

$E_c - 0,17$ $X // J // [100]$, $n - Si$ $\gamma -$ $n - Si$) [3].
 $E_c - 0,17$ $X // J // [100]$.

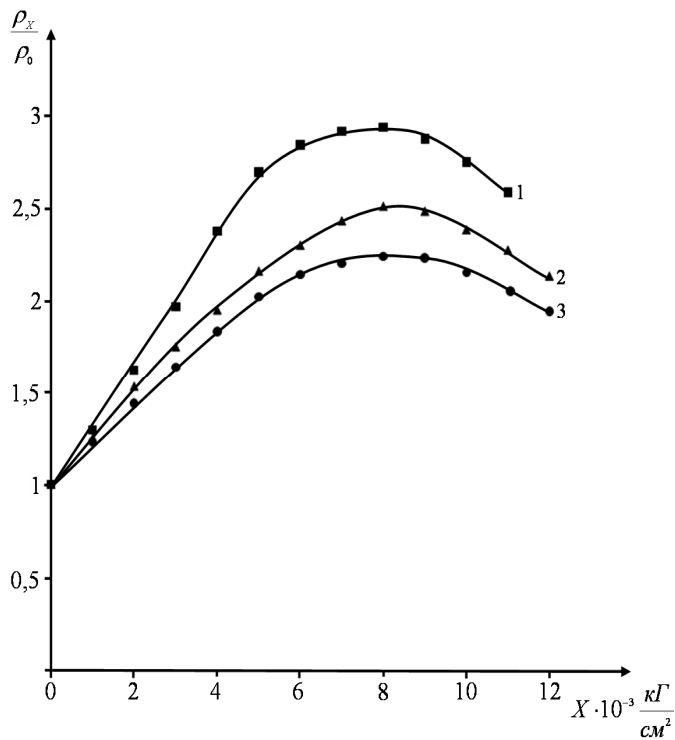
$$\frac{\rho_x}{\rho_0} = f(X)$$

$E_c - 0,17$ [4].

T_0 , [5],

$$\mu = \mu_0 \frac{\left\langle \frac{\rho_i}{\rho_{i+1}} \right\rangle^{\frac{X}{\Delta X}}}{\frac{\rho(T_0, X)}{\rho(T_0)}} \quad (1)$$

ρ_i, ρ_{i+1} , X_i, X_{i+1} ; $X_i, X_{i+1} > X'$, X' , $\frac{\rho_x}{\rho_0} = f(X)$; μ_0 T_0 .

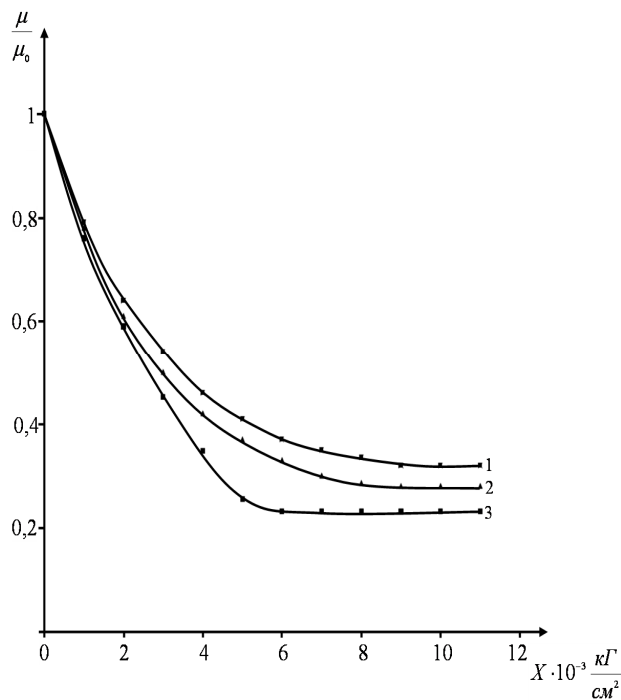


1. $\frac{\rho_x}{\rho_0} = f(X) \gamma - n - Si$ $1,9 \cdot 10^{17} \frac{cm^{-3}}{2}$
 $X // J // [100]$, $T, K : 1-77; 2-110; 3-150$.

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$E_c - 0,17$

(1) $\frac{\mu}{\mu_0} = f(X) \quad n - Si$ (.2).



2. $\frac{\mu}{\mu_0} = f(X) \quad \gamma - \quad n - Si \quad 1,9 \cdot 10^{17} \frac{cm^3}{cm^2}$,
 $X // J // [100]$, $T, K : 1-150; 2-110; 3-77$.

