USEFUL FORMULAS

$N_A = 6.0222 \times 10^{23} mol^{-1}$

$c = 2.9979 \times 10^{10} cm/sec.$

$e = 1.6022 \times 10^{-19} coul$

$= 4.8032 \times 10^{-10} \sqrt{erg-cm}$

$= 3.7945 \times 10^{-4} \sqrt{eV-cm}$

$m_0 = 9.1096 \times 10^{-28}$ gm

$= 5.1100 \times 10^5 eV/c^2$

$h = 6.6262 \times 10^{-27}$ erg-sec.

$\hbar = 1.0546 \times 10^{-27}$ erg-sec.

$\hbar = 6.5822 \times 10^{-16}$ eV-sec.

$k = 1.3806 \times 10^{-16}$ erg/°K

$= 8.6171 \times 10^{-5}$ eV/°K

$E_{Photon}(eV) = 1.2395/\lambda_{Air}(\mu)$

$E_{Photon} = 1.2395 \times 10^{-4} wv.no._{Air}(cm^{-1})$

$E_{Photon} = 4.1357 \times 10^{-15} \nu(sec^{-1})$

$C(pf) = 0.08854 \epsilon A(cm^2)/t(cm)$

$a_n(\mathring{A}) = 0.529 \times n^2 \epsilon [m_0/m^*]$

$= 7.20 \times n^2 [\epsilon E_0(eV)]$

$E_0(eV) = 13.6[m^*/m_0]\epsilon^{-2}$

$R_{Hall}(cm^3/coul) = t(cm) 10^8 V_H(V)/[B(gauss) \times I(amp)]$

$\mu_{Hall}(cm^2/V\text{-}sec) = R(cm^3/coul)/\rho(ohm\text{-}cm)$

$n(carriers/cc) \cong 6.25 \times 10^{18}/R(cm^3/coul)$

$T = (1-R)^2 e^{-\alpha x}/(1-R^2 e^{-2\alpha x})$

$T_{Max} = (1-R)/(1+R);\ R = (n_i - n_0)^2/(n_i + n_0)^2$

m^*_e D.S. $= [\delta^2 (m_L m_T)]^{1/3}$

m^*_e Cond. $= 3 m_L m_T/(2 m_L + m_T)$

m^*_h D.S. $= (m_1^{3/2} + m_2^{3/2})^{2/3}$

m^*_h Cond. $= (m_1^{3/2} + m_2^{3/2})/(m_1^{1/2} + m_2^{1/2})$

$n_i = 2.5 \times 10^{19} (m^*_e m^*_h / m_0^2)^{3/4} (T/300)^{3/2}$

$\exp[-19.3E(eV)(300/T)]$

$v_{thermal}(cm/sec.) = 1.168 \times 10^7 \sqrt{(m_0/m^*)(T/300)}$

$\mu(cm^2/V-sec) = 1.50 \times 10^{10} \ell(cm) \sqrt{(m_0/m^*)(300/T)}$

$\mu(cm^2/V-sec) = 1.76 \times 10^{15} (m_0/m^*) \tau(sec)$

$h\omega_c(eV) = 1.16 \times 10^{-8} B(gauss)(m_0/m^*)$

$N_{Met.\ Cond.}(cm^{-3}) \gtrsim [0.2/a_1]^3$

SOME IMPORTANT PROPERTIES OF SEMICONDUCTOR MATERIALS

Monsanto

PRODUCTS

SILICON — Mon-X and Zero-D Ingots, Slices, Lapped, Polished, Oxide Coated and Subdiffused Wafers; Epitaxial Wafers, Polycrystalline Rods and Chunks.

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MONSANTO COMMERCIAL PRODUCTS COMPANY

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(314)272-7676-TWX(910)760-1591

