M.A. Omar, *Elementary Solid State Physics: Principles and Applications*, Addison-Wesley, London, 1993.
- [2] Charles Kittel, *Introduction to Solid State Physics*, 7th ed., Wiley, 1996
- [3] METAL OXIDE PHOTOCATALYTIC NANOSTRUCTURES FABRICATED BY DYNAMIC SHADOWING GROWTH - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Fermi-Dirac-distribution-function-at-different-temperatures-T3-T2T1-and-T0-0-K-At_fig2_280311898 [accessed 16 Jun, 2020]

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- 2 The Fermi surface and the Fermi sphere [1, asdfadf] 3