.2, $\frac{\mu}{\mu_0} = f(X) \quad X$,
 $n - Si$, $X // J // [100]$.

$E_c - 0,17$

$n - Si$ [6].

$\mu = \mu_{\perp} \sin^2 \theta + \mu_{\parallel} \cos^2 \theta$, (2)

$\theta -$; $\mu_{\perp} \mu_{\parallel} -$

$n - Si \quad X // [100]$
 (2), :

$\mu_1 = \mu_{\parallel}, \mu_2 = \mu_{\perp}$ (3)

$n - Si \quad X // [100]$:

$\sigma_X = 2en_1(X)\mu_{\parallel} + 4en_2(X)\mu_{\perp} = en(X)\mu(X)$, (4)

$n_1(X) -$

, $n(X) -$

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$$E_c - 0,17$$

X , K_τ

$$X \cdot K_\tau \quad n - Si \quad E_c - 0,17$$

[7]

, , $T > 100K$.

(4) $X_1 \quad X_2$,

$X \quad X_1 \quad X_2$

$$E_c - 0,17$$

$$\sigma_{X_1} = 2en_1(X_1)\mu_{\parallel} + 4en_2(X_1)\mu_{\perp} = en(X_1)\mu(X_1) \quad (5)$$

$$\sigma_{X_2} = 2en_1(X_2)\mu_{\parallel} + 4en_2(X_2)\mu_{\perp} = en(X_2)\mu(X_2) \quad (6)$$

$$\begin{cases} 2n_1(X_1) + 4n_2(X_1) = n(X_1) \\ 2n_1(X_2) + 4n_2(X_2) = n(X_2) \end{cases}, \begin{cases} \frac{n_2(X_1)}{n_1(X_1)} = e^{\frac{\Delta E_1}{kT}} = a_1 \\ \frac{n_2(X_2)}{n_1(X_2)} = e^{\frac{\Delta E_2}{kT}} = a_2 \end{cases}, \quad (7)$$

$\Delta E_1, \Delta E_2 -$

$X_1 \quad X_2 \quad n - Si$

[100].

(5), (6) (7), :

$$\frac{\mu(X_1)}{\mu(X_2)} = \frac{\mu_{\parallel} + 2\mu_{\perp}a_1}{\mu_{\parallel} + 2\mu_{\perp}a_2} \cdot \frac{1 + 2a_2}{1 + 2a_1} \quad (8)$$

$$\frac{\mu(X_1)}{\mu(X_2)} = \frac{1 + 2Ka_1}{1 + 2Ka_2} \cdot \frac{1 + 2a_2}{1 + 2a_1}, \quad (9)$$

$$K = \frac{\mu_{\perp}}{\mu_{\parallel}} -$$

K (9):

$$K = \frac{(1 + 2a_2)\mu(X_2) - (1 + 2a_1)\mu(X_1)}{2a_2(1 + 2a_1)\mu(X_1) - 2a_1(1 + 2a_2)\mu(X_2)} \quad (10)$$

$$K = \frac{K_m}{K_\tau}, \quad (11)$$

$K_m -$

$K_\tau -$

(10) (11),

$$K_\tau = K_m \frac{2a_2(1 + 2a_1)\mu(X_1) - 2a_1(1 + 2a_2)\mu(X_2)}{(1 + 2a_2)\mu(X_2) - (1 + 2a_1)\mu(X_1)} \quad (12)$$

K_τ

[9].

$$K_\tau = \frac{\langle \tau_{\parallel} \rangle}{\langle \tau_{\perp} \rangle} \quad (13)$$

$$\langle \tau_{\parallel} \rangle = \int_0^{\infty} dx x^{\frac{3}{2}} e^{-x} \tau_{\parallel}, \quad \langle \tau_{\perp} \rangle = \int_0^{\infty} dx x^{\frac{3}{2}} e^{-x} \tau_{\perp} \quad (14)$$

τ_{\parallel}

τ_{\perp}

:

$$\tau_{\parallel} = \frac{a_{\parallel}}{\sqrt{k} T^{\frac{3}{2}}} \cdot \frac{x^{\frac{3}{2}}}{x^2 + b_0}, \quad \tau_{\perp} = \frac{a_{\perp}}{\sqrt{k} T^{\frac{3}{2}}} \cdot \frac{x^{\frac{3}{2}}}{x^2 + b_1}, \quad (15)$$