SOME PROPERTIES OF SEMICONDUCTORS

	IV		III-V												II-VI					
Units	Si	Ge	AlP	AlAs	AlSb	GaN	GaP	$GaAs_{.6}P_{.4}$	GaAs	GaSb	InP	InAs	InSb	ZnS	ZnSe	ZnTe	CdS	CdSe	CdTe
E_g (eV)	1.11I	0.65I	2.45I	2.14I	1.62I	3.39D	2.26I	~1.93D	1.43D	0.70D	1.35D	0.356D	0.180D	3.66D	2.67D	2.25D	2.42D	1.74D	1.50D
E_g (μ)	1.117	1.907	0.506	0.579	0.765	0.366	0.548	0.642	0.867	1.77	0.918	3.48	6.89	0.339	0.464	0.551	0.512	0.712	0.861
E_g 4.2°K (eV)	1.21	0.74	2.52	2.22	~1.70	3.47	2.34		1.52	0.81	1.42	0.409	0.235	3.80	2.80	2.38	2.58	1.84	1.60
$E_{CB2} - E_{VB}$ (eV)	~1.9I	0.81D	3.6D	3.14D	2.22D		2.81D	~2.03I	1.87I	0.78I	2.25I	1.82I	~0.8I			3.7I			3.4I
$\Delta E_{Spin\ Orbit}$ (eV)	0.038	0.29		0.29	0.75		0.08		0.34	0.80	0.11	0.41	0.82	0.07	0.45	0.93			0.81
a_o (Å)	5.431	5.658	5.463	5.661	6.138	3.180	5.449	5.572	5.654	6.095	5.868	6.058	6.479	5.409	5.669	6.104	4.137	4.299	6.481
c_o (Å)						5.166											6.716	7.015	
d (gm/cc)	2.328	5.323	2.40	~3.73	4.26	6.10	4.129	~4.88	5.316	5.613	4.787	5.667	5.775	4.09	~5.26	~5.64	4.82	5.81	~5.86
Therm. Exp. (10^{-6}/°C)	2.56	5.92		5.20	4.88	†5.59/3.17	5.8	5.9	6.8	6.7	4.5	5.19	5.04	6.2	7	8	†4/2.1		5.5
Therm. Cond. (W/cm°C)	1.41	0.61	~0.9	~0.8	0.54		0.97	0.16	0.54	0.35	0.68	0.26	0.18	0.26	0.13	0.112	0.2	.063	.07
Hardness (Knoop)	1150	780	~500	481	360		945		750	450	535	381	223	178	~150	~130	55	44	~100
Melting Pt. (°C)	1415	958	>2,000	1740	1080	~1,500	1,467		1,238	712	1,070	943	525	1830	1520	1295	1475	1239	1098
Molecular Weight	28.09	72.60	57.95	101.90	148.74	83.73	100.70	127.06	144.64	191.48	145.79	189.74	236.58	97.45	144.34	192.99	144.48	191.37	240.02
m_e (m_o)	‡.19/.90	‡.082/1.64		~0.35	0.39	0.19	0.35	~0.089	0.065	0.049	0.078	0.023	0.014	0.34	0.17	0.09	0.20	0.13	0.11
m_{h1} (m_o)	0.15	0.042			0.11		0.14		0.087	0.056		0.025	.016			0.15	0.7	0.45	0.13
m_{h2} (m_o)	0.52	0.34			0.5	0.6	0.86		0.47	0.33	0.8	0.41	0.43		0.6	0.68	5	>1	2.1
*$\mu_{e300°K}$ (cm^2/V-sec)	1,900	3,600	80	280	200	150	190	2,900	8,800	6,000	4,700	22,600	$8.2\text{-}10^4$	140	600	~340	350	650	1,050
*$\mu_{e77°K}$ (cm^2/V-sec)	19,000	40,000	30	18	700		2,700	17,000	$2.1\text{-}10^5$	10,000	60,000	$1.2\text{-}10^5$	$1.2\text{-}10^6$		7,000		5,000	5,000	15,000
*$\mu_{h300°K}$ (cm^2/V-sec)	425	2,300			400		120		400	800	150	260	1,700	~5	28	110	15		80
*$\mu_{h77°K}$ (cm^2/V-sec)	8,000	40,000			4,000		2,000		7,500	6,000	1,200	350	7,000			900			500
Phonon LO/TO(me V)	51.0/57.4	28.1/33.3	62.0/54.6	49.8/45.1	42.1/39.5		49.9/45.5		36.2/33.3	29.8/26.8	42.8/37.7	30.2/27.1	24.2/22.6	36.9/28.4	31/26	25.5/22.3	36.8/32.1	26.2/20.6	21.2/17.4
**Ref. Index	3.5	4.1		3.1	3.4	2.1	3.3	3.4	3.4	3.8	3.1	3.5	3.9	2.4	2.8	3.1	2.5	2.6	2.8
E_∞	11.94	16.0		8.16	10.24	4	9.04	~10.2	10.9	14.44	9.52	11.8	15.7	5.07	6.1	7.3	†5.3/5.4	†6:2/6.3	6.7
E_o	11.94	16.0		10.06	14.4		11.1	~12.4	13.18	15.69	12.35	14.55	17.72	8.3	9.2	10.4	†8.9/8.5	†9.3/10.	9.4

All values at 300°K unless otherwise noted; Compiled by D. E. Hill
*Highest experimental Hall mobilities; †⊥/II to c axis; **Value near Eq on long λ side; ‡m_L/m_T

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