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3.5.1

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(,). . , .
, $I = 0$. U :

$$U = U_2 - U_1 = (U_f + \Delta U_2) - (U_f + \Delta U_1) = \Delta U_2 - \Delta U_1 \quad (1)$$

, :

$$I_1 = I_{in} - I_{e_0} \cdot exp\frac{eU_1}{k_B T_e} = I_{in} - \left[I_{e_0} \cdot exp\frac{eU_f}{k_B T_e}\right] \cdot exp\frac{e\Delta U_1}{k_B T_e}$$

$\Delta U_1 = 0$. , I_i.

$$I_1 = I_{in}\left[1 - exp\frac{eU_1}{k_B}\right] \quad (2)$$

I_2. , $I_1 = -I_2 = I$. U

$$U = \Delta U_1 - \Delta U_2 = \frac{k_B T_e}{e} ln(1 - \frac{I}{I_{in}}) - \frac{k_B T_e}{e} ln(1 + \frac{I}{I_{in}}) = \frac{k_B T_e}{e} ln\frac{I_{in} - I}{I_{in} + I}$$

I,

$$I_1 = I_{in} th\frac{eU}{2k_B T_e} \quad (3)$$

U $U = 0$,

$$k_B T_e = \frac{1}{2}\frac{eI_{in}}{\frac{dI}{dU}} \quad (4)$$

$\frac{dI}{dU}$ - , I_{in}

$$I_{in} = 0,4 n_i e S\sqrt{\frac{2k_B T_e}{m_i}} \quad (5)$$

:

$$\omega_p = \sqrt{\frac{4\pi n_e e^2}{m_e}} = 5,6 \cdot 10^4 \sqrt{{n_e}^{-3}} \ / \tag{6}$$

R_D, $T_i \approx 300K$, :

$$r_D = \sqrt{\frac{kT_i}{4\pi n_i e^2}} \tag{7}$$

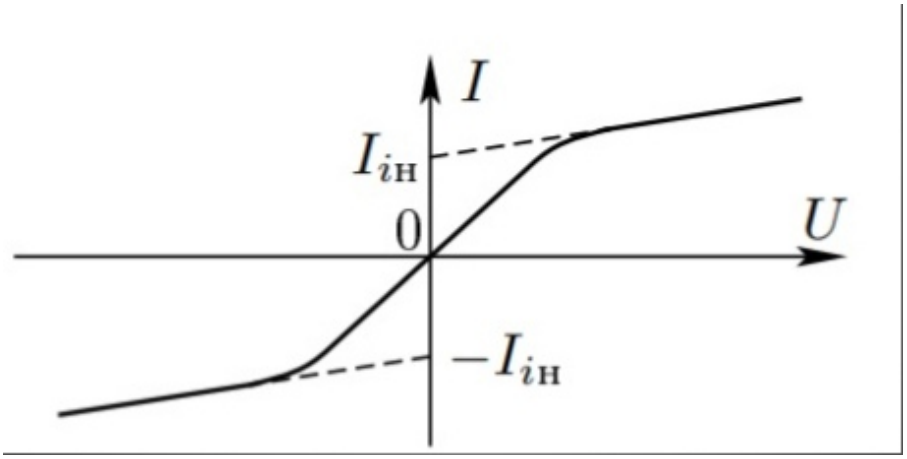
($N_D >> 1$):

$$N_D = n_i \frac{4}{3} \pi {r_D}^3 \tag{8}$$

:

$$\alpha = \frac{n_i}{n} \tag{9}$$

n $P = nkT$ $P \approx 1$ ($n = N_L$, N_L -).



. 1: -

.1

. 2:

, , - . 2 . .. 1 R_b (≈ 500) . . .
- 1 . 1, - $V1$, $\frac{R_1+R_2}{R_1}$
- 2 - 2 , , .