$$a_{\parallel} = \frac{\pi c_{11} \hbar^4}{k \Xi_d^2 \sqrt{2m_{\parallel} m_{\perp}^2}} \cdot \frac{1}{0}, \quad a_{\perp} = \frac{\pi c_{11} \hbar^4}{k \Xi_d^2 \sqrt{2m_{\parallel} m_{\perp}^2}} \cdot \frac{1}{1} \quad (16) \quad 0 = 1 + 1,645 \frac{\Xi_u}{\Xi_d} + 1,03 \frac{\Xi_u^2}{\Xi_d^2},$$

$$1a = 1 + 0,818 \frac{\Xi_u}{\Xi_d} + 0,688 \frac{\Xi_u^2}{\Xi_d^2} \quad (17)$$

$$b_0 = \frac{a_{\parallel} 0}{\sqrt{k} T^{\frac{3}{2}} \tau_0 (kT)}, \quad b_1 = \frac{a_{\perp} 1}{\sqrt{k} T^{\frac{3}{2}} \tau_0 (kT)}, \quad (18)$$

$$\tau_0 (k T) = \frac{\sqrt{2m_{\perp}} \varepsilon_0^2 (k T)^{\frac{3}{2}}}{\pi e^4 \sqrt{m_{\parallel}}}, \quad (19)$$

$n -$, $\varepsilon_0 -$, $e -$

$$0 = \frac{3}{2\beta^3} \left[\left(\frac{\beta}{1+\beta^2} - a \right) \ln \gamma^2 - a \ln(1+\beta^2) + 2L(a) + \right.$$

$$\left. \frac{\beta \gamma^2}{2} \left(\frac{\beta^2 - 1}{\beta^2 + 1} + \frac{a(\beta^2 + 1)}{\beta} \right) \right],$$

$$1 = \frac{3}{4\beta^3} \left[((1-\beta^2)a - \beta) \ln \gamma^2 + 2(\beta^2 - 1)L(a) - \right.$$

$$\left. 2\beta^2 a - (\beta^2 - 1)a \ln(1+\beta^2) + \frac{\gamma^2}{2} (\beta(1+3\beta^2) + \right. \quad (20)$$

$$\left. a(3\beta^4 + 2\beta^2 - 1) \right]$$

$$\beta^2 = \frac{m_{\parallel} - m_{\perp}}{m_{\perp}}, \quad a = \arctg \beta, \quad L(a) = - \int_0^a \ln \cos \varphi d\varphi -$$

$$\gamma^2 = \frac{\pi \hbar^2 e^2}{2m_{\parallel} \varepsilon_0 k^2} \cdot \frac{n}{T^2 x}, \quad x = \frac{\varepsilon}{k T}.$$

$$(16) (19), \quad (18)$$

$$b_0 = \frac{nA}{\Xi_d^2 0}, \quad b_1 = \frac{nA}{\Xi_d^2 1}, \quad (21)$$

$$A = \frac{\pi^2 c_{11} \hbar^4 e^4}{2k^3 m_{\perp}^2 T^3 \varepsilon_0^2}.$$

(12-21), :

$$\frac{1}{0} \cdot \frac{\int_0^\infty dx \frac{x^3 e^{-x}}{x^2 + \frac{nA_0}{\Xi_d^2}}}{\int_0^\infty dx \frac{x^3 e^{-x}}{x^2 + \frac{nA_1}{\Xi_d^2}}} =$$

$$= K_m \frac{2a_2(1+2a_1) \frac{\mu(X_1)}{\mu_0} - 2a_1(1+2a_2) \frac{\mu(X_2)}{\mu_0}}{(1+2a_2) \frac{\mu(X_2)}{\mu_0} - (1+2a_1) \frac{\mu(X_1)}{\mu_0}} \quad (22)$$

(4) X :

$$\frac{d\sigma}{dX} = e\left(\mu \frac{dn}{dX} + n \frac{d\mu}{dX}\right) \quad (23)$$

$$-\frac{1}{\rho^2} \frac{d\rho}{dX} = e\left(\mu \frac{dn}{dX} + n \frac{d\mu}{dX}\right) \quad (24)$$

[9]:

$$n = n_0 e^{\frac{\Delta E}{\alpha kT}}, \quad (25)$$

ΔE - , α - , 1 2 , n_0 - .
(25),

$$\frac{d\rho}{dX} = -en\rho^2 \frac{d\mu}{dX} + \frac{\rho}{\alpha kT} \frac{d(\Delta E)}{dX}. \quad (26)$$

$$\frac{\rho_X}{\rho_0} = f(X) \quad (\cdot 1, \quad 1) \quad X = X_0,$$

$$\frac{d\rho}{dX} \Big|_{X=X_0} = 0.$$

$$\Delta E = \frac{d(\Delta E)}{dX} X \quad [9]. \quad (25) \quad (26),$$

$$\frac{\ln(en_0\mu(X_0)\rho(X_0))}{X_0} = \frac{1}{\mu(X_0)} \frac{d\mu}{dX} \Big|_{X=X_0} \quad (27)$$

$$X \geq X_0 \quad [100]$$

$n-Si$

$$\mu = \mu_{\parallel} .$$

$$\mu_{\parallel} = \frac{e}{m_{\parallel}} \langle \tau_{\parallel} \rangle, \quad (28)$$

