Physics of Semiconductor Devices, 3rd Edition
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Appendix E

Physical Constants

Quantity	Symbol	Value
Atmospheric pressure		1.01325×10^{5} N/cm^2
Avogadro constant	N_{AV}	6.02204×10^{23} mol^{-1}
Bohr radius	a_B	0.52917 Å
Boltzmann constant	k	1.38066×10^{-23} J/K (R/N_{AV})
		8.6174×10^{-5} eV/K
Electron rest mass	m_0	9.1095×10^{-31} kg
Electron-volt energy	eV	1 eV = 1.60218×10^{-19} J
Elementary charge	q	1.60218×10^{-19} C
Gas constant	R	1.98719 cal/mol-K
Magnetic flux quantum ($h/2q$)		2.0678×10^{-15} Wb
Permeability in vacuum	μ_0	1.25663×10^{-8} H/cm ($4\pi\times10^{-9}$)
Permittivity in vacuum	ε_0	8.85418×10^{-14} F/cm ($1/\mu_0 c^2$)
Planck constant	h	6.62617×10^{-34} J-s
		4.1357×10^{-15} eV-s
Proton rest mass	M_p	1.67264×10^{-27} kg
Reduced Planck constant ($h/2\pi$)	$\hbar$	1.05458×10^{-34} J-s
		6.5821×10^{-16} eV-s
Speed of light in vacuum	c	2.99792×10^{10} cm/s
Thermal voltage at 300 K	kT/q	0.0259 V

Appendix F

Properties of Important Semiconductors

Semiconductor			Crystal Struct.	Lattice Const. at 300 K (Å)	Bandgap (eV)		Band	Mobility at 300 K (cm^2/V-s)		Effective Mass		$\varepsilon_s/\varepsilon_0$
					300 K	0 K		μ_n	μ_p	m_n^*/m_0	m_p^*/m_0	
	C	Carbon (diamond)	D	3.56683	5.47	5.48	I	1,800	1,200	0.2	0.25	5.7
	Ge	Germanium	D	5.64613	0.66	0.74	I	3,900	1,900	1.64^l,0.082^t	0.04^{lh},0.28^{hh}	16.0
	Si	Silicon	D	5.43102	1.12	1.17	I	1,450	500	0.98^l,0.19^t	0.16^{lh},0.49^{hh}	11.9
IV-IV	SiC	Silicon carbide	W	a=3.086,c=15.117	2.996	3.03	I	400	50	0.60	1.00	9.66
III-V	AlAs	Aluminum arsenide	Z	5.6605	2.36	2.23	I	180		0.11	0.22	10.1
	AlP	Aluminum phosphide	Z	5.4635	2.42	2.51	I	60	450	0.212	0.145	9.8
	AlSb	Aluminum antimonide	Z	6.1355	1.58	1.68	I	200	420	0.12	0.98	14.4
	BN	Boron nitride	Z	3.6157	6.4		I	200	500	0.26	0.36	7.1
	,,	,,	W	a=2.55,c=4.17	5.8		D			0.24	0.88	6.85
	BP	Boron phosphide	Z	4.5383	2.0		I	40	500	0.67	0.042	11
	GaAs	Gallium arsenide	Z	5.6533	1.42	1.52	D	8,000	400	0.063	0.076^{lh},0.5^{hh}	12.9
	GaN	Gallium nitride	W	a=3.189,c=5.182	3.44	3.50	D	400	10	0.27	0.8	10.4
	GaP	Gallium phosphide	Z	5.4512	2.26	2.34	I	110	75	0.82	0.60	11.1
	GaSb	Gallium antimonide	Z	6.0959	0.72	0.81	D	5,000	850	0.042	0.40	15.7
	InAs	Indium arsenide	Z	6.0584	0.36	0.42	D	33,000	460	0.023	0.40	15.1
	InP	Indium phosphide	Z	5.8686	1.35	1.42	D	4,600	150	0.077	0.64	12.6
	InSb	Indium antimonide	Z	6.4794	0.17	0.23	D	80,000	1,250	0.0145	0.40	16.8
II-VI	CdS	Cadmium sulfide	Z	5.825	2.5		D			0.14	0.51	5.4
	,,	,,	W	a=4.136,c=6.714	2.49		D	350	40	0.20	0.7	9.1
	CdSe	Cadmium selenide	Z	6.050	1.70	1.85	D	800		0.13	0.45	10.0
	CdTe	Cadmium telluride	Z	6.482	1.56		D	1,050	100			10.2
	ZnO	Zinc oxide	R	4.580	3.35	3.42	D	200	180	0.27		9.0
	ZnS	Zinc sulfide	Z	5.410	3.66	3.84	D	600		0.39	0.23	8.4
	,,	,,	W	a=3.822,c=6.26	3.78		D	280	800	0.287	0.49	9.6
IV-VI	PbS	Lead sulfide	R	5.9362	0.41	0.286	I	600	700	0.25	0.25	17.0
	PbTe	Lead telluride	R	6.4620	0.31	0.19	I	6,000	4,000	0.17	0.20	30.0

D = Diamond, W = Wurtzite, Z = Zincblende, R = Rock salt. I, D = Indirect, direct bandgap. l,t,lh,hh = Longitudinal,transverse,light-hole,heavy-hole effective mass.