

固物 2018 期末答案

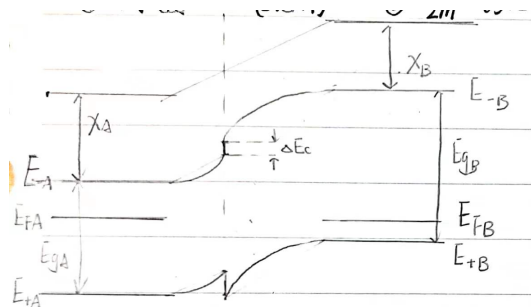
Deschain

2022 年 6 月 17 日

1.

- (1) ①X 射线衍射/中子衍射/电子衍射②中子非弹性散射/拉曼散射/布里渊散射/光子非弹性散射/X 射线散射/X 射线衍射 (写出一种即可)
- (2) ①电子的自旋磁矩②电子的轨道磁矩③电子的感生磁矩④铁磁性⑤亚铁磁性⑥反铁磁性⑦ 正⑧负
- (3) ①定向②晶格
- (4) ①迁移率②载流子浓度③总掺杂
- (5) ① $[-\frac{\pi}{2a}, \frac{\pi}{2a}]$ ② $\sqrt{15} : 1$
- (6) ① $24N_A$ ② $21N_A$ ③ $3N_A$ ④ $\frac{4\pi}{G}$
- (7) ① $-\frac{A}{r^6}$ ② $\frac{B}{r^{12}}$ ③ $\sqrt[6]{\frac{2B}{A}}$ ④ $-\frac{NA^2}{8B}$
- (8) ① $4.14 \times 10^{-15} J$ ② 8.48°
- (9) ① $38.4 cm/\Omega (\mu_n = 300, \mu_p = 150)$
- (10) ① $-1.28 \times 10^{-5} m^3/C$ ② $4.88 \times 10^{23} m^{-3}$
- (11) ① $1.57 \times 10^6 m/s$ ② 6.3×10^{-30} ③ 9.9×10^{-24}
- (12) ①独立②统一
- (13) ①球面② $(3\pi^2 n)^{\frac{1}{3}}$ ③ $\frac{\hbar^2}{2m} (3\pi^2 n)^{\frac{2}{3}}$ ④略低

2.)



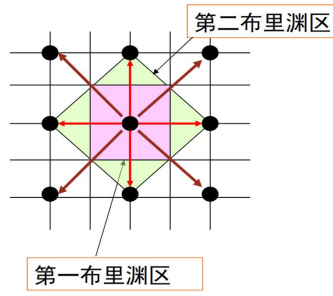
$$\Delta E_C = \chi_A - \chi_B = 0.17 eV$$

$$\Delta E_V = |\chi_A + E_{gA} - (\chi_B + E_{gB})| = 0.3 eV$$

$$V_D = \left| \frac{1}{e} (E_{FA} - E_{FB}) \right| = 0.3 V$$

3.

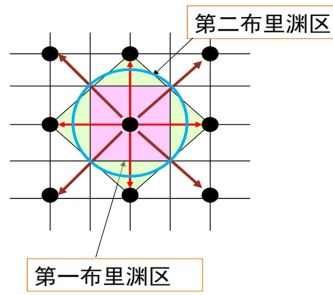
(1)



(2)

$$k_F = \sqrt{2\pi n} = \sqrt{\frac{\pi}{2A^2}}$$

(3)



4.

(1)

$$n_{iSi} = (N_- N_+)^{\frac{1}{2}} e^{-\frac{E_{gSi}}{2k_B T}} = \frac{2}{h^3} (2\pi k_B T)^{\frac{3}{2}} (m_n^* m_p^*)^{\frac{3}{4}} e^{-\frac{E_{gSi}}{2k_B T}} = 9.40 \times 10^{11} \text{ cm}^{-3} < N_D$$

$$n_{iGe} = (N_- N_+)^{\frac{1}{2}} e^{-\frac{E_{gGe}}{2k_B T}} = \frac{2}{h^3} (2\pi k_B T)^{\frac{3}{2}} (m_n^* m_p^*)^{\frac{3}{4}} e^{-\frac{E_{gGe}}{2k_B T}} = 2.15 \times 10^{14} \text{ cm}^{-3} > N_D$$

(2) Si 可以形成 N 结

(3)

$$V_D = \frac{1}{e} (E_{Fn} - E_{Fp}) = \frac{k_B T}{e} \ln\left(\frac{N_D N_A}{n_{iSi}^2}\right) = 0.3745V$$

5.

(1)

$$W(x) = \sum V_n e^{j\frac{2\pi n}{a}x}, V_n = \frac{1}{a} \int_{-\frac{a}{2}}^{\frac{a}{2}} W(x) e^{-j\frac{2\pi n}{a}x} dx = \frac{2V_0}{a} \cos\left(\frac{2\pi nb}{a}\right)$$

$$V_{g1} = |2V_1| = \frac{4V_0}{a} \cos\left(\frac{2b}{a}\pi\right), V_{g2} = |2V_2| = \frac{4V_0}{a} \cos\left(\frac{4b}{a}\pi\right)$$

(2) $a > 4b$ 不是导体, $a = 4b$ 是导体。

(3) $a = 8b$