Properties of Semiconductors and Insulators (at 300 K unless otherwise noted)

Property	Symbol	Units	Si	Ge	GaAs	GaP	SiO_2	Si_3N_4
Crystal structure			Diamond	Diamond	Zincblende	Zincblende	Amor-phous	Amor-phous
Atoms per unit cell			8	8	8	8		
Atomic number	Z		14	32	31/33	31/15	14/8	14/7
Atomic or molecular weight	MW	g/g-mole	28.09	72.59	144.64	100.70	60.08	140.28
Lattice constant	a_o	nm	.54307	.56575	.56532	.54505		.775
Atomic or molecular density	N_o	cm^{-3}	$5.00 \cdot 10^{22}$	$4.42 \cdot 10^{22}$	$2.21 \cdot 10^{22}$	$2.47 \cdot 10^{22}$	$2.20 \cdot 10^{22}$	$1.48 \cdot 10^{22}$
Density		$g\ cm^{-3}$	2.328	5.323	5.316	4.13	2.19	3.44
Energy gap (300 K)	E_g	eV	1.124	.67	1.42	2.24	8 a 9	4.7
Energy gap (0 K)	E_g	eV	1.170	.744	1.52	2.40		
Temperature dependence	$\Delta E_g/\Delta T$	$eV \cdot K^{-1}$	$-2.7 \cdot 10^{-4}$	$-3.7 \cdot 10^{-4}$	$-5.0 \cdot 10^{-4}$	$-5.4 \cdot 10^{-4}$		
Relative permittivity	ϵ_r		11.7	16.0	13.1	10.2	3.9	7.5
Index of refraction	n		3.44	3.97	3.3	3.3	1.46	2.0
Melting point	T_m	°C	1412	937	1237	1467	≃1700	≃1900
Vapor pressure		Torr (mmHg) (at °C)	10^{-7}(1050) 10^{-5}(1250)	10^{-9}(750) 10^{-7}(880)	1(1050) 100(1220)	10^{-6}(770) 10^{-4}(920)		
Specific heat	C_p	$J(g \cdot K)^{-1}$	0.70	0.32	0.35		1.4	0.17
Thermal conductivity	κ	W(cm·K)-1	1.412	0.606	0.455	0.97	0.014	0.185?
Thermal diffusivity	D_{th}	cm^2s^{-1}	0.87	0.36	0.44		0.004	0.32?
Coefficient of linear thermal expansion	α'	K^{-1}	$2.5 \cdot 10^{-6}$	$5.7 \cdot 10^{-6}$	$5.9 \cdot 10^{-6}$	$5.3 \cdot 10^{-6}$	$5 \cdot 10^{-7}$	$2.8 \cdot 10^{-6}$
Intrinsic carrier concentration	$n_i(300K)$	cm^{-3}	$1.45 \cdot 10^{10}$	$2.4 \cdot 10^{13}$	$9.0 \cdot 10^{6}$			
Lattice mobility electron	μ_n (T)	$cm^2(V \cdot s)^{-1}$	1417	3900	8800	300	20	
Lattice mobility hole	μ_p (T)	$cm^2(V \cdot s)^{-1}$	471	1900	400	100	$\simeq 10^{-8}$	
Effective density of states								
Conduction band	N_c (T)	cm^{-3}	$2.8 \cdot 10^{19}$	$1.04 \cdot 10^{19}$	$4.7 \cdot 10^{17}$			
Valence band	N_v (T)	cm^{-3}	$1.04 \cdot 10^{19}$	$6.0 \cdot 10^{18}$	$7.0 \cdot 10^{18}$			
Electric field at breakdown	E_l	$V \cdot cm^{-1}$	$3 \cdot 10^5$	$8 \cdot 10^4$	$3.5 \cdot 10^5$		$6\text{-}9 \cdot 10^6$	
Effective mass - electron	m_n^*/m_o		1.08[a] 0.26[b]	0.55[a] 0.12[b]	0.068	0.5		
Effective mass - hole	m_p^*/m_o		0.81[a] 0.386[b]	0.3	0.5	0.5		
Electron affinity	$q\chi$	eV	4.05	4.00	4.07	≃4.3	1.0	
Average energy loss per phonon scatering		eV	0.063	0.037	0.035			
Optical phonon mean-free path - Electron	l_{ph}	nm	6.2	6.5	3.5			
- Hole	l_{ph}	nm	4.5	6.5	3.5			

[a] Used in density-of-state calculations
[b] Used in conductivity calculations

Constante de Boltzmann $K = 8.6 \cdot 10^{-5}\ eV \cdot K^{-1}$
Número de Avogadro $N_A = 6.022 \cdot 10^{23}\ mol^{-1}$
constante de Plank $h = 6.63 \cdot 10\text{-}34\ J \cdot s = 4.14 \cdot 10^{-15}\ eVs$
carga del electrón $q = 1.6 \cdot 10^{-19}\ C$
masa del electrón libre $m_o = 9.11 \cdot 10^{-31}\ Kg$
permitividad del vacío $\epsilon_o = 8.854 \cdot 10^{-14}\ F \cdot cm^{-1}$

$\varepsilon = \varepsilon_0 \cdot \varepsilon_r$