(14-20), (27) :

$$\frac{\ln(en_0\mu(X_0)\rho(X_0))}{X_0} = \frac{1}{\mu(X_0)} \frac{\pi c_{11} \hbar^4}{(kT)^{\frac{3}{2}} \cdot \Xi_d \sqrt{2m_{\parallel} m_{\perp}^2}} \times$$

$$\times \frac{d}{dX} \left[\int_0^{\infty} dx \frac{x^3 e^{-x}}{x^2 + \frac{NA_0}{\Xi_d}} \right] \Big|_{X=X_0} \quad (29)$$

$$\frac{A_0 \pi_{11} e \hbar^4}{(kT)^{\frac{3}{2}} \Xi_d^4 \sqrt{2m_{\parallel}^3 m_{\perp}^2}} \times$$

$$\times \int_0^{\infty} dx \frac{x^3 e^{-x}}{\left(x^2 + \frac{A_0}{e\mu(X_0)\rho(X_0)\Xi_d} \right)^2} = e\mu^2(X_0)\rho(X_0) \quad (30)$$

(22) (30),

$$\left\{ \begin{array}{l} \Xi_u \quad \Xi_d : \\ \frac{1}{0} \cdot \frac{\int_0^{\infty} dx \frac{x^3 e^{-x}}{x^2 + \frac{nA_0}{\Xi_d^2}}}{\int_0^{\infty} dx \frac{x^3 e^{-x}}{x^2 + \frac{nA_1}{\Xi_d^2}}} = K_m \frac{2a_2(1+2a_1) \frac{\mu(X_1)}{\mu_0} - 2a_1(1+2a_2) \frac{\mu(X_2)}{\mu_0}}{(1+2a_2) \frac{\mu(X_2)}{\mu_0} - (1+2a_1) \frac{\mu(X_1)}{\mu_0}} \\ B \cdot \int_0^{\infty} dx \frac{x^3 e^{-x}}{\left(x^2 + \frac{A_0}{e\mu(X_0)\rho(X_0)\Xi_d} \right)^2} = e\mu^2(X_0)\rho(X_0), \\ B = \frac{A_0 \pi_{11} e \hbar^4}{(kT)^{\frac{3}{2}} \Xi_d^4 \sqrt{2m_{\parallel}^3 m_{\perp}^2}} \end{array} \right.$$

- 1) $\Xi_u = 9,23 \quad \Xi_d = -2,12$,
 2) $\Xi_u = -66 \quad \Xi_d = 29$.

1.

2.

3.

$$\Xi_u = 9,3$$

$$(\Xi_u = 9,23)$$

[10],

 $\gamma-$

[11].

$$\Xi_u,$$

[10] [11]

" \emptyset - , 2012. 9 : , , " γ -
 Ξ_u Ξ_d \emptyset . - ,
Ge, GaAs, GaSb, CdSb

[12, 13]. [13],

1. / ó .
2. : , 1972. ó 584 c. γ - *n-Si*
3. // . ó 2010. - .55, 3.- .323-326. " " "
4. . ó : , 1974. ó 200 c. / ó :
5. \emptyset , 2001. ó 323 c. / ó :
6. *n-Si* // 8- . ó . ó 2009. ó .357-359.
7. *n-Si* *n-Ge* / . . . // . ó 2010. - .1. ó . 11-14.
8. // *n-Si* / ó 1988. ó .22, 9. ó . 170461705.
9. , ó .: , 1977. ó 269 c. , \emptyset ó ,
10. *n-Si* / . . . // , 2011, .56, 1.- .70-74. / ó 1976. ó .
11. γ - / . . . // .: . ó 1988. - 2565 ó . ó .79.
12. Uniaxial-Process-Induced Strained-Si: Extending the CMOS Roadmap / S.E Thompson, Sun Guangyu, Youn Sung Choi, T. Nishida // Electron Devices, IEEE Transactions on, 2006, Volume 53, Issue 5., p. 1010 ó 1020.
13. Murphy-Armando F. Deformation Potentials and Electron Phonon Coupling in Silicon Nanowires / F. Murphy-Armando, G. Fagas and J. C. Greer // Nano Letter, 2010, Volume 10, Issue 3, p. 8696873.