2

$R_b = 450 \ \ kOm, d = 0.2 \ \ mm, l = 5.2 \ \ mm$

1: c

V, volt	I, mkA	V, volt	I, mkA
34.43	0.5	27.26	4.4
33.14	0.76	27.27	3.76
32.04	1.24	27.47	3.2
30.1	1.64	28.09	2.62
28.79	2.36	29.22	2.14
27.94	2.86	30.05	1.78
27.59	3.34	32.05	1.22
27.4	3.72	33.83	0.62
27.36	4	-16.3	-32.75
27.41	4.36	-19.12	-33.95
27.38	4.96	-22.32	-35.38
27.22	5	-24.91	-36.43

2.1 -

, 1:
U(I) - - .

. 3: $i_{razr} = 5\,mA$

$R_{max} \approx 2\,kOm$:

2.2

- - $\sigma I_{rarz} = 0.03\,mA$, 2:
$I(U)$:

. 4: I(U) . .

2: c

U1, volt	I1m mkA	U2, volt	I2, mkA	U3, volt	I3, mkA
24,91	24.89	24.91	90.91	24.91	52.54
21.36	23.94	21.33	91.09	21.79	50.64
18.86	23.31	18.27	89.2	18.03	48.38
15.37	22.38	14.59	84.05	14.92	46.37
11.85	20.93	10.5	71.16	12.31	43.62
8.76	17.79	9.14	64.39	9.76	38.86
7.27	15.28	8.3	59.41	6.17	26
6.23	13.09	7.49	53.87	5.36	21.92
5.26	10.62	7.65	55.04	4.26	15.8
4.26	7.88	6.69	48	2.69	6.12
3.53	5.62	5.36	36.81	2.04	1.81
2.44	1.83	4.13	25.11	1.78	0
1.94	0.16	1.78	0.41	-0.78	-15.4
-1.94	-13.21	-1.77	-29.95	-2.33	-25.6
-3.29	-17.49	-3.55	-47.48	-3.46	-32
-4.44	-20.5	-4.12	-52.58	-5.15	-40.43
-5.56	-23.08	-5.04	-60.34	-7.17	-48.21
-6.9	-25.48	-6.14	-68.57	-8.85	-52.74
-8.01	-27.04	-7.32	-76.24	-10.95	-56.71
-9.87	-29.14	-8.95	-84.92	-14.37	-60.63
-10.7	-29.81	-10.13	-90.05	-18.12	-63.58
-13.2	-31.35	-13.09	-99.2	-21.16	-65.62
-16.3	-32.75	-15.95	-104.67	-23.36	-67.18
-19.12	-33.95	-19.62	-108.4	-24.91	-68.31
-22.32	-35.38	-21	-109.22		
-24.91	-36.43	-24.91	-110.1		

. 5: $i_{razr} = 1,5\,mA$

. 6: $i_{razr} = 3\,mA$

. 7: $i_{razr} = 5\,mA$

1, 2, 3, 4 I, $\frac{dI}{dU}$, $U = 0$. . 1:

.

3:

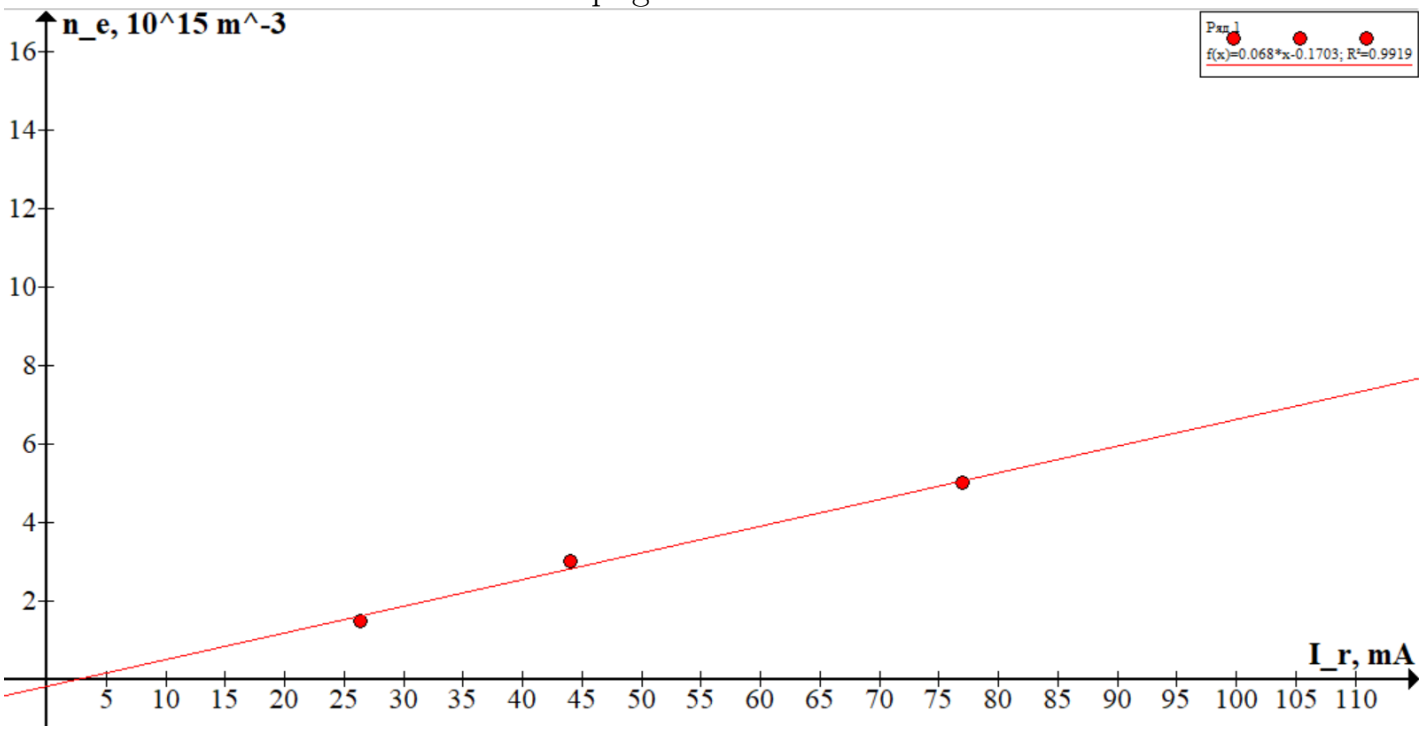
‘ I_{razr}, mA	I_{iH}, mkA	$\frac{dI}{dU}, \frac{mkA}{V}$
1.5	19	6.96
3.0	39	32
5.0	73	82

4:

$I_{razr},\ mA$	$kT_e,\ el \cdot Volt$	$n_e \cdot 10^{15}, m^{-3}$	$T_e, K \cdot 10^4$	$\sigma T_e,\ K \cdot 10^4$
1.5	1.36	26.3	1.6	0.18
3.0	0.64	44	0.7	0.08
5.0	0.44	77	0.5	0.06

T_e (?), n_e - (?).
$n_e = f(I_{razr})$

.png .bb



. 8: $n_e I_{razr}$

ω_e, (,).
N_D. $r_D \approx 10^{-3} m$. $R_D \approx 10^8$ α , $P \approx 2\,Torr$. 5.

5:

I_{razr}, mA	$\omega_p, \cdot 10^{11}, \frac{rad}{sec}$	$r_D \cdot 10^{-2}, cm$	N_D	$\alpha \cdot 10^{-7}$
1.5	0.87	0.21	387	4.60
3.0	1.56	0.16	171	7.81
5.0	2.18	0.13	92	13.6

3

- . .
, $T_e \approx 10^4\ K,\ \ kT_e \approx 1\ eV.$
$n_e \approx 10^{16}$.
$\omega_p \approx 10^{16}\ \frac{rad}{sec}$.
c $r_D \approx 10^{-3}\ m,$ (. 5